

Wimmera Waterway Health Strategy 2006 - 2011

a regional river health strategy



Wimmera Catchment Management Authority



Waterways for Life.

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For further information, please contact:

Waterways Manager
Wimmera CMA
PO Box 479 HORSHAM VICTORIA 3402
Ph: (03) 5382 1544
Fax: (03) 5382 6076
Email: wca@wcma.vic.gov.au
Web: www.wcma.vic.gov.au

minister's foreword

wimmera waterway health strategy



The Wimmera Waterway Health Strategy - a Regional River Health Strategy - is one of 10 strategies developed across the State to achieve key river health objectives in the Bracks Government's *Our Water Our Future* action plan and the Victorian River Health Strategy.

This river health strategy is the result of extensive stakeholder and community involvement. This vital input has provided a framework for communities, industries and Government to work in partnership with river health managers to protect and restore our rivers over the long-term.

The strategy establishes regional priorities for river protection and restoration. It will be used by a wide range of stakeholders and community groups and steer river health investment.

An innovative asset-based approach has allowed river health managers to document the range of social, environmental and economic values of local waterways. It also helps identify the threats and risks to these values and establish priority actions to protect and restore our rivers.

This strategy highlights the importance of managing the Wimmera River, a Victorian Heritage River. It also identifies a range of programs for rivers and wetlands of environmental, social and economic significance including MacKenzie River, Pyans Creek and the Ramsar wetland Lake Albacutya.

Wimmera catchment communities are strongly committed to river health. Their continuing support of river and wetland management should be applauded. This plan also highlights the cooperation of many regional agencies to achieve improvements in river health through land and water management.

I commend all those involved in planning and implementing this innovative strategy.

Your valuable contribution in protecting and restoring our precious rivers will benefit all Victorians.

A handwritten signature in dark ink, appearing to read 'John Thwaites'.

John Thwaites,
Minister for Water and Environment

Disclaimer: It should be noted that specific reference to funding levels in this strategy are for indicative purposes only. The level of Government investment in this strategy will depend upon budgets and Government priorities.

foreword

wimmera waterway health strategy



The Wimmera CMA region is home to a unique range of waterways that support life in an otherwise dry landscape. Unfortunately, these lifelines are under threat from reduced flows, sedimentation and erosion, invasion by pest plants and animals and declining water quality. Gully and land erosion occur extensively throughout the catchment, particularly in the upper catchment, and is contributing significant sediment to waterways. The associated decline in water quality is further exacerbated by grazing pressure on the bed and banks of waterways. Changes in flow regimes and increasing sedimentation are leading to significant changes in aquatic vegetation growth and, combined with a history of snag removal, are having a significant impact on aquatic habitats.

In publishing this Strategy, Wimmera CMA reaffirms its commitment to improving not only the health of streams, but also wetlands across the region. For this reason, and to emphasise the importance of wetlands in the Wimmera and Millicent Coast basins, Wimmera CMA has chosen to release this as the Wimmera Waterway Health Strategy, as it applies to all forms of surface water bodies. The key assets that are the prime focus of the Strategy are the Wetlands and Streams of the Wimmera River Basin, Terminal Lakes of the Wimmera River Basin, and Wetlands and Streams of the Millicent Coast Basin.

The strategic vision encompassed by the strategy is '*waterways for life*'. To achieve this vision, Wimmera CMA in its role as caretaker of river health in the region, is committing effort and dollars to protecting the best waterways in the region, maintaining those waterways in good condition, restoring at-risk waterways, ensuring that future generations enjoy the health diversity and productivity of healthy waterways, and that Indigenous values are respected.

Wimmera CMA recognises that the community and other agencies involved in natural resource management are key players in achieving improvements in waterway health. The scope of the work identified in this Strategy is vast. To achieve improvements in the health of our waterways, we need to be working together to meet the challenges of implementing this Strategy.

I thank everyone who has contributed to the development of this Strategy, and invite you to actively participate in achieving healthier waterways in the Wimmera.

Ms Jo Bourke
Chairman
Wimmera CMA Board

acknowledgements

wimmera waterway health strategy

Wimmera Catchment Management Authority (Wimmera CMA) acknowledges the following people who contributed to this Strategy.

For overseeing the development of the Strategy, members of the Wimmera Regional Waters Committee:

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Wimmera CMA staff

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Max Skeen – Landcare and landholder partnerships
Melissa Morris – Local Government partnerships

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The staff of Department of Primary Industries, Department of Sustainability and Environment, Environment Protection Authority, Parks Victoria, GWMWater and Local Government for their contributions during the development of the strategy. The *Wimmera Waterway Health Strategy* is presented in eight sections. Each section is written in a way that allows it to stand alone, as well as be read in conjunction with the other parts. When approaching the document, it is important to consider your motivations for reading it, as this will determine which part of the document you should read.

abbreviations

wimmera waterway health strategy



µS/cm	units used to measure Electrical Conductivity of water
%	Percent
AMF	Adaptive Management Framework
ANZECC	Australian and New Zealand Environment and Conservation Council
AT	Aspirational Target
AUSRIVAS	Australian River Assessment System
BOM	Bureau of Meteorology
CAMBA	China-Australia Migratory Birds Agreement
COAG	Council of Australian Governments
CMA	Catchment Management Authority
CMSS	Catchment Management Support System
CP	Cost-sharing Principle
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EC	Electrical Conductivity
EPA	Environmental Protection Authority
EVC	Ecological Vegetation Class
EWR	Environmental Water Reserve
FO	Flooding Overlay
GIS	Geographical Information Systems
GL	Gigalitres

ha	Hectares
ISC	Index of Stream Condition
IWC	Index of Wetland Condition
JAMBA	Japan-Australia Migratory Birds Agreement
km	Kilometres
LCC	Land Conservation Council
LSIO	Land Subject to Inundation Overlay
LWD	Large Woody Debris
MA	Management Action
MAT	Management Action Target
MDB	Murray-Darling Basin
MDBC	Murray-Darling Basin Commission
m	Metres
ML	Megalitres
mm	Millimetres
MSS	Municipal Strategic Statement
NAP	National Action Plan for Salinity and Water Quality
NHT	Natural Heritage Trust
NRM	Natural Resource Management
NTU	Nephelometric Turbidity Units
P	Principle
pH	unit for measure of acidity of alkalinity
RC	Resource Condition
RCI	Resource Condition Indicator
RCIP	Regional Catchment Investment Plan
RCS	Regional Catchment Strategy
RCT	Resource Condition Target
REALM	Resource Allocation Model
RiVERS	River Values and Environmental Risk System
SDL	Sustainable Diversion Limits
SEPP (WoV)	State Environment Protection Policy (Waters of Victoria)
SFMP	Streamflow Management Plan
SIGNAL	Stream Invertebrate Grade Number-Average Level
SKM	Sinclair Knight Merz
VicSES	Victorian State Emergency Services
VRHS	Victorian River Health Strategy
Wimmera WHS	Wimmera Waterway Health Strategy
Wimmera CMA	Wimmera Catchment Management Authority
Wimmera NVP	Wimmera Native Vegetation Plan (Draft)
Wimmera RCS	Wimmera Regional Catchment Strategy
Wimmera SAP	Wimmera Regional Salinity Action Plan
Wimmera WQS	Wimmera Water Quality Strategy
WMSDSS	Wimmera Mallee Stock and Domestic Supply System

how to read and use the Wimmera WHS

wimmera waterway health strategy



- part 1:** **Introduction** introduces the Wimmera CMA's vision for the waterways of the region and provides a brief overview of the regional and Statewide context for the *Wimmera WHS*. The Introduction also provides information on the process used to develop the *Wimmera WHS*.
- part 2:** **Waterways of the Wimmera** describes the waterways of the Wimmera region in detail, their various environmental, social and economic values, and their current condition. Waterway reaches of high priority for actions in the *Wimmera WHS* are identified.
- part 3:** **Wimmera WHS Strategic Framework** sets the Statewide and regional strategic direction for waterway health in the Wimmera and should be read by those people who wish to develop an understanding of the broad context of the region with respect to waterway health.
- part 4:** **Waterway Management Units and Reaches** focuses on waterway management issues at the local scale (subcatchments and individual waterway reaches). This part forms the core of the Regional River Health Strategy as outlined in the Victorian River Health Strategy, and identifies the key values, threats, and management actions for each waterway reach in the region. This part is likely to be of most interest to those people who are interested in a specific geographic location within the Wimmera.
- part 5:** **Waterway Health Programs** identifies issues that are considered important across the Wimmera region, referred to as Waterway programs. Programs are issue-specific and may apply to a number of different locations in the region. The individual programs contained within this part of the Strategy can be read separately, however there are links made to other sections of the Strategy, so as to avoid unnecessary duplication.
- part 6:** **Resource Book** (available in CD only) contains the background information, data, analysis, the risk assessment and other results that have been developed in producing the Strategy and the conduct of the consultation.
- part 7:** **References** contains some key documents that support the *Wimmera WHS*.
- part 8:** **Glossary** provides definitions of key terms and phrases used in the *Wimmera WHS*.

The reason behind adopting this structure is to ensure that the Strategy is an easy to use document that may be referred to from time-to-time during the course of everyday work. It is hoped that the Strategy will become a handy reference tool for people engaged in waterway management in the Wimmera CMA region.

Wimmera CMA trusts that you find the Strategy a useful tool in the journey towards protecting and enhancing waterway health.

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introduction

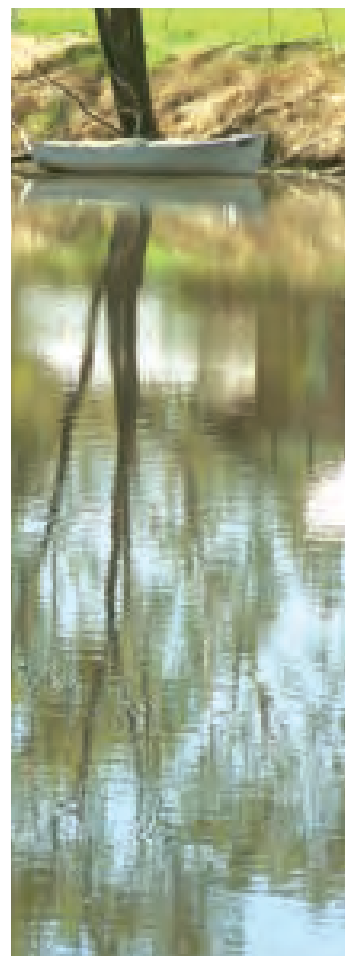
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1 introduction

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introduction

The Wimmera community and Wimmera Catchment Management Authority (Wimmera CMA), in partnership with Local Government and the Victorian and the Australian Governments, have united to manage the waterways of the Wimmera and to work collaboratively in identifying actions that address waterway health issues across the Wimmera CMA region.

The Wimmera Regional Catchment Strategy (2003-2008) (RCS) provides a vision for the future landscape of the Wimmera and is helping guide natural resource management through the challenges from now until 2008. It represents a change in focus from the issues that confront us such as salinity, soil erosion and loss of biodiversity, to the assets that we wish to enhance and protect – our land, water, biodiversity and communities.

The *Wimmera RCS* identifies waterways of the Wimmera River and Millicent Coast basins and the Terminal Lakes of the Wimmera River as being high value assets of the region. *The Wimmera Waterway Health Strategy (WHS)* has been developed to provide the strategic framework to assist the catchment community and agencies to protect and enhance the waterways of the region.

The *Wimmera WHS* is the first attempt to combine the elements of waterway management in one umbrella document. The *Wimmera WHS* integrates waterway programs into a multi-disciplinary framework and considers floodplains, wetlands, riparian land, instream habitat and channel-form, environmental water reserve management, water quality, significant flora and fauna, and communication, education and engagement. The Strategy also includes an adaptive management framework for monitoring, evaluating and reporting on the achievements of activities undertaken in implementing the Strategy.

The *Wimmera WHS* brings together a large amount of work, completed by numerous agencies, into one document that prioritises previously-identified actions into a coherent plan for protecting and enhancing waterway health. The Strategy draws together the strategies, actions, knowledge, and resources of multiple groups to achieve integrated management of natural resources across the Wimmera region.

The *Wimmera WHS* takes this one step further by identifying the values intrinsic to waterways. It then prioritises the threats against those values to clearly identify which actions need to be implemented, and in what order. It provides a vision for the future of waterways of the region and will guide waterway management actions through the challenges of the next five years.

The *Wimmera WHS* has been developed and will be implemented within the broader state-wide strategic frameworks of the *Victorian River Health Strategy (2002) (VRHS)*, *State Environmental Protection Policy (Waters of Victoria) (2004) (SEPP) (WoV)*, the *Victorian Biodiversity Strategy (1997)*, *Victorian Nutrient Management Strategy (1997)*, *Victorian Flood Management Strategy (1998)*, *Victoria's Native Vegetation Management – A Framework for Action (2002)*, *Victoria's Salinity Management Framework (2000)* and the Government's commitments in the *Our Water Our Future* action plan for water (2004).

The Strategy builds on the regional frameworks of the *Wimmera Regional Catchment Strategy (RCS)* and regional strategies and action plans for specific waterway health threats or waterway reaches.

The Strategy is supported by a series of regional sub-strategies, action plans and guiding documents including *Wimmera Water Quality Strategy* (2002), *Wimmera Floodplain Management Strategy* (2001), *Wimmera Rural Drainage Strategy* (2001), *Wimmera Regional Salinity Action Plan* (2004), *Wimmera Native Vegetation Plan* (revised Draft 2004), *Wimmera Weed Action Plan* (2000), *Wimmera Rabbit Action Plan* (2000), various Waterway Action Plans, *Wimmera River Stressed Rivers Report* (2002), *Environmental Flow Recommendations for the Bulk Entitlements* (2004), *Wimmera River Geomorphic Investigation, Sediment Sources, Transport and Fate* (2001), *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003), *Geomorphic Investigation of Wetlands in the Wimmera CMA Section of the Millicent Coast Basin* (2004), *Social and Economic Drivers of Wetland Rehabilitation* (2005) and the *Wimmera Wetland Condition Assessment Project* (2005).

The Strategy provides the regional framework for integration of actions which will enable waterways of high value to be protected and others to be enhanced for current and future generations.

1.1 vision

Wimmera CMA's vision for waterways of the Wimmera is **waterways for life.**

1.2 objectives

The *Wimmera WHS* aims to achieve its vision through four key objectives:

1. The waterways of the Wimmera region are proactively managed by all to protect and enhance their environmental, social and economic values.
2. The condition of ecologically healthy waterways are maintained.
3. An overall improvement in the environmental condition of the region's waterways is achieved.
4. Damage to waterways from future management activities is prevented.

To achieve these objectives the *Wimmera WHS*:

- Identifies environmental, economic and social values associated with our waterways.
- Identifies threats which may impact on those environmental, economic and social values.
- Provides a framework for developing and implementing issues-based action plans.
- Develops targets for waterway health.
- Provides a basis for developing and implementing multi-benefit actions and programs.
- Allows identification of gaps in current waterway health management.



1.3 regional overview

The Wimmera CMA region (Map 1.1) covers sections of the Wimmera River Basin and the Millicent Coast Basin. The Wimmera region is diverse; with mountains, plains and desert, moist foothill forest, box ironbark forest, woodlands, grasslands, mallee heath and mallee woodlands. Average annual rainfall varies from up to 1000 millimetres (mm) in the Grampians to as low as 300 mm in the northern plains. This diverse environment also contains a broad-scale agricultural landscape and an ageing and declining population.


The major waterway of the Wimmera River Basin is the Wimmera River. The Wimmera River has a catchment of about 2.4 million hectares (ha) in northwest Victoria. Numerous tributaries rise in the Mount Buangor State Park and the Pyrenees Ranges to the southeast, joining the main Wimmera River upstream of Glenorchy. Water is also received from the major sub-catchments of Wattle, Concongella and Mt William creeks.

legend

— Rivers*


WETLANDS

-  Freshwater Meadow
-  Shallow Freshwater Meadow
-  Deep Freshwater Meadow
-  Permanent Open Freshwater
-  Semi-Permanent Saline
-  Permanent Saline

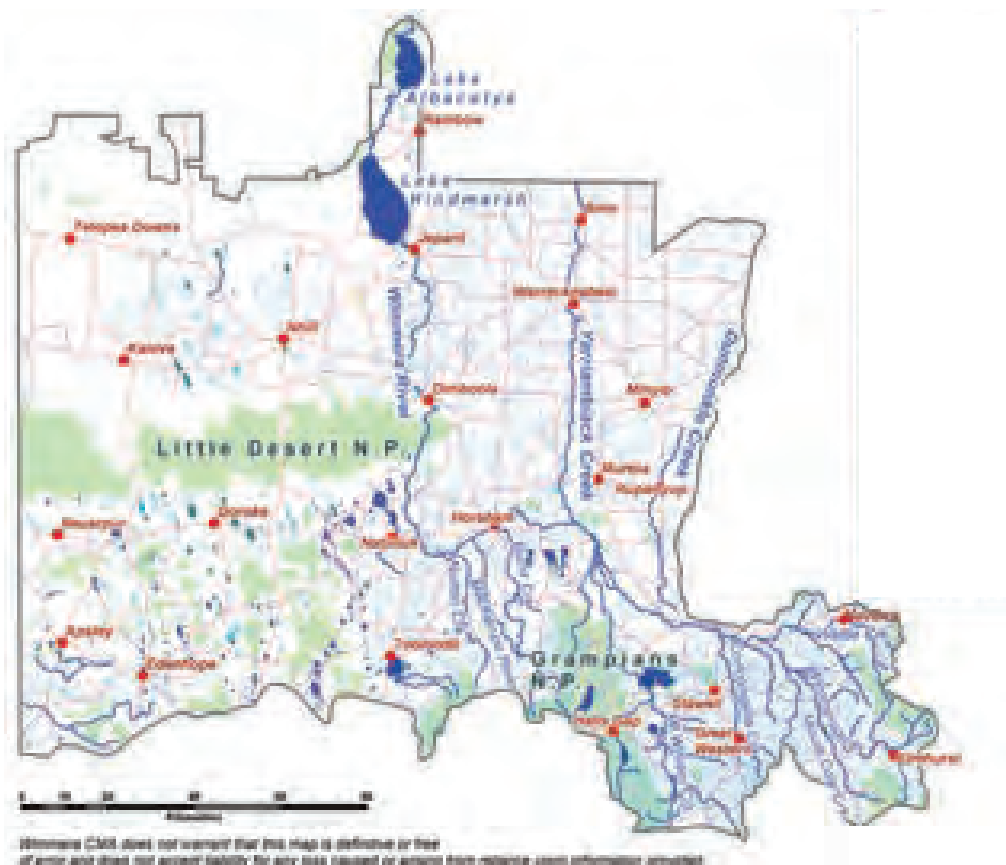
 Major Towns*

 Major Roads*

 Public Land*

 Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 1.1 waterways of the wimmera CMA region

The Wimmera River flows west to Horsham where it collects the waters of Burnt Creek. Just downstream, the MacKenzie River, and Norton Creek flow in from the south. The MacKenzie River and these other streams flow from the northern part of the Grampians National Park, which lies at the southern boundary of the Wimmera CMA region.

Just east of Mt Arapiles, the river swings to the north and continues through Dimboola and Jeparit to Lake Hindmarsh, Victoria's largest freshwater lake. During exceptionally wet periods Lake Hindmarsh overflows into the ephemeral Outlet Creek and onto Lake Albacutya, a Ramsar wetland, extending to the Wirrengren Plain in Victoria's Mallee region. Overflow of Lake Hindmarsh into Outlet Creek has only occurred five times this century, the last in 1996. Historic records show flooding of lakes beyond Lake Albacutya, though they have not received floodwater since 1974/75.

The Wimmera River between Polkemmet (10 km northwest of Horsham) and Wirrengren Plain has been proclaimed a Victorian 'Heritage River' under the *Heritage Rivers Act* 1992.

A notable feature of the Wimmera River system is the two effluent streams or distributaries, Yarriambiack and Dunmunkle creeks, which carry water from the Wimmera River. Yarriambiack Creek flows from Longerenong through Warracknabeal, Brim and Beulah into Lake Corong near Hopetoun. Dunmunkle Creek, a highly-modified stream, carries water north from Glenorchy through Rupanyup, dissipating in the southern Mallee.

The main features of Millicent Coast Basin waterways are wetlands, terminal streams and small ephemeral west-flowing streams.

There are over 3,000 wetlands in the region, 90% of which are in private ownership. Most of these occur in the Millicent Coast Basin. Many of these wetlands are ecologically of state significance as well as being important water storages and recreational areas. These wetlands are also economically important for agriculture and tourism.

The Millicent Coast Basin is also characterised by a number of streams that flow west into South Australia. Management of these streams including Mosquito, Kojak, Morambro, Tatiara and Thompson creeks is important due to cross-border impacts.

2 wimmera WHS development

wimmera waterway health strategy



Figure 1.2 describes the process used to develop the *Wimmera WHS*. The process included consultation with the community and agencies at key stages, and combined information gathered from the community and agencies with that collected through the Index of Stream Condition (ISC) process and current knowledge of waterways documented in sub-strategies, plans and reports.

All these actions helped develop a full picture of the current condition of Wimmera waterways and the key values and threats to waterway health. The end result is a snapshot of the environmental, economic and social conditions of waterways in the region.

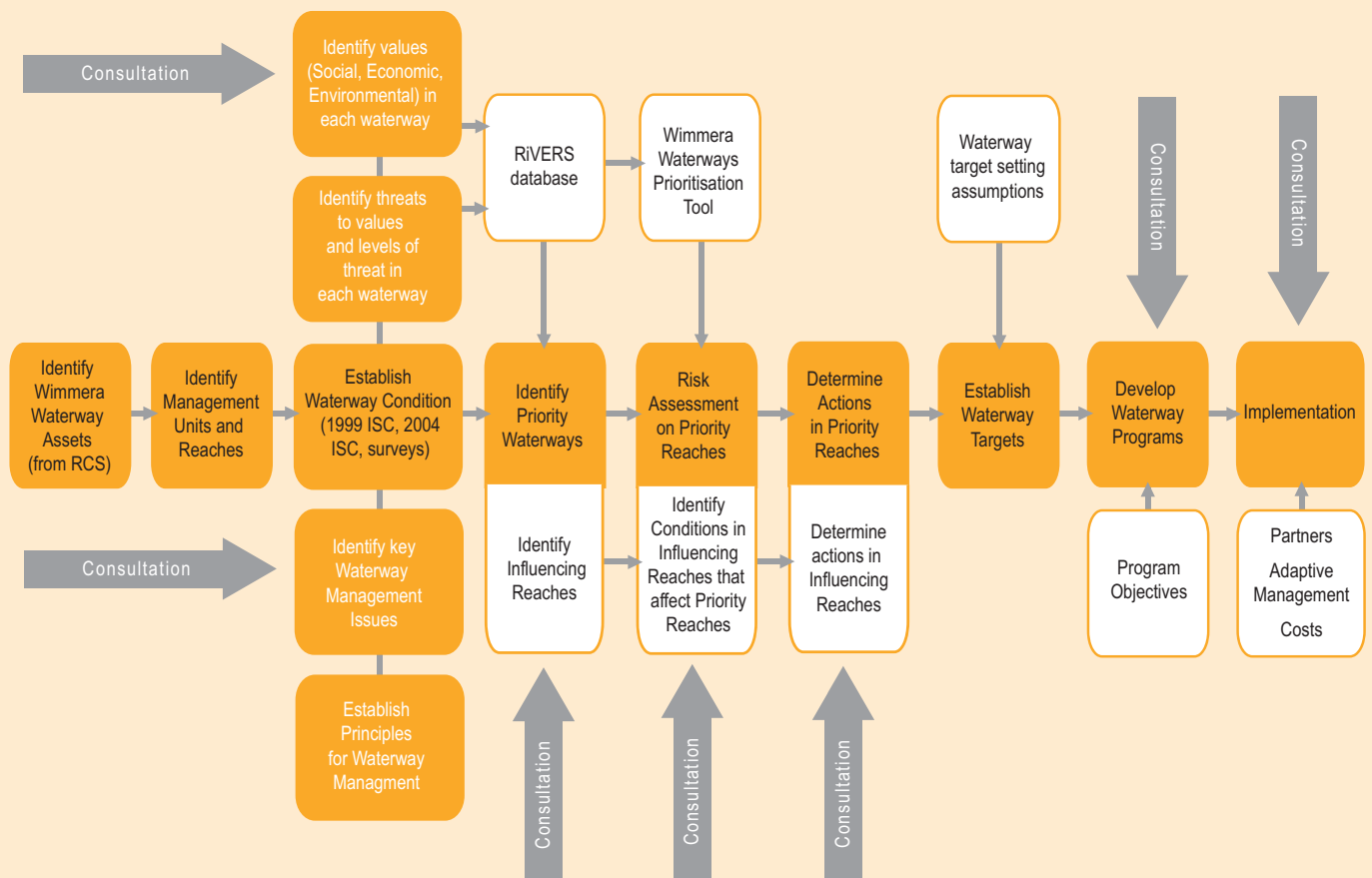


FIGURE 1.2 Wimmera WHS process flowchart

2.1 assets based approach

The Wimmera WHS was developed within an assets based approach.

The Wimmera has a rich suite of natural assets including open forests and semi-arid landscapes, aesthetic features, agricultural areas, the Wimmera River, wetlands and ephemeral streams. The prominent regional industries of agriculture and tourism are dependent on the conservation and sustainable use of the natural assets. Continued agricultural productivity is dependent upon the soil and water resources, while many recreational activities rely on healthy natural ecosystems.

Three biophysical themes occur throughout all natural assets: biodiversity, water and land. Each theme is inextricably bound to the others and elements of all three can be seen in any of the region's assets.

Protecting and enhancing waterway assets is the key objective of the *Wimmera WHS*. It is important to keep this objective at the forefront of our minds when using this document. The focus of natural resource management is on protecting the environmental services provided by the environment. The *Wimmera WHS* goes one step further to focus on the threats to those values, as well as the values themselves.

The key waterway assets of the Wimmera are identified in the *Wimmera RCS* and include:

- Wetlands and Streams of the Wimmera River Basin.
- Terminal Lakes of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.

For more details of the waterway assets of the Wimmera, refer to Part 2 – Waterways of the Wimmera.

2.2 consultation

Extensive communication and consultation was undertaken throughout the development of the *Wimmera WHS*.

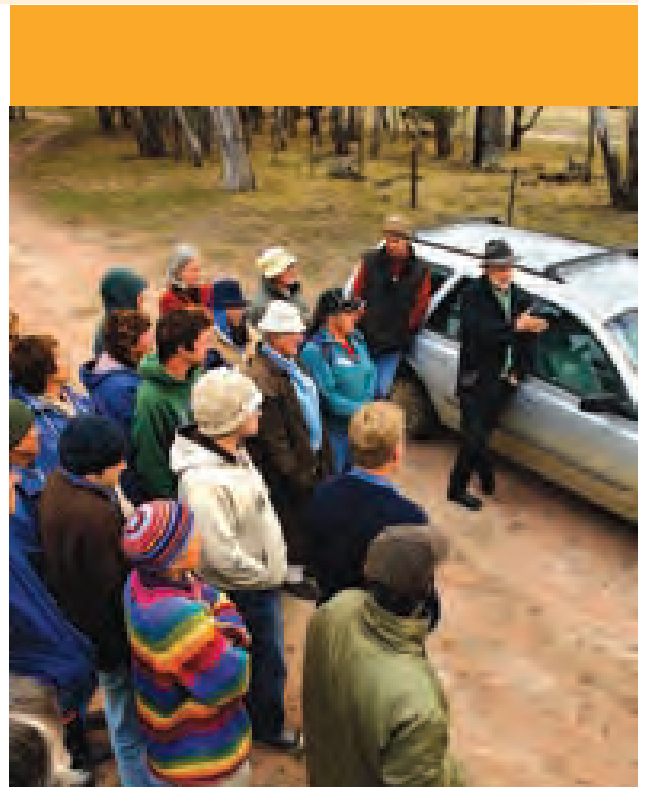
The Communications Strategy for the *Wimmera WHS* development had two main objectives. The first objective was to obtain data regarding social and economic aspects of the waterways in the catchment area, so as to fully develop the River Value and Environmental Risk System (RiVERS) database. The second objective was to engage the community and agencies and achieve a greater level of understanding and cooperation between them, as well as achieve ongoing participation by the community in waterway health management programs.

During the early stages of preparing the *Wimmera WHS*, six workshops were held across the region. The data for the social and economic values in RiVERS were generated in these workshops. In addition, scores for the Introduced Exotic Fauna were also generated at these workshops.

These workshops were followed up by numerous meetings with individual agency representatives to discuss specific aspects of waterway health.

A range of Issues Papers were produced and circulated as a means of generating discussion on waterway health issues in the region. The feedback received on these Issues Papers informed development of Parts 4 and 5 of the Strategy. Copies of these Issues Papers are contained in the *Wimmera WHS* Resource Book in Part 6, Sub-folder 12.

A *Draft Wimmera WHS* was then prepared and circulated for comment. The comments received during this period have been used to refine the Strategy.



Key community and agency groups and individuals consulted during development of the Wimmera WHS include:

Wimmera CMA Board	West Wimmera Shire Council
Wimmera CMA Water Functional Committee	Ararat Rural City Council
Wimmera CMA Staff	Pyrenees Shire Council
Department of Sustainability and Environment (DSE)	Parks Victoria
DSE Land Victoria	Wotjobaluk Land Council
DSE Land Victoria Committees of Management	Goolum Goolum Aboriginal Corporation
DSE Native Title	Landcare groups and facilitators
DSE Flora and Fauna	Top Crop groups
Department of Primary Industries (DPI)	Victorian Farmers Federation
Environment Protection Authority (EPA)	VRFish
GWMWater	Wimmera Anglers Association
GWMWater water user groups	Horsham Rowers Club
Horsham Rural City Council	Friends of Hindmarsh
Hindmarsh Shire Council	Friends of MacKenzie
Yarriambiack Shire Council	Friends of Lake Albacutya
Northern Grampians Shire Council	

Further information on consultation undertaken as a part of preparing the Strategy is contained in the *Wimmera WHS Resource Book* in Part 6, Sub-folder 7.

2.3 Wimmera river values and environmental risk system (RiVERS)

As Figure 1.2 describes, the process of developing the *Wimmera WHS* involved data collection, analysis, and review.

The River Values and Environmental Risk System, better known as RiVERS, is a tool to assist in priority setting and planning and enables the manager to:

- Consider the values of the waterways (basin to site specific).
- Consider the threats (type and magnitude).
- Identify key values and threats.
- Identify priority catchments, sub catchments, streams and reaches.
- Identify targets.
- Identify actions.
- Establish the basis for integrated management activities.
- Establish a reporting mechanism to enable greater community/stakeholder understanding of prioritising programs.

The process for developing and populating the Wimmera RiVERS database was as follows:

- Incorporating data from the 1999 ISC assessments and other Statewide data sets.
- Populating ISC data for the reaches identified in the *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003).
- Workshops with members of the community to establish social and economic values. This data was then incorporated into the database.
- Reviewing all fields for all reaches to identify fields that contained no data. Undertook gap analysis.
- Reviewing all existing local knowledge and information to refine the data in RiVERS and fill gaps in the data from the Statewide sets.
- Document the data sources for locally-inputted data.

There were four main sources of data used to populate the Wimmera RiVERS database:

- 1999 ISC data.
- 2002 ISC field data (from the *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003)).
- Community workshops (social and economic values).
- Local knowledge and scientific/technical reports such as:
 - Geomorphology studies.
 - Environmental Water Releases investigations.
 - Local water quality monitoring.

For the Wimmera region, two ISC assessments were undertaken, one in 1999 (the state-wide assessment) and one in 2002 (following the geomorphic categorisation of the waterways in the Wimmera which identified that the 1999 ISC reaches were not representative of the geomorphic types within the Wimmera). The ISC assessments undertaken in 2002 only provided data for two of the five sub-indices that make up ISC – physical form and streamside zone. The remaining three sub-indices – water quality, hydrology and aquatic life were established using best available knowledge at the time from the 1999 ISC information and local knowledge.

This data, combined with Heritage Victoria, the National Trust, Local Government planning schemes, GWMWater Proclaimed Water Supply Catchment map, and Land Conservation Council final recommendations, was used to identify the high priority waterway reaches within the region.

The RIVERS database was then used to assess the values of and threats and risks to individual waterway reaches.

The waterway values in RIVERS are classified according to whether they are environmental, social and economic. The waterway values in RIVERS are detailed in Table 1.1. The threats identified that may present a risk to these values are shown in Table 1.2.

Each of these environmental, social and economic values of waterways has been assessed, and accorded a value rating, in each waterway reach in the Wimmera region.

The *Wimmera WHS Resource Book* in Sub-folder 6 of Part 6 of this Strategy contains a report that identifies in much greater detail the way RIVERS was developed as a component of the *Wimmera WHS*. Please refer to this document if you require further explanation of RIVERS.

TABLE 1.1 environmental, social and economic values of waterways in RIVERS

environmental	social	economic
Significant flora	Fishing	Water supply – irrigation
Ecological Vegetation Class	Non-motor boat activities	Water supply - proclaimed catchment
Significant fauna	Motor boat activities	Infrastructure
Invertebrates observed/expected	Camping	Land value
Width of riparian vegetation	Swimming	Tourism
Longitudinal continuity of riparian vegetation	Passive recreation	Power generation
Structural intactness of riparian vegetation	European heritage	
Native fish observed/expected	Listed landscape	
Proportion of introduced fish	Flagship species	
Native fish migration		
Wetland significance		
Wetland rarity and depletion		
Heritage river or representative river		
Sites of significance		
Ecological river health		

TABLE 1.2 threats to environmental, social and economic values of waterways

threats to environmental, social and economic values		
Bank erosion	Water quality level	Exotic fauna
Bed instability	Water quality trend	Exotic flora
Barriers to fish migration	Water quality SIGNAL	Los of instream habitat
Channel modification	Water temperature	Changed wetland connectivity
Flow deviation	Algal blooms	Uncontrolled stock access

2.4 priority setting

Setting priorities for management ensures that resources are allocated to the most important areas and issues.

Prioritisation is especially critical where the values are high and the threats are great and resources are limited. The best use of those resources can only be directed by the information currently available. Given the array of values and threats that characterise the waterway management issues in the Wimmera CMA region, the *Wimmera WHS* uses a clear method to determine the:

- location of priority waterways and reaches; and
- priority actions to address key values and threats along these reaches.

The *VRHS* states that when selecting priorities for river protection and enhancement, they will be based on:

- Protection of existing high-value areas or areas in good condition.
- Restoration of those areas where there is:
 - the highest environmental and community gains for the resources invested
 - real community commitment towards long-term improvement of river health.

The prioritisation principles used in developing the *Wimmera WHS* closely reflect the prioritisation framework outlined in the *VRHS*.

priority waterways

High priority waterways and reaches in the Wimmera region were identified using the following sources:

- RiVERS.
- ISC 2004 results.
- *Heritage Rivers Act* 1992.
- Ramsar-listed wetlands.
- Wetlands identified in Directory of Nationally Important Wetlands (2001).
- High value and in near-pristine condition waterways identified in *Wimmera River Geomorphic Investigation – Sediment Sources, Transport and Fate* (2001).
- High value and in near-pristine condition waterways identified in *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003).

For the *Wimmera WHS*, waterways and reaches of the highest community value in the Wimmera CMA region are identified as:

- Wimmera Heritage River.
- Waterways and reaches associated with international or nationally-significant wetlands.
- Waterways and reaches classified as environmental sites of significance.
- Waterways and reaches classified as having high to very high overall environmental significance (identified in RiVERS).
- Waterways and reaches classified as having high to very high overall social value (identified in RiVERS).
- Waterways and reaches classified as having high to very high overall economic value (identified in RiVERS).

The Wimmera has a number of waterways of that are of high value for environmental, social, and/or economic purposes. In line with the principle of 'protect the best', the waterways that have the highest environmental, social, and/or economic values are the high priority waterways in the *Wimmera WHS* are identified in Part 2 – Waterways of the Wimmera.

influencing waterways/reaches

Influencing waterways/reaches are those non-priority areas where conditions present a risk to waterway health in downstream or nearby priority reaches. The types of threats occurring in influencing reaches that can have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to waterways, resulting in a decline in water quality in downstream priority waterways.
- Bed, bank and gully erosion elevating sediment loads in waterways and contributing to the loss of instream habitat in downstream priority waterways.
- Pest plants, providing a continuous source of seed/rhizomes to invade downstream or nearby priority waterways.
- Pest animal populations providing a continuous source and animals to invade downstream or nearby priority waterways.
- Water harvesting altering flows in downstream priority waterways.
- Degraded riparian zones, through loss of vegetation and stock grazing, contributing nutrients and sediments (turbidity) to waterways, resulting in a decline in water quality in downstream priority waterways.



For these reasons, management actions have also been identified and prioritised for influencing waterways/reaches within Part 4 – Waterway Management Units and Reaches – of the *Wimmera WHS*.

prioritisation of actions within waterway management units

Prioritisation of actions in individual waterway reaches in the *Wimmera WHS* was completed using a methodology that combines threat level and value rating. This methodology provides a ranking of values (environmental, social, and/or economic from RiVERS) that are being impacted upon by various threats.

The key tool in the risk assessment and prioritisation in the *Wimmera WHS* is the *Wimmera Waterways Management Prioritisation Tool*, which is included in the *Wimmera WHS* Resource Book Sub-folder 16 of Part 6. This tool prioritises the values that are under threat, thus allowing identification of actions to overcome the threats.

Using the value and threat scores in RiVERS, risk assessments were conducted for combinations of threat and value in each reach in the *Wimmera CMA* region.

Various combinations of threat levels and value ratings were determined to have various degrees of risk, which could be associated with a specified management response (action priority).

These are:

- **Very High:** Where a high level of threat is almost certain to have an impact on a high value asset. This risk level has the highest priority for a management response, with an urgent need to reduce the level of the threat to protect the asset.
- **High:** Where a threat is very likely to have an impact on a high value asset. This rating suggests that threat reduction should be a high priority (but less than for a Very High risk threat).
- **Medium:** Where there is some elevated chance that the asset may be affected. If possible, threat reduction should be considered, but the value should at least be monitored to establish any decline, and the threat should not be allowed to increase in severity.
- **Low:** Where the immediate risk to the asset is relatively low, but any increase in the threat level is potentially serious. The management response is to prevent an increase in the level of threat.

The methodology is outlined in more detail in the *Wimmera WHS* Resource Book, Part 6, Sub-folder 16.

2.5 setting targets

In accordance with National and Victorian Frameworks, the *Wimmera WHS* includes aspirational, resource condition and management action targets. The definitions of the different targets are:

- **Target:** a measurable result expected to be achieved within a given timeframe.
- **Aspirational Target (AT):** long-term visions or goals to be achieved over 50+ years.
- **Resource Condition Target (RCT):** medium-term condition goals to be achieved by completing the Management Action Target (over a 10-20 year period).
- **Management Action Target (MAT):** short-term targets specific to management actions that need to be implemented to achieve progress towards the Aspirational Targets (to be conducted over a 1-5 year period).



The *Wimmera WHS* does not stand in isolation, and must be considered in the context of other policies, strategies and plans for the management of waterway health. The targets set in the *Wimmera* must be consistent with objectives and targets established elsewhere. This includes international objectives, such as those established under the Ramsar convention, national targets for salinity and waterway health and Victorian targets and objects such as those in the *VRHS* and the *SEPP (WoV)*. In addition, there are already existing targets and management actions within the *Wimmera RCS* with which the targets set in the Strategy should consider and build upon.

Initially, Aspirational Targets were set to identify key conditions that need to be met for achieving the vision for *Wimmera* waterways (see Part 3).

Actions in priority and influencing waterways were developed under the prioritisation process described in 2.4 above. The completion of these actions were developed into Management Action Targets for each Reach and Waterway Management Unit (see Part 4).

Based on a number of assumptions relating to how the environment will respond to management actions, and how those responses will become evident in subsequent monitoring, Resource Condition Targets were set that represent the outcomes of the actions. These assumptions are outlined in the *Wimmera WHS* Resource Book, Part 6, Sub-folder 17.

Finally, it is recognised that all of the actions identified cannot be completed in the lifetime of this strategy (by 2011). When integrated into the broader Waterway Health Programs (Part 5), some overall Management Action Targets have been modified to annual targets to represent pragmatic and achievable outcomes, given the potential constraints of capacity and funding.

All targets were set on the basis of the best information available at the time. Targets were set in accordance with the National Framework for Natural Resource Management Targets and the *VRHS*. Additional targets, not mandated by either of these documents were developed for assets and programs specific to the *Wimmera CMA* region (see Part 5).

More details on targets are in the *Wimmera WHS* Resource Book, Part 6, Sub-folder 17.

2.6 strategic actions

The *Wimmera WHS* is informed by a wide range of sub-strategies, action plans, management plans, and guiding documents. The review of these documents, undertaken in the early stages of preparation of the Strategy, identified that a wide range of actions had already been developed to achieve waterway health outcomes.

With the identification of high priority waterways and waterway values at risk and resource condition and management action targets established, identification of actions that would achieve targets and address threatening processes was undertaken. Parts 4 and 5 of the *Wimmera WHS* contain a series of strategic and specific management actions that bring together targets, actions, costs, responsible agencies and priority waterways.

3 strategy implementation

wimmera waterway health strategy

Improvement in the health of waterways in the Wimmera CMA region can only occur when all parties engage in the planning and implementation of the *Wimmera WHS*. The skills, capabilities and roles of individuals, organisations, Local Government and other Government agencies have the potential to give effect to the Strategy, however the challenge remains to foster the relationships between these groups, and to ensure that actions to achieve improvements in waterway health are undertaken in partnership.

The implementation of the *Wimmera WHS* is the primary responsibility of Wimmera CMA, in partnership with the Wimmera community, Local Government, GWMWater, and State Government agencies (DSE, DPI, EPA). Resources from these agencies, groups and individuals needs to be directed to the areas of highest priority, as identified in the Strategy, while reflecting the cost-sharing principles, also outlined in the Strategy.

Wimmera CMA, as the caretaker of waterway health and the statutory waterway and floodplain manager, is responsible for implementation of the bulk of the actions identified in the Strategy. Actions to be undertaken by other agencies and individuals have been identified where possible. It is also important to note that other Strategies, Action Plans, and the like, that are developed under the auspices of the *Wimmera RCS* may also contribute to waterway health, but are not directly costed or implemented under the *Wimmera WHS*.

The *Wimmera WHS* will be implemented within an adaptive management framework. The implementation of monitoring, evaluation and reporting is necessary in ensuring that management actions are being implemented and are contributing to the achievement of Resource Condition Targets and ultimately conservation or improvement in the Wimmera's waterways.

With much of the knowledge in waterway health under development, the *Wimmera WHS* will be subject to periodic review to ensure that listed actions are accurate, up-to-date and based on the best available information.

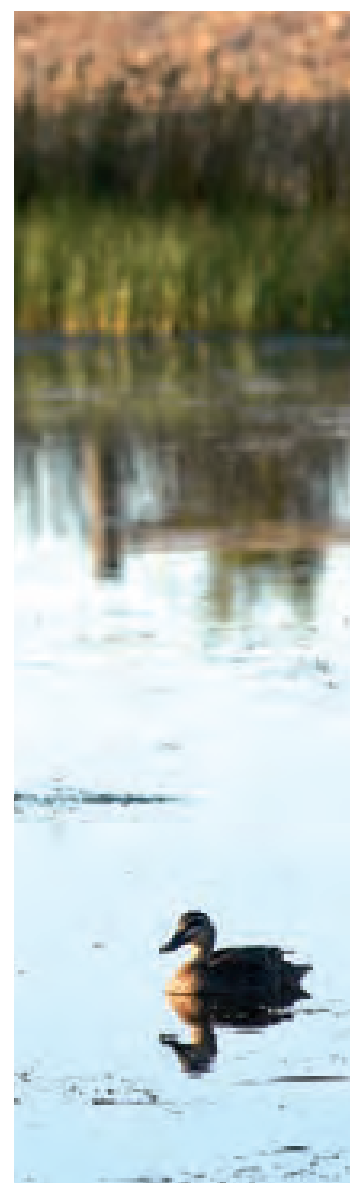
Further to this, as actions are completed, priorities for ongoing actions will shift, necessitating review of the strategy. The *Wimmera WHS* is intended to be reviewed every five years.



part two

waterways of the wimmera

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1 waterways of the wimmera

wimmera waterway health strategy



The Wimmera CMA region covers sections of the Wimmera River Basin and the Millicent Coast Basin (Map 2.1).

The major waterway of the Wimmera River Basin is the Wimmera River. The Wimmera River has a catchment of about 2.4 million hectares (ha) in northwest Victoria. Numerous tributaries rise in the Mount Buangor State Park and the Pyrenees Ranges, joining the main Wimmera River upstream of Glenorchy. Water is also received from the major sub-catchments of Wattle, Concongella and Mt William creeks. The Wimmera River flows west to Horsham where it collects the waters of Burnt Creek and, just downstream the MacKenzie River, and Norton Creek from the south. MacKenzie River and these other streams flow from the northern part of the Grampians National Park, which lies at the southern boundary of the Wimmera CMA region.

↑ legend

— Rivers*

WETLANDS

— Freshwater Meadow

— Shallow Freshwater Meadow

— Deep Freshwater Meadow

— Permanent Open Freshwater

— Semi-Permanent Saline

— Permanent Saline

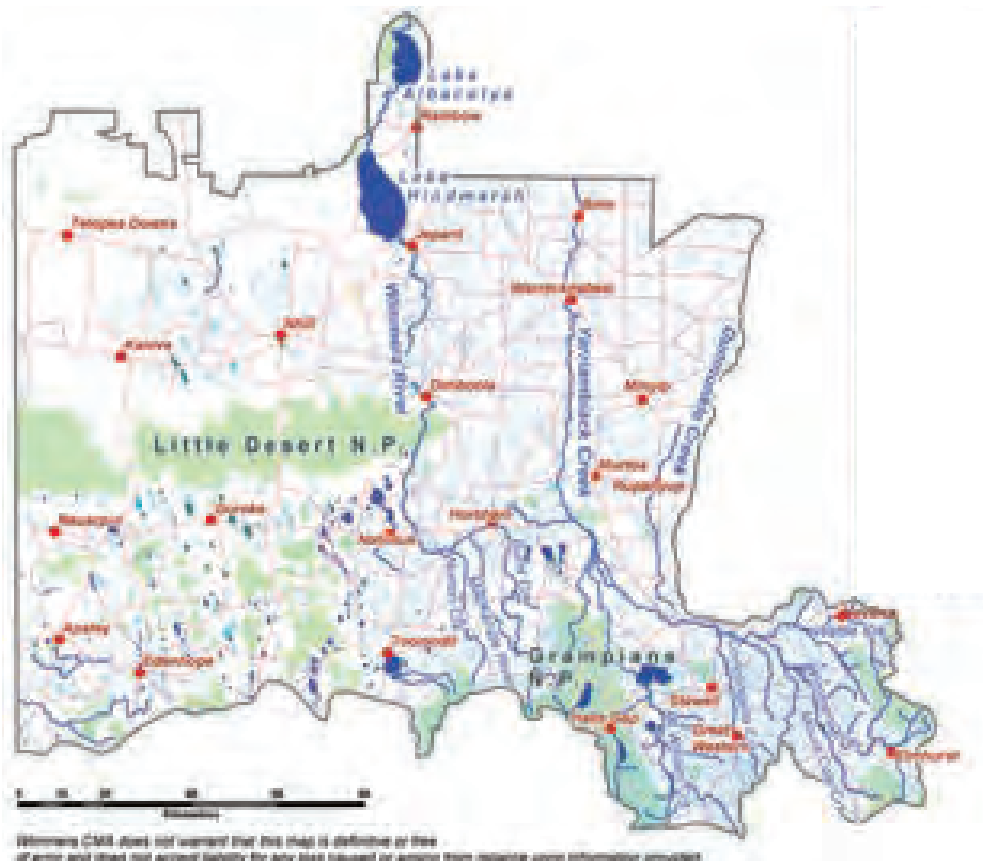
● Major Towns*

— Major Roads*

— Public Land*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.1 waterways of the wimmera CMA region

Just east of Mt Arapiles, the river swings to the north and continues through Dimboola and Jeparit to Lake Hindmarsh, Victoria's largest freshwater lake. During exceptionally wet periods Lake Hindmarsh overflows into the ephemeral Outlet Creek and onto Lake Albacutya, a Ramsar wetland, extending to the Wirrengren Plain in Victoria's Mallee region. Overflow of Lake Hindmarsh into Outlet Creek has only occurred five times this century, the last in 1996. Historic records show flooding of lakes beyond Lake Albacutya, though they have not received floodwater since 1974/75.

The Wimmera River between Polkemmet (10 km northwest of Horsham) and Wirrengren Plain has been proclaimed a Victorian 'Heritage River' under the Heritage Rivers Act 1992.

A notable feature of the Wimmera River system is the effluent streams or distributaries, Yarriambiack and Dunmunkle creeks, which carry water from the Wimmera River. Yarriambiack Creek flows from Longerenong through Warracknabeal, Brim and Beulah into Lake Coorong near Hopetoun. Dunmunkle Creek, carries water north from Glenorchy through Rupanyup, dissipating in the southern Mallee.

The main features of Millicent Coast Basin waterways are wetlands, terminal streams and small ephemeral west-flowing streams.

There are over 3,000 wetlands in the region, 90% of which are in private ownership. Most of these occur in the Millicent Coast Basin. Many of these wetlands are ecologically of state significance as well as being important water storages and recreational areas. These wetlands are also economically important for agriculture and tourism.

The Millicent Coast Basin is also characterised by a number of streams that flow west into South Australia. Management of these streams including Mosquito, Koijak, Morambro, Tatiara and Thompson creeks is important due to cross-border impacts.



2 waterway management units

wimmera waterway health strategy

The Wimmera CMA region is divided into 19 Waterway Management Units (Map 2.2):

- | | |
|---|--|
| 1. Upper Wimmera River system | 11. Natimuk Creek system |
| 2. Mt Cole Creek system | 12. Heritage River system |
| 3. Wattle Creek system | 13. Terminal Lakes system |
| 4. Concongella Creek system | 14. Yarriambiack Creek system |
| 5. Upper Mt William Creek system | 15. Dunmunkle Creek system |
| 6. Lower Mt William Creek system | 16. Millicent Coast lakes system |
| 7. Grampians system | 17. Millicent Coast west-flowing system |
| 8. MacKenzie River and Burnt Creek system | 18. Little Desert National Park system |
| 9. Norton Creek system | 19. North from the Little Desert National Park |
| 10. Lake Toolondo Creek system | |

Within management units, the waterways are identified by waterway reaches and wetlands. Eighty-six individual reaches have been identified in rivers and streams of the region. Reach numbering in this strategy is based on Wimmera CMA reach numbering which may differ from the revised 2004 ISC reach numbering. A list of the CMA reach numbers and the revised 2004 ISC reach numbers can be found in the *Wimmera WHS Resource Book*, Part 6, Sub-folder 11 (in the Summary of 1999 and 2004 ISC Condition Results for Wimmera file and in Table 2.1 on page 2-9).

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Other Waterways/Channels*

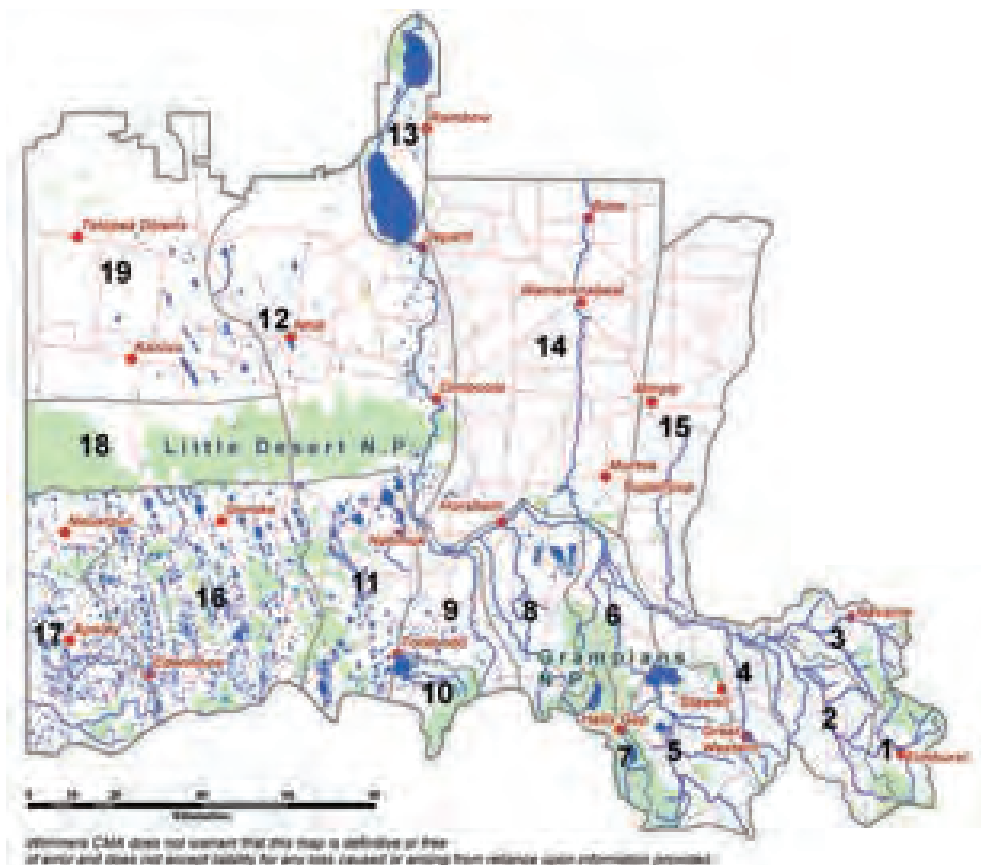
Major Towns*

Major Roads*

Public Land*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.2 Wimmera CMA region waterway management units

3 waterway assets

wimmera waterway health strategy

Protecting waterway assets is a key objective of the *Wimmera WHS*. It is important to keep this objective at the forefront of our minds when using the Strategy. The focus of natural resource management is on protecting the environmental services provided by the environment. The *Wimmera WHS* goes one step further to focus on the threats to those values, as well as the values themselves.

The key waterway assets of the Wimmera are identified in the *Wimmera RCS* and include:

- Wetlands and Streams of the Wimmera River Basin.
- Terminal Lakes of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.

3.1 wetlands and streams of the Wimmera river basin

The Wimmera River is the major waterway in the Wimmera (Map 2.3). The river is the focus of many social, cultural and environmental values. The lower reaches of the Wimmera River have been proclaimed as a Victorian 'Heritage River' in recognition of many of these values.

↑ legend

-  Rivers*
-  Wetlands*
-  Waterways*
-  Major Towns*
-  Public Land*
-  Wimmera River Basin Boundary*



MAP 2.3 wetlands and streams of the Wimmera river basin

The *Wimmera RCS* objective for the Wetlands and Streams of the Wimmera River Basin is that the flow regime and water quality of its wetlands and streams should be sufficient for recreation, stock and domestic and commercial purposes while sustaining viable populations of native flora and fauna. Stream courses should not erode at accelerated rates and floodplain management should be sympathetic to natural processes.

3.2 terminal lakes of the Wimmera river basin

The Wimmera River is the largest river in Victoria that does not flow to the sea. The river flows into a series of Terminal Lakes in the north of the region, starting at Lake Hindmarsh and flowing through to the Ramsar-listed Lake Albacutya (Map 2.4). Sustained high flows are required for water to flow to Lake Albacutya. In extremely wet periods, Lake Albacutya overflows to a series of smaller wetlands and the Wirrengren Plain in the Mallee region.

The *Wimmera RCS* objective for the Terminal Lakes system is to maintain and improve the environmental values of the lakes' ecosystems and connecting waterways and provide sustainable recreation opportunities.



↑ legend

-  Rivers*
-  Wetlands*
-  Waterways*
-  Major Towns*
-  Public Land*
-  Wimmera River Basin Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



Wimmera CMA does not warrant that this map is definitive or free of error and does not accept liability for any loss caused or arising from reliance upon information provided.

MAP 2.4 terminal lakes of the Wimmera river basin

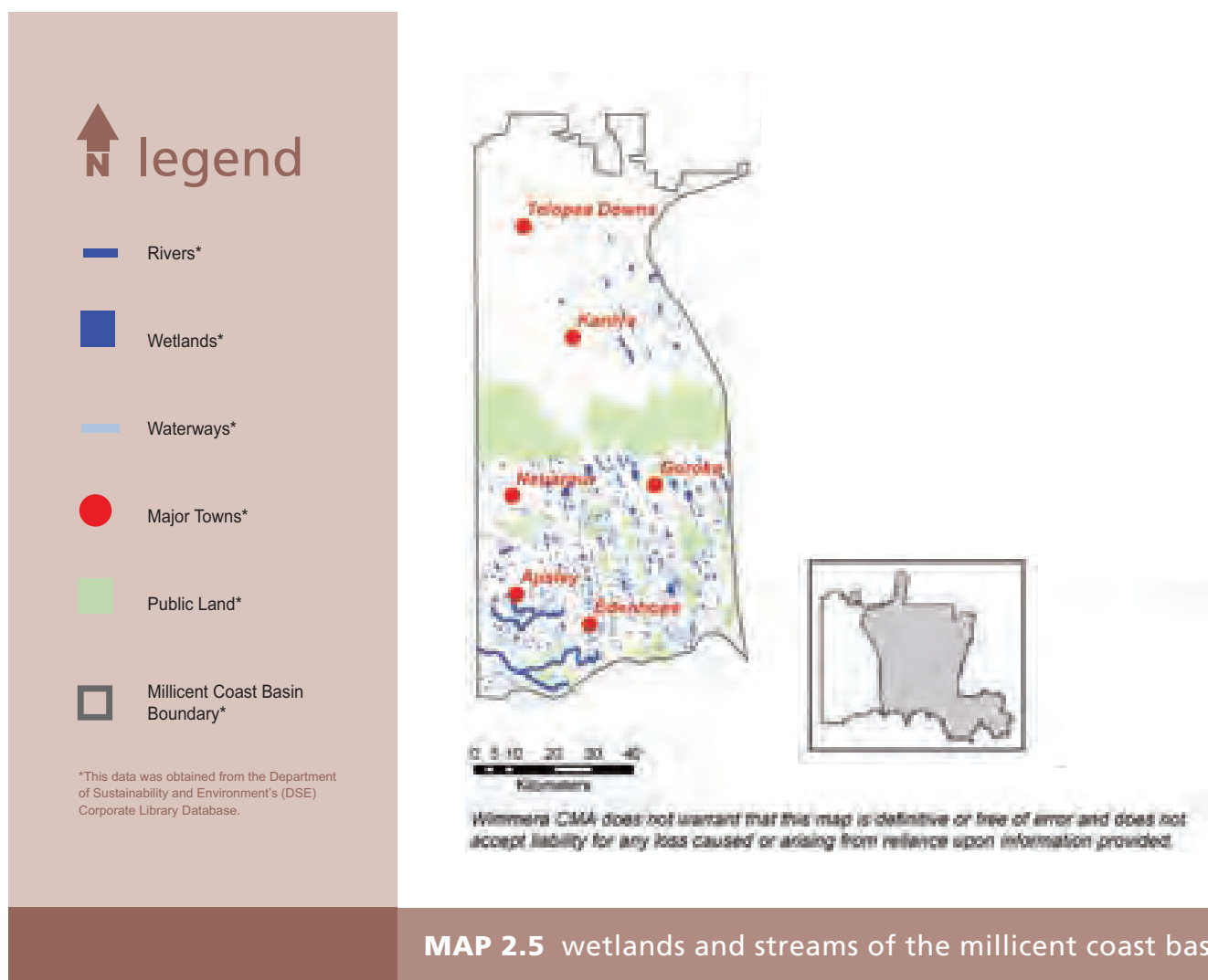
3.3 wetlands and streams of the millicent coast basin

The Wimmera is home to one-quarter of Victoria's wetlands including permanent lakes and seasonal and saline wetlands. Many of these are located in the Millicent Coast Basin part of our region (Map 2.5).

The Millicent Coast Basin also has a number of waterways that flow across the border into South Australia and terminal waterways that end in wetlands.

The *Wimmera RCS* objective for the Wetlands and Streams of the Millicent Coast Basin is that the surface waters are protected for their ecological, social and economic values by:

- Maintaining and protecting their biodiversity.
- Protecting and enhancing surface water quality.
- Averting and removing drainage works that unduly impact on the natural flow regime.



4 wimmera waterway condition

wimmera waterway health strategy

4.1 rivers and streams

The conditions of many of the waterways within the Wimmera CMA region were classified in 1999 and 2004 using the Index of Stream Condition (ISC) waterway health assessment. The condition of the region's streams varied quite considerably (Figure 2.6). The waterway classifications were distributed in an approximate 'bell-curve' shape, with over half of the length of waterways in the region being in a 'moderate' condition (875 km) with the remainder mainly being classified in 'good' (148 km) and 'poor' (266 km) condition, as well as smaller lengths in 'excellent' (27 km) and 'very poor' (25 km) condition.

Within the Wimmera River Basin, the total ISC scores were heavily influenced by the many low scores calculated for the hydrology sub-index. The low scores are due to the presence of highly-modified flow regimes as large volumes of water are diverted for use in the stock and domestic channel system. Some reaches in the upper Wimmera region as well as Norton Creek and Golton Creek score highly due their natural or near-natural flow regimes.

The classifications of numerous stream reaches, especially the smaller tributaries of the Wimmera River, are also affected by relatively low scores for the streamside zone and physical form sub-indices. The low scores for the streamside zone sub-index are attributed to heavily-modified vegetation due to land clearing, stock access and the presence of invasive weeds. The physical form sub-index scores are affected by such things as the accelerated erosion of the stream banks and beds. The most concerning issue is the absence of Large Woody Debris (LWD) from channels.



legend

River Reaches by 2004 Index of Stream Condition (ISC)

- Excellent
- Good
- Insufficient Data
- Moderate
- Poor
- Very Poor

11 River Reach No.

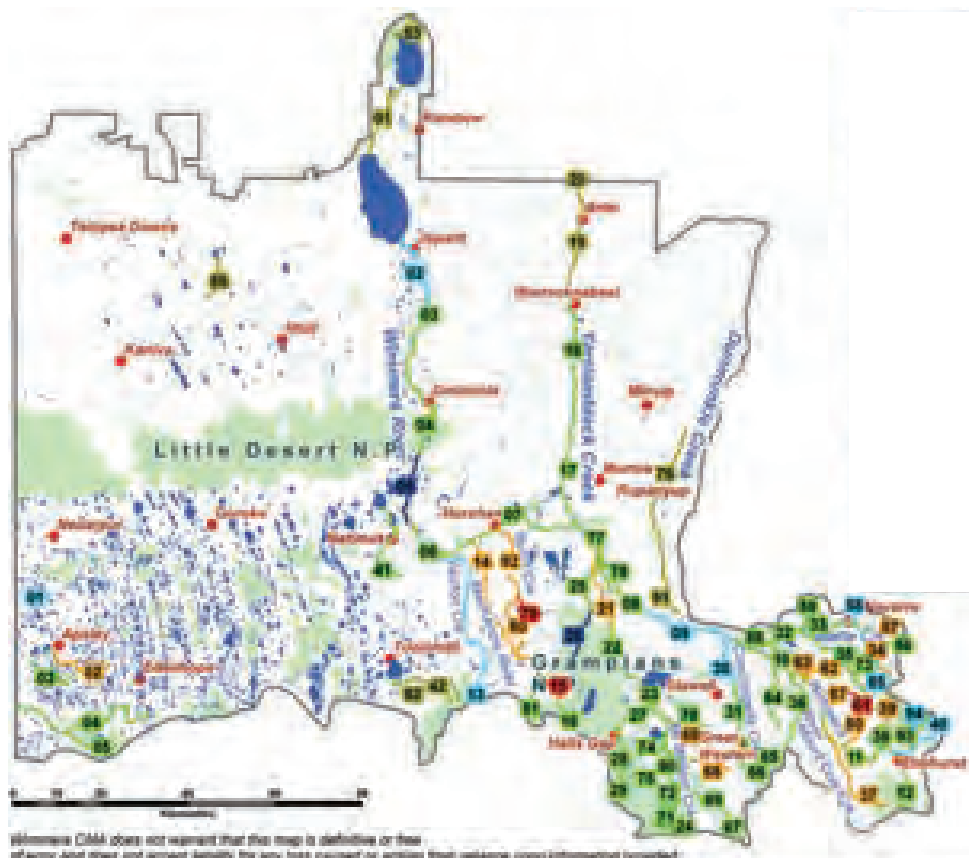
Wetlands*

Major Towns*

Public Land*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.6 environmental condition of waterways in the Wimmera CMA region (2004 ISC)

Measurement of the water quality and aquatic life sub-indices only took place at relatively few reaches monitored by the Environment Protection Authority (EPA) and Victorian Water Quality Monitoring Network. However, their higher ISC scores demonstrate that water quality and aquatic life are generally classified as being in a better condition than the other sub-indices.

The stream reaches within the Millicent Coast Basin (Map 2.6) are on the whole in better condition than those in the Wimmera River Basin, mostly due to the fact that flows are unmodified by diversions – thereby gaining high scores for the hydrology sub-index. The physical form sub-index scores were also relatively high, indicating that the streams are relatively unaffected by accelerated erosion/aggradation and other impacts to the physical form and habitat. The streamside zone sub-index scores were slightly lower because these waterways flow through mostly rural land. Aquatic life and water quality sub-index scores were not obtained for the Millicent Coast Basin.

For a summary of the 2004 ISC ratings for Wimmera Waterways, refer to Table 2.1.

The condition of the rivers and streams in the Wimmera River and Millicent Coast basins will be determined and regularly using the state-wide ISC tool.

TABLE 2.1 summary of 2004 index of stream condition results for Wimmera waterways

basin	mgt unit	reach no.	waterway	length (km)	2004 stream condition	2004 ISC reach no.
WIMMERA RIVER BASIN	1	12	Wimmera River	30	moderate	12
		38	Glenlofty Creek	09	moderate	72
		39	Glenlofty Creek	10	poor	73
		40	Glenpatrick Creek	17	good	76
		93	Nowhere Creek	12	moderate	74
		94	Tributary of Nowhere Creek	05	good	75
	2	10	Wimmera River	35	moderate	10
		11	Wimmera River	21	moderate	11
		36	Six Mile Creek	25	moderate	65
		37	Mt Cole Creek	29	poor	70
		60	Spring Creek	12	poor	71
		61	Unknown 13	08	very poor	69
		62	Unknown 12	08	poor	66
		63	Tributary of Aston's Scour	11	poor	67
		64	Seven Mile Creek	20	moderate	64
		87	Unknown 13	08	poor	68
		88	Seven Mile Creek	15	moderate	52
	3	32	Wattle Creek	14	moderate	53
		33	Heifer Creek	23	moderate	54
		34	Heifer Creek	10	poor	55
		35	Melakoff Creek	29	moderate	58
		55	Unknown 8	08	good	56
		56	Unknown 7	08	moderate	63
		57	Unknown 6	05	poor	62
		58	Unknown 5	08	good	61
		59	Heifer Station Creek	11	moderate	57
		73	Native Youth Creek	06	moderate	60
		83	Tributary of Wattle Creek	04	moderate	59
	4	09	Wimmera River	30	good	09
		30	Concongella Creek	16	good	48
		31	Concongella Creek	23	moderate	49
		65	Upper Tributary of Allenvale Creek	11	moderate	50
		66	Tributary of Concongella Creek	16	moderate	51

TABLE 2.1 (continued)

basin	mgt unit	reach no.	waterway	length (km)	2004 stream condition	2004 ISC reach no.
WIMMERA RIVER BASIN	5	23	Mt William Creek	27	moderate	30
		24	Georges Creek	20	moderate	31
		27	Fyans Creek	10	moderate	32
		67	Unknown 9	10	moderate	42
		68	Upper Tributary of Pentland Creek	12	poor	40
		69	Unknown 4	11	poor	37
		70	Basin Creek	13	moderate	36
		71	Reservoir Creek	15	moderate	44
		72	Unknown 2	09	moderate	43
		74	Unknown 3	09	moderate	38
		89	Lower Tributary of Spears Creek	18	moderate	41
		90	Lower Tributary of Pentland Creek	09	moderate	39
	6	08	Wimmera River	32	moderate	08
		21	Mt William Creek	24	poor	28
		22	Mt William Creek	19	moderate	29
		25	Golton Creek	15	moderate	26
		26	Golton Creek	14	excellent	27
		77	Anabranh of Wimmera River	04	moderate	25
		78	Sheepwash Creek	14	moderate	45
	7	16	MacKenzie River	10	moderate	16
		28	Fyans Creek	08	moderate	33
		29	Fyans Creek	10	moderate	34
		75	Barney Creek	05	moderate	35
	8	07	Wimmera River	45	moderate	07
		14	MacKenzie River	45	poor	14
		15	MacKenzie River	08	very poor	15
		79	Tributary of Burnt Creek	09	very poor	20
		80	Burnt Creek	25	poor	19
		81	Boggy Creek	14	moderate	17
		92	Burnt Creek	24	poor	18
	9	06	Wimmera River	29	moderate	06
		13	Norton Creek	47	good	13
	10	42	Mt Talbot Creek	17	i.d.	87
		82	Tributary of Toolondo Reservoir	20	i.d.	88
	11	41	Natimuk Creek	25	moderate	89
	12	02	Wimmera River	32	poor	02
		03	Wimmera River	30	moderate	03
		04	Wimmera River	21	moderate	04
		05	Wimmera River	23	moderate	05
		86	Yanac Creek	11	i.d.	90
	13	01	Outlet Creek	28	i.d.	01
		53	Outlet Creek	72	i.d.	91

Note: i.d. – insufficient data to determine ISC score or rating

TABLE 2.1 (continued)

basin	mgt unit	reach no.	waterway	length (km)	2004 stream condition	2004 ISC reach no.
WIMMERA RIVER BASIN	14	17	Yarriambiack Creek	34	moderate	21
		18	Yarriambiack Creek	32	moderate	22
		19	Yarriambiack Creek	37	i.d.	23
		20	Yarriambiack Creek	40	i.d.	24
	15	76	Dunmunkle Creek	44	i.d.	47
		91	Dunmunkle Creek	14	i.d.	46
MILLICENT COAST BASIN	17	01	Thompson Creek	03	good	01
		02	Kojak Creek	14	good	02
		03	Yalla Creek	14	moderate	03
		04	Mosquito Creek	39	moderate	04
		05	Mosquito Creek	13	excellent	05

Note: i.d. – insufficient data to determine ISC score or rating

4.2 wetlands

In 2005, Wimmera CMA conducted an assessment of wetland condition for wetlands in the Natimuk-Douglas Chain of Lakes (Wimmera River Basin) and the Millicent Coast Basin (Map 2.7). A selection of representative wetlands were assessed for their physical, chemical and biological condition.

Most wetlands assessed appear to be in good to moderate condition with 75% of the wetlands surveyed as moderate to good. In the Natimuk-Douglas Chain of Lakes and the wetlands south of the Little Desert, the general condition of wetlands is good with only a few wetlands showing signs of stress. Wetlands south of Edenhope show a higher proportion of sites with moderate to poor hydrological integrity. Wetlands north of Little Desert are all showing signs of stress from prolonged drought. It is, however, anticipated that flowing rains will result in many of these systems being considered as in a moderate to good condition.

While these preliminary investigations reveal that most wetlands are in a moderate condition, it should be noted that the wetlands are being threatened by drainage works, altered flow regimes, agricultural practices and invasion of pest plant and animal species.

For more details on wetland condition refer to *Wimmera Wetland Condition Assessment Project* (2005).

The condition of the wetlands in the Wimmera River and Millicent Coast basins will be determined regularly, using a state-wide Index of Wetland Condition (IWC) tool.



legend

— River Reaches*

WETLAND CONDITION RATING

- Good
- Moderate - Good
- Moderate
- Poor - Moderate
- Poor

WETLANDS

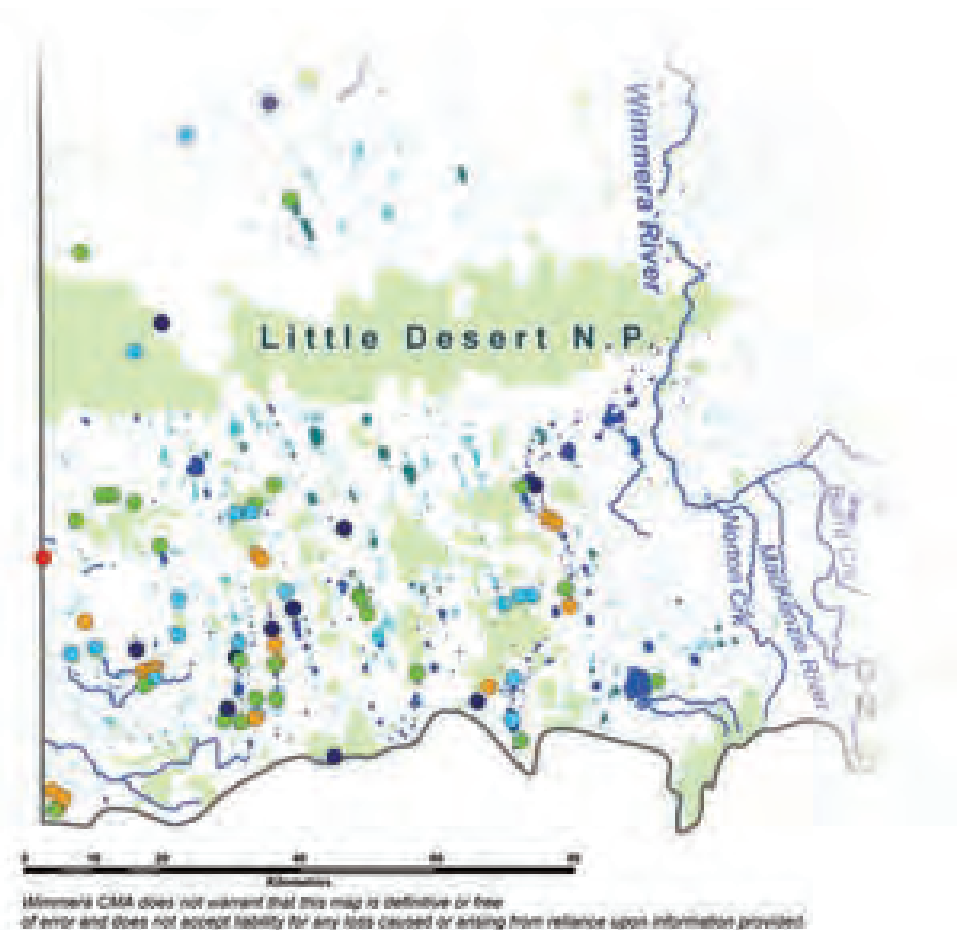
- Freshwater Meadow
- Shallow Freshwater Meadow
- Deep Freshwater Meadow
- Permanent Open Freshwater
- Semi-Permanent Saline
- Permanent Saline

— Other Waterways/Channels*

Public Land*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.7 wetland condition in the Wimmera CMA region assessed during the 2005 wetland condition assessment

5 wimmera waterway values

wimmera waterway health strategy

Waterways make up only a small portion of the Victorian landscape and yet their overall significance for the economy, the ecology and the social fabric of the state is immense.

In an economic sense, our society is dependent on waterways as a key component of our natural infrastructure.

Waterways provide safe drinking water for four million people, and water to support our rural production, including \$5.2 billion of irrigated agricultural and aquacultural production. They are a key input to our manufacturing industries. However, this statement of the community's economic reliance on waterways does not acknowledge their social value. In the past, nearly every town in Victoria was situated on or near a river to provide a source of water and transport.

Consequently, the waterways have become entwined in the lives and histories of people. Waterways have been the focus for recreation, and have provided community meeting places and an attraction for people outside their region.

Communities have fought their waterways during floods and anxiously watched them in droughts. People have grown up beside their waterways, linking their personal growth with the annual or seasonal changes in the waterway. As a result of this, for many in the community, waterways have a special place in their memories and are deeply associated with their 'sense of place' and 'belonging'. This is particularly true for Indigenous Victorians.

Waterways are also important to Victorians at play. They provide a pleasant environment for walking, picnicking, swimming, hiking, canoeing and rafting. In particular, they are the focus for some 550,000 anglers who contribute at least \$400 million to the state economy. Moreover, waterways are becoming more and more the hub for regional tourism as the interest in nature-based and adventure tourism increases.

Finally, waterways and their associated floodplains are diverse and complex ecosystems in their own right. They support a large array of native flora and fauna (many of which are threatened or endangered); are highly important in the movement and cycling of sediment and nutrients through the landscape; and are a significant interface between aquatic and terrestrial systems. While these environmental values have long been well-known and appreciated, we are only now becoming aware of a range of ecosystem services that functioning riverine ecosystems can provide to human communities, such as purification of water by natural catchments. As we start to fully appreciate the level of service provided by waterways in these areas, it will be possible to put an economic value on them.

Virtually all these values that waterways provide to our community, whether they are economic, social or environmental, are reliant to some extent on river condition. Some values, such as maintaining ecological communities, tourism, supply of clean drinking water or recreational fishing, require rivers to be in good condition. Others, such as irrigation or power boating, have less stringent requirements.

The following discussion provides information on the social (cultural and recreational), economic and environmental values of Wimmera waterways.

5.1 cultural values of waterways in the wimmera

Waterways have always played an important role in the lives of people living in the region. Cultural heritage sites are the physical manifestation of human occupation and utilisation of the landscape, normally relating to cultural groups, processes and activities in the past, and are representative of a wider cultural landscape that are representative of activities practised in the past. Many sites of cultural significance as well as artefacts and structures from the past can be found on or near waterways.



aboriginal cultural heritage

Given the degree of disturbance through landscape clearance, intensive modern farming techniques, urban development, and natural erosion, evidence of traditional Aboriginal activities has become an increasingly diminishing component of the wider cultural landscape.

Modern Aboriginal people place a high social value on the comparatively few sites that have survived the impact of European settlement, as they collectively help the community preserve knowledge of its traditional mode of existence. Given the pace of land clearance in the 19th Century, the dispossession of Aboriginal people from their land and the subsequent natural and human erosion processes, every single occurrence of cultural material can be seen as a unique and irreplaceable element of Aboriginal heritage, which should not be undervalued.

Aboriginal cultural values can frequently be integrated with natural values; hence undeveloped reserve land represents the survival of both important cultural sites and the resources essential for continuation of traditional life. This is understandably viewed by Aboriginal people as an ancestral inheritance, as demonstrated by the number of claims made throughout Victoria under the *Native Title Act 1993*.

It is important to protect Aboriginal heritage cultural sites, as they are an unrenowable source of both scientific information about traditional culture, and spiritual and cultural value to Indigenous Australians. A number of cultural heritage studies have been done across the Wimmera that make recommendations for managing sites of Aboriginal cultural heritage. These studies have been completed for Yarriambiack Creek and the upper and middle sections of the Wimmera River Basin. Over 2,000 sites of Aboriginal archaeological significance have been recorded in the Wimmera. The Grampians National Park contains the most important Koori art site in southeast Australia from Aboriginal occupation of the area that dates back more than 5,000 years.

Known sites of Aboriginal cultural significance are listed by the National Trust and Aboriginal Affairs Victoria. However, significant sites may be located in areas where the natural landscape is less disturbed such as along the banks of waterways. As such, these areas should be investigated and Aboriginal peak bodies consulted prior to any development proceeding.

The *Wimmera RCS* recognises Indigenous communities and their perspectives of landscapes and tradition and interests and rights in the land in the region. Wimmera CMA is committed to involving the Wimmera Indigenous community in natural resource management.

european cultural heritage

Sites of European cultural heritage also exist throughout the region. They too offer insight into past practices and associations with the landscape. Knowledge of these sites tends to be more available, as the history of European heritage in the region is still only about 160 to 180 years old.

Timber production, gold mining, quarrying, farming and the establishment of the Wimmera Mallee Stock and Domestic Supply System (WMSDSS) (which is the largest of its type in the world) have all contributed to a rich European heritage in the region. Examples are Lake Wartook, built in 1886, Heatherlie Quarry, cemeteries, the Murtoa Grainstore (Stick Shed) and Ebenezer Mission. Ebenezer is also a significant Aboriginal heritage site.

Local Government and Heritage Victoria are the lead agencies for protecting European heritage assets. Local Government planning schemes, Heritage Victoria's Heritage Register and the National Trust Register all contain the information required to determine if a site has European significance.

The consultation completed as part of preparing the *Wimmera WHS* also identified sites of local heritage, some of which may not be included in the local planning scheme or on the Victorian Heritage Register due to their significance being of local interest only. The Burra Charter provides guidance when considering the conservation of sites such as these.

wimmera heritage river

The main stem of the Wimmera River rises in the Pyrenees Range near Ararat and flows west, then north before reaching the Terminal Lakes of Hindmarsh and Albacutya. The Heritage River section of the Wimmera River extends from Polkemmet Bridge to Wirrengren Plain in Wyperfeld National Park, taking in lakes Hindmarsh and Albacutya and the Outlet Creek system (Map 2.8).

Lake Hindmarsh is the biggest natural fresh-water body in Victoria. During exceptionally wet periods, Lake Hindmarsh overflows via Outlet Creek to Lake Albacutya and onto a series of smaller lakes and the Wirrengren Plain in the Mallee region. The Terminal Lakes provide significant wildlife habitat and are important for their social and economic values.

The Wimmera Heritage River corridor is 229 km long and covers an area of 56,020 ha. The boundary of the Heritage River corridor follows the public land water frontage and streamside reserves downstream of Polkemmet, with generally a 200-metre (m) corridor on either side of the river as it passes through Little Desert National Park and Wail State Forest.

↑ legend

- Heritage River WCA
- River Reaches
- Wetlands*
- Waterways*
- Major Towns*
- Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.8 heritage river section of the Wimmera river

The Heritage River corridor has high environmental, social and cultural heritage values. The key values for the Heritage River are:

- **Environmental:**
 - The Terminal Lakes system is the largest landlocked drainage system in the state.
 - Lake Albacutya is designated as a wetland of international significance under the Ramsar Convention.
 - Lake Hindmarsh is the largest natural fresh-water body in Victoria and supports a number of significant bird species, including species listed under Japan-Australia Migratory Birds Agreement (1994) (JAMBA) and China-Australia Migratory Birds Agreement (1986) (CAMBA).
 - 87 species of significant flora.
 - Significant riparian vegetation of river red gum–black box association.
 - River red gums at Lake Albacutya are significant for their salt tolerance.
 - A vital and unique wildlife corridor in an otherwise cleared landscape.

- **Social:**
 - Recreation.
 - High local significance for recreation.
 - Opportunities for camping, fishing, swimming and water sports, particularly the Polkemmet to Little Desert area and Lake Hindmarsh.
- **Cultural Heritage:**
 - A long Aboriginal association with the area, evidenced by many archaeological site types including numerous middens and scarred trees.
 - Remains of Ebenezer Mission.

Scores for these values in the Wimmera RIVERS database demonstrate how highly the Wimmera Heritage River is rated, however, they also show there are a number of threatening processes that impact upon these values.

Lakes Hindmarsh and Albacutya are part of the Wimmera Heritage River. Under the *Heritage Act 1992*, a draft management plan has been developed for this section of the river. The draft *Heritage River Management Plan* specifies directions for:

- Preserving cultural heritage.
- Providing opportunities for recreation.
- Improving water quality.
- Managing flow regimes.
- Preventing dieback in the riparian vegetation.
- Conserving flora and fauna.

Wimmera CMA has developed a *Waterway Action Plan* for the Wimmera Heritage River in consultation with key agencies and landholders. The plan identifies high priority activities required to protect the environmental and social values of the waterway. The Wimmera WHS supports the implementation of priority actions in the *Draft Heritage River Management Plan* and the *Wimmera Heritage River Waterway Action Plan* (2005) through prioritising management actions.

5.2 social values of waterways in the wimmera

Waterways in the Wimmera CMA region play an important role in the social lives of the region's residents. At a broad level, a waterway can be the main focus for a town, with the urban area built right up to waterway banks. In these instances, the strength and vitality of the town is directly proportional to the status of the waterway; if the waterway is in poor condition, then in many instances so too is the town.

The community's views on waterway health stem from perceptions on what the issues are. For example, some individuals hold the view that the overall condition of waterway health is deteriorating, while others hold the view that it is improving. The difference in these two positions stems from the level of knowledge that each individual has. A survey conducted by Wimmera CMA as part of developing the *Wimmera RCS* indicates that the more involved a person is in natural resource management, the more up-beat their view of the state of waterway health.

Improvement in waterway health in the Wimmera CMA region can only occur if the community is fully engaged and committed to long-term objectives. Decisions made by the community regarding waterway management ultimately affect community livelihoods and quality of life.



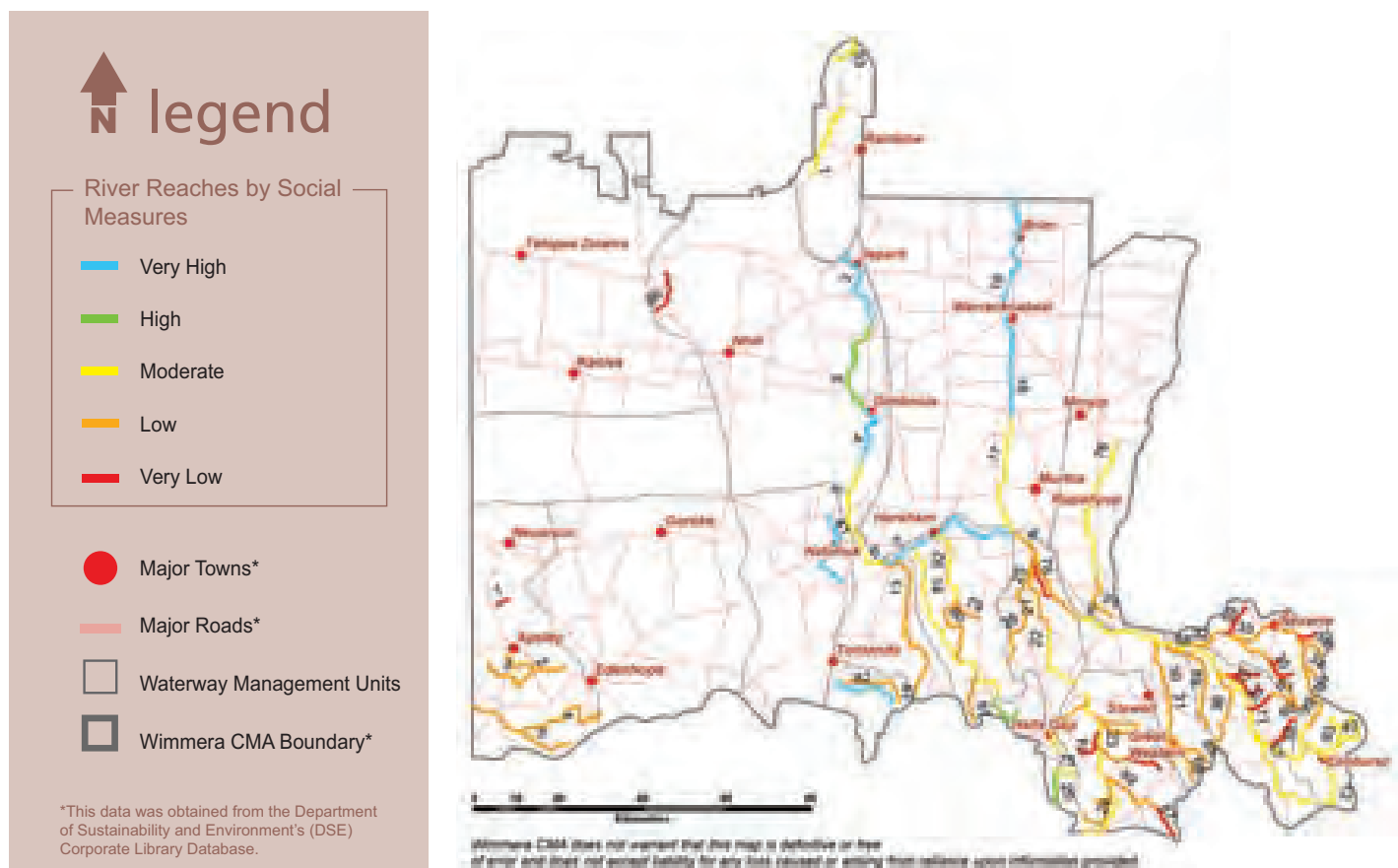
social and recreational activity

Waterways are often the focus for many social and recreational activities, by which people may measure (consciously or unconsciously) their quality of life. Results from the community consultation conducted at the start of the Wimmera WHS (using the RiVERS database) shows that for every reach in the region, at least one social value achieves the highest possible score. This demonstrates quite clearly that regardless of the waterway type, or the condition it is in, there is always some attribute of the waterway that people can strongly identify with.

Social ratings measured how popular a waterway reach was with respect to fishing, non-motor boating, motor boating, camping, and swimming. The popularity of these activities were all ranked from 1 to 5, where 1 means the activity does not occur in the reach and 5 means the reach is popular for the particular activity. The presence of European heritage was also measured in the same way; 1 means there are no heritage assets present, 3 is identified but not formally listed in any official record, 4 means where the heritage asset is listed in the local planning scheme, and 5 means the heritage asset is listed in the Victorian Heritage Register and/or the National Estate List.

Introducing the community to waterways via a social or a recreational activity is a good way of developing an appreciation of the value of waterways. This can lead to engaging the community in the broader process of waterway health planning and priority-setting.

RiVERS also calculates an overall social rating by adding the scores for the nine individual social sub-components evaluated (see Part 1). This allows Wimmera CMA to gain an objective assessment of those waterways with very high and high overall social (and cultural) values (Map 2.9).



MAP 2.9 social values of waterways

5.3 economic values in the wimmera

The economic vitality of the Wimmera can be directly related to the health of its waterways. Water is a scarce and valuable resource. A continuing decrease in waterway health in the region has led to decreases in the environmental, economic and social conditions of the region. As such, actions to address the decline in waterway health need to be couched in terms of environmental, economic and social dimensions. This is often referred to as the 'triple bottom line' approach, where the three values are given equal weight.



Agriculture is the dominant land use in the Wimmera, with almost one-third of the population depending directly on agriculture for their income. In addition to agriculture, the region has healthy manufacturing and retail sectors within the main town centres. Education, health and community services are the other major employers of the region.

agriculture

The Wimmera region's agricultural sector is dominated by broadacre cropping of cereals, oilseeds and pulses. Agricultural production in the Wimmera was worth approximately \$700 million in 1997. This included 3.4% of Victoria's livestock production and over 20% of the value of non-pasture crop production (*Wimmera RCS*, 2003).

There is significant irrigation in the Millicent Coast Basin using groundwater, largely supporting small seed production and some horticulture. Two small irrigation areas near Horsham and Murtoa utilise water from the Wimmera-Mallee storages to support mixed farming of mainly sheep and dairy cattle.

emerging industries

In recent years a vibrant viticulture industry has been established in the upper Wimmera River catchment. This depends largely on catchment dams for irrigation water. This region has been identified as an emerging area for viticulture in Australia and growth in this sector is expected to continue. This industry relies heavily on water for irrigation, and as such it is expected that as the industry grows, so too will the demand for dams and extraction licences.

Local Government also has an important role in fostering new and emerging industries. A number of municipality economic development strategies have identified the emerging viticulture industry as a priority for their region. Other water-intensive activity, such as extractive industries, has also been identified as a priority for Local Government to facilitate. While acknowledging that economic development is important for the region, it should also be noted that new development must be accommodated within the Murray-Darling Basin (MDB) cap and the Victoria-wide Sustainable Diversion Limits (SDL).

Another emerging industry in the Wimmera with significant economic values is mineral sand mining.

wimmera mallee stock and domestic supply system (WMSDSS)

Agriculture and other industries in the region are heavily dependant on water delivered to stock and domestic dams and town storages by the WMSDSS. The Wimmera River is regulated by the operation of this system and this regulation has severely altered natural flows in the Wimmera River. The WMSDSS comprises 17,500 km of open, earthen channels and 12 storages that have been in operation since the early 1900s. The distribution system suffers losses of 80-90% due to evaporation, distance and seepage.

The Wimmera Mallee storages have a full capacity of 770,000 megalitres (ML). Generally, all commitments can be fully delivered when the amount of water held in storage is more than 350,000 ML at the end of the winter/spring re-filling period. Water is harvested primarily from the Wimmera and Glenelg catchments.

Water harvested from Wimmera Mallee storages during winter/spring is stored for allocation:

- In the subsequent irrigation season which extends from November to April.
- To the environment for releases between November and May.
- For stock and domestic users for release between May and October.

Since construction of the Northern Mallee Pipeline, a total volume of 40,536 ML of water has become available for allocation to the Wimmera and Glenelg catchments for environmental purposes. This total allocation only became available in 2005/2006 but has not been delivered in full due to the limited volume of water available in storages as a consequence of low rainfall since 1997. Piping of the open channel system will soon start as part of the Wimmera Mallee Pipeline Project, and will make more water available for our region, including more water for the environment.

The Wimmera Mallee Pipeline Project will have the single greatest impact in the Wimmera during the life of the *Wimmera WHS*. A piped water supply will greatly increase surety of supply to both the environment and commercial users, providing a host of economic, social and environmental benefits to the catchment and the community.

town water supplies

GWMWater is the responsible authority for delivering town water supply and waste water services. The supply of town water should not be confused with the supply of domestic water from the WMSDSS, as described above.

GWMWater supplies water to 74 towns in the region. The quality of this water varies from fully-treated water for the larger towns to untreated water to smaller towns. GWMWater receives its water for town supplies from four major sources; the WMSDSS, headworks in the Grampians, groundwater supplies and the Northern Mallee Pipeline. Of these, the open channel system and groundwater sources (for towns in the Millicent Coast Basin) are coextensive with the Wimmera CMA region. Sixty-four stream and river reaches in the RiVERS database fall inside the Proclaimed Catchment region (Map 2.10).

public infrastructure

A vast amount of public infrastructure either crosses or is located within waterways in the region. These structures represent a significant investment of public and private capital. They need to be maintained to ensure the public continues to enjoy the use of these structures. These structures may also have an effect on the flow of water, either through altering flow or via accelerated erosion or deposition of waterway beds and/or banks. Ongoing management of these infrastructure assets needs to ensure it achieves appropriate structure height and flow management in town and regulation weirs and in other structures that alter natural flow paths.

↑ legend

Wimmera Proclaimed Water Supply Catchments*

- Wimmera Systems*
- Malakoff Creek (with special area plan)*

River Reaches

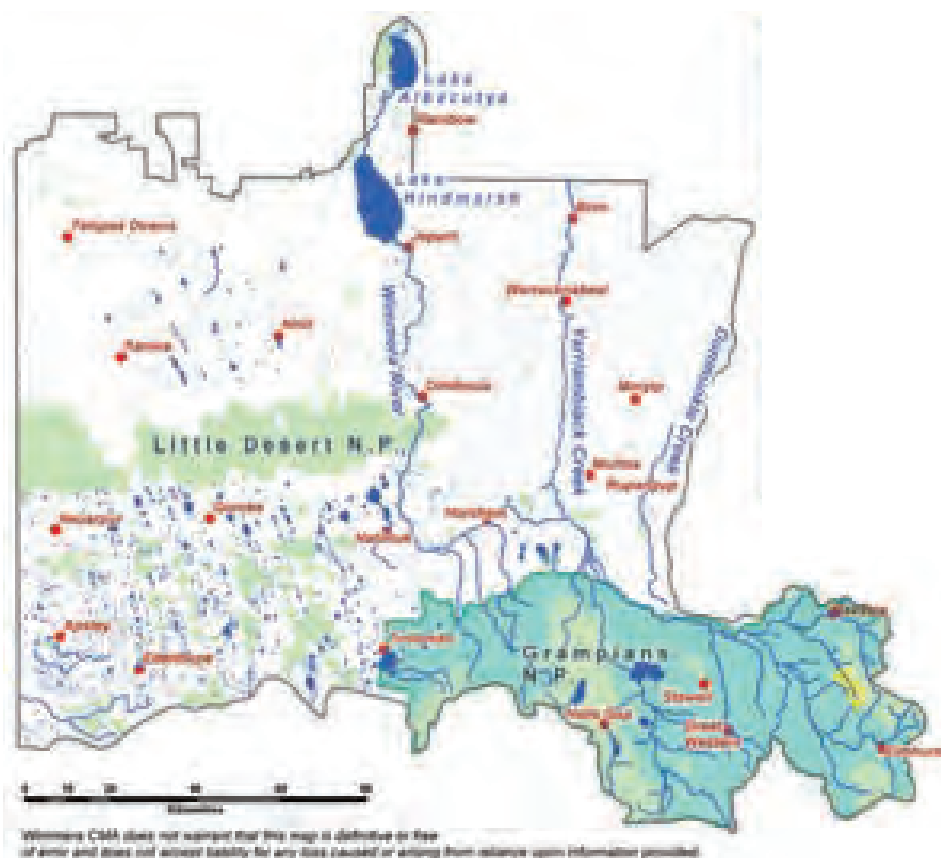
Wetlands*

Major Towns*

Public Land*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.10 proclaimed catchment in the wimmera region

tourism

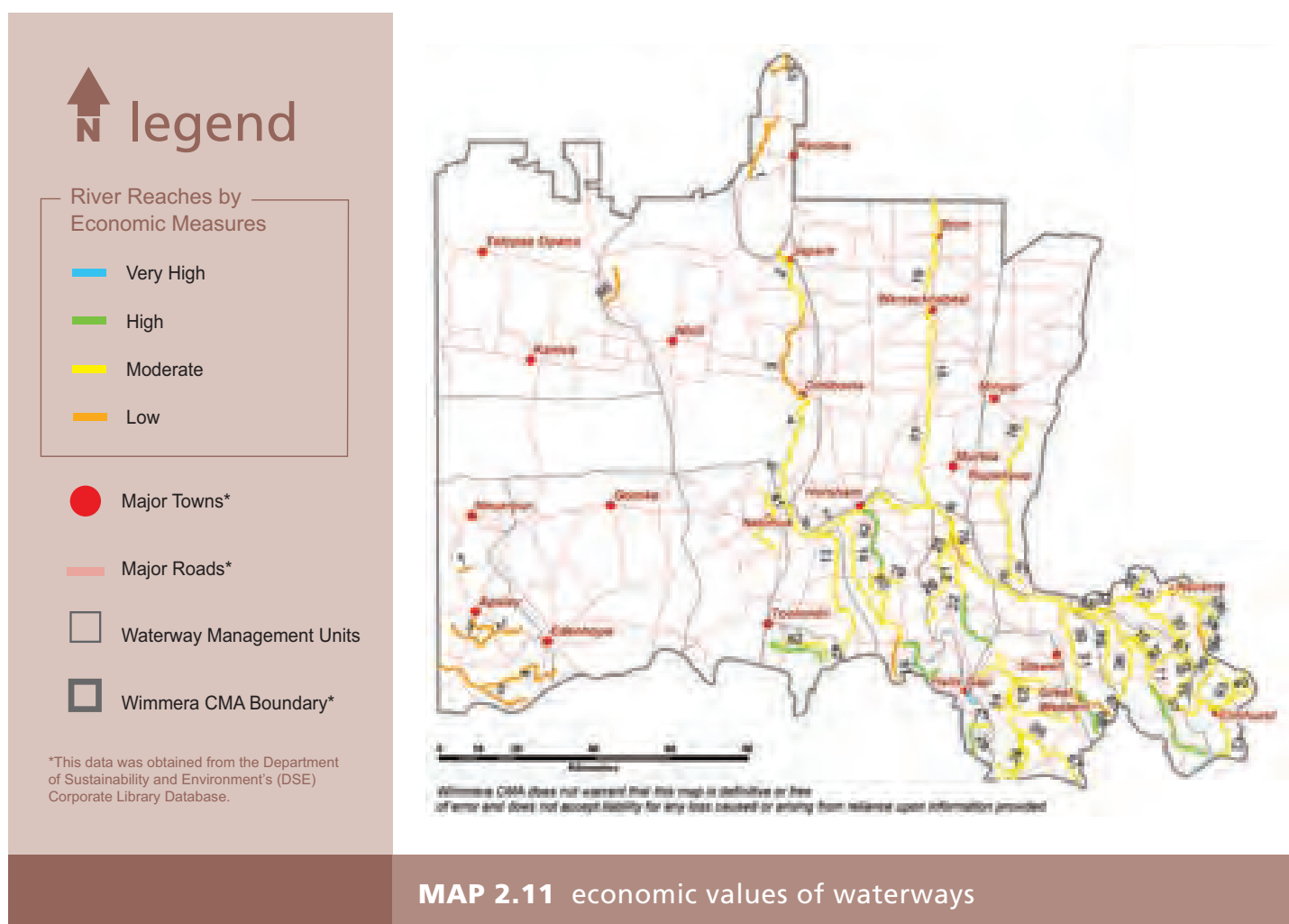
Waterways in the Wimmera CMA region also form the focus for a number of activities and events that bring tourists into the area. Recreation and tourism are also significant contributors to the regional economy. Recent estimates of income from tourism and related industries set the total value of tourism in the Wimmera region at about \$200 million per annum (Wimmera RCS, 2003-2008).

The Grampians, Big Desert and Little Desert national parks are high quality natural areas that attract visitors from throughout Australia and overseas. Lakes Hindmarsh and Albacutya are also high quality tourist attractions; bringing people to the region to participate in activities such as hunting, fishing and water sports, as well as enjoyment of scenic values. Lake Albacutya is also a Ramsar-listed wetland, which in itself attracts many bird watchers to the area.

Management plans for many parks and reserves throughout the Wimmera CMA region have been developed, and the actions identified in these are included in Parts 4 and 5 of this Strategy.

Emerging tourism opportunities may exist in the emerging viticulture industry, and in the area of eco-tourism based around the region's natural assets. Local Governments have developed, or are in the process of developing, economic development strategies that seek to develop the potential that exists in these ventures.

RiVERS also calculates an overall economic rating by adding the scores for the six individual economic sub-components evaluated (see Part 1). This allows the Wimmera CMA to gain an objective assessment of those waterways with very high and high economic values (Map 2.11).



5.4 environmental values in the wimmera

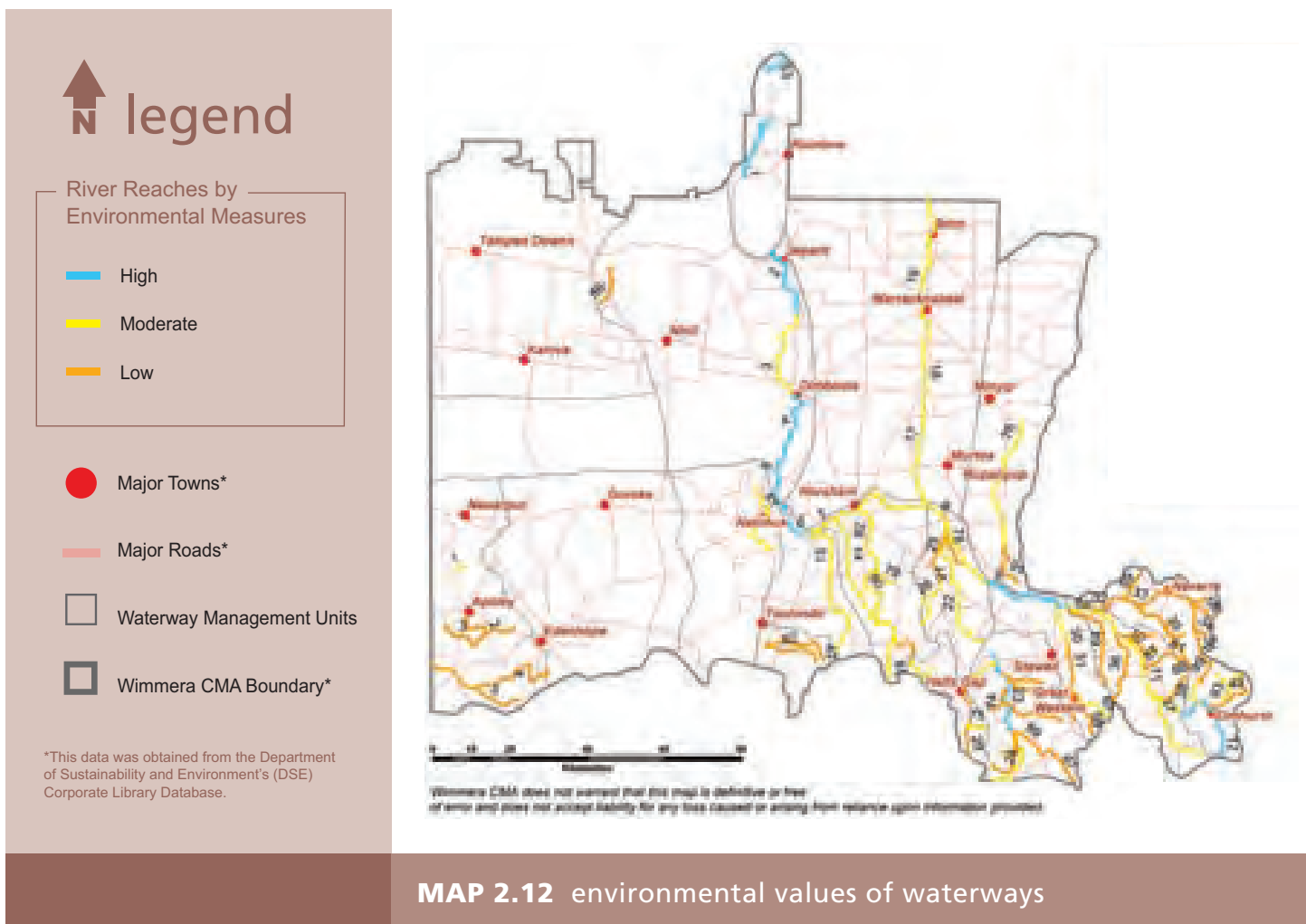
Rivers, streams and wetlands support an enormous diversity of life and provide a range of 'ecosystem services'. Healthy waterway-floodplain systems:

- Provide habitat for species of commercial, aesthetic and recreational value.
- Provide aesthetic and recreation services.
- Provide fresh water for domestic supply, irrigation and other purposes.
- Mitigate floods by holding back water on floodplains and in wetlands.
- Remove sediment, nutrients and other pollutants through riparian filtering, sedimentation and other mechanisms.

An ecologically healthy waterway will have flow regimes, water quality and channel characteristics such that:

- In the waterway and riparian zones, the majority of plants and animal species are native, and no exotic species dominate the system.
- Natural ecosystem processes are maintained.
- Major natural habitat features are represented and are maintained over time.
- Native riparian vegetation communities exist sustainably for the majority of its length.
- Native fish and other fauna can move and migrate up and down the river.
- Linkages between river and floodplain and associated wetlands are able to maintain ecological processes.
- Natural linkages with Terminal Lakes are maintained.
- Associated Terminal Lakes' systems are productive ecosystems.

RiVERS also calculates an overall environmental rating by adding the scores for the fifteen individual environmental sub-components evaluated (see Part 1). This allows the Wimmera CMA to gain an objective assessment of those waterways with very high and high environmental values (Map 2.12).



5.5 balancing social, economic and environmental values

In managing our waterways it is important to balance the social, economic and environmental values. At times it may be necessary to make trade-offs between economic, environmental and social values. It is important to identify the consequences of mitigating threats to one value (ecological) and subsequently increasing the threat to others (social and economic).

6 threats to waterway health

wimmera waterway health strategy

The key threats to waterway health in the Wimmera can be grouped into the following:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Loss of native biodiversity.
- Changed channel form.
- Deficient floodplain management.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Drainage of wetlands and of paddocks to wetlands.
- Unsustainable water harvesting from our waterways.
- Increased runoff from urban areas.
- Point-source and diffuse-source pollution.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Accelerated bed and bank erosion through increased runoff from cleared catchments, changes in hydraulics as a result of road crossings, channel modifications, etc.
- Earthworks that alter the flow of water.
- Weirs and other instream structures creating flow barriers.
- Ageing and poorly-managed structures.
- Inappropriate development on floodplains.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge.
- Planning deficiencies.
- Lack of adequate/appropriate community knowledge.



The Wimmera's catchment and water management planning processes have identified a number of issues that effect the health of the region's wetlands and waterways. Many of these threats are interrelated and can impact on a number of key aspects of waterway health. For example, changed flow regimes greatly affect biodiversity, recreation and economic uses. Altered flow regimes can cause a decline in water quality, increased groundwater intrusion into streams and wetlands with a resultant increase in salt loads, a loss of native biodiversity (riparian and aquatic) and result in changes to the channel form. Accelerated stream erosion is reducing the availability of habitats and threatening land and infrastructure. It is also important to maintain a balance between the beneficial effects of floods on biodiversity and the loss or damage that might arise to floodplain infrastructure.

7 high priority waterways in the wimmera

wimmera waterway health strategy

RIVERS also calculates an overall threat rating by adding the scores for the 15 individual threat measures identified (see Part 1). By using RIVERS, Wimmera CMA was able to gain an objective understanding of those waterways under greatest threat (Map 2.13).

In line with the objectives of the *Wimmera WHS*, waterways of highest community (environmental, social and economic) value in the Wimmera CMA region were identified as:

- Heritage Rivers.
- Waterways (reaches and wetlands) associated with international or nationally-significant wetlands.
- Waterways (reaches and wetlands) classified as environmental sites of significance (including Ecologically Healthy Rivers and Representative Rivers).
- Waterways (reaches and wetlands) classified as having high to very high overall environmental significance.
- Waterways (reaches and wetlands) classified as having high to very high overall social value.
- Waterways (reaches and wetlands) classified as having high to very high overall economic value.

↑ legend

River Reaches by Threat Measures

- High
- Moderate
- Low
- Very Low

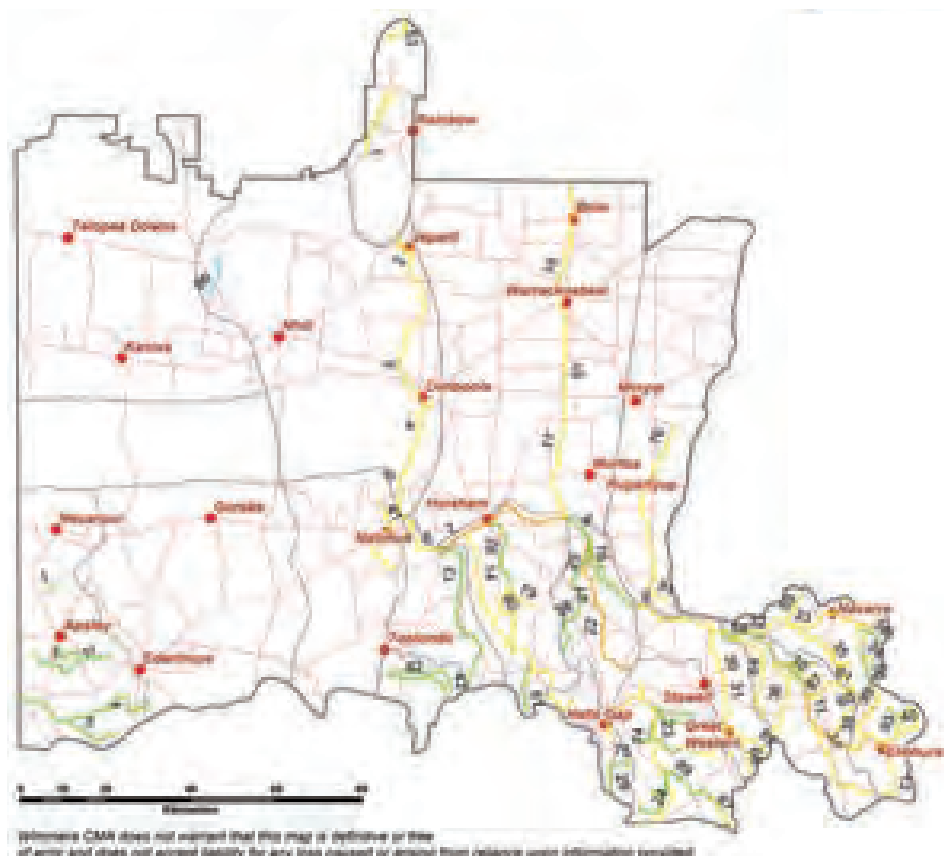
Major Towns*

Major Roads*

Waterway Management Units

Wimmera CMA Boundary*

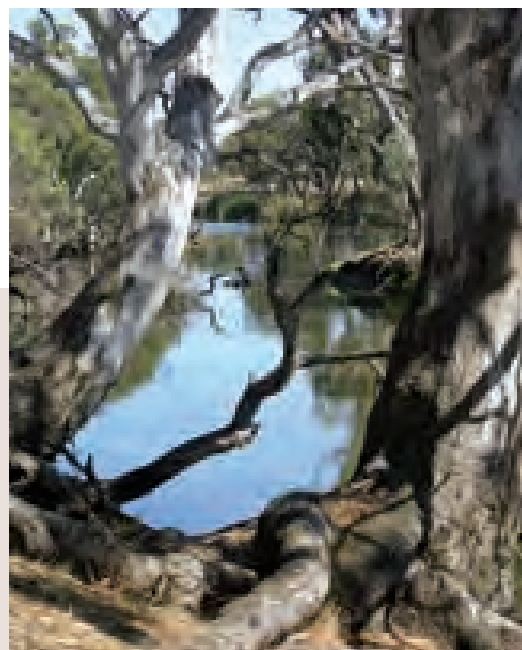
*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 2.13 waterways under threat

7.1 wimmera heritage river

The Heritage River section of the Wimmera River extends from Polkemmet Bridge to Wirrengren Plain in Wyperfeld National Park, taking in lakes Hindmarsh and Albacutya and the Outlet Creek system (Map 2.8).



7.2 waterways associated with international or nationally-significant wetlands

The Wimmera CMA region has a number of wetlands identified in the Directory of National Important Wetlands in Australia (2001). The criteria for determining nationally important wetlands in Australia, and hence inclusion in the directory, are those agreed to by the Australian and New Zealand Environment and Conservation Council (ANZECC) Wetlands Network in 1994.

A wetland may be considered nationally important if it meets at least one of the following criteria:

1. It is a good example of a wetland type occurring within a biogeographic region in Australia.
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa.
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level.
6. The wetland is of outstanding historical or cultural significance.

Fifteen wetlands in the Wimmera region were identified in the Directory as wetlands of national importance.



7.3 environmental sites of significance

There are a number of waterways in the Wimmera that have been identified as being environmental sites of significance. These waterways were identified in the:

- *Wimmera River Geomorphic Investigation – Sediment Sources, Transport and Fate* (2001).
- *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003).

These two reports identified waterways such as Glenlofty Creek (Reaches 38 and 39), Wimmera River upstream of Glenorchy (Reaches 9 and 10) and MacKenzie River (Reaches 14, 15 and 16) as being in near ecologically healthy condition. In addition, Glenlofty Creek was identified as a rare and threatened chain of ponds waterway that is in good health and should be preserved.

No waterways were identified as Representative Rivers in the VRHS.

7.4 waterways with very high or high environmental, social and/or economic values in RiVERS

The waterways (reaches and wetlands) identified in RiVERS as having a high or very high overall rating for environmental, social and economic values have been identified as priority waterways in the *Wimmera WHS*.

7.5 waterways in excellent condition (index of stream condition)

Two river reaches were identified as being in excellent condition in the 2004 ISC survey – Golton Creek Reach 26 in the Wimmera Basin and Mosquito Creek Reach 5 in the Millicent Coast Basin.

7.6 summary

Thirty river reaches and 23 wetlands have been identified as high priority waterways for the *Wimmera WHS*. The high priority waterways of the Wimmera are shown in Map 2.14 and listed in Table 2.2.



↑ legend

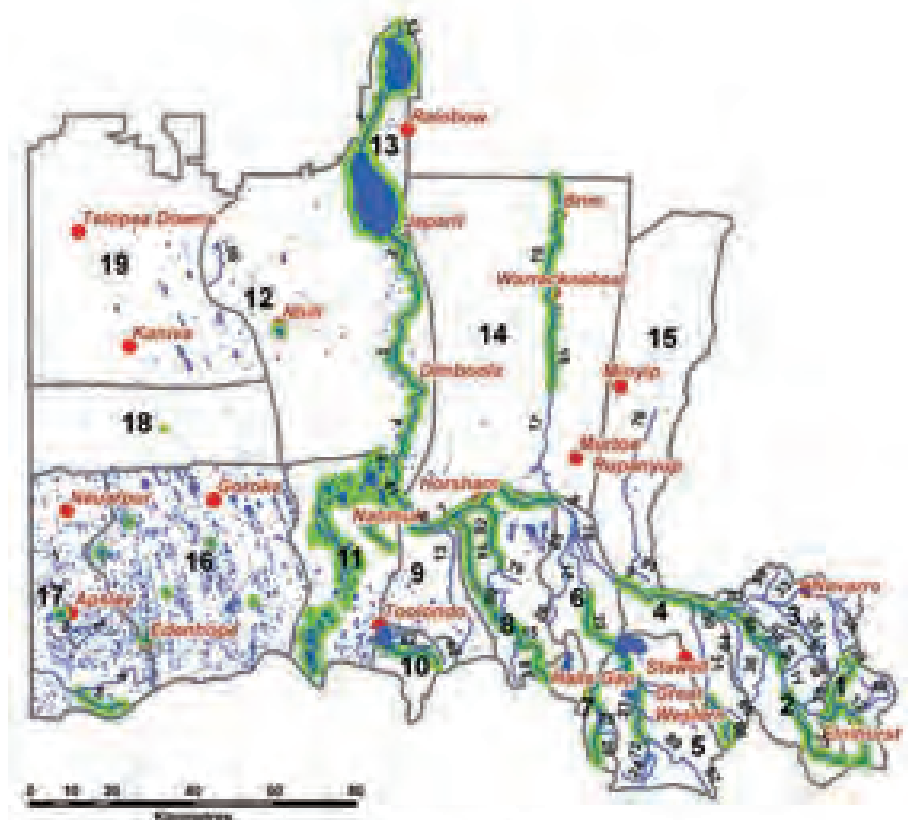
- Priority Rivers
- Priority Wetlands

WATERWAY MANAGEMENT UNITS

- 1 Upper Wimmera River
- 2 Mt Cole Creek
- 3 Wattle Creek
- 4 Concongella Creek
- 5 Upper Mt William Creek
- 6 Lower Mt William Creek
- 7 Grampians
- 8 MacKenzie River and Burnt Creek
- 9 Norton Creek
- 10 Lake Toolondo Creek
- 11 Natimuk Creek
- 12 Heritage River
- 13 Terminal Lakes
- 14 Yarriambiack Creek
- 15 Dunmunkle Creek
- 16 Millicent Coast lakes
- 17 Millicent Coast west-flowing
- 18 Little Desert National Park
- 19 North from Little Desert National Park

- Major Towns*
- Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



Wimmera CMA does not warrant that this map is definitive or free of error and does not accept liability for any loss caused or arising from reliance upon information provided.

MAP 2.14 high priority waterways in the wimmera CMA region

TABLE 2.2 high priority waterways in the Wimmera CMA region

basin	mgt unit	reach no.	waterway	reason
WIMMERA RIVER BASIN	1	12 38 39	Wimmera River Glenlofty Creek Glenlofty Creek	High environmental values (RiVERS) Rare geomorphic type in good condition ² Rare geomorphic type in good condition ²
	2	10 37	Wimmera River Mt Cole Creek	In near ecologically healthy condition ¹ High economic values (RiVERS)
	4	9 66	Wimmera River Tributary of Concongella Creek	In near ecologically healthy condition ¹ High environmental value (RiVERS) High economic values (RiVERS)
	5	23	Mount William Creek	High environmental values (RiVERS)
	6	22 26	Mount William Creek Golton Creek	High economic values (RiVERS) Waterway in excellent condition ⁵
	7	16 28 29	MacKenzie River Fyans Creek Fyans Creek	In near ecologically healthy condition ¹ High social values (RiVERS) High economic values (RiVERS) Very high economic values (RiVERS) High economic and high social values in RiVERS
	8	7 14 15 92	Wimmera River MacKenzie River MacKenzie River Burnt Creek	Very high social values (RiVERS) In near ecologically healthy condition ¹ In near ecologically healthy condition ¹ High economic values (RiVERS) High economic values (RiVERS)
	9	6	Wimmera River	High environmental values (RiVERS) Very high economic values (RiVERS)
	10	82	Tributary of Toolondo	High economic values (RiVERS) Very high social values (RiVERS)
	11	41	Natimuk Creek Heards Lake Mitre Lake White Lake Saint Marys Lake Natimuk Lake Lake Wyn Wyn Natimuk Douglas Wetlands Bitter Swamp	Very high social values (RiVERS) Waterway associated with wetlands of national and international significance Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³ Wetlands of national significance ³ Wetland of national significance ³

TABLE 2.2 (continued)

basin	mgt unit	reach no.	waterway	reason
WIMMERA RIVER BASIN	11		Friedman's Salt Lake Grass Flat (Telfer's) Swamp Hatley's Lake (swamp) Oliver's Swamp (lake)	Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³ Wetland of national significance ³
	12	2	Wimmera River	Heritage River ⁴ Very high social value (RiVERS)
		3	Wimmera River	Heritage River ⁴ High social values (RiVERS)
		4	Wimmera River	Heritage River ⁴ High environmental value (RiVERS)
		5	Wimmera River	Very high social value (RiVERS) Heritage River ⁴
			Pink Lake (Lochiel) Nhill Lake	High environmental value (RiVERS) Wetland of national significance ³ High economic and social values by the community
	13	1	Outlet Creek	Heritage River ⁴ High environmental value (RiVERS)
		53	Outlet Creek	Heritage River ⁴ High environmental value (RiVERS)
			Lake Albacutya Lake Hindmarsh	Ramsar wetland Wetland of national significance ³
	14	18	Yarriambiack Creek	Very high social values (RiVERS)
		19	Yarriambiack Creek	Very high social values (RiVERS)
		20	Yarriambiack Creek	Very high social values (RiVERS)
MILLICENT COAST BASIN	16		Lake Charlegrark Lake Ratzcastle Lake Bringalbert Broughtons Swamp Lake Wallace	High economic and social values by the community High economic and social values by the community High economic and social values by the community High economic and social values by the community High economic and social values by the community
	17	5	Mosquito Creek Newlands Lake	Waterway in excellent condition ⁵ High economic and social values by the community
	18		Broughton Waterholes	High economic and social values by the community

¹ *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)*

² *Wimmera River Geomorphic Investigation – Sediment Sources, Transport and Fate (2001)*

³ *A Directory of National Importance in Australia (2001)*

⁴ *Heritage Rivers Act 1992*

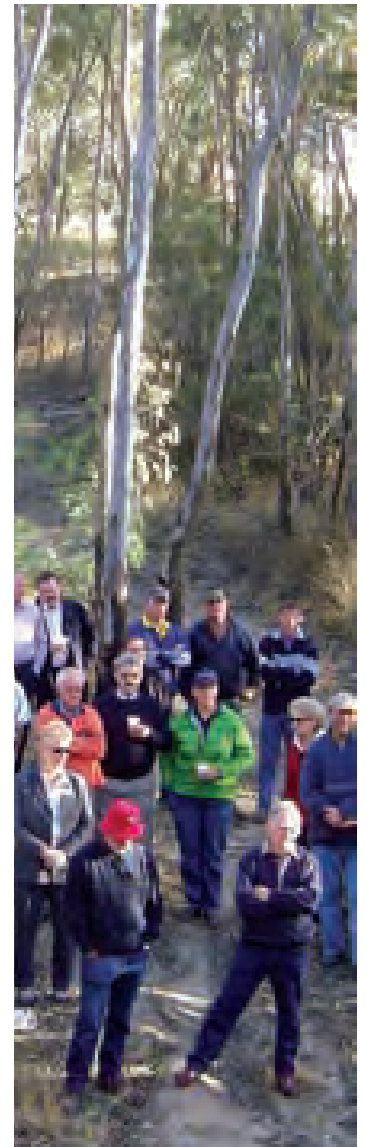
⁵ *Index of Stream Condition (2004)*

part three

wimmera WHS

strategic framework

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2	Strategic Basis for Wimmera WHS	3 - 2
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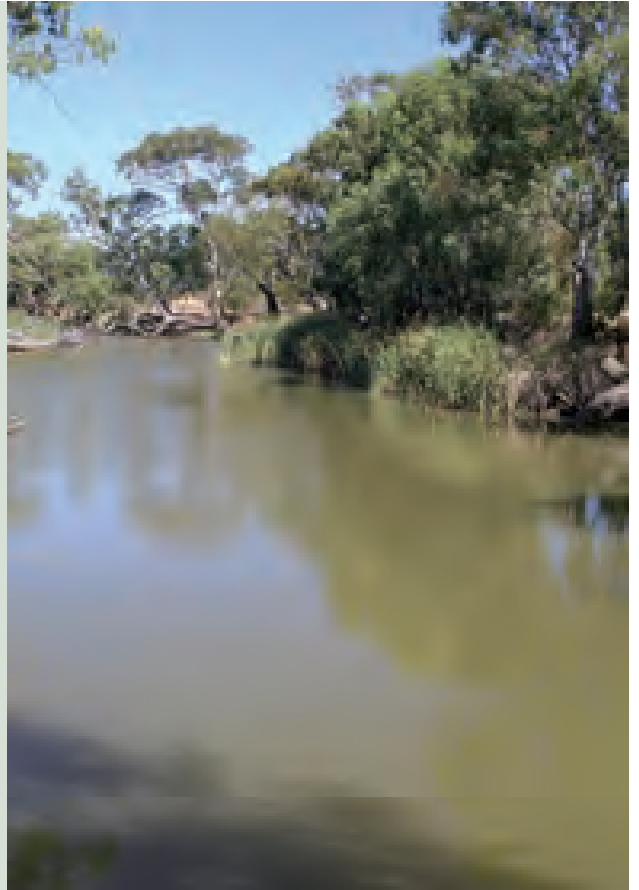
1 introduction

wimmera waterway health strategy

A key determinant for achieving improvements in waterway health is to establish a clear vision, or framework within which the Strategy is implemented. Establishing a shared vision for waterway health will determine the success of the *Wimmera WHS*, in that all agencies and the Wimmera community need to be working towards common waterway health outcomes for there to be real change. This part of the *Wimmera WHS* establishes the framework for waterway health in the Wimmera CMA region.

This part of the *Wimmera WHS* also establishes the key links from state policy to the Strategy, and establishes the key concepts of values, threats, targets, costs, communication strategy, and adaptive management framework, which are developed further in Parts 4 and 5. In this way, it can be seen that this part of the *Wimmera WHS* provides the overall directions for improving waterway health across the region. The concepts discussed in this part of the document do not have a geographic basis, but instead are concerned with institutional relationships and processes of engagement with and between key stakeholders in waterway health.

Part 3 of the *Wimmera WHS* is intended to be read by those who are interested in the overarching strategic direction of waterway health in the Wimmera CMA region.



2 strategic basis for wimmera WHS

wimmera waterway health strategy

The *Wimmera WHS* has been developed and will be implemented within the broader state-wide strategic frameworks of the *Victorian River Health Strategy – Healthy Rivers Healthy Communities and Regional Growth* (2002) (VRHS), the *Victorian Government White Paper Our Water Our Future – Action Plan for Water* (2004), the *State Environmental Protection Policy (Waters of Victoria)* (2004) (SEPP) (WoV), the *Victorian Biodiversity Strategy* (1997), the *Victorian Nutrient Management Strategy* (1995), the *Victorian Flood Management Strategy* (1998), *Victoria's Native Vegetation Management – A Framework for Action* (2002), *Victoria's Salinity Management Framework* (2000) and regional frameworks of the *Wimmera RCS* and regional strategies and action plans for specific waterway health threats or waterway reaches (Figure 3.1).

2.1 state-wide policy frameworks

The *VRHS* sets out the framework for reaching Victoria's long-term vision for its rivers. The *VRHS* outlines the approach that Government, in partnership with the community, will use to make decisions on managing and restoring Victoria's rivers. It provides:

- A common vision for managing rivers in Victoria.
- State-wide targets for river restoration.
- A planning framework which:
 - is based on community decision-making within an integrated catchment management context,
 - balances environmental, economic and social needs,
 - integrates the management of all activities impacting on rivers, and
 - is based on the best available scientific understanding of river functioning and is responsive to new knowledge.
- Criteria for priority-setting for investment in river protection and restoration.
- An overview of Government policy relating to management of activities affecting river health, including environmental water releases and water allocation.
- The institutional arrangements for managing river health in Victoria.

The management approach for achieving Victoria's vision is:

- Protecting the rivers that are of highest community value from any decline in condition.
- Maintaining the condition of ecologically healthy rivers.
- Achieving an 'overall improvement' in the environmental condition of the remainder of the state's rivers.
- Preventing damage from future management activities.

The *VRHS* fits into the broader Government vision for the management of water in the state to ensure that rivers are managed in accordance with relevant Victorian Government policies. These include many Victorian catchment management policies and strategies, including the *SEPP (WoV)*, the *Victorian Biodiversity Strategy* (1997), the *Victorian Nutrient Management Strategy* (1995), *Victoria's Native Vegetation Management – A Framework for Action* (2002), and *Victoria's Salinity Management Framework* (2000).

In June 2004, the Victorian Government released the White Paper, *Our Water Our Future*, an action program including new initiatives to secure Victoria's water for the next 50 years.



The White Paper is a key policy document aimed at guiding water management in Victoria into the future, and needs to be considered in the development of the *Wimmera WHS*.

The White Paper represents one of the most innovative, integrated water strategies in Australia and indeed the world. The strategies in the action plan will help Victoria improve water management from the moment rain falls in catchments to when it enters aquifers and rivers and moves to homes, farms and business and to the recycling plant. The strategies will ensure that we all play our part in 'securing our water future together', as we grow as a state.

The White Paper identifies a number of key initiatives in the Wimmera CMA region, including:

- Identifying Wimmera CMA as the caretaker of river health (including establishment of the Environmental Water Reserve, progress of regional stream flow and groundwater management plans).
- Identifying the Wimmera Mallee Pipeline as a high priority water-saving project for the region.
- Establishing Environmental Water Reserve and improved flow regimes in Wimmera rivers.
- Making 'sales' water into secure, tradeable entitlements.
- Establishing projects to improve on-farm water efficiencies and reuse systems.
- Establishing water recycling projects.

Along with the *VRHS*, the *SEPP (WoV)* is a key state-wide statutory policy for surface waters in Victoria. The regional environmental, social and economic assets used in the *Wimmera WHS* equate, in general terms, to the 'beneficial uses' protected by the *SEPP (WoV)*.

The *SEPP (WoV)* includes a range of actions required to protect and enhance waterway health. Many of these actions form part of the *Wimmera WHS* and sub-strategies as appropriate.

The *SEPP (WoV)* contains objectives for water quality and biological health. These environmental quality objectives provide the 'benchmarks' that describe the environmental quality needed to protect all beneficial uses/assets. The *Wimmera WHS* integrates these objectives as Resource Condition Targets where appropriate.

2.2 regional frameworks

The *Wimmera RCS* was ministerially endorsed in December 2003. The *Wimmera RCS* provides a vision for the future landscape of the Wimmera and is helping guide natural resource management through the challenges from now until 2008. It represents a change in focus from the issues that confront us such as salinity, soil erosion and loss of biodiversity, to the assets that we wish to enhance and protect – our land, water, biodiversity and communities.

This shift is still allowing management of the issues, but is also helping develop a more integrated approach to natural resource management. It is allowing us to focus on the complete picture, and not just the many parts that make up this picture.

Extensive consultation with a broad range of stakeholders from Local Government and community members right through to agencies and extension staff, derived the assets that are listed in the *Wimmera RCS*.





Parallel to this consultation process was a survey by Charles Sturt University of almost one-quarter of the Wimmera's landholders. This survey has validated the consultation process and provided valuable direction for natural resource management in the Wimmera.

Social themes dominated every level of the consultation process for the *Wimmera RCS*, and were consistently ranked as the highest priority by stakeholder groups. Concerns such as employment opportunities for young people, the decline of small communities and people's capacity to undertake natural resource management activities dominated discussions.

In this context, rather than being identified as a single asset that we wish to protect and enhance, the *Wimmera RCS* has adopted the community as the common theme across all other assets identified. 'Community' is the theme that unites all assets, assigns value to them and governs the level of work we can undertake.

In addition to the *Wimmera RCS*, the region has a number of guiding documents for waterway health including the *Wimmera Water Quality Strategy* (2002), *Wimmera Floodplain Management Strategy* (2001), *Wimmera Rural Drainage Strategy* (2001), *Wimmera Regional Salinity Action Plan* (2004), *Wimmera Native Vegetation Plan* (revised Draft 2004), *Wimmera Weed Action Plan* (2000-2005), *Wimmera Rabbit Action Plan* (2000-2005), *Waterway Action Plans* (Various), *Stressed Rivers Project – Environmental Flow Study Wimmera River System* (2002), *Environmental Flow Recommendations for the Bulk Entitlements* (2004), *Wimmera River Geomorphic Investigation, Sediment Sources, Transport and Fate* (2001), *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003), *Geomorphic Investigation of Wetlands in the Wimmera CMA Section of the Millicent Coast Basin* (2004), *Social and Economic Drivers of Wetland Rehabilitation* (2005) and *Wimmera Wetland Condition Assessment Project* (2005).

3 emerging initiatives

wimmera waterway health strategy

There are a number of emerging initiatives that will impact on achieving waterway health objectives in the Wimmera CMA region. Two of particular note are the Wimmera-Mallee Sustainable Water Strategy and the Wimmera Mallee Pipeline Project.

3.1 sustainable water strategy

Sustainable water strategies will plan for water security by assessing the various requirements for water and the quantity (in terms of volume and quality) of all existing and potential sources of water supply available in five regions across Victoria.

The strategies will:

- Identify and manage arising threats to the supply and quality for water for cities and towns or industry or rivers and aquifers.
- Exploit emerging opportunities to improve water security and/or the health of rivers and aquifer.
- Communicate to communities what their water situation looks like over the long-term, and actions they can take to improve it.

The aim of sustainable water strategies is to provide flexible planning instruments that draw on existing information sources and reporting frameworks such as state water accounts, water supply and demand plans, regional river health strategies and the state water data warehouse to underpin regional water allocation decisions. It is likely that sustainable water strategies will identify knowledge gaps and additional studies may be required to provide information to feed into the analysis of opportunities for improving water security and/or the health of rivers and aquifers.

Each sustainable water strategy will be produced through a collaborative process with numerous stakeholders. As stakeholders will often have competing interests associated with the use of available water resources, an independent panel of experts will be used to facilitate interactions and provide a neutral assessment of the issues and options identified by stakeholders.

3.2 wimmera mallee pipeline project

The Wimmera Mallee Pipeline Project is a major initiative in the region that will deliver significant water savings to the Wimmera, Glenelg, and other river systems in the area. As the COAG agreement is the main driving policy for the restoration of flows in the Wimmera River system, the pipeline project is expected to deliver the water savings that will be passed onto the environment via Environmental Water Reserve management. These allocations will, over time, play a pivotal role in the rehabilitation of the region's biodiversity, and assist in reversing the demonstrable and unsustainable decline in waterway health.



STATEWIDE POLICY AND LEGISLATION

- Victorian River Health Strategy (2002)
- Victorian White Paper - Our Water Our Future Action Plan (2004)
- State Environment Protection Policy (SEPP) (Waters of Victoria) (2003)
- Victorian Nutrient Management Strategy (1995)
- Victorian Biodiversity Strategy (1997)
- Victorian Flood Management Strategy (2001)
- Victoria's Salinity Management Framework (2000)
- Victoria's Native Vegetation Management - A Framework for Action (2002)

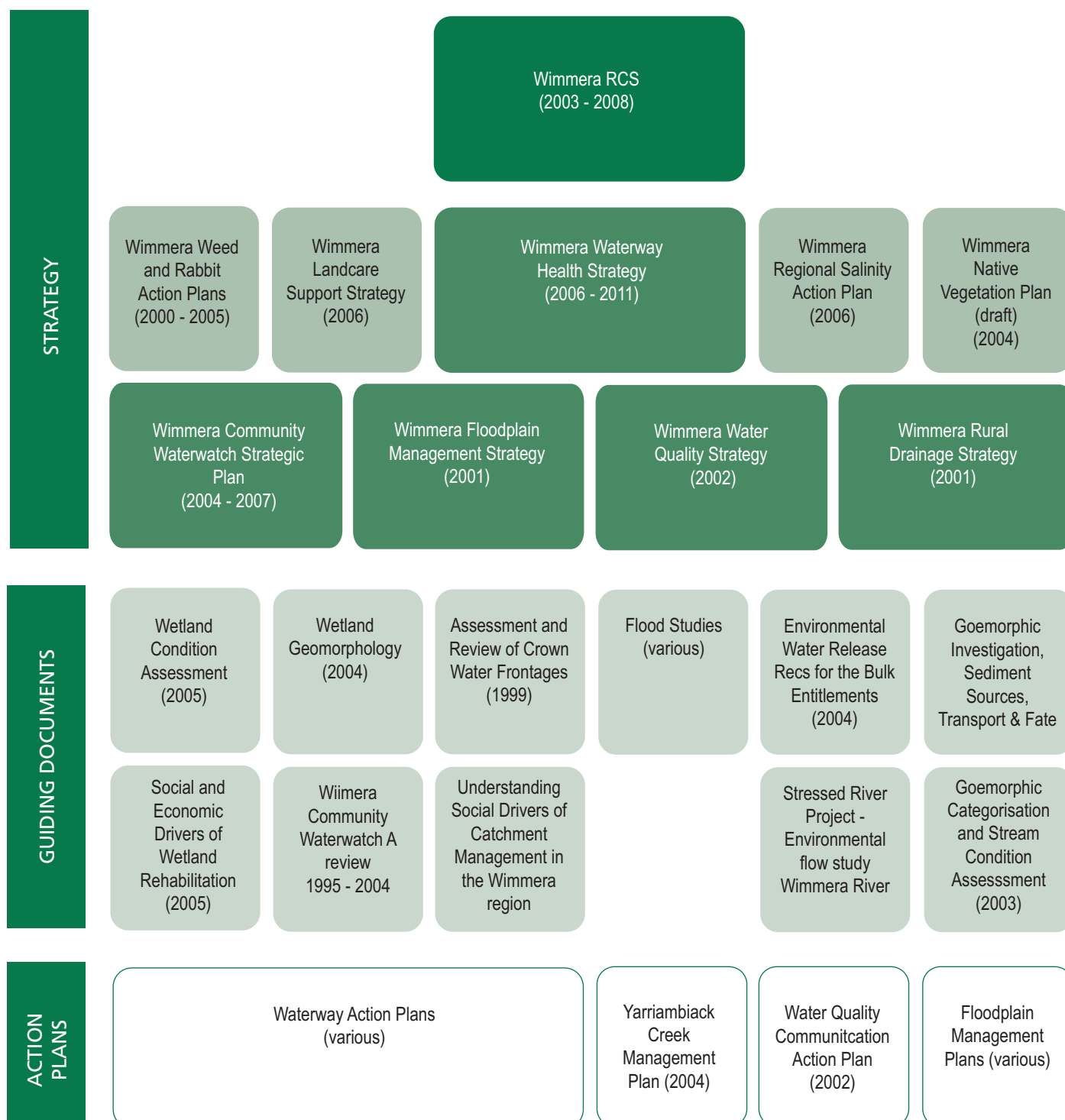


FIGURE 3.1 strategic basis for the Wimmera WHS

4 strategic framework of the wimmera WHS

wimmera waterway health strategy

The Wimmera has a rich suite of natural assets including open forests and semi-arid landscapes, aesthetic features, agricultural areas, the Wimmera River, wetlands and ephemeral streams. The prominent regional industries of agriculture and tourism are dependent on the conservation and sustainable use of the natural assets. Continued agricultural productivity is dependent upon the soil and water resources, while many recreational activities rely on healthy natural ecosystems.

Three biophysical themes occur throughout all natural assets: biodiversity, water and land. Each theme is inextricably bound to the others and elements of all three can be seen in any of the region's assets.

The *Wimmera RCS* identifies waterways as being high value assets. The key waterway assets of the Wimmera are identified in the *Wimmera RCS* and include:

- Wetlands and Streams of the Wimmera River Basin.
- Terminal Lakes of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.

Protecting and enhancing waterway assets is the key objective of the *Wimmera WHS*. It is important to keep this objective at the forefront of our minds when using the Strategy. The focus of natural resource management is on protecting the environmental services provided by the environment. The *Wimmera WHS* goes one step further to focus on the threats to those values, as well as the values themselves.

The *Wimmera WHS* has been developed to assist the catchment community and agencies in protecting and enhancing the waterways of the region.

The *Wimmera WHS* is the first attempt to combine the elements of waterway management in one umbrella document. The *Wimmera WHS* integrates waterway programs into a multi-disciplinary framework and considers floodplains, wetlands, riparian land, instream habitat and channel form, Environmental Water Reserve management, water quality, significant flora and fauna and communication, education and engagement. The Strategy also includes an adaptive management framework for monitoring, evaluating and reporting on the achievements of activities undertaken in implementing the Strategy.

The Strategy builds on existing regional strategies and action plans and is supported by a series of sub-strategies, action plans and guiding documents (Figure 3.1).

The *Wimmera WHS* provides the regional framework for integration of actions which will enable waterways of high value to be protected and others to be enhanced for current and future generations.



4.1 vision

The vision for waterways in the Wimmera is *waterways for life*.

4.2 objectives

The *Wimmera WHS* aims to achieve its vision through four key objectives:

1. Waterways of the Wimmera region are proactively managed by all to protect and enhance their environmental, social and economic values.
2. The condition of ecologically healthy waterways are maintained.
3. Overall improvement in the environmental condition of the region's waterways is achieved.
4. Damage to waterways from future management activities is prevented.

4.3 principles for waterway health

The following guiding principles have been adopted as the fundamental basis for managing waterways and waterway health in the Wimmera CMA region.

P1. Protect the best

- Preserve areas with near-pristine values.
- Restore areas of high value.
- Rehabilitate areas that place other values at risk or provide good opportunity for restoring values.
- Maintain degraded areas to prevent values declining to unacceptable levels.
- Prevent damage from future management activities.

P2. Equity within and between generations

The present generation should ensure that the health, diversity and productivity of waterways is maintained or enhanced for the benefit of future generations.

P3. Respect Indigenous values

We respect the Indigenous communities, their perspectives of landscapes, traditions, interests and rights in the land and waterways.

P4. Integrated river health outcomes (social, economic and environmental)

Waterways are the lifeblood of our catchments. The impacts of management activities within our catchments are mirrored in our waterways. Land, biodiversity and waterway management must be integrated.

Decisions affecting waterway health must be made within an integrated catchment management context:

- Recognising the integral relationship between waterways and their catchments, their position within broader landscapes, and their linkages with and importance for wetland and floodplain systems.
- Addressing problem causes as well as symptoms.
- Balancing social, economic and environmental needs.

P5. Biological diversity and ecological integrity

The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.

For all waterways and floodplains:

- Maintain natural structures and functions that are essential to waterway health.
- Prevent serious and irreversible loss of natural diversity.
- Mimic natural streamflow characteristics to support the health of target species/communities.
- Protect rare or threatened structures and functions.
- Conserve representative examples of waterways and their natural features.

Greater protection for waterways and floodplains of high conservation priority:

- Maintain the integrity of natural structures and functions that contribute to ecological value.
- Maintain natural diversity.
- Maintain natural streamflow characteristics.

P6. Partnerships and shared responsibility

Protection of the environment is a responsibility shared by all levels of government and industry, business, communities and the people of the Wimmera.

All members of the community, including industry, landholders, individuals, and rural and urban communities, derive benefits from the use of waterways and share responsibility for managing these resources sustainably.

Ecologically-sustainable management of waterways can only be achieved through a long-term partnership between all these parties, each with clear agreed roles.

P7. Community engagement, awareness and capacity building

Communities and stakeholder groups will have the opportunity to be involved in all the major phases of planning and implementation of programs to address waterway health.

P8. Precautionary approach

If there are threats of serious or irreversible waterway damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent waterway degradation.

Decision-making should be guided by:

- A careful evaluation to avoid serious or irreversible damage to the environment wherever practicable.
- An assessment of the risk-weighted consequences of various options.

P9. Continual improvement

Recognising the variability of natural systems and our incomplete knowledge of waterway and catchment processes requires that waterway health management be adaptive; improving in response to knowledge gained through monitoring and research.

P10. Accountability

Progress towards meeting state and regional targets will be measured.

Those involved in waterway health activities and management will be clearly accountable to government and the community for waterway health outcomes.

P11. Co-investment and cost-sharing

Relative contributions to investment in waterway management and restoration will reflect the long-term private and public costs and benefits involved.

4.4 targets for waterway health

Targets in the *Wimmera WHS* have been established under the frameworks of the Australian (Natural Resource Management Ministerial Council (*National Framework for Natural Resource Management Standards and Targets* 2002)) and the Victorian (*VRHS* 2002) Governments.

The *National Framework for Natural Resource Management Standards and Targets* identifies the minimum sets of matters for which agencies must set targets for Australian catchments and regions.

The *VRHS* identifies a range of targets for the protection and enhancement of river health. Each catchment management authority has set targets to align with the *VRHS*. This enables each catchment management authority to measure their contribution to regional and state-wide targets, which have been set for river health.

By setting targets for waterway health under these two frameworks, Wimmera CMA will be able to measure its contribution to regional, state-wide and national targets. Three types of targets have been set in the *Wimmera WHS*:

- Aspirational Target (AT): long-term visions or goals to be achieved over 50+ years.
- Resource Condition Target (RCT): pragmatic and achievable medium-term goals (over a 10-20 year period).
- Management Action Target (MAT): short-term targets specific to management actions (to be conducted over a 1-5 year period).

Aspirational targets are statements of the conditions that need to be met to achieve the vision for waterways in the Wimmera region ('Waterways for Life'). Ten Aspirational Targets have been set for the *Wimmera WHS* (Table 3.1). They cannot be measured directly, but achieving the Aspirational Targets is reliant on achieving specified condition in resources, the Resource Condition Targets (RCTs), which is achieved through the effective delivery of implementation, the Management Action Targets (MATs).

TABLE 3.1 aspirational Wimmera WHS targets

aspirational targets for the Wimmera WHS	
AT1.	Floodplains and floodplain wetlands of the Wimmera River Basin managed to maintain their ecosystem services while protecting social, cultural and economic assets.
AT2.	Utilise flow savings from the Wimmera Mallee Pipeline to fulfil the environmental water requirements of floodplains and floodplain wetlands in the Wimmera River Basin.
AT3.	Wetlands of the Millicent Coast Basin in an ecologically healthy condition with no loss of wetland type or extent from 1994 levels.
AT4.	To retain or re-establish natural riparian vegetation along all significant waterways and wetlands of the Wimmera region.
AT5.	Preserve reaches/waterways in geomorphologically pristine condition, restore high value reaches/waterways and rehabilitate degraded reaches through stability assessment, grade control, maintenance of structures, vegetation and stock management.
AT6.	Streams and rivers of the Wimmera region to have adequate Environmental Water Releases to sustain ecosystem functions and processes.
AT7.	To utilise the water savings from the Wimmera Mallee Pipeline to meet environmental water requirements for waterways of the Wimmera region.
AT8.	A net increase in water quality across the Wimmera region, with appropriate water quality standards met at all high priority reaches and wetlands.
AT9.	Natural ecosystems, habitats and landscapes are conserved, restored, linked and managed to provide increased viability for significant native species and communities.
AT10.	An informed and engaged community actively participating in waterway management in the Wimmera CMA region.

Aspirational, resource condition and management action targets have been set in the key areas of waterway management (Floodplain, Wetlands, Riparian, Instream Habitat and Channel Form, Environmental Water Reserve, Water Quality, Significant Flora and Fauna, and Communication, Education and Engagement). For details of the specific resource condition and management action targets that measure progress towards achieving the Aspirational Targets, refer to Parts 4 and 5 of the *Wimmera WHS*.



5 strategy implementation

wimmera waterway health strategy



To assist in the implementation of the *Wimmera WHS*, it has been structured in three distinctly different formats:

- Part 3 (this section) provides the reader with the strategic framework of the *Wimmera WHS*.
- Part 4 provides the reader with details of the waterways in each Waterway Management Unit and the priority actions needed to address specific waterway health risks to priority waterways.
- Part 5 of the Strategy puts the actions in Part 4 in a regional context, detailing the strategic actions to achieve the vision and objectives of the strategy for the region as a whole. This part is structured into waterway health programs that apply across the region.

Parts 3, 4 and 5 of the Strategy are designed for different audiences depending on the reader's interests. The document is, however, linked in a way that can be read to provide the reader with an overall picture of waterway health needs in the Wimmera from programs through to a specific reach.

5.1 waterway health programs

The *Wimmera WHS* has been designed to be delivered in seven programs (order does not reflect priority) targeting the key areas of waterway management (floodplains, wetlands, riparian land, instream habitat and channel form, Environmental Water Reserve management, water quality and significant flora and fauna).

Program 1. Floodplain Management

Floodplains provide natural overland flow paths and storage areas where floodwaters remain for slow release as stream heights recede; thereby reducing the potential for channel erosion from high energy flows. Nutrients, debris and sediment settle out during this process, protecting waterways from high sediment and nutrient loads and contributing to floodplain productivity. Floodplain swamps and billabongs support wetland communities, which have environmental, recreational and tourism values.

Flood management is a subset of floodplain management, and is focused mainly on activities that control flooding and limit damage caused by flooding.

Wimmera CMA's aim in floodplain management is to minimise the risk from flooding, and promote the sustainable use of floodplains in the region through community involvement and best management practice.

The *Wimmera Floodplain Management Strategy* (2001) sets the strategic direction for floodplain management in the Wimmera. It provides Wimmera CMA with its planning framework for future flood-related studies and projects within the region. It is the key document that clarifies and defines roles, responsibilities and cost-sharing arrangements for agencies, authorities and other stakeholders in floodplain management.

Program 2. Wetland Management

Wetlands in the Wimmera CMA region are an extremely important element of the waterway system. Wetlands are freshwater, brackish or saline, and vary widely in depth, size and shape. Definitions and classifications of wetlands are different at the state, national and international level. At the national level, the Ramsar Convention on Wetlands of International Importance and the Australian Directory of Important Wetlands are used to determine wetland importance.

Surveys of Victorian wetlands began in 1975 with the intention of providing information on wetland distributions, water bird usage and threats. A classification system was developed for Victoria with seven main categories of wetlands identified, based on hydrology and salinity. These categories, known as the Corrick Classification System, are Freshwater Meadows, Shallow Freshwater Marshes, Deep Freshwater Marshes, Permanent Open Freshwater, Semi-permanent Saline Wetlands, Permanent Saline Wetlands and Man-made wetlands. Under these categories, a total of 15 sub-categories based on vegetation have been developed.

The section of the Millicent Coast Basin in the Wimmera CMA region contains the Wimmera's most extensive system of wetlands. In this area, Wimmera CMA has added another dimension to the classification of wetlands by classifying wetlands based on their geomorphology.

Other wetland systems in the Wimmera River Basin, such as the Natimuk-Douglas saline wetland system, are also significant in the region. Also significant are lakes Albacutya and Hindmarsh (also known as the Terminal Lakes) and numerous other wetlands associated with Wimmera River system including Darlot Swamp and Dooen Swamp.

Most, if not all, issues relevant to rivers and streams also apply to wetlands. Although there are obvious differences that distinguish wetlands from rivers and streams, for example, the geomorphology and the biota, wetlands are subject to similar risks and threats.

Program 3. Riparian Management

Riparian land is any land that adjoins or directly influences a body of water. It includes:

- The land immediately alongside creeks and rivers, including the riverbank itself.
- Gullies and dips which sometimes run with surface water.
- Areas surrounding lakes and wetlands.
- Wetlands on floodplains that interact with the river in times of flood.

It is important not to think of riparian land as just a narrow strip along or around the banks of streams and wetlands. Depending on the nature of the land and the surrounding land use, the width of riparian land that needs special management will vary. Riparian land is often more productive than other land, with better, more moist soils. Riparian land also plays an important role in the life cycle of many native animals and plants. By its very nature, riparian land is fragile, and overuse can cause it to deteriorate.

In the Wimmera, most impacts on riparian land emerge from agricultural use of land for cropping and stock grazing. Using riparian land for recreational purposes also has a significant impact on this land system.



Good reasons to better manage riparian land include:

- Decreased erosion.
- Improved water quality.
- Healthy ecosystems.
- Maintaining river courses.
- Easier to manage stock.
- Decrease in insect pests.
- Increase in capital values.
- Shelter effects.
- Opportunities for diversification.
- Retained nutrients.
- Lowered watertables.
- Increased fish numbers.
- Landscape refuge.
- Decreased algal growth.
- Ecotourism.

Program 4. Instream Habitat and Channel-form Management

Each waterway type has particular characteristics, which in turn support different ecological communities and have different nutrient and sediment movements. Understanding the processes occurring in each stream requires an understanding of the geomorphology, or the shape and form of a waterway as influenced by underlying geology and land form, of the waterway. This knowledge then allows management actions that are considerate of the individual characteristics of a waterway.

The Wimmera CMA region has been subject to substantial post-European changes. Such changes have included water harvesting and catchment clearing for agriculture, mining and settlement. The Wimmera River Basin also contains some of Victoria's highest densities of active gully erosion. The gully erosion is primarily located in the upper catchment. This erosion contributes sediment to the waterways. Sediment accumulations within waterways adversely affect waterway values. In addition, landholders adjacent to the Wimmera River have raised concerns regarding sediment accumulations within the river that may increase the occurrence of flooding on their properties.

Wimmera CMA has completed two geomorphic investigations: *Wimmera River Geomorphic Investigation: Sediment Sources, Transport and Fate* (2001) and *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003). These reports provide guidance on waterway instream habitat and channel-form management actions.

Program 5. Environmental Water Reserve Management

Private water harvesting from the Wimmera River Basin, combined with developing and operating the Wimmera Mallee Stock and Domestic Supply System (WMSDSS) have significantly altered natural flow regimes of Wimmera waterways. This altered flow regime has had significant effects on the health of waterways in the region.

The Victorian Government sees maintaining the health of rivers and groundwater as vital in securing Victoria's water for the future. One of the key initiatives from the June 2004 action plan, *Our Water Our Future*, is the establishment of a legal share of water for the environment.

This share of water draws a line on the amount of water we can remove from waterways, maintaining as many features of natural flow patterns as possible.

The environment's share of water is called the Environmental Water Reserve (EWR).

The EWR is not a separate physical construction like a dam. It can be held in existing water supply storages and released into a waterway or it can be run-of-river flow.

Water in the EWR has been legally protected under the *Water (Resource Management) Act 2005*.

In establishing or enhancing the EWR, the Victorian Government will ensure existing water entitlement holders are recognised. In priority catchments, the Government will assess the adequacy of the EWR and in consultation with the community, improve it where necessary.

The EWR will be used to:

- Maintain the environmental values of the water system and the other water services that depend on environmental condition.

- Sustain biodiversity, ecological functioning and water quality.
- Have legal status and be held by the Crown.

Within the Wimmera CMA region, there are regulated and unregulated waterways. EWR management covers both regulated and unregulated waterways with differing arrangements in place for their management.

The regulated waterways of the Wimmera include the Wimmera River downstream of Glenorchy, MacKenzie River and Mount William, Burnt, Yarriambiack and Dunmunkle creeks.

In June 2004, the Bulk Entitlement (Wimmera and Glenelg Rivers—Flora and Fauna) Conversion Order (2004) was gazetted. The order includes an allocation for the environments of waterways in the Wimmera and Glenelg river catchments. The water allocated to the environment was saved through the Northern Mallee Pipeline Project.

The primary objective for management of the Bulk Entitlement (Wimmera and Glenelg Rivers—Flora and Fauna) Conversion Order (2004) is to achieve maximum benefits for biodiversity conservation in the rivers, streams and wetlands of the Wimmera and Glenelg basins affected by the WMSDSS. Environmental water is released as individual, or sets of recommended flow components, to meet specific waterway and environmental objectives.

Environmental water releases are used to:

- Protect existing high value areas, or areas in good condition.
- Restore areas where the highest environmental benefit will be achieved for the resource invested and where there is strong community commitment towards long-term improvement in waterway health.



The Bulk Entitlement (Wimmera and Glenelg Rivers—Flora and Fauna) Conversion Order (2004) is for the purpose of achieving ecological outcomes. Other types of bulk entitlement allocations are for economic and social outcomes (urban supplies, stock and domestic, irrigation, recreation lakes, compensation flow).

It is expected that some of the water savings as a result of the Wimmera Mallee Pipeline Project will be passed onto the environment. These allocations will over time, play a pivotal role in the rehabilitation of the region's biodiversity, and assist in reversing the demonstrable and unsustainable decline in waterway health.

Unregulated waterways of the Wimmera CMA region are also flow stressed. Environmental water needs have been determined for each waterway in the Wimmera River catchment and management of harvesting from the waterway needs to take into condition the environmental requirements of the waterway. The *Wimmera WHS* also includes strategic actions to achieve environmental water requirements in the unregulated waterways of the Wimmera.

Program 6. Water Quality

The quality of water in a waterway is a crucial determinant of the overall health of that waterway. Water quality can be described as the condition of water relevant to the measures of a number of parameters compared against their naturally-occurring condition. Electrical conductivity (EC), dissolved oxygen, litter, pathogens, chemicals, pH, temperature, turbidity, macroinvertebrates and nutrients are the usual parameters used to give an overall indication of water quality.

There is an intrinsic cause and effect relationship between land use (agriculture, urban, forest, etc), land type (soil type and soil attributes) and water quality.

Of the list above, there are four main parameters that indicate areas for concern in the Wimmera; salinity, phosphorus, nitrogen, and turbidity. It is important to understand that each of these elements is linked and no one element should be considered in isolation when developing strategy or management actions.

Conceptual models of these parameters have been developed to allow an understanding of the current state of knowledge within the catchment while helping prioritise the future direction for water quality research in the region.

Low or reduced water flows throughout the region have the ability to increase concentrations of all elements to a point where potential problems start to present.

The main causes of water quality problems are:

- Increased runoff from urban areas.
- Point and diffuse pollution sources.
- Salinity and rising watertables.
- Planning and knowledge deficiencies.
- Limited community understanding and awareness of water quality issues and management.

These issues are also exacerbated by a lack of water. The actions identified in the *Wimmera RCS* and the *Wimmera Water Quality Strategy* (2002) (*Wimmera WQS*) canvas a range of mechanisms to control point and diffuse sources of pollution in urban and rural settings. In addition, the *Wimmera Regional Salinity Action Plan* (2005) (*Wimmera SAP*) identifies key actions to manage the impact of groundwater on water quality of waterways in the region.

Improved water quality is required to ensure the beneficial uses of water can be sustained; yet the Wimmera community believes the attainment of naturally-occurring levels of nutrients is unachievable (*Wimmera WQS*). This divergence demonstrates why a robust planning framework and community understanding is required to address the causes of water quality decline.

Program 7. Significant Flora and Fauna

Biodiversity includes the variety of all life forms; the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part. For the most part, biodiversity is protected, enhanced and restored through the Wimmera's native vegetation program, riparian land management, EWR management, instream habitat and channel-form management, wetland management and water quality.

Habitat management activities are focused on protecting the best quality remnants, enhancing other remnants and restoring Ecological Vegetation Classes (EVCs). In a highly-cleared landscape, protecting habitat and improving management is the most efficient way of achieving the highest positive impact on a broad range of species that are not well known.

The *National Strategy for the Conservation of Australia's Biological Diversity* (1996), the *National Strategy for Ecologically Sustainable Development* (1992), the *Victorian Biodiversity Strategy* (1997), and the *Flora and Fauna Guarantee Act 1988* all provide overarching objectives for the conservation and management of biodiversity. The Wimmera CMA region also contains a Ramsar-listed wetland (Lake Albacutya), listed threatened species and communities, and migratory species which are protected under JAMBA, CAMBA and the Convention on the Conservation of Migratory Species of Wild Animals (called the Bonn Convention or CMS) (1983).

The Wimmera boasts 1,900 plant species and 440 animal species including 58 mammal species, 66 reptile species and over 280 bird species. Of these, 84 are rare, 60 are vulnerable and 29 are endangered (listed under the *Environment Protection and Biodiversity Conservation Act 1999*). Sixty-one of these are listed under the *Flora and Fauna Guarantee Act 1998*. Habitats for these species occur across the landscape, in the parks and reserve system, state forests, on private land and in the region's waterways.

The significant flora and fauna of Wimmera waterways include native indigenous fish species such as river blackfish, the iconic platypus, rare and threatened vegetation, pest plants such as blackberry and gorse and pest animals such as foxes, rabbits and carp. The actions identified in the *Wimmera WHS* aim to protect and restore habitats and manage pest plants and animals.

5.2 stakeholders and their responsibilities

The health of a waterway is a cumulative outcome of the combined impacts of land and water management within the catchment and the waterways. Therefore, managing waterway health in the Wimmera is undertaken within a broader integrated catchment management context. It is linked into broader programs of land and water management through the regional planning framework based on the *Wimmera RCS*.

As part of the broader program of catchment management, managing and restoring waterway health is undertaken as a partnership between agencies and the community, with clear, agreed responsibilities for each partner.

This section of the *Wimmera WHS* outlines the responsibilities for waterway management across the Wimmera CMA region.

The goals for waterway health can only be achieved with the full and ongoing commitment and input from regional communities and resource managers, Local Government and the State and Australian Governments.

Wimmera CMA

Wimmera CMA, as the caretaker of waterway health, is the lead agency for coordinating the implementation of the *Wimmera WHS*. Wimmera CMA has responsibility for waterway and floodplain management under the *Water Act 1989* and Environmental Water Reserve Management under the *Water (Resource Management) Act 2005*. Wimmera CMA works with landholders, Local Government, water authorities and Government agencies to improve the health of waterways in the region.



Department of Sustainability and Environment (DSE)

DSE is the key natural resource management provider within the Wimmera. DSE derives statutory authority from a range of acts and operates at a regional level to deliver a wide range of services across various programs, including:

- Commercial forests.
- Flora and Fauna (Biodiversity).
- Land Victoria, including Crown land management.
- Aboriginal Affairs and Indigenous Communities and Culture.
- Coordination of Statutory Planning functions.
- Forest management.
- Fire management.

Department of Primary Industries (DPI)

DPI provides a wide range of services across various programs within a statutory framework. DPI provides education and extension services, enforces legislation and corresponding regulations and manages data and information relative to their area of authority which includes:

- Sustainable Landscapes, including Sustainable Agriculture and Land management, Pest Plants and Animals and Sustainable Rural Development.
- Fisheries.
- Minerals and Petroleum management including the administration of licenses for sand and gravel extraction within waterways.



Environment Protection Authority (EPA)

EPA is responsible for implementing the *Environment Protection Act 1970* (Vic). Through this Act the EPA is responsible for the protection of air, water and land from pollution, control of noise and minimisation of waste initiatives. The Act provides a range of tools to achieve this including the development of statutory policies which set standards for environmental quality in Victoria, licensing of significant discharges to the environment and enforcement and partnership tools. Monitoring and research work support these activities. With respect to the *Wimmera WHS*, EPA's lead document for implementation is the *State Environmental Protection Policy (Waters of Victoria)* (2004) (*SEPP WoV*).

Parks Victoria

Parks Victoria is a service provider to DSE. There are nearly 600 parks and reserves located within the Wimmera that Parks Victoria manages. This comprises 11% of the region's area. Parks Victoria's primary role is to protect natural and cultural values of both terrestrial and marine parks and reserves through ecologically-sustainable management and visitor access.

Local Government

There are seven Local Governments that are wholly or partly within the Wimmera CMA area: Pyrenees Shire Council, Ararat Rural City Council, Northern Grampians Shire Council, Horsham Rural City Council, Yarriambiack Shire Council, Hindmarsh Shire Council and West Wimmera Shire Council. Through statutory responsibilities for administering local planning schemes, Local Government provides a key mechanism for ensuring that new land use and development are appropriately located within the capability of the land. Local Government significantly influences natural resource management in the region.

GWMWater

The urban and rural water authorities in the Wimmera CMA region amalgamated in mid 2004 and officially became GWMWater. GWMWater provides water supply services to approximately 52,000 urban customers, living in 74 towns, and wastewater services to 24 of these towns. Domestic and stock water supplies are provided to approximately 7,000 rural customers via the WMSDSS, Northern Mallee Pipeline, and from diversions from groundwater and waterways.

Landholders

Achieving the Strategy outcomes requires changes in the way we manage our natural assets. Under the *Catchment and Land Protection Act 1994*, landholders are required to:

1. Avoid causing or contributing to land degradation which causes or may cause damage to land of another owner;
2. Conserve soil;
3. Protect water resources;
4. Eradicate regionally prohibited weeds;
5. Prevent the growth and spread of regionally controlled weeds; and
6. Prevent the spread of and, as far as possible, eradicate established pest animals. Landowner co-operation and participation is essential to achieve waterway health targets.

5.3 cost-sharing arrangements

While the *Wimmera WHS* recommends that resources be directed to the areas of highest priority based on the guiding principles of waterway health, it is clear that the task to be undertaken to achieve the vision of 'Waterways for Life' is a major one requiring significant resources and long-term commitment by Victorian and Australian Governments and the regional community.

It is important that long-term funding reflects the general cost-sharing principles for natural resource management (*VRHS*, 2002) and truly represents, in a fair and equitable way, the impacting groups and the various beneficiaries of improved river health.

The following cost-sharing principles will be applied in developing and implementing waterway protection and enhancement programs.

CP1. Duty of care

All natural resource users and managers have a duty of care to ensure they do not damage the natural resource base. They are responsible for making good any damage incurred as a result of their actions.

CP2. Beneficiary pays

When it is not possible to attribute damage, then primary beneficiaries should pay. Users, both existing and future, are expected to pay for activities which provide private benefits. Contributions from secondary beneficiaries will, where appropriate, be negotiated with the primary beneficiaries.

CP3. Government contributions for public benefit

Government contributes primarily for activities which produce public benefits. Government may agree to contribute to land and water management activities that provide private benefits, where the cumulative uptake of these activities provides significant public benefit and Government support is required to facilitate this uptake.

CP4. Positive benefit-cost

Before Government will contribute to any land or water management activity, the activity must be technically sound, the benefits must justify the costs and it must be considered a priority activity.

CP5. Risk assessment

Before any activity starts, the risks of undertaking/not undertaking the activity must be given due consideration. All stakeholders should share in that risk.

CP6. State-wide policy and monitoring

Government will contribute to the cost of state-wide planning, state-wide resource monitoring and assessment, and research and investigations where they are crucial to sustainable land and water management.



6 communication, education and engagement

wimmera waterway health strategy

To achieve the Wimmera WHS vision, all stakeholders (agencies and the community) need to share a common picture of a healthy waterway. Achieving this vision requires meaningful long-term change in behaviour by all agencies and the community.

The goal of the communication, education and engagement actions in the Wimmera WHS is to bring about this change in behaviour. Changed behaviour will result in a fundamental shift in the way waterways are managed by all agencies and the community. This will require an investment in people's skills, and ensure that management decisions and strategic actions are based on improved knowledge.

Objectives are considered to be the key milestones in achieving the goal and the ultimate vision for waterway health. Objectives for communication, education and engagement activities under the Wimmera WHS are to:

- Achieve common goals throughout the community for waterway health.
- Establish partnerships between all stakeholders.
- Ensure all stakeholders increase their knowledge of waterway health.
- Facilitate knowledge-transfer between stakeholders.
- Ensure all stakeholders have ownership of waterways and issues affecting waterway health.
- Ensure all stakeholders accept responsibility for waterway health and waterway management issues.
- Achieve a common belief/acceptance that waterway health issues need to be addressed by all stakeholders.
- Ensure all stakeholders understand links between land management and waterway health issues.
- Achieve an understanding of, and commitment to, compromise and tradeoffs between the often-competing needs of economic, social and environmental concerns.
- Achieve a good understanding of floodplain management, wetland management, water-sensitive urban design, by key stakeholders such as Local Government and state partnership agencies.
- Reduce the number of referrals on waterway health issues between key stakeholders such as Local Government and state partnership agencies.

The core elements of communication, education and engagement activities in the Wimmera WHS are:

- Establishing partnerships with stakeholders.
- Establishing the transfer of information between stakeholders.
- Increasing the knowledge base, and therefore the abilities, of stakeholders to improve waterway health.



7 adaptive management framework

wimmera waterway health strategy

The framework for managing waterway health must be adaptive. Adaptive management is about learning and applying what has been learnt to improve the management of operational or investment programs and is often referred to as 'learning by doing' (Schreiber et al. 2004). As with most terms, the actual definition can vary depending on its use, and there are two main types; passive and active. Both approaches synthesize existing information about the system, monitor responses, and adjust future actions and objectives.

Active adaptive management involves comparing possible alternatives by designing management interventions as experiments. Passive adaptive management relies on implementing a single management policy or practice, based on existing understanding of the ecosystem. The Adaptive Management Framework for the *Wimmera WHS* includes both active and passive adaptive management.

An effective adaptive management framework as shown in Figure 3.2 should include:

- Clearly-stated goals and targets.
- Sound baseline/reference conditions.
- An effective process for learning from management actions.
- A transparent and explicit process for refining and improving future management actions.

The National NRM Monitoring and Evaluation Framework (Figure 3.3), together with the *VRHS*, will be used as the basis for the adaptive management framework of the *Wimmera WHS*.

Adaptive management frameworks include monitoring, evaluating and reporting.

Monitoring is the systematic collection of data. Baseline monitoring provides the baseline social, economic or environmental data necessary for evaluating and reporting on catchment health. Targeted monitoring allows for the measurement of trends or changes that may be direct or indirect results of activities.

Evaluation is conducted to assess the efficiency, effectiveness and appropriateness of actions. Evaluation may be based on qualitative or quantitative data.

Reporting involves the documentation of results of monitoring and evaluation. Key purposes of reporting may include accounting for expended funds or feeding data into decision-making processes.

7.1 monitoring

Monitoring can be broken into two types:

1. **Implementation monitoring** – simply indicates whether or not an activity such as MAT has occurred (yes or no answer).
2. **Effectiveness monitoring** – indicates whether implementation of MAT is contributing to achievement of RCT, and ultimately AT.

Indicators for monitoring

All monitoring programs need to select a core set of indicators which relate to either the goals of the program, or are linked to targets. There are three types of indicators; resource condition, management action and social and economic. The *Wimmera WHS* details resource condition and management action indicators in Parts 4 and 5.

The social and economic indicators are not considered further as reporting on these is largely the responsibility of the Australian Government (NRM Ministerial Council, 2002).

For more details on monitoring refer to Part 5 of the *Wimmera WHS*.

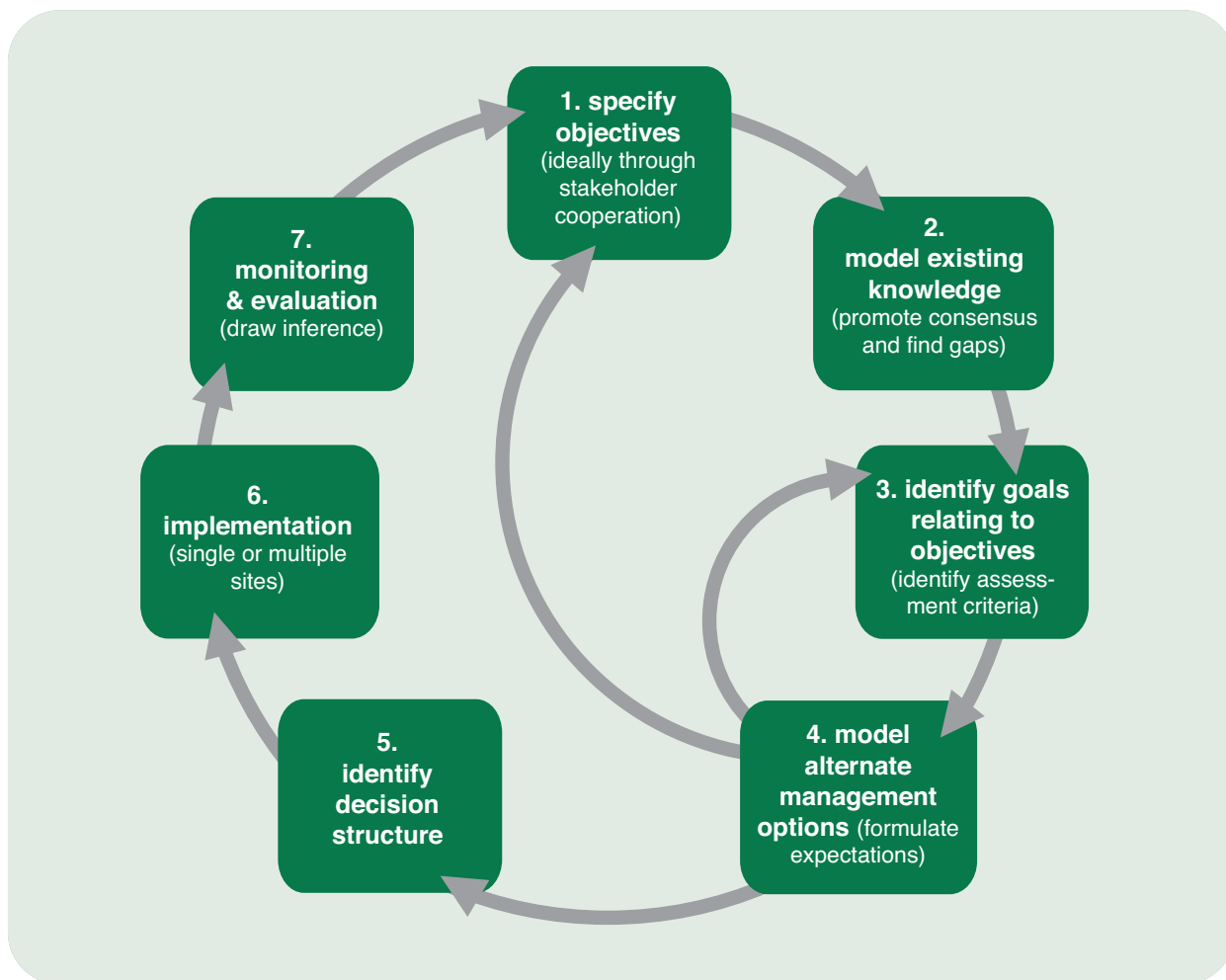


FIGURE 3.2 general adaptive management framework (Schreiber et al. 2004)

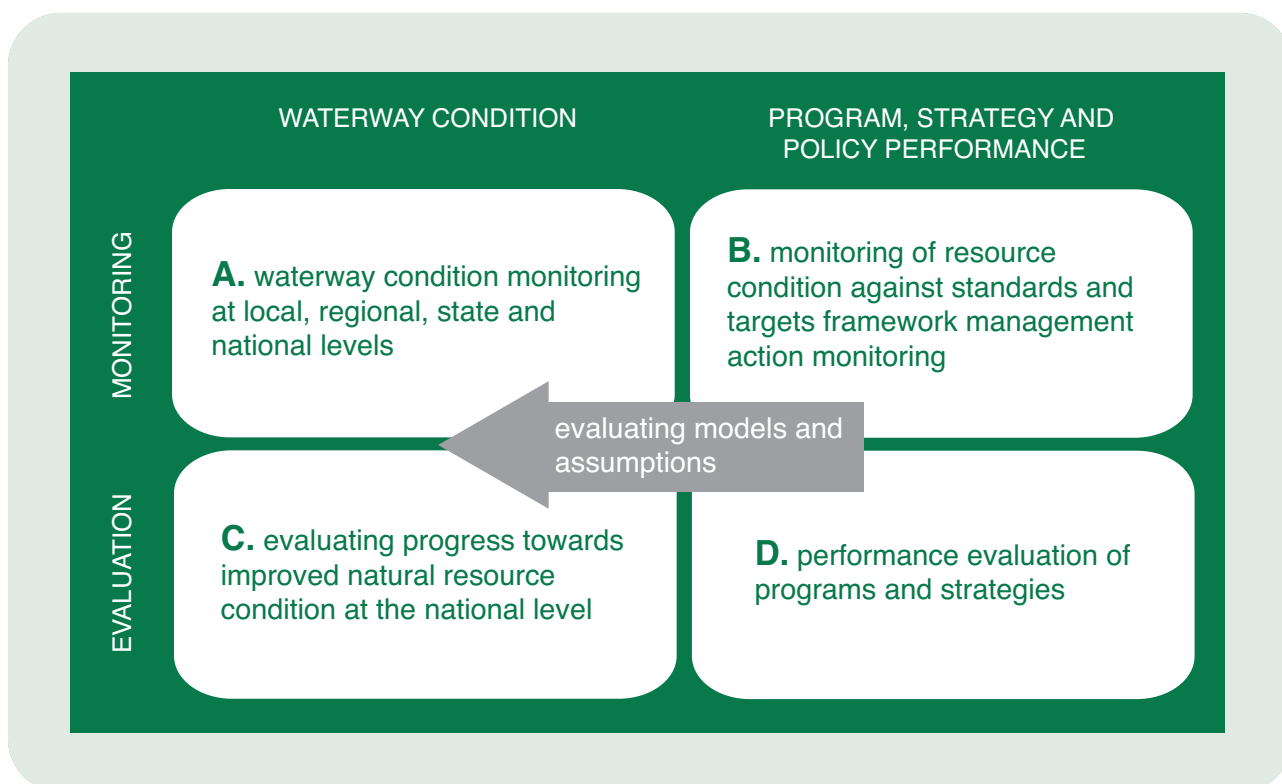


FIGURE 3.3 national NRM monitoring and evaluation framework

7.2 evaluation

Evaluation of the *Wimmera WHS* accounts for more than just the objectives of individual management actions in the Strategy. It also makes provision for monitoring the Strategy's design to ensure it places projects in the best position to achieve maximum impact on waterway health. In looking at Strategy design, the guiding question is whether there exists a logical link between the elements of the Strategy from policy documents right through to outcomes.

The four main parts to evaluating the *Wimmera WHS* and management actions are:

1. Evaluate achievement of objectives of management activities.
2. Evaluate management activities.
3. Evaluate strategy design.
4. Assess indirect effects.

For details on undertaking evaluation in the *Wimmera WHS* refer to Part 5.



7.3 reporting

Reporting on management actions and progress towards targets will be undertaken on a regular basis through the Wimmera CMA investment framework.

7.4 Wimmera WHS adaptive management framework

The Adaptive Management Framework for the *Wimmera WHS* is provided in Figure 3.4. This simple framework illustrates the linkages between Aspirational, Resource Condition and Management Action targets and most importantly, the actual condition of the natural resource in question. Implementation of the monitoring and evaluation necessary to apply this framework will require significant resources and coordination. However, this coordinated effort is necessary to ensure not only that management actions are being implemented, but that these actions are contributing to achieving Resource Condition Targets and ultimately conservation or improvement in the Wimmera's waterways.

8 review of the wimmera WHS

wimmera waterway health strategy

The *Wimmera WHS* is a strategic framework for protecting and enhancing waterway health in the Wimmera CMA region. Much of the knowledge in waterway health is still developing, and as such the *Wimmera WHS* will be subject to periodic review to ensure that listed actions are accurate, up-to-date and based on the best available information.

Further to this, as actions are completed, priorities for ongoing actions will shift, necessitating review of the strategy.

The *Wimmera WHS* is intended to be reviewed every five years.

In addition, the State will lead a review of the RiVERS database to look at the values and threats currently used in the production of Regional River Health Strategies. Consideration may be given to modifying the current list of values and threats in line with additional knowledge and pressures.

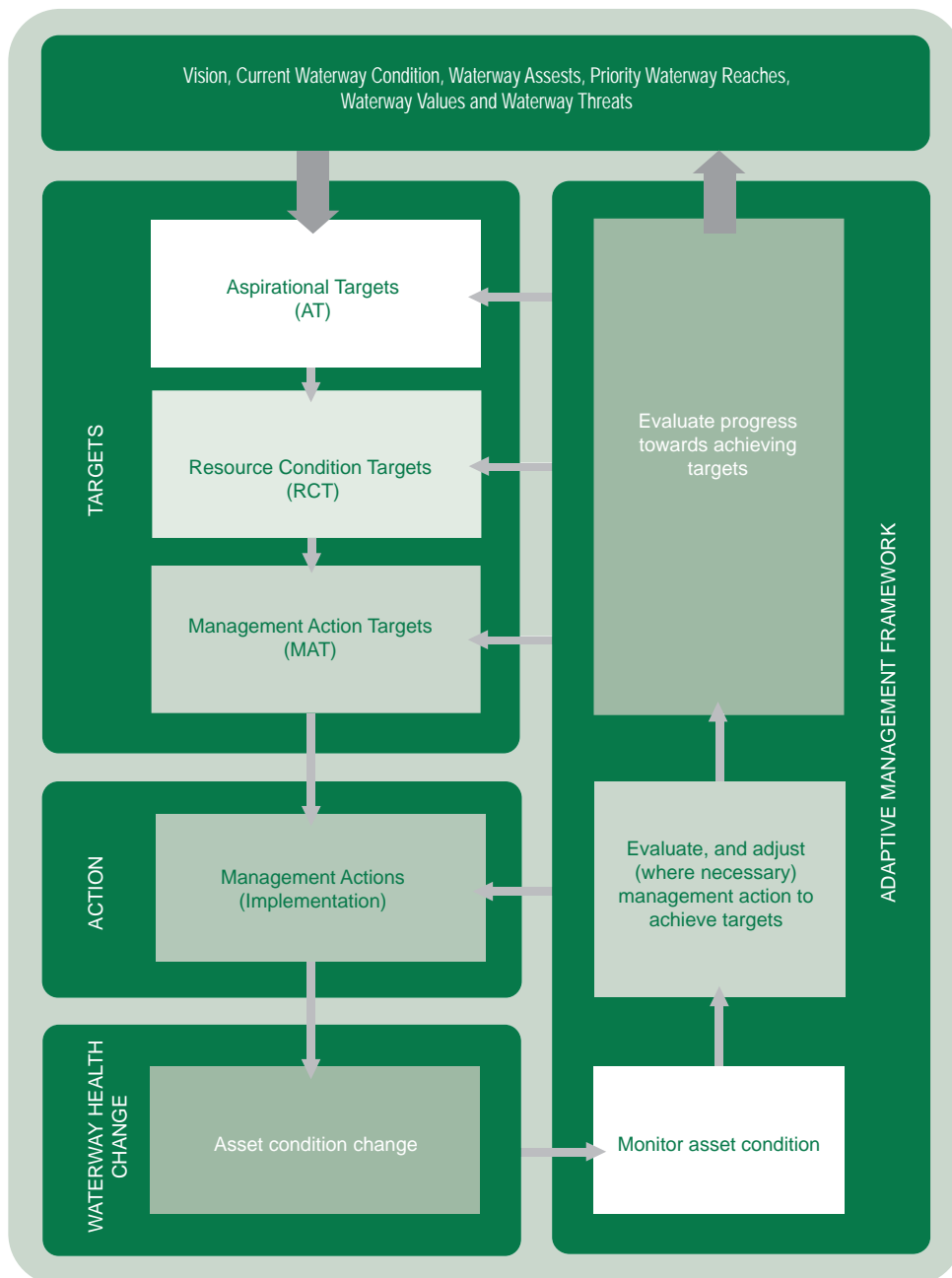
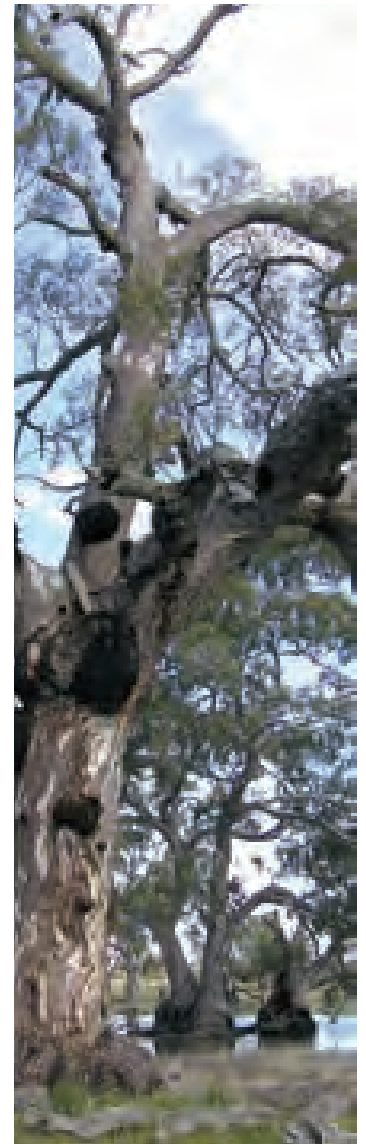


FIGURE 3.4 adaptive management framework for the Wimmera WHS

part four

priority waterways, reaches and actions

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1 introduction

wimmera waterway health strategy

This section of the *Wimmera WHS* is the detailed actions for priority waterway reaches and wetlands across the Wimmera CMA region.

The region is divided into 19 Waterway Management Units (Figure 4.1):

- | | | | |
|----|--|----|--|
| 01 | Upper Wimmera River system | 10 | Lake Toolondo Creek system |
| 02 | Mt Cole Creek system | 11 | Natimuk Creek system |
| 03 | Wattle Creek system | 12 | Heritage River system |
| 04 | Concongella Creek system | 13 | Terminal Lakes system |
| 05 | Upper Mt William Creek system | 14 | Yarriambiack Creek system |
| 06 | Lower Mt William Creek system | 15 | Dunmunkle Creek system |
| 07 | Grampians system | 16 | Millicent Coast Lakes system |
| 08 | Mackenzie River and Burnt Creek system | 17 | Millicent Coast West-flowing system |
| 09 | Norton Creek system | 18 | Little Desert National Park system |
| | | 19 | North from the Little Desert National Park |

Within each Waterway Management Unit the various waterway reaches are identified by a specific number as shown on a map, which identifies each reach as a specific geographic location. This allows specific actions to be attributed to specific locations.

The actions in this section have been identified based on the risk assessment and prioritisation process undertaken as part of developing the Wimmera WHS. A summary of the risk assessment and prioritisation process is presented in a table for each Waterway Management Unit. The actions for each Waterway Management Unit details the actions, values being protected/enhanced and the threatening process being addressed, links to the strategic actions in Part 4 and identifies where those actions are to take place, and the priority for undertaking those actions.

Further information on the identification process for Waterway Management Units and risk assessment and prioritisation is detailed in the *Wimmera WHS Resource Book* in Part 6, Sub-folder 16.




legend

 Waterway Management Units

18 Waterway Management Unit Number

 River Reaches

 Waterways*

 Wetlands*

 Priority Waterways

 Priority Wetlands

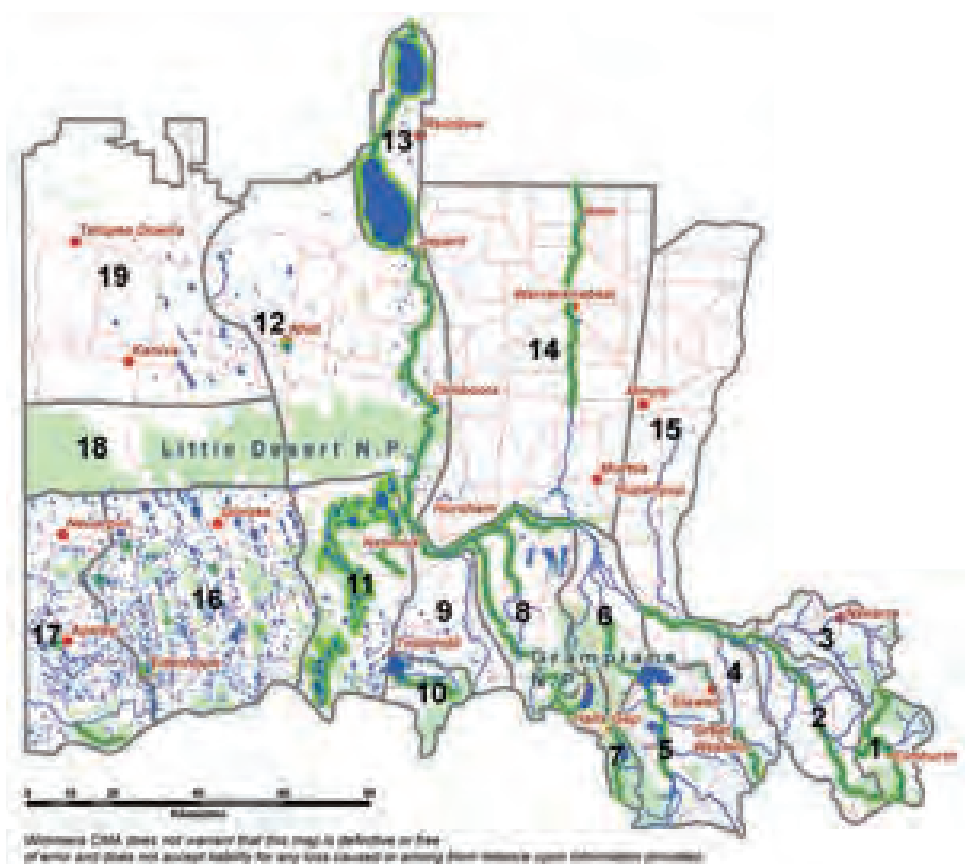
 Major Towns*

 Major Roads*

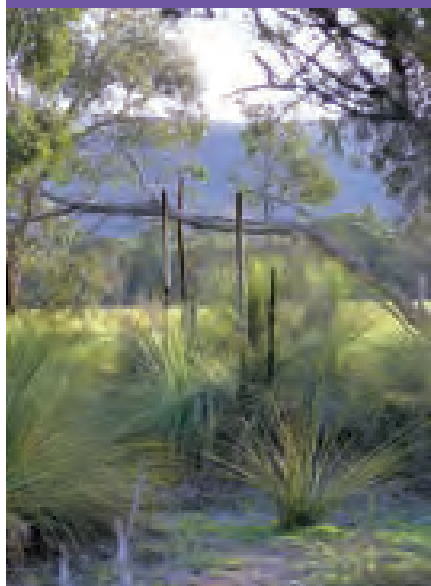
 Public Land*

 Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.1 Wimmera CMA region waterway management units



For each Waterway Management Unit, a brief description of the current condition (based on the ISC survey) is given. Any significant flora and fauna species and EVCs located near waterways in the Management Unit are also identified.

Priority reaches (see Part 2) in the Management Unit are listed, along with the reason for their determination as priorities. Influencing waterways, those reaches that have an impact on water quality or pest plants and/or animals in the priority reaches are identified.

The primary management objectives for the Management Unit are presented. These represent the major aims for waterway management in the Management Unit.

The results of the risk assessment to significant values in priority reaches are provided. The risk assessment results are given in table form with the following characteristics (see figure next page):

- The name and reach number of the priority reach.
- A list of threats that may be acting in the reach, and the rating of the threat level (from the RiVERS database).
- A list of values in the reach. It is important to note that these values only include those environmental, social and/or economic values associated with the reason for the reach being identified as a priority reach.
- The rating of each value (from the RiVERS database).
- The risk rating for each value/threat combination. These provide an assessment of the potential for each threat to have a detrimental effect on each value.



list of values

list of threats

rating of threat (RIVERS)

rating of value (RIVERS)

name of reach

risk ratings for each threat on each value

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		3	3	5	3	1	2	0	0	1	1	4	5	1	4	1	5
significant flora	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
significant EVC	5	0	0	0	0	0	0	0	0	0	2	6	4	0	7	2	8
significant fauna	5	0	0	4	0	0	0	0	0	2	2	7	8	2	7	2	4
significant wetland	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
wetland rarity	5	0	0	0	0	2	2	0	0	0	2	6	0	0	0	2	7
heritage river	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
sites of significance	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
ecologically healthy	4	3	3	4	3	2	2	0	0	2	2	6	7	2	6	2	6
riparian width	5	3	0	0	0	0	0	0	0	0	2	6	0	0	7	0	8
riparian continuity	5	3	0	0	0	0	0	0	0	0	2	7	0	0	7	0	8
riparian intactness	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
invertebrate O/E	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish O/E	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish proportion	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0
fish migration	4	0	0	7	3	2	0	0	0	2	0	0	6	0	2	2	6

WIMMERA RIVER (MU 1/R 12)

The level of the risk rating determines the priority of actions to reduce the level of the threat according to the following key: **8 Very High risk**, high priority for action; **5, 6 or 7 High risk**, high priority for action; **3 or 4 Medium risk**, medium priority for action; **1 or 2 Low risk**, low priority for action.

For more detail on the Risk Assessment Procedure, see the *Wimmera WHS Resource Book Part 6 Resource Book*, Sub-folder 16 – Risk Assessment and Prioritisation.

name of influencing reach	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access	list of threats that may affect downstream reaches
Glenpatrick Creek Reach 40	4	4	1	2	0	0	1	4	3	1	5	5	
Nowhere Creek Reach 93	2	1	1	2	0	5	1	3	3	1	3	5	
Nowhere Creek Reach 94	1	1	1	2	0	0	1	2	3	1	2	1	rating of threat (RiVERS)

For influencing reaches, only a sub-set of the available threat data is used to determine priority actions. These threats are those that have the ability to affect downstream water quality, flow regime or provide a source of pest plants and animals. The level of the threat rating in the influencing reach determines the possibility that the threat will affect a downstream priority reach. Therefore, the threat level determines the priority of actions in the influencing reach according to the following key: **5 or 4 High threat level** in reach, so high possibility of affecting downstream priority reach (therefore High *Wimmera WHS* priority for action), **3 Medium threat level** in reach (Medium *Wimmera WHS* priority for action), **2 or 1 Low threat level** in reach (Low *Wimmera WHS* priority for action).

It is recognised that actions to address risks to significant values have additional benefits for the reaches, the Management Unit and/or the *Wimmera Basin*. Some of these additional benefits are identified.

Actions identified to reduce the level of risk are then presented. Each action has a unique identifier, a description of the action, a list of reaches where the action is to be implemented, the priority for the action to be implemented, an indicative cost of the action, a link to the region-wide Waterway Program actions identified in Part 5, and the determination of Management Action Targets (MATs) and Resource Condition Targets (RCTs) for that particular action.

For a list of assumptions used to determine RCTs, see the *Wimmera WHS Resource Book* Part 6 Resource Book, Sub-folder 17 – Targets.

Finally, a summary of the changes in condition (based on the ISC), the overall MATs and RCTs if all the actions are implemented in the Management Unit is provided. When summed across the region, these form the basis of many of the MATs and RCTs identified for the Waterway Programs in Part 5.



waterway management unit 1. upper wimmera river system

reaches 12, 38, 39, 40, 93 and 94

1.1 waterways and their condition

Waterway Management Unit 1 is the upper Wimmera region including the first 30 km of the Wimmera River that flows from its headwaters near the northern edge of the Great Dividing Range, north-west towards Elmhurst (Map 4.2). This part of the catchment is significant in that Glenlofty Creek and the Wimmera River lack a continuously defined channel along their lengths in this Management Unit. These waterways also contain reaches of the distinctive and very rare 'Chain of Ponds' fluvial systems due to a combination of geological controls and a small catchment size. The 'Chain of Ponds' fluvial systems historically continued along a much greater proportion of the Wimmera River however most of these systems have been drained or subjected to incision processes. The 'Chain of Ponds' are much less common now (currently only approximately 0.6% of total stream length) and due to their scarce distribution, it is vital to preserve these remaining areas.

The physical forms of channels within this part of the region were generally in a moderate condition. The range of ISC bank stability scores indicates that the stream banks are undergoing moderate to limited erosion in this portion of the catchment. The ISC also takes into account artificial barriers to fish migration. All of the waterways within this portion of the catchment were affected by downstream reaches that contained artificial barriers that provided only intermittent opportunities for the migration of indigenous fish species. There were sparse quantities of Large Woody Debris visible in the waterways in this management unit, with all reaches apart from a tributary of Nowhere Creek, classified as having poor to very poor in-stream habitat.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

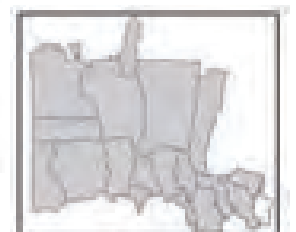
Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.2 waterway management unit 1 and reaches

The ISC showed that the condition of streamside zones in this Management Unit varied considerably between individual waterways, apart from a low percentage cover of weeds across the board. The streamside zones for the Wimmera River and Glenlofty Creek are generally in a poor to very poor condition. This was mainly due to the absence or limited nature of such features as large tree cover, thereby affecting the connectivity of vegetated areas, the recruitment of native species, the composition of the understorey and the presence of native organic litter and logs. On the other hand, Glenpatrick Creek, Nowhere Creek and one of its tributaries had a much better standard of streamside zone with larger areas of tree canopy cover. As there are more large trees, this led to higher levels of recruitment of native species and often a better condition understorey with more organic litter and logs.

As this is an upland area, the hydrology of this area of this Management Unit is amongst the best in the Wimmera region. The ISC 2004 survey showed that all of the stream flows are relatively unaffected by water diversions and apart from unnaturally low-flow volumes in summer, the rest of the flow regime does not impact too much on the health of the waterways in this area.

No water quality or aquatic life sub-index data was obtained for this Management Unit for the ISC 2004 survey.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.1). Although not of conservation significance, the presence of platypus in the waterways of the Management Unit is considered of particular regional value.

TABLE 4.1 significant flora, fauna and EVC recorded in waterway management unit 1

Significant fauna	Square-tailed Kite, Mountain Galaxias
Significant flora	None recorded
Significant EVC	Alluvial Terraces Herb-rich Woodland/Plains Grassy Woodland Complex Creekline Grassy Woodland Grassy Dry Forest Herb-rich Foothill Forest Hills Herb-rich Woodland Low Rises Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic Riparian Forest Valley Grassy Forest

1.2 priority waterways

Priority reaches in Waterway Management Unit 1 are:

- **Wimmera River Reach 12** (High environmental value from RiVERS).
- **Glenlofty Creek Reach 38** (a geomorphological site of significance).
- **Glenlofty Creek Reach 39** (a geomorphological site of significance).

Priority waterways downstream of this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 1 are:

- Yarriambiack Creek Reaches 18 – 20.
- Wimmera River Reaches 2 – 7.
- Wimmera River Reaches 9 – 10.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.





1.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches that flow into Priority Reach 12 in Waterway Management Unit 1:

- Glenpatrick Creek Reach 40.
- Nowhere Creek Reach 93.
- Tributary of Nowhere Creek Reach 94.

1.4 primary management objectives

The primary management objectives for priority reaches in Waterway Management Unit 1 are:

- Protect the High environmental rating of Wimmera River Reach 12.
- Protect geomorphological significant features (Chain of Ponds) in Glenlofty Creek.
- Prevent damage to priority reaches from conditions in influencing reaches.

1.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 1. A summary of the risks for priority reaches related to the high values in need of protection is presented in Table 4.2.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 1 include:

- Barriers to fish migration, Exotic fauna, Loss of instream habitat, Degraded streamside vegetation and Stock access in Wimmera River Reach 12.
- Channel modification, Loss of instream habitat, Degraded streamside vegetation and Stock access in Glenlofty Creek Reach 38.
- Exotic flora and Loss of instream habitat in Glenlofty Creek Reach 39.

Medium risks to significant values in priority reaches in Waterway Management Unit 1 include:

- Bank erosion, Bed instability and Channel modification in Wimmera River Reach 12.
- Bed instability and Exotic fauna in Glenlofty Creek Reach 38.
- Bed instability, Water quality (nutrients), Exotic fauna and Degraded streamside vegetation in Glenlofty Creek Reach 39.

Potential threats to priority reach Wimmera River Reach 12 from the three influencing waterways (Glenpatrick Creek Reach 40, Nowhere Creek Reach 93 and Tributary of Nowhere Creek Reach 94) can be seen in Table 4.3. High priority threats from bank erosion, bed instability, exotic flora and stock access can be identified in Glenpatrick Creek Reach 40, while water quality (SIGNAL, indicating nutrient status) and stock access are the major threats identified in Nowhere Creek.

TABLE 4.2 risks to significant values in priority reaches in waterway management unit 1

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Overall Environmental Value		3	3	5	3	1	2	0	0	1	1	4	5	1	4	1	5
significant flora	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
significant EVC	5	0	0	0	0	0	0	0	0	0	2	6	4	0	7	2	8
significant fauna	5	0	0	4	0	0	0	0	0	2	2	7	8	2	7	2	4
significant wetland	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
wetland rarity	5	0	0	0	0	2	2	0	0	0	2	6	0	0	0	2	7
heritage river	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
sites of significance	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1
ecologically healthy	4	3	3	4	3	2	2	0	0	2	2	6	7	2	6	2	6
riparian width	5	3	0	0	0	0	0	0	0	0	2	6	0	0	7	0	8
riparian continuity	5	3	0	0	0	0	0	0	0	0	2	7	0	0	7	0	8
riparian intactness	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
invertebrate O/E	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish O/E	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish proportion	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0
fish migration	4	0	0	7	3	2	0	0	0	2	0	0	6	0	0	2	6

WIMMERA RIVER REACH 12

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
Site of Geomorphic Significance		1	3	5	4	1	2	0	0	1	2	3	4	1	4	1	5
sites of significance	5	2	3	0	6	2	0	0	0	0	2	3	6	0	6	2	8

GLENLOFTY CREEK REACH 38

TABLE 4.2 (continued)

	bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
Site of Geomorphic Significance	2	3	5	2	1	2	0	5	1	5	3	4	1	3	1	1
sites of significance	5	2	3	0	2	0	0	4	0	7	3	6	0	3	2	2

GLENLOFTY CREEK REACH 39

Key: 8 **Very High** risk, high priority for action, 7 **High** 1 risk, high priority for action, 6 **High** 2 risk, high priority for action, 5 **High** 3 risk, high priority for action, 4 **Medium** 1 risk, medium priority for action, 3 **Medium** 2 risk, medium priority for action, 2 **Low** 1 risk, low priority for action, 1 **Low** 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

TABLE 4.3 threat levels influencing waterways in waterway management unit 1

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Glenpatrick Creek Reach 40	4	4	1	2	0	0	1	4	3	1	3	5
Nowhere Creek Reach 93	2	1	1	2	0	5	1	3	3	1	3	5
Nowhere Creek Reach 94	1	1	1	2	0	0	1	2	3	1	2	1

Key: 5 or 4 **High** threat level in reach (High *Wimmera WHS* priority for action), 3 **Medium** threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 **Low** threat level in reach (Low *Wimmera WHS* priority for action).

1.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other benefits for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to retaining or re-establishing natural riparian vegetation along all significant waterways and wetlands of the Wimmera region (AT4).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

1.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU01-01	Undertake fencing and/or revegetation of riparian land identified in the River Reach 2 Waterway Action Plan (2003), the Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan, and the Glenpatrick/Nowhere Creek Waterway Action Plan.	Degraded riparian vegetation Uncontrolled stock access	12	40, 93	High	1,312,500	RL1, 2	141.60 ha of riparian land revegetated and under management agreement for off-stream watering.	29.5 km of riparian zone with improved ISC Streamside Zone sub-index score 29.5 km of waterway with improved ISC Physical Form sub-index score
WMU01-02	Encourage off-stream watering of stock.	Uncontrolled stock access	12	40, 93	High	20,000	RL5		
WMU01-03	Work with landholders in Glenlofty Creek sub-catchment to develop appropriate mechanisms for reducing and managing stock access and grazing pressure as outlined in the Glenlofty Creek Waterway Action Plan (2002).	Degraded riparian vegetation Uncontrolled stock access	38		High	187,500	RL1, 11, 26	21.6 ha of riparian land under management agreements.	4.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 4.5 km of waterway with improved ISC Physical Form sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU01-04	Work with landholders in Glenlofty Creek sub-catchment to develop appropriate mechanisms for reducing and managing stock access and grazing pressure as outlined in the Glenlofty Creek Waterway Action Plan (2002).	Degraded riparian vegetation Uncontrolled stock access	39		Medium	187,500	RL1, 11, 26	14.4 ha of riparian land under management agreements.	5.0 km of riparian zone with improved ISC Streamside Zone sub-index score 5.0 km of waterway with maintained ISC Physical Form sub-index score.
WMU01-05	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	39		High	115,000	RL3, 9, 33	Priority weed control on 6.0 km of waterways.	5.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU01-06	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation	39		High	50,000	RL3, 33	Weed control on 6.0 km of waterways.	
WMU01-07	Undertake management of priority weed species as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation		93	Medium	60,000	RL3, 9, 33	Priority weed control on 7.2 km of waterways.	6.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU01-08	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation		93	Medium	25,000	RL3, 33	Priority weed control on 7.2 km of waterways.	
WMU01-09	Undertake management of priority weed species as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	12, 38	40	Low	170,000	RL3, 9, 33	Priority weed control on 33.6 km of waterways.	28.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU01-10	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation	12, 38	40	Low	75,000	RL3, 33	Weed control on 33.6 km of waterways.	Weed control on 33.6 km of waterways.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU01-11	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna Degraded riparian vegetation	12		High	30,000	RL10	83.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU01-12			38, 39	40, 93, 94	Medium	52,000	RL10		
WMU01-13	Implement priority bed and bank stabilisation actions as outlined in the Glenlofty Creek Waterway Action Plan (2002), especially to protect the high value Chain of Ponds system.	Bed instability Channel modification Loss of instream habitat	38, 39		High	375,000	RL11, 12, ICF5, 6, ICF22, 23	3.0 km of bed and banks stabilised.	9.5 km of waterway with improved ISC Physical Form sub-index score.
WMU01-14	Implement priority bed and bank stabilisation actions in the Wimmera River Reach 2 Waterway Action Plan (2003) and the Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan.	Bank erosion Bed instability Channel modification Loss of instream habitat	12		Medium	800,000	RL12, 25 ICF6, 19	1.5 km of bed and banks stabilised.	15 km of waterway with improved ISC Physical Form sub-index score.
WMU01-15	Implement priority bed and bank stabilisation actions in the Glenpatrick/Nowhere Creek Waterway Action Plan, the Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003) and Wimmera River Geomorphic Investigation-Sediment Sources, Transport and Fate (2001) .	Bank erosion Bed instability		40,93	High	500,000	RL11, 12, 26, ICF5, 6, ICF20, 22, 23, 29, 30	3.0 km of bed and banks stabilised.	14.5 km of waterway with improved ISC Physical Form sub-index score.
WMU01-16	Re-introduce Large Woody Debris (LWD) at priority sites to restore instream habitat as specified in sub-reach 2.4 in the Wimmera River Reach 2 Waterway Action Plan.	Loss of instream habitat	12		High	85,000	ICF25	2 sites with LWD reintroduced.	15 km of waterway with improved ISC Physical Form sub-index score.
WMU01-17	Implement sound water resource management in unregulated waterways.	Changes to flow (flow deviation)	12, 38, 39		Low	204,000	EWR4,5 6, 11,12, 13, 15, 16,17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 3 priority reaches.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU01-18	Investigate and implement options to return summer flows to the Wimmera River upstream of Eversley.	Changes to flow (flow deviation)	12, 38, 39		Low	125,000	EWR18	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 3 priority reaches.
WMU01-19	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	12, 38, 39	40, 93, 94	Low	61,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU01-20	Monitor flows and achievement of environmental water requirements at Eversley.	Changes to flow (flow deviation)	12		Low	50,000	EWR9	Monitoring program implemented.	Improved flow regime achieving environmental objectives in priority reach.
WMU01-21	Undertake research into nutrient sources, particularly in Glenlofty Creek Reach 39 and Nowhere Creek Reach 93.	Water quality trends Water quality attainment	39	93	High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU01-22	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to native fish migration	12		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage by 2010.	Targets set by investigation.
WMU01-23	Monitor erosion and advancing headcut downstream of Hanging Swamp.	Bank erosion Bed instability	12		High	12,500	RL 12, ICF6, ICF22, 23, MON13	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU01-24	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	12, 38, 39	40	High	225,000	WQ12, MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy Reviews.
WMU01-25	Monitor platypus populations in the upper Wimmera River.	All threats	12		High	15,000	MON7	Monitoring program implemented and actions developed.	Condition target to be set by 2008 after completion of biodiversity surveys.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
COMMUNITY COMMUNICATIONS, EDUCATION AND ENGAGEMENT									
WMU01-26	Increase community understanding of waterway health.	All threats	12, 38	40, 93	High	170,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU01-27	Actively engage community and stakeholders in managing waterways.	All threats	12, 38, 39	40, 93, 94	High	24,000	RL37, ICF38 WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 1 cost summary

Total Cost of all Actions	\$5,008,500
High Priority Actions	\$3,199,000
Medium Priority Actions	\$1,124,500
Low Priority Actions	\$685,000



1.8 overall ISC condition, management action and resource condition targets

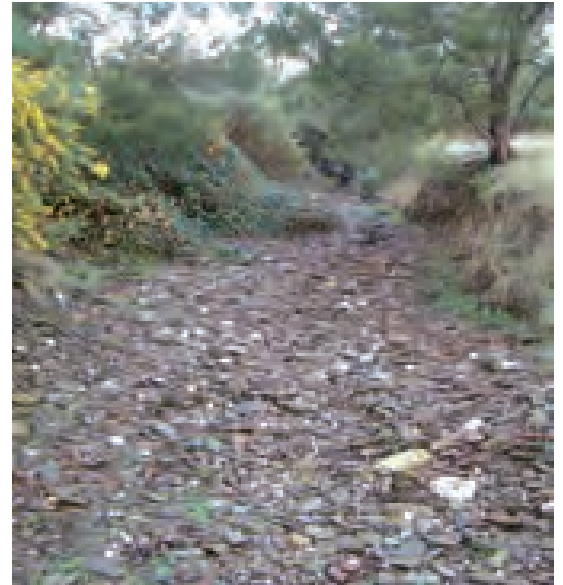
Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 12 ISC score raised from 21 to 31 (Moderate to Good)</p> <p>Reach 38 ISC score raised from 19 to 28 (Moderate to Good)</p> <p>Reach 39 ISC score raised from 15 to 23 (Poor to Moderate)</p> <p>Reach 40 ISC score raised from 29 to 36 (maintained at Good)</p> <p>Reach 93 ISC score raised from 26 to 33 (Moderate to Good)</p> <p>Reach 94 ISC score maintained at 34 (maintained at Good)</p>	<p>22.0 km (Reaches 40 and 94) maintained at Good</p> <p>51.0 km (Reaches 12, 38 and 93) raised from Moderate to Good</p> <p>10.0 km (Reach 39) raised from Poor to Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>141.6 ha of riparian land fenced and/or revegetated</p> <p>6.0 ha of riparian land under management agreement for fencing and revegetation</p> <p>117.6 ha of priority stream under land management agreement for off-stream watering</p> <p>69.6 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 46.8 km of waterways</p> <p>Weed control on 46.8 km of waterways</p> <p>7.5 km of bed and banks stabilised</p> <p>2 sites with LWD introduced</p> <p>83.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 3 priority reaches</p>	<p>39.0 km of riparian zones with improved ISC</p> <p>Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 15.0 km raised from 3 to 6 in Reach 12 • 4.5 km raised from 3 to 6 in Reach 38 • 5.0 km raised from 1 to 4 in Reach 39 • 8.5 km raised from 5 to 8 in Reach 40 • 6.0 km raised from 5 to 7 in Reach 93 <p>34.0 km of waterway channel with improved ISC</p> <p>Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 15.0 km raised from 5 to 7 in Reach 12 • 4.5 km raised from 4 to 6 in Reach 38 • 8.5 km raised from 5 to 7 in Reach 40 • 6.0 km raised from 5 to 6 in Reach 93 <p>Improved flow regime achieving environmental objectives in 3 priority reaches</p>

waterway management unit 2. mt cole creek system

reaches 10, 11, 36, 37, 60, 61, 62, 63, 64, 87 and 88

2.1 waterways and their condition

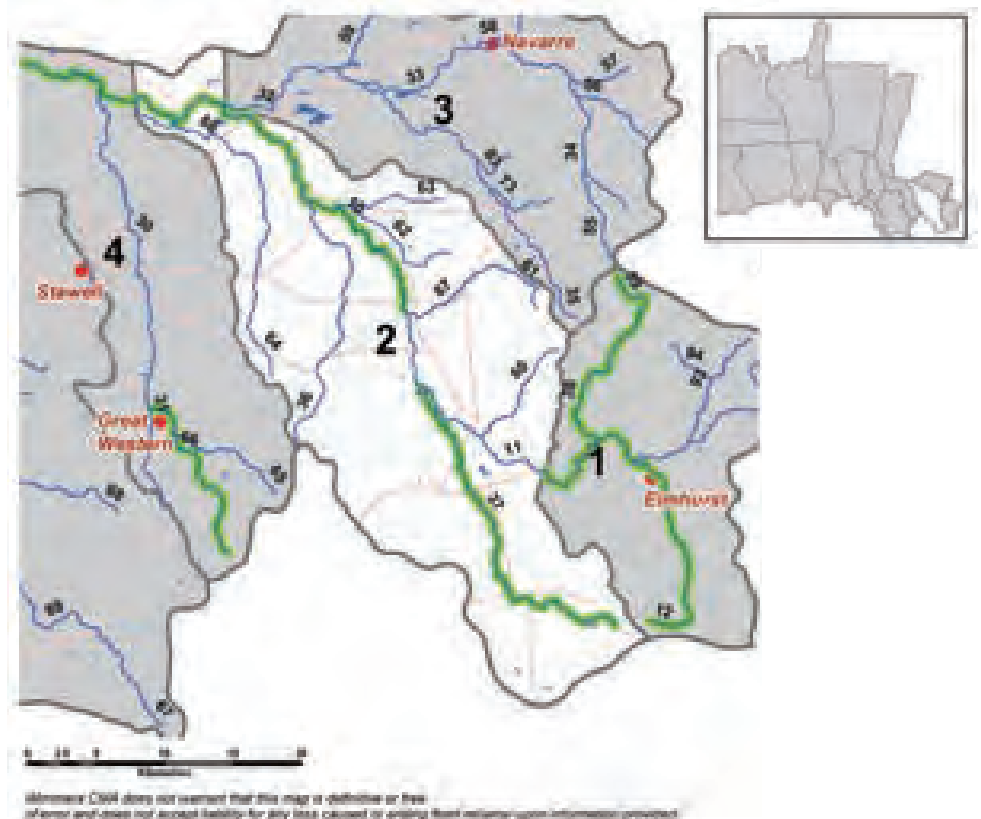
Waterway Management Unit 2 is located in the upper part of the Wimmera River catchment. It is named after Mount Cole Creek which flows north around the western edge of Mount Cole (Map 4.3). This Management Unit also includes Six Mile and Seven Mile creeks that flow into the Wimmera River to the north-west of Mount Cole Creek. Spring Creek, Glendhu Creek, Shays Creek as well as several other smaller waterways also flow west into the Wimmera River. The Wimmera River, between Eversley and Campbells Bridge alters from a small, aggrading channel in the upper parts to a naturally anabranching channel and has undergone little modification when compared to other reaches of the Wimmera River. The Wimmera River is in its most pristine state in this section of the catchment.



↑ legend

-  Waterway Management Units
- 18** Waterway Management Unit Number
-  River Reaches
-  Wetlands*
-  Waterways*
-  Priority Wetlands
-  Priority Waterways
-  Major Towns*
-  Major Roads*
-  Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.3 waterway management unit 2 and reaches

According to the ISC 2004 results, the Wimmera River in this Management Unit has a good condition streamside zone with significant areas of tree canopy cover. There are several continuous stretches of large trees, leading to higher levels of recruitment of native species resulting in a better condition understorey with the more organic litter and logs. However, the streamside zones for other waterways within this Management Unit are generally in a poor to very poor condition.

The ISC 2004 survey showed that the physical forms of the waterways within this Management Unit were generally in a poor condition. Low survey scores indicate that areas of extensive erosion are visible on some stream banks. Furthermore, the amount of woody vegetation protecting the banks with their roots was relatively minor. Some stream banks had unstable locations with exposed roots indicating where parts of the bank had been washed away. Shays, Glendhu and Spring creeks are noted significant sources of sediment. There were sparse quantities of woody debris visible along these reaches, with all reaches apart from one reach of the Wimmera River achieving scores that placed them in the poor to very poor habitat categories. Artificial barriers located further downstream on the Wimmera River meant that there are only intermittent opportunities for the migration of native fish species.

The aquatic life survey results for the Wimmera River show that it has an abundant diversity of macroinvertebrates, including macroinvertebrate families that are sensitive to the effects of water pollution. On the other hand the abundance and diversity of macroinvertebrates sampled from Mount Cole Creek was much lower.

This signifies that the effects of habitat loss (both from LWD in the stream channel and the streamside zone vegetation) as well as water quality issues have had a negative impact on the aquatic life forms in this part of the catchment.

The waterways in Mount Cole Creek Management Unit have been affected by diversions for irrigation and stock use which has in turn affected the volumes of low flows in these streams and the duration of periods of no flow, particularly in the summer months. This increases the stress on the waterways and the aquatic communities within them through limiting the amount of habitat during these times.

Water quality was measured at one location on the Wimmera River within this portion of the catchment for the ISC 2004 survey. Water quality results indicate that the waters contain high levels of total phosphorus, salinity and pH, with the seepage of saline groundwater into several of the upland creeks affecting these results. Turbidity levels decreased slightly since the previous ISC survey in 1999.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.4). Although not of conservation significance, the presence of platypus in the waterways of the Management Unit is considered of particular regional value.

TABLE 4.4 significant flora, fauna and EVC recorded in waterway management unit 2

Significant fauna	Powerful Owl, River Blackfish
Significant flora	None recorded
Significant EVC	Alluvial Terraces Herb-rich Woodland Alluvial Terraces Herb-rich Woodland/Plains Grassy Woodland Complex Creekline Grassy Woodland Grassy Dry Forest Grassy Woodland Grassy Woodland/Heathy Dry Forest Complex Heathy Woodland Herb-rich Foothill Forest Low Rises Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic Plains Grassy Woodland Plains Woodland Riparian Woodland

2.2 priority waterways

Priority Reaches in Waterway Management Unit 2 are:

- **Wimmera River Reach 10** (identified in near ecologically healthy condition).
- **Mt Cole Creek Reach 37** (high economic value).

Priority waterways downstream of this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 2 are:

- Yarriambiack Creek Reaches 18-20.
- Wimmera River Reaches 2-7.
- Wimmera River Reach 9.
- Lake Hindmarsh and Lake Albacutya.

2.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Wimmera River Reach 11.
- Six Mile Creek Reach 36.
- Spring Creek Reach 60.
- Unnamed tributaries of Wimmera River Reaches 61, 62 and 87.
- Tributary of Aston's Scour Reach 63.
- Seven Mile Creek Reaches 64 and 88.

2.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 2 are:

- Improve the environmental condition of Wimmera River Reach 10 from near ecologically healthy status to ecologically healthy status.
- Protect the high economic values in Mt Cole Creek Reach 37.
- Prevent damage to priority reaches from conditions in influencing reaches.

2.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 2. A summary of the risks for priority reaches related to the high values in need of protection is presented in Table 4.5.



TABLE 4.5 risks to significant values in priority reaches in waterway management unit 2

Near Ecologically Healthy Condition		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		2	1	5	3	1	2	0	1	1	1	3	3	1	2	1	1
significant flora	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
significant EVC	5	0	0	0	0	0	0	0	0	0	2	3	0	0	2	2	2
significant fauna	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sites of significance	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ecologically healthy	4	2	2	4	3	2	2	0	2	2	2	3	3	2	2	2	2
riparian width	5	2	0	0	0	0	0	0	0	0	2	3	0	0	2	0	2
riparian continuity	4	2	0	0	0	0	0	0	0	0	2	3	0	0	2	0	2
riparian intactness	4	2	0	0	0	2	0	0	0	0	2	3	0	0	2	0	2
invertebrate O/E	5	2	2	0	3	0	2	0	2	2	2	0	3	2	2	2	2
native fish O/E	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish proportion	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
fish migration	4	0	0	7	3	2	0	0	2	2	0	0	3	0	0	2	2

WIMMERA RIVER REACH 10

High Economic Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		2	1	5	3	1	2	0	1	1	1	3	3	1	2	1	1
water supply delivery	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
water supply collection	5	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
infrastructure	5	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	4	5	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0
tourism	5	4	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0
power generation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MT COLE CREEK REACH 37

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 2 include:

- Barriers to fish migration in Wimmera River Reach 10.
- Bank erosion and Bed instability in Mt Cole Creek Reach 27.

Medium risks to significant values in priority reaches in Waterway Management Unit 2 include:

- Channel modification, Exotic fauna and Loss of in-stream habitat in Wimmera River Reach 10.
- Degraded streamside vegetation in Mt Cole Creek Reach 37.

Potential threats to priority reach Wimmera River Reach 10 from the nine influencing waterways can be seen in Table 4.6. High and medium threats from bank erosion, bed instability, exotic fauna, degraded streamside zone and stock access are common throughout the influencing waterways, while water quality (primarily salinity and nutrients measured at station 415207) is a high priority threat in the Wimmera River Reach 11.

TABLE 4.6 threat levels influencing waterways in waterway management unit 2

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Wimmera River Reach 11	1	3	1	5	5	3	1	2	4	1	4	5
Six Mile Creek Reach 36	4	3	1	2	0	0	1	2	3	1	3	5
Spring Creek Reach 60	3	3	1	2	0	0	1	2	3	1	4	5
Trib. of Wimmera River Reach 61	1	1	1	2	0	0	1	2	3	1	4	5
Trib. of Wimmera River Reach 62	5	3	1	2	0	0	1	2	3	1	4	1
Trib. of Aston's Scour Reach 63	3	3	1	2	0	0	1	2	3	1	3	1
Seven Mile Creek Reaches 64	1	3	1	2	0	0	1	2	3	1	4	5
Trib. of Wimmera River Reach 87	4	3	1	2	0	0	1	2	3	1	4	5
Seven Mile Creek Reaches 88	3	3	1	2	0	0	1	2	3	1	4	5

Key: 5 or 4 High threat level in reach (High Wimmera WHS priority for action), 3 Medium threat level in reach (Medium Wimmera WHS priority for action), 2 or 1 Low threat level in reach (Low Wimmera WHS priority for action).

2.6 additional benefits

Actions developed to achieve these objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).

- Contribute to retaining or re-establishing natural riparian vegetation along all significant waterways and wetlands of the Wimmera region (AT4).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

2.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU02-01	Implement priority bed and bank stabilisation management actions in the Mt Cole Creek Waterway Action Plan (2005).	Bank erosion Bed instability	37		High	500,000	RL22 ICF16	1.5 km of bed and banks stabilised.	14.5 km of waterway with improved ISC Physical Form sub-index score.
WMU02-02	Undertake fencing and/or revegetation of riparian land actions in the Mt Cole Creek Waterway Action Plan (2005).	Degraded riparian vegetation	37		Medium	500,000	RL1, 2	69.6 ha of riparian land revegetated.	14.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 14.5 km of waterway with improved ISC Physical Form sub-index score.
WMU02-03	Undertake fencing and/or revegetation of riparian land identified in the Wimmera River Reach 6.2 Waterway Action Plan (2002), the Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan, the Spring/Tuckers Creek Waterway Action Plan, the Six Mile Creek Waterway Action Plan (2003).	Bank erosion Degraded riparian vegetation		11, 60, 61, 62, 64, 87, 88	High	3,187,500	RL1, 2	220.8 ha of riparian land revegetated.	46.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 46.0 km of waterway with improved ISC Physical Form sub-index.
WMU02-04		Bank erosion Degraded riparian vegetation	10	36, 63	Medium	950,000	RL1, 2	170.4 ha of riparian land revegetated.	35.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 35.5 km of waterway with improved ISC Physical Form sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU02-05	Encourage off-stream watering of stock.	Stock Access	37		Medium	20,000	RL5	69.6 ha under management for off-stream watering.	Contribute to targets for WMU02-02 to WMU02-04.
WMU02-06		Stock Access		11, 36, 60, 61, 64, 87, 88	Medium	20,000	RL5	469.8 ha under management for off-stream watering.	
WMU02-07		Stock Access	10		Low	20,000	RL5	84.0 ha under management for off-stream watering.	
WMU02-08	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	10, 37		Low	218,000	RL3, 9, 33	Priority weed control on 64.0 km of waterways. 32.0 km of riparian zone with improved ISC Streamside Zone sub-index score.	32.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU02-09	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation	10, 37		Low	95,000	RL3, 33	Weed control on 64.0 km of waterways.	
WMU02-10	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna		11	High	24,000	RL10	21.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU02-11	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	10	36, 60, 61, 62, 63, 64, 87, 88	Medium	165,000	RL10	142.0 km of stream with rabbit control.	
WMU02-12	Implement priority bed and bank stabilisation management actions in the Glendhu Waterway Action Plan (2004).	Bed instability		11	Medium	865,000	ICF11	1.5 km of bed and banks stabilised.	10.5 km of waterway with improved ISC Physical Form sub-index score.
WMU02-13	Implement priority bed and bank stabilisation management actions in the Seven Mile Creek Waterway Action Plan (2003).	Bed instability		64, 88	Medium	750,000	ICF9	3.0 km of bed and banks stabilised.	17.5 km of waterway with improved ISC Physical Form sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU02-14	Implement priority bed and bank stabilisation management actions in the Shays Creek Waterway Action Plan (2004).	Bank erosion Bed instability		61, 87	Medium	900,000	ICF12	3.0 km of bed and banks stabilised.	8.0 km of waterway with improved ISC Physical Form sub-index score.
WMU02-15	Implement priority bed and bank stabilisation management actions in the Six Mile Creek Waterway Action Plan (2003).	Bank erosion Bed instability		36	High	750,000	ICF10	1.5 km of bed and banks stabilised.	12.5 km of waterway with improved ISC Physical Form sub-index score.
WMU02-16	Implement priority bed and bank stabilisation management actions, including protection of floodout zones in the lower section of reach 62, in the Wimmera River Reach 6.2 Waterway Action Plan (2002) and the Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan	Bank erosion Bed instability	10	11, 62, 63	High	630,000	ICF7, 19 ICF22, 23	6.0 km of bed and banks stabilised.	37.5 km of waterway with improved ISC Physical Form sub-index score.
WMU02-17	Implement priority bed and bank stabilisation and riparian management actions in the Spring/Tuckers Creek Waterway Action Plan.	Bank erosion Bed instability	10	11, 60, 61	Medium	250,000	ICF18	6.0 km of bed and banks stabilised.	38.0 km of waterway with improved ISC Physical Form sub-index score.
WMU02-18	Re-introduce LWD at priority sites to restore instream habitat.	Loss of in-stream habitat	10	11	Medium	85,000	ICF25	4 sites with LWD introduced.	35.0 km of waterway with improved ISC Physical Form sub-index score.
WMU02-19	Implement sound water resource management in unregulated waterways.	Changes to flow (flow deviation)	10, 37	11, 36, 60, 61, 62, 63, 64, 87, 88	Low	473,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches.
WMU02-20	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	10, 37	11, 36, 60,	Low	142,000	RL8 WQ6	Planting and groundwater pumping actions implemented.	Site specific salinity targets to be set by 2010.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU02-21	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	10		High	40,000	SFF12, 3, 7	Investigate the cost-benefit of the removal of barriers to fish passage by 2010.	Targets set by investigation.
WMU02-22	Investigate and document the movement of the instream sediment slug in the Wimmera River.	Bed instability		11	High	100,000	ICF27	Investigation implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU02-23	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability		36, 62, 87	High	12,500	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU02-24	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability		11, 60, 61, 63	Medium	20,000	RL11, 12 ICF5, 6, 29, 30		
WMU02-25	Investigate stability of existing erosion control structures and maintain where appropriate.	Bank erosion Bed instability		62	High	75,000	RL11, 12 ICF5, 6, 29, 30	Investigation implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU02-26	Investigate stability of existing erosion control structures and maintain where appropriate.	Bank erosion Bed instability		64, 88	Low	75,000			
WMU02-27	Monitor bed stability and undertake action to ensure that existing sediment slugs in the Wimmera River, Glendhu Creek and Shays Creek do not mobilise, as outlined in the Wimmera River Reach 6.2, Glendhu Creek and Shays Creek Waterway Action Plans actions.	Bed instability	10	11	Low	10,000	RL13, 17, 18, 25 ICF7, 11, 12, 19, 22, 23, 27	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU02-28	Investigate and implement options to return summer flows to the Wimmera River.	Changes to flow (flow deviation)	10	11	Low	125,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU02-29	Monitor flows and achievement of environmental water requirements at Glynwylln.	Changes to flow (flow deviation)	10		Low	50,000	EWR9	Monitoring program implemented.	Improved flow regime achieving environmental objectives in priority reach.
WMU02-30	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality attainment		11	Medium	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU02-31	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats		11	High	520,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy Reviews.
WMU02-32	Monitor platypus populations in the Wimmera River.	All threats	10	11	High	15,000	MON7	Monitoring program implemented and actions developed.	Condition target to be set by 2008 after completion of biodiversity surveys.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU02-33	Increase community understanding of waterway health.	All threats	10, 37	11, 36, 60, 61, 62, 64, 87, 88	High WQ16, 17, CEE1, 2, 3	393,000 EWR56,	RL36 ICF35,	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU02-34	Actively engage community and stakeholders in managing waterways.	All threats	10, 37	11, 36, 60,	High	56,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 2 cost summary

Total Cost of all Actions	\$12,073,500
High Priority Actions	\$6,303,000
Medium Priority Actions	\$4,562,500
Low Priority Actions	\$1,208,000

2.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 10 ISC score raised from 23 to 26 (maintained at Moderate)</p> <p>Reach 11 ISC score raised from 22 to 25 (maintained at Moderate)</p> <p>Reach 36 ISC score raised from 20 to 33 (Moderate to Good)</p> <p>Reach 37 ISC score raised from 17 to 23 (Poor to Moderate)</p> <p>Reach 60 ISC score raised from 15 to 23 (Poor to Moderate)</p> <p>Reach 61 ISC score raised from 11 to 23 (V. Poor to Moderate)</p> <p>Reach 62 ISC score raised from 14 to 24 (Poor to Moderate)</p> <p>Reach 63 ISC score raised from 15 to 24 (Poor to Moderate)</p> <p>Reach 64 ISC score raised from 18 to 25 (maintained at Moderate)</p> <p>Reach 87 ISC score raised from 14 to 24 (Poor to Moderate)</p> <p>Reach 88 ISC score raised from 20 to 26 (maintained at Moderate)</p>	<p>25.0 km (Reach 36) raised from Moderate to Good</p> <p>91.0 km (Reaches 10, 11, 64 and 88) maintained at Moderate</p> <p>68.0 km (Reaches 37, 60, 62, 63, 87) raised from Poor to Moderate</p> <p>8.0 km (Reach 61) raised from Very Poor to Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>25.0 km (Reach 36) raised from Moderate to Good</p> <p>91.0 km (Reaches 10, 11, 64 and 88) maintained at Moderate</p> <p>68.0 km (Reaches 37, 60, 62, 63, 87) raised from Poor to Moderate</p> <p>8.0 km (Reach 61) raised from Very Poor to Moderate</p> <p>460.8 ha of riparian land fenced and/or revegetated</p> <p>153.6 ha of priority stream under land management agreement for off-stream watering</p> <p>256.8 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 64 km of waterways</p> <p>Weed control on 64 km of waterways</p> <p>22.5 km of bed and banks stabilised</p> <p>4 sites with LWD introduced</p> <p>163.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 2 priority reaches</p>	<p>96.0 km of riparian zone with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 17.5 km raised from 6 to 8 in Reach 10 • 10.5 km raised from 5 to 7 in Reach 11 • 12.5 km raised from 3 to 6 in Reach 36 • 14.5 km raised from 3 to 6 in Reach 37 • 6.0 km raised from 3 to 6 in Reach 60 • 4.0 km raised from 1 to 5 in Reach 61 • 4.0 km raised from 2 to 6 in Reach 62 • 5.5 km raised from 2 to 5 in Reach 63 • 10.0 km raised from 3 to 6 in Reach 64 • 4.0 km raised from 2 to 5 in Reach 87 • 7.5 km raised from 4 to 6 in Reach 88 <p>96.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 17.5 km raised from 6 to 8 in Reach 10 • 10.5 km raised from 5 to 7 in Reach 11 • 12.5 km raised from 4 to 7 in Reach 36 • 14.5 km raised from 4 to 6 in Reach 37 • 6.0 km raised from 3 to 6 in Reach 60 • 4.0 km raised from 3 to 5 in Reach 61 • 4.0 km raised from 3 to 5 in Reach 62 • 5.5 km raised from 4 to 6 in Reach 63 • 10.0 km raised from 4 to 6 in Reach 64 • 4.0 km raised from 3 to 6 in Reach 87 • 7.5 km raised from 4 to 7 in Reach 88 <p>Aquatic life protected in 27.5 km of river (Reach 11) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 2 priority reaches</p>

waterway management unit 3. wattle creek system

reaches 32, 33, 34, 35, 55, 56, 57, 58, 59, 73, and 83

3.1 waterways and their condition

Waterway Management Unit 3 is located in the far eastern part of the Wimmera region, bordering the Richardson/Avon catchment to the east (Map 4.4). The waterways within it flow almost directly west, converging at Wattle Creek to the north of Stawell, which is a major tributary of the Wimmera River. Due to relatively high relief, land clearing activities and a sedimentary lithology, there has been a history of waterway erosion in this area.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

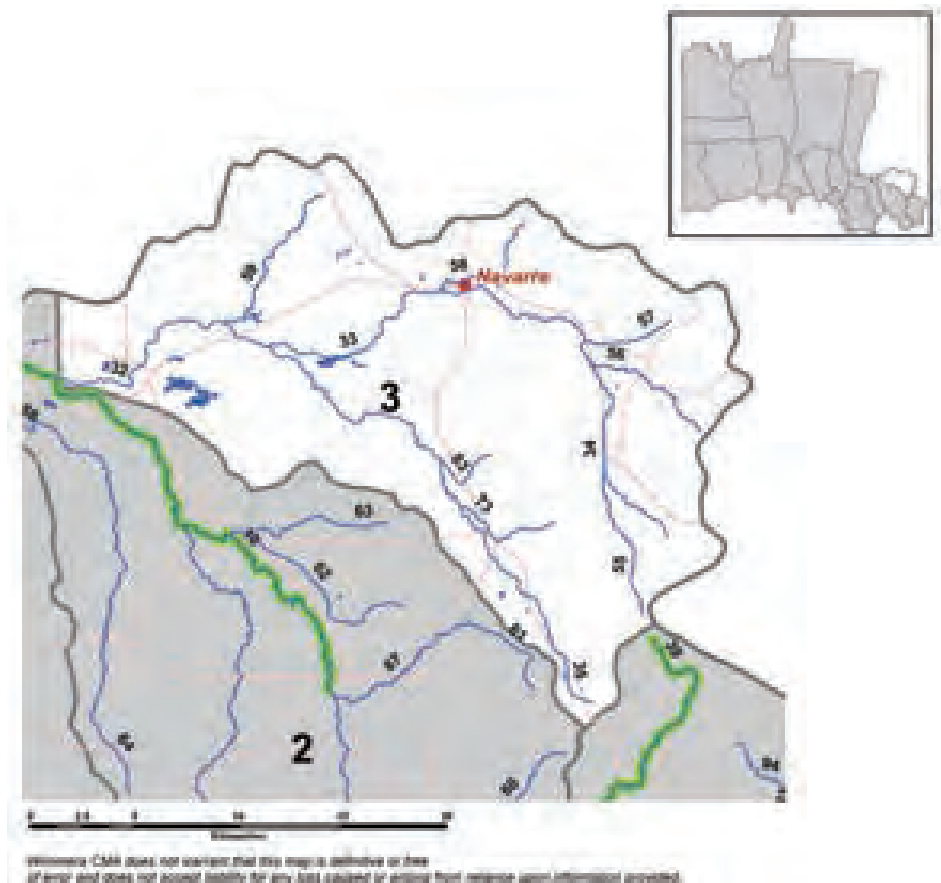
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.4 waterway management unit 3 and reaches

The influence of several factors previously mentioned has resulted in waterways within this region having a physical form classified in the ISC 2004 survey as being in a poor to moderate condition. Although severe erosion is not taking place within this part of the catchment, there are several indications that there is moderate erosion in areas that will need to be addressed. An absence of continuous woody vegetation has led to an acceleration of erosion rates in places. It has also been noted that livestock access to numerous reaches within this Management Unit has increased the previously natural rates of erosion. Parts of Sandy Creek and Heifer Station Creek contained negligible quantities of LWD, depriving the aquatic life forms of sufficient habitat when streams are in flow. The creeks within the Wattle Creek Waterway Management Unit are affected by artificial barriers that only allow intermittent opportunities for indigenous fish migration during times of particularly high flow.

The timing and volume of flows in the waterways in this portion of the catchment are predominantly unmodified. The ISC 2004 survey scores for the hydrology sub-index are amongst the highest in the Wimmera region meaning that they are in a relatively pristine condition. The only issue for the hydrology of these waterways is the duration of periods of zero flow, which is most likely attributable to minor diversions of flows during dryer periods.

The streamside zones for these waterways show some variability in their condition, however it appears that the majority of streamside zones are in a generally poor to moderate condition. Reaches of Morl Morl, Melakoff, Heifer Station and Wattle creeks scored particularly poorly in the ISC 2004 survey of streamside zones. This can be attributed to a lack of large trees that enable regeneration through seeding and provide organic litter and loose branches that are essential contributors to a healthy streamside zone. There was also little continuity in the streamside zone with large breaks between areas of tree canopy cover. Another important feature of the streamside zone is the understorey which was missing or heavily altered in the majority of reaches in this Management Unit. The quantity of groundcover weeds was quite high although the amount of weed shrubs and trees was much lower.



Although aquatic life forms were not sampled in this Management Unit during the ISC 2004 survey, data on the aquatic communities was obtained during the ISC 1999 survey for reaches of Wattle, Heifer Station and Melakoff creeks. Results indicate that apart from Melakoff Creek, the condition of aquatic life within this part of the catchment is very good. The results for Melakoff Creek showed that there was some reduction in the diversity of aquatic life and many macroinvertebrate species that have a low tolerance to poor quality water were not found in the samples.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.7).

TABLE 4.7 significant flora, fauna and EVC recorded in waterway management unit 3

Significant fauna	Tree Goanna, Bibron's Toadlet
Significant flora	None recorded
Significant EVC	Alluvial Terraces Herb-rich Woodland Box Ironbark Forest Creekline Grassy Woodland Grassy Dry Forest Grassy Woodland Herb-rich Foothill Forest Hillcrest Herb-rich Woodland Low Rises Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic Plains Woodland Riparian Woodland Swampy Riparian Woodland Valley Grassy Forest

3.2 priority waterways

There are no Priority Reaches identified in Waterway Management Unit 3.

Priority waterways downstream of this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 3:

- Yarriambiack Creek Reaches 18-20.
- Wimmera River Reaches 2-7.
- Wimmera River Reach 9.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

3.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

Even though there are no priority reaches within the Management Unit, many streams in the Management Unit feed directly into the priority waterways Wimmera River Reaches 9 and 10. For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Wattle Creek Reach 32.
- Heifer Station Creek Reaches 33 and 34.
- Melakoff Creek Reach 35.
- Tributaries of Heifer Station Creek Reaches 55 – 58.
- Heifer Station Creek Reach 59.
- Native Youth Creek Reach 73.
- Tributary of Wattle Creek Reach 83.

3.4 primary management objectives

The primary waterway health objectives for influencing reaches in Waterway Management Unit 3 are:

- Protect significant values in downstream priority reaches by improving water quality and quantity flowing out of the Management Unit.
- Protect significant values in downstream priority reaches by reducing the threat of spread from exotic flora and fauna.

3.5 risks to waterway health

Potential threats to priority reaches Wimmera River Reaches 9 and 10 from the 10 influencing waterways can be seen in Table 4.8. High or medium threats from bank erosion, bed instability, exotic fauna, degraded streamside zone and stock access are common throughout many of the influencing waterways. Water quality (particularly nutrients) is a high threat in two of the Wattle Creek reaches.



TABLE 4.8 threat levels influencing waterways in waterway management unit 3

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Wattle Creek Reach 32	3	3	1	2	0	5	1	2	3	5	4	5
Heifer Station Creek Reach 33	3	3	1	2	0	0	1	2	3	1	4	5
Heifer Station Creek Reach 34	5	3	1	2	0	5	1	2	3	1	3	5
Melakoff Creek Reach 35	1	1	1	2	0	0	1	2	3	1	3	5
Trib. of Heifer Station Creek Reach 55	2	3	1	2	0	0	1	1	3	1	2	1
Trib. of Heifer Station Creek Reach 56	4	3	1	2	0	0	1	1	3	1	2	1
Trib. of Heifer Station Creek Reach 57	5	5	1	2	0	0	1	2	3	1	4	5
Trib. of Heifer Station Creek Reach 58	1	1	1	2	0	0	1	2	3	1	4	5
Heifer Station Creek Reach 59	3	1	1	2	0	0	1	2	3	1	4	5
Native Youth Creek Reach 73	4	3	1	2	0	0	1	2	3	1	3	5
Trib. of Wattle Creek trib Reach 83	4	5	1	2	0	0	1	1	3	1	3	1

Key: 5 or 4 High threat level in reach (High *Wimmera WHS* priority for action), 3 Medium threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 Low threat level in reach (Low *Wimmera WHS* priority for action).

3.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

3.7 actions

Ref.	Action	Threats	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
							MAT	2025 RCT
ON-GROUND ACTIONS								
WMU03-01	Undertake fencing and/or revegetation of riparian land.	Degraded riparian vegetation Uncontrolled stock access Bank erosion	32, 33, 57, 58, 59	High	1,000,000	RL1, 2	146.4 ha of riparian land revegetated.	30.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 30.5 km of waterway with improved ISC Physical Form sub-index score.
WMU03-02			34, 35, 73, 83	Medium	730,000		117.6 ha of riparian land revegetated.	24.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 24.5 km of waterway with improved ISC Physical Form sub-index score.
WMU03-03			55, 56	Low	370,000		38.4 ha of riparian land revegetated.	8.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 8 km of waterway with improved ISC Physical Form sub-index score.
WMU03-04	Encourage off-stream watering of stock.	Uncontrolled stock access	32, 33, 34, 35, 57, 58, 59, 73	High	33,000	RL5	254.4 ha under management for off-stream watering.	Contribute to targets for WMU03-01 to WMU03-03.
WMU03-05			55, 56, 83	Low	7,000		48.0 ha under management for off-stream watering.	
WMU03-06	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson’s Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	Low	143,000	RL3, 9, 33	Priority weed control on 126.0 km of waterways.	63.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU03-07	Undertake management of other pest plant species where they are having significant impact on waterway health.		32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	Low	62,000	RL3, 33	Weed control on 126.0 km of waterways.	

Ref.	Action	Threats	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
							MAT	2025 RCT
ON-GROUND ACTIONS								
WMU03-08	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	Medium	124,000	RL10	126.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU03-09	Implement priority bed and bank stabilisation and riparian management actions in the Wattle Creek Waterway Action Plan (2005).	Bank erosion Bed instability	32, 33, 34, 55, 56, 57, 59, 73, 83	High	1,955,000	RL21, ICF15	13.5 km of bed and banks stabilised.	44.5 km of waterway with improved ISC Physical Form sub-index score.
WMU03-10	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trend	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	Low	93,000	RL8, WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING								
WMU03-11	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	34, 56, 57, 73, 83	High	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU03-12			32, 33, 55, 59	Medium	20,000			
WMU03-13			35, 58	Low	10,000			
WMU03-14	Investigate stability of existing erosion control structures and maintain where appropriate.	Bank erosion Bed instability	57	High	75,000	ICF30	Investigation implemented and actions developed within Adaptive Management Framework.	Targets set by Adaptive Management Framework.
WMU03-15			34, 83	Medium	75,000	ICF30		
WMU03-16			55, 56	Low	75,000	ICF30		
WMU03-17	Implement sound water resource management in unregulated waterways.	Changes to flow (flow deviation)	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	310,000	EW4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Contribute to improved flow regime achieving environmental objectives in downstream priority reaches.

Ref.	Action	Threats	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
							MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING								
WMU03-18	Investigate and implement options to return summer flows to the waterways.	Changes to flow (flow deviation)	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	125,000	EWR18	Environmental Water Reserve established and implemented.	Contribute to improved flow regime achieving environmental objectives in downstream priority reaches.
WMU03-19	Monitor flows and achievement of environmental water requirements.		32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	50,000	EWR9	Monitoring program implemented.	Improved flow regime achieving environmental objectives in downstream priority reach.
WMU03-20	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality (SIGNAL)	32, 34	High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU03-21	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Changes to flow (flow deviation) Water quality trend	32, 33, 56, 57, 58, 59	Low	10,000	RL8, WQ6	Investigation implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU03-22	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	341,000	WQ12, MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented and actions developed.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT								
WMU03-23	Increase community understanding of waterway health.	All threats	32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	258,000	RL36, ICF35 EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU03-24	Actively engage community and stakeholders in managing waterways.		32, 33, 34, 35, 55, 56, 57, 58, 59, 73, 83	High	37,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 3 cost summary

Total Cost of all Actions	\$5,965,500
High Priority Actions	\$4,246,500
Medium Priority Actions	\$949,000
Low Priority Actions	\$770,000

3.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 32 ISC score raised from 20 to 31 (Moderate to Good)</p> <p>Reach 33 ISC score raised from 28 to 38 (Moderate to Excellent)</p> <p>Reach 34 ISC score raised from 17 to 32 (Poor to Good)</p> <p>Reach 35 ISC score raised from 23 to 34 (Moderate to Good)</p> <p>Reach 55 ISC score raised from 30 to 38 (Good to Excellent)</p> <p>Reach 56 ISC score raised from 24 to 34 (Moderate to Good)</p> <p>Reach 57 ISC score raised from 17 to 28 (Poor to Moderate)</p> <p>Reach 58 ISC score raised from 30 to 35 (maintained at Good)</p> <p>Reach 59 ISC score raised from 20 to 31 (Moderate to Good)</p> <p>Reach 73 ISC score raised from 25 to 35 (Moderate to Good)</p> <p>Reach 83 ISC score raised from 23 to 31 (Moderate to Good)</p>	<p>8.0 km (Reach 55) raised from Good to Excellent</p> <p>23.0 km (Reach 33) raised from Moderate to Excellent</p> <p>8.0 km (Reach 58) maintained at Good</p> <p>72.0 km (Reaches 32, 35, 56, 59, 73 and 83) raised from Moderate to Good</p> <p>10.0 km (Reach 34) raised from Poor to Good</p> <p>5.0 km (Reach 57) raised from Poor to Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>302.4 ha of riparian land fenced and/or revegetated</p> <p>302.4 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 126.0 km of waterways</p> <p>Weed control on 126.0 km of waterways</p> <p>13.5 km of bed and banks stabilised</p> <p>126.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 11 influencing reaches</p>	<p>63.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> 7.0 km raised from 3 to 6 in Reach 32 11.5 km raised from 5 to 8 in Reach 33 5.0 km raised from 2 to 6 in Reach 34 14.5 km raised from 3 to 7 in Reach 35 4.0 km raised from 5 to 7 in Reach 55 4.0 km raised from 4 to 7 in Reach 56 2.5 km raised from 2 to 5 in Reach 57 4.0 km raised from 5 to 8 in Reach 58 5.5 km raised from 3 to 6 in Reach 59 3.0 km raised from 6 to 9 in Reach 73 2.0 km raised from 6 to 7 in Reach 83 <p>59.0 km of waterway channel with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> 7.0 km raised from 4 to 7 in Reach 32 11.5 km raised from 5 to 7 in Reach 33 5.0 km raised from 3 to 6 in Reach 34 14.5 km raised from 6 to 8 in Reach 35 4.0 km raised from 6 to 8 in Reach 55 4.0 km raised from 4 to 6 in Reach 56 2.5 km raised from 3 to 5 in Reach 57 5.5 km raised from 4 to 7 in Reach 59 3.0 km raised from 4 to 7 in Reach 73 2.0 km raised from 3 to 6 in Reach 83 <p>Contribute to improved flow regime achieving environmental objectives in downstream priority reaches</p>

waterway management unit 4. concongella creek system

reaches 9, 30, 31, 65 and 66

4.1 waterways and their condition

Located in the south-eastern part of the catchment, Concongella Creek, the main waterway in Waterway Management Unit 4, flows from its headwaters in the Great Dividing Range between Ararat and Great Western (Map 4.5). Concongella Creek and its tributaries including Allanvale Creek, flow through land used mostly for grazing and viticulture before flowing into the Wimmera River to the north of Stawell. Issues with erosion and incision are of chief concern in this Management Unit, the absence of a floodout zone in the lower reaches of Concongella Creek as well as a deep, narrow channel means that eroded sediments are often transported into the Wimmera River.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

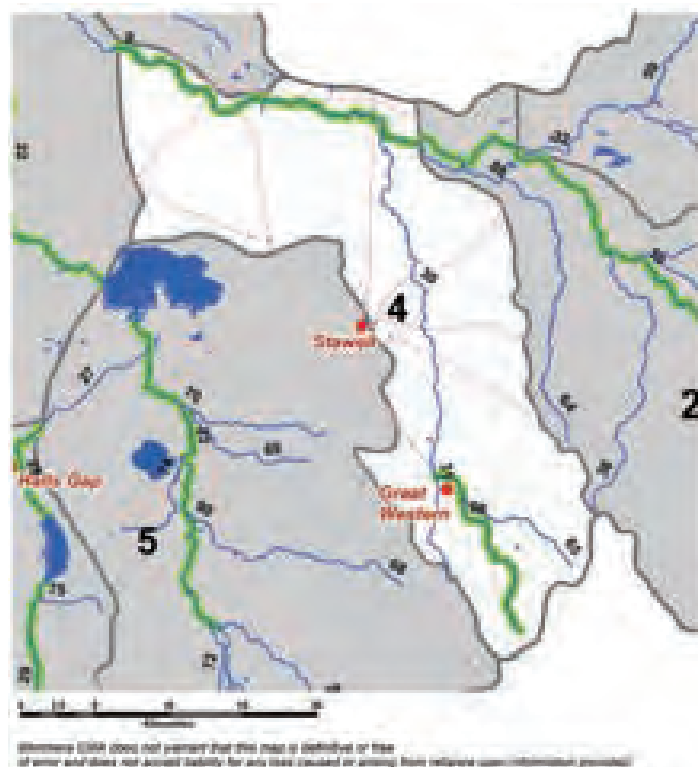
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.5 waterway management unit 4 and reaches

The condition of the flow regime in Concongella Creek is relatively unmodified, with all aspects of the volume and timing of flows receiving either very high or maximum scores for the hydrology sub-index in the ISC 2004 survey. Only limited periods of stress caused by lower than natural flows during both summer and winter indicate any alteration from a pristine flow regime. The Wimmera River has a more modified flow regime, especially upstream of its confluence with Concongella Creek. Modifications include lower flows than what would naturally take place and a longer duration of zero flows during the summer.

Concongella and Allanvale creeks and the Wimmera River are similar to many of the waterways in the upper portion of the Wimmera region by exhibiting problems with areas of unstable banks. Extensive lengths of stream banks have very few or no large trees present to help bind the soil with their roots. This has led to poor to moderate distribution of large wood within the waterway channels in this portion of the catchment. Reaches have also been affected by downstream artificial barriers allowing only intermittent opportunities for migration of indigenous fish species.

There was a fair degree of variability observed in the condition of the streamside zones along the reaches in this management unit. Near the confluence of the Wimmera River and Concongella Creek there are numerous large trees resulting in good quantities of leaf litter and large logs. The longitudinal continuity and tree canopy cover were also quite high in contrast to other reaches within this part of the catchment. Unfortunately other reaches of Concongella Creek and the Wimmera River received lower scores for the ISC 2004 survey due to the fact they are mostly located within tracts of grazing land. Allanvale Creek also received a very low score for its streamside zone, being classified as 'extremely modified', and failing to score any points for many components of the streamside zone.



Water quality was measured at one location within this Management Unit, on the Wimmera River downstream of its confluence with Concongella Creek. The water quality results indicate that they contained elevated levels of total phosphorus, turbidity and salinity. The high salinity levels can be partially attributed to saline groundwater entering several waterways in the upper catchment.

Sampling for aquatic life was not undertaken in this portion of the catchment during the ISC 2004 survey. However data was obtained during the ISC 1999 survey for locations on the Wimmera River and Concongella Creek. Results indicate that the aquatic communities were in a very good condition, particularly those in the Wimmera River. There was a large diversity of macroinvertebrate families present, including those sensitive to poor water quality.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.9). Although not of conservation significance, the presence of platypus in the waterways of the Management Unit is considered of particular regional value.

TABLE 4.9 significant flora, fauna and EVC recorded in waterway management unit 4

Significant fauna	Barking Owl, Bush Stone-curlew, Glossy Ibis, Great Egret, Pied Cormorant, Regent Parrot, Black-chinned Honeyeater, Brown Treecreeper, Eastern Bearded Dragon, Southern Brown Bandicoot
Significant flora	Grampians Boronia, Hairy-pod Wattle, Large-leaf Ray-flower
Significant EVC	Alluvial Terraces Herb-rich Woodland Creekline Grassy Woodland Drainage Line Woodland Grassy Dry Forest Grassy Woodland Heathy Woodland Plains Grassy Woodland Plains Woodland Riparian Woodland

4.2 priority waterways

Priority Reaches in Waterway Management Unit 4:

- **Wimmera River Reach 9**
(identified in near ecologically healthy condition).
- **Tributary of Concongella Creek Reach 66**
(high economic value).

Priority waterways outside this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 4:

- Yarriambiack Creek Reaches 18 – 20.
- Wimmera River Reaches 2 – 7.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

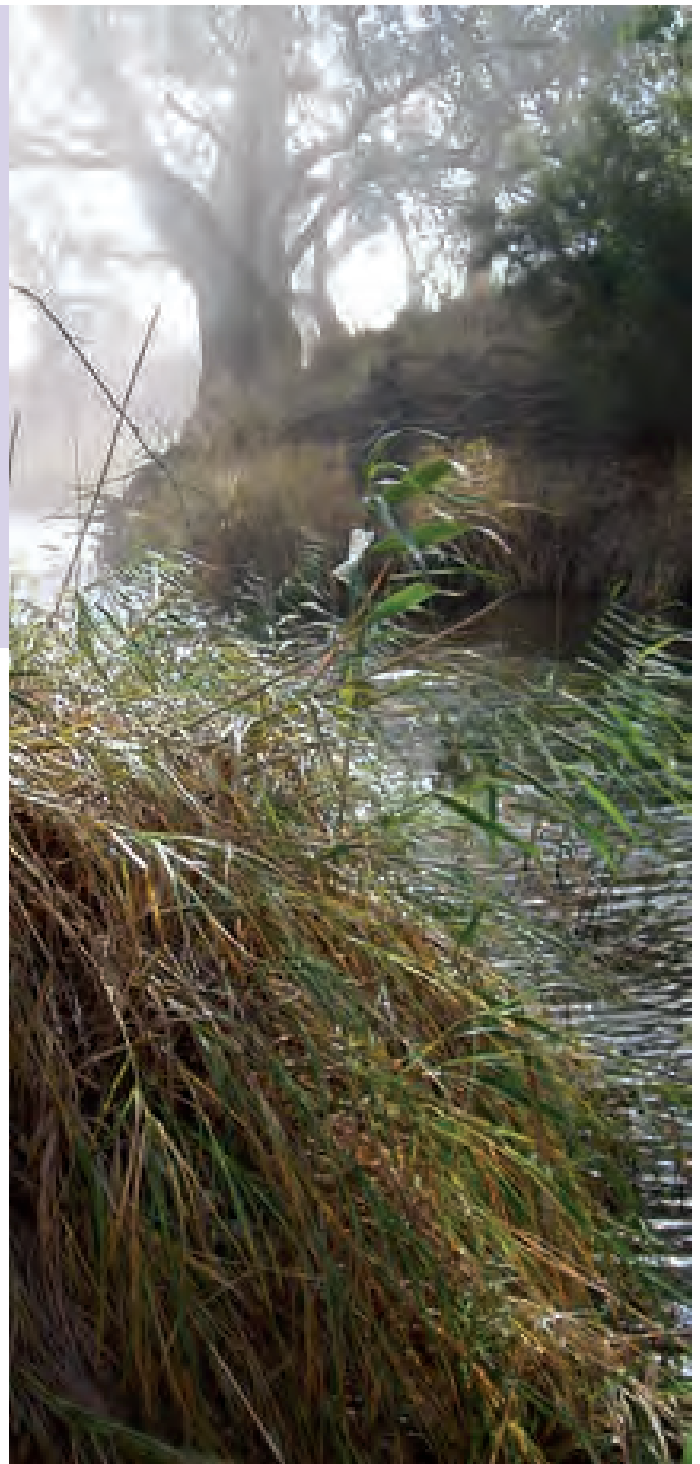
4.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Concongella Creek Reach 30.
- Concongella Creek Reach 31.
- Upper Tributary of Allenvale Creek Reach 65.



4.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 3 are:

- Improve the environmental condition of Wimmera River Reach 9 from near ecologically healthy status to ecologically healthy status.
- Protect the high economic values in the tributary of Concongella Creek Reach 66.
- Prevent damage to priority reaches from conditions in influencing reaches.

4.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 4. A summary of the risks for the two priority reaches is presented in Table 4.10.

TABLE 4.10 risks to significant values in priority reaches in waterway management unit 4

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
Near Ecologically Healthy Condition		1	1	5	2	1	5	5	5	1	1	3	3	1	2	2	5
significant flora	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
significant EVC	5	0	0	0	0	0	0	0	0	0	2	3	0	0	2	2	8
significant fauna	5	0	0	4	0	0	0	0	0	2	2	3	3	2	2	2	4
ecologically healthy	4	2	2	4	2	2	6	6	6	2	2	3	3	2	2	2	6
riparian width	5	2	0	0	0	0	0	0	0	0	2	3	0	0	2	0	8
riparian continuity	5	2	0	0	0	0	0	0	0	0	2	3	0	0	2	0	8
riparian intactness	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
invertebrate O/E	5	2	2	0	2	0	7	8	8	2	2	0	3	2	2	2	7
native fish O/E	2	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0
native fish proportion	2	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0
fish migration	4	0	0	7	2	2	4	6	6	2	0	0	3	0	0	2	6

WIMMERA RIVER REACH 9

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Economic Value		3	3	5	2	1	2	0	0	1	2	4	2	5	4	2	1
water supply delivery	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
water supply collection	5	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
infrastructure	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	4	3	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0
tourism	5	0	0	0	0	0	0	0	0	0	0	0	0	7	6	0	0
power generation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TRIBUTARY OF CONGELLA CREEK REACH 66

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.)

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6 Resource Book, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 4 include:

- Barrier to fish migration, Water quality trend, Water quality level, Water quality (SIGNAL) and Uncontrolled stock access in Wimmera River Reach 9. Water quality data at monitoring site 415201 indicate that turbidity, conductivity, dissolved oxygen and nutrient levels (both nitrogen and phosphorous) fail to meet the SEPP (WoV) targets.
- Algal blooms and Degraded streamside vegetation in the tributary to Concongella Creek Reach 66.

Medium risks to significant values in priority reaches in Waterway Management Unit 4 include:

- Exotic fauna and Loss of in-stream habitat in Wimmera River Reach 9.
- Bank erosion and Bed instability in the tributary to Concongella Creek Reach 66.

Potential threats to priority reach Wimmera River Reach 9 and Tributary of Concongella Creek Reach 66 from the three influencing waterways can be seen in Table 4.11. High and medium priority threats from bank erosion, bed instability, exotic fauna, degraded streamside zone and stock access are common throughout the influencing waterways.

TABLE 4.11 threat levels influencing waterways in waterway management unit 4

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Concongella Creek Reach 30	3	3	1	0	0	0	1	2	4	1	4	5
Concongella Creek Reach 31	4	3	1	0	0	0	1	2	4	1	3	5
Trib. of Allenvale Creek Reach 65	4	3	1	2	0	0	1	2	4	1	4	5

Key: 5 or 4 High threat level in reach (High *Wimmera* WHS priority for action), 3 Medium threat level in reach (Medium *Wimmera* WHS priority for action), 2 or 1 Low threat level in reach (Low *Wimmera* WHS priority for action).

4.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).

- Contribute to retaining or re-establishing natural riparian vegetation along all significant waterways and wetlands of the Wimmera region (AT4).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

4.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU04-01	Undertake fencing and/or revegetation of riparian land outlined in the in the Concongella Creek Waterway Action Plan (2003) and the Glenorchy Floodplain Management Plan (2006).	Bank erosion Degraded riparian vegetation	9, 66	30, 65	High	850,000	RL1, 2	175.2 ha of riparian land revegetated.	36.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 36.5 km of waterway with improved ISC Physical Form sub-index score.
WMU04-02		Bank erosion Degraded riparian vegetation		31	Medium	25,000		55.2 ha of riparian land revegetated.	11.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 11.5 km of waterway with improved ISC Physical Form sub-index score.
WMU04-03	Encourage off-stream watering of stock.	Stock access	9	30, 31, 65	High	24,000	RL5	72.0 ha under management for off-stream watering.	Contribute to targets for WMU04-01 to WMU04-02.
WMU04-04			66		Low	28,000		38.4 ha under management for off-stream watering.	
WMU04-05	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	9, 66	30, 31, 65	Low	109,000	RL3, 9, 33	Priority weed control on 96.0 km of waterways.	48.0 km of riparian zone with improved ISC Streamside Zone sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU04-06	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation	9, 66	30, 31, 65	Low	47,000	RL3, 33	Weed control on 96.0 km of waterways.	48.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU04-07	Re-introduce LWD at priority sites to restore instream habitat.	Bank erosion		30	Medium	85,000	ICF25	2 sites with LWD introduced.	8.0 km of waterway with improved ISC Physical Form sub-index score.
WMU04-08	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	9		Medium	40,000	RL10	30.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU04-09	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna		30, 31, 65	High	55,000	RL10	50.0 km of stream with rabbit control.	
WMU04-10	Implement priority bed and bank stabilisation actions in the Concongella Creek Waterway Action Plan (2003).	Bank erosion Bed instability		31, 65	High	375,000	RL14 ICF8	3.0 km of bed and banks stabilised.	17.0 km of waterway with improved ISC Physical Form sub-index score.
WMU04-11	Implement priority bed and bank stabilisation actions in the Concongella Creek Waterway Action Plan (2003).	Bank erosion Bed instability	66	30	Medium	350,000	RL14 ICF8	3.0 km of bed and banks stabilised.	16.0 km of waterway with improved ISC Physical Form sub-index score.
WMU04-12	Implement priority waterway management actions the Glenorchy Floodplain Management Plan (2006).	Water quality trends Water quality attainment	9		High	100,000	FM5, 14, 19	3.0 km of bed and banks stabilised.	15.0 km of waterway with improved ISC Physical Form sub-index score by 2025. Site specific water quality targets to be set by 2010.
WMU04-13	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	66	30, 31, 65	Low	236,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches by 2020.
WMU04-14	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	9		Low	150,000	EWR23, 25, 26, 27, 30		

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU04-15	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	9		Low	300,000	EWR51, 52	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches by 2020.
WMU04-16	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	9		High	21,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
WMU04-17			66	30, 31, 65	Low	50,000			
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU04-18	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	9		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage by 2010.	Targets set by investigation.
WMU04-19	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	66	31, 65	Medium	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU04-20		Bank erosion Bed instability	9		Low	25,000			
WMU04-21	Investigate stability of existing erosion control structures and maintain where appropriate.	Bank erosion Bed instability		65	Medium	75,000			
WMU04-22	Investigate and implement options to return summer flows to the waterways.	Changes to flow (flow deviation)	66	30, 31, 65	Low	125,000	EWR18	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU04-23	Monitor flows and achievement of environmental water requirements.	Changes to flow (flow deviation)	66	30, 31, 65	Low	50,000	EWR9	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU04-24	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	9		Low	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU04-25	Investigate septic tank and greywater leakage in Great Western.	Water quality level	66		Low	50,000	WQ7, 8, 10	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU04-26	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	9		High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU04-27	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	9, 66	30, 31, 65	Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU04-28	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	9, 66	30, 31, 65	High	260,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU04-29	Increase community understanding of waterway health.	All threats	9, 66	30, 31, 65	High	197,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU04-30	Actively engage community and stakeholders in managing waterways.	All threats	9, 66	30, 31, 65	High	28,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 4 cost summary

Total Cost of all Actions	\$3,777,500
High Priority Actions	\$1,987,500
Medium Priority Actions	\$600,000
Low Priority Actions	\$1,190,000

4.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 9 ISC score raised from 31 to 32 (maintained at Good)</p> <p>Reach 30 ISC score raised from 30 to 36 (maintained at Good)</p> <p>Reach 31 ISC score raised from 24 to 36 (Moderate to Good)</p> <p>Reach 65 ISC score raised from 19 to 30 (Moderate to Good)</p> <p>Reach 66 ISC score raised from 25 to 34 (Moderate to Good)</p>	<p>46.0 km (Reaches 9 and 30) maintained at Good</p> <p>50.0 km (Reaches 31, 65 and 66) raised from Moderate to Good</p>
Management Action Target summary	Resource Condition Target summary
<p>230.4 ha of riparian land fenced and/or revegetated</p> <p>72.0 ha of priority stream under land management agreements for off-stream watering</p> <p>38.4 ha of influencing stream under land management agreements for off-stream watering</p> <p>Priority weed control on 96.0 km of waterways</p> <p>Weed control on 96.0 km of waterways</p> <p>7.5 km of bed and banks stabilised</p> <p>2 sites with LWD introduced</p> <p>80.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 2 priority reaches</p>	<p>48.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> 15.0 km raised from 6 to 7 in Reach 9 8.0 km raised from 6 to 7 in Reach 30 11.5 km raised from 4 to 7 in Reach 31 5.5 km raised from 3 to 6 in Reach 65 8.0 km raised from 5 to 7 in Reach 66 <p>48.0 km of waterway channel with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> 15.0 km raised from 6 to 7 in Reach 9 8.0 km raised from 5 to 7 in Reach 30 11.5 km raised from 4 to 7 in Reach 31 5.5 km raised from 3 to 5 in Reach 65 8.0 km raised from 4 to 6 in Reach 66 <p>Aquatic life protected in 25.0 km of river (Reach 9) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 2 priority reaches</p>

waterway management unit 5. upper mt william creek system

reaches 23, 24, 27, 67, 68, 70, 71, 72, 74, 89 and 90

5.1 waterways and their condition

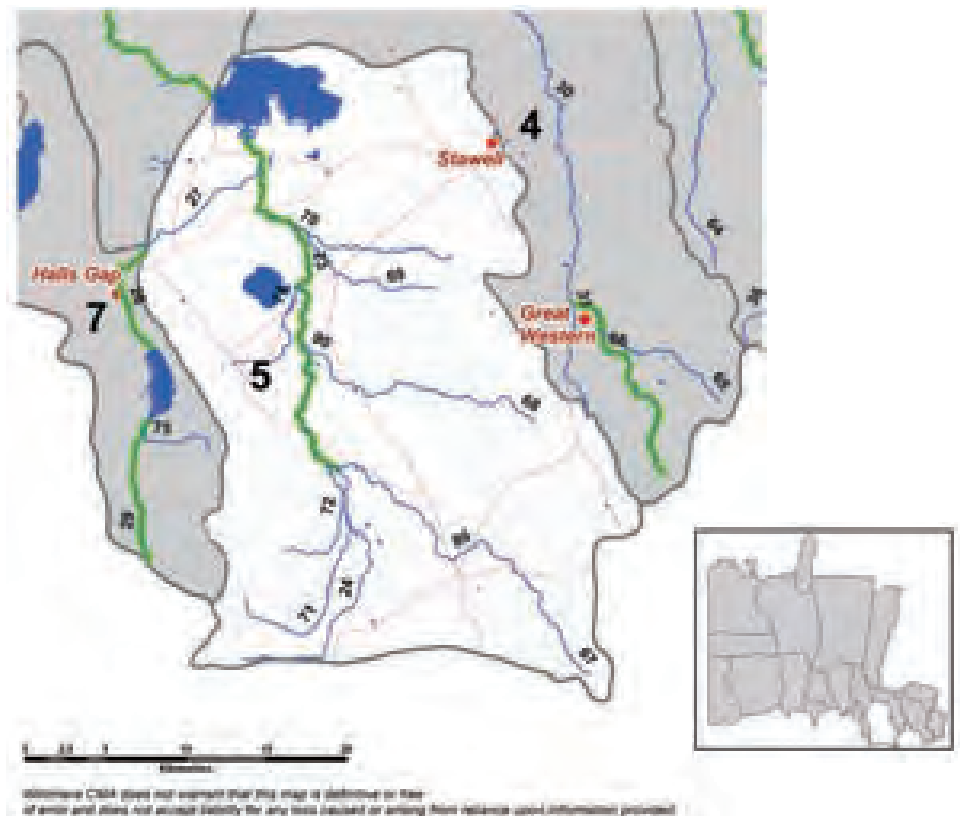
Waterway Management Unit 5 is located in the most southerly section of the Wimmera region and includes some streams that have their sources in the Grampians National Park such as Mount William, Georges and Fyans creeks (Map 4.6). Others waterways such as Basin, Nine Mile and Salt creeks flow from the undulating land to the east of the Grampians. They all converge on Mount William Creek before flowing into Lake Lonsdale. Most creeks flow through land that is primarily used for cropping and grazing. Although there is relatively little water extracted from these creeks, there are still issues associated with the increased deposition of eroded sediments due to decreased flows. The presence of Lake Lonsdale ensures that the transported sediments in Mount William Creek are prevented from entering the Wimmera River.



↑ legend

- Waterway Manangement Units
- 18** Waterway Management Unit Number
- River Reaches
- Wetlands*
- Waterways*
- Priority Wetlands
- Priority Waterways
- Major Towns*
- Major Roads*
- Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.6 waterway management unit 5 and reaches

Stream banks in the area generally display only limited to moderate erosion and there are only a small number of bank instabilities in this portion of the catchment. Few of these instabilities extend to the toe of the bank thereby showing that only some bank areas are more susceptible to erosion. Despite the fact that there is not rapidly accelerating erosion within this portion of the catchment, the physical forms of the channels have been impacted by poor quantities of LWD. This is especially the case for Salt, Basin and Nine Mile creeks partly due to wood being removed by landholders or to natural influences. The opportunities for migration of indigenous fish species are limited to times of extensive flow due to the presence of artificial downstream barriers. This is especially the case for the upper reaches of Mount William Creek where Lake Lonsdale completely blocks fish migration.

The streamside zones of Mount William Creek were observed to be in a good condition during the ISC 2004 survey. However the ISC scores for the streamside zones of Nine Mile and Salt creeks were quite low indicating that vegetation in the riparian zone has been significantly modified. An absence of large trees has impacted on the extent of tree canopy cover and the regeneration of native species as well as on the amount of large logs and leaf litter. The extent of weed coverage was only moderate along all of the reaches, with Mount William and Georges creeks having particularly low proportions of introduced groundcover weeds.

There was no sampling for aquatic life undertaken in the upper Mount William Creek Waterway Management Unit during the ISC 2004 survey. An analysis of the results from the ISC 1999 survey shows that there was good diversity of aquatic life in the samples retrieved from Mount William and Fyans creeks. This illustrates that water quality was good as a diverse range of macroinvertebrate families that are sensitive to the effects of pollution were present.

Scores for the hydrology sub-index for the 2004 ISC survey indicated that this Management Unit has been heavily impacted by water diversions. This has resulted in an extensively modified flow regime which in turn has led to streams being classified as being in a moderately stressed condition when compared to the other waterways across the state. The magnitude of low flows and duration of zero flows have been altered most of all, particularly affecting the summer flow regime. Although all creeks have been affected by this, Fyans Creek has undergone the greatest change to its flow regime due to the influence of diversions from Lake Bellfield, Stawell's town water supply.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.12).

TABLE 4.12 significant flora, fauna and EVC recorded in waterway management unit 5

Significant fauna	Mountain Galaxias, Heath Mouse, Smoky Mouse
Significant flora	None recorded
Significant EVC	Alluvial Terraces Herb-rich Woodland Creekline Grassy Woodland Damp Sands Herb-rich Woodland Damp Sands Herb-rich Woodland / Shrubby Woodland Granitic Hills Woodland Grassy Woodland Heathy Woodland Hills Herb-rich Woodland Plains Grassy Woodland Plains Woodland/Plains Sedgy Woodland/Damp Sands Herb-rich Woodland Red Gum Wetland Sand Forest Shallow Freshwater Marsh Shrubby Woodland Valley Grassy Forest

5.2 priority waterways

Priority Reaches in Waterway Management Unit 5 are:

- **Mount William Creek Reach 23** (high environmental value in RiVERS).

Priority waterways outside this Waterway Management Unit that are impacted by actions implemented in Waterway Management Unit 5 are:

- Mount William Creek Reach 22.
- Yarriambiack Creek Reaches 18 – 20.
- Wimmera River Reaches 2 – 7.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

5.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Georges Creek Reach 24.
- Fyans Creek Reach 27.
- Upper Tributary of Spears Creek Reach 67.
- Lower Tributary of Spears Creek Reach 89.
- Upper Tributary of Pentland Creek Reach 68.
- Lower Tributary of Pentland Creek Reach 90.
- Unnamed Tributaries of Mount William Creek Reaches 69, 72 and 74.
- Basin Creek Reach 70.
- Reservoir Creek Reach 71.

5.4 primary management objectives

The primary waterway health objective for the priority reach in Waterway Management Unit 5 is to:

- Protect the high environmental condition of Mount William Creek Reach 23.
- Prevent damage to priority reaches from conditions in influencing reaches.

5.5 risks to waterway health

Risk assessments have been undertaken for Mt. William Creek Reach 24 in Waterway Management Unit 5. A summary of the risks is presented in Table 4.13.



TABLE 4.13 risks to significant values in priority reaches in waterway management unit 5

High Overall Environmental Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		2	3	5	3	1	2	0	1	1	1	3	4	1	3	3	5
significant flora	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
significant EVC	5	0	0	0	0	0	0	0	0	0	2	3	4	0	3	3	8
significant fauna	5	0	0	4	0	0	0	0	0	2	2	3	7	2	3	3	4
significant wetland	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
wetland rarity	5	0	0	0	0	2	2	0	2	0	2	3	0	0	0	3	7
heritage river	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
sites of significance	5	2	3	0	3	2	0	0	0	0	2	3	6	0	3	3	8
ecologically healthy	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
riparian width	5	2	0	0	0	0	0	0	0	0	2	3	0	0	3	0	8
riparian continuity	5	2	0	0	0	0	0	0	0	0	2	3	0	0	3	0	8
riparian intactness	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
invertebrate O/E	5	2	3	0	3	0	2	0	2	2	2	0	7	2	3	3	7
native fish O/E	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
native fish proportion	4	2	3	6	3	2	2	0	2	2	0	3	6	0	3	3	4
fish migration	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1

MT WILLIAM CREEK REACH 23

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in the priority reach in Waterway Management Unit 5 include:

- Barriers to fish migration, Loss of in-stream habitat and Stock access.

Medium risks to significant values in the priority reach in Waterway Management Unit 5 include:

- Bed instability, Channel modification, Exotic fauna, Degraded streamside vegetation and Wetland connectivity.

Potential threats to priority reach Mt William Creek Reach 23 from the eleven influencing waterways can be seen in Table 4.14. High and medium priority threats from bank erosion, bed instability, exotic fauna, degraded streamside vegetation and stock access can be identified in many reaches, while a high priority threat from changes to flow regime in Fyans Creek Reach 27.

TABLE 4.14 threat levels influencing waterways in waterway management unit 5

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Georges Ck Reach 24	1	1	1	2	0	0	1	2	3	1	3	5
Fyans Ck Reach 27	2	1	5	2	0	1	1	2	3	1	3	5
Trib. of Spears Ck Reach 67	4	5	1	2	0	0	1	2	3	1	4	5
Trib. of Pentland Ck Reach 68	4	3	1	2	0	0	1	2	3	1	4	5
Trib. of Mt William Ck Reach 69	2	3	1	2	0	0	1	2	3	1	3	1
Basin Ck Reach 70	1	1	1	2	0	0	1	2	3	1	4	1
Reservoir Ck Reach 71	2	1	1	2	0	0	1	2	3	1	2	1
Trib. of Mt William Ck Reach 72	3	3	1	2	0	0	1	1	3	1	2	1
Trib. of Mt William Ck Reach 74	1	3	1	2	0	0	1	1	3	1	2	1
Trib. of Spears Ck Reach 89	4	3	1	2	0	0	1	2	3	1	0	0
Trib. of Pentland Ck Reach 90	3	3	1	2	0	0	1	2	3	1	0	0

Key: 5 or 4 High threat level in reach (High *Wimmera WHS* priority for action), 3 Medium threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 Low threat level in reach (Low *Wimmera WHS* priority for action).

5.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

5.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU05-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation		67, 68, 70	High	175,000	RL1, 2	84.0 ha of riparian land revegetated.	17.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 17.0 km of waterway with improved ISC Physical Form sub-index score.
WMU05-02		Bank erosion Degraded riparian vegetation	23	24, 27, 69	Medium	300,000		163.2 ha of riparian land revegetated.	34.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 34.0 km of waterway with improved ISC Physical Form sub-index score.
WMU05-03		Bank erosion Degraded riparian vegetation		71, 72, 74	Low	12,000		79.2 ha of riparian land revegetated.	16.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 16.5 km of waterway with improved ISC Physical Form sub-index score.
WMU05-04	Encourage off-stream watering of stock.	Stock access	23	24, 27, 67, 68	High	20,000	RL5	189.6 ha under management for off-stream watering.	Contribute to targets for WMU05-01 to WMU05-03.
WMU05-05		Stock access		74, 89	Low	20,000		64.8 ha under management for off-stream watering.	
WMU05-06	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	23	24, 27, 67, 68, 69, 70, 71, 72, 74, 89, 90	Low	185,000	RL3, 9, 33	Priority weed control on 163.0 km of waterways.	81.2 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU05-07	Undertake management of other pest plant species where they are having significant impact on waterway health.	Exotic flora Degraded riparian vegetation	23	24, 27, 67, 68, 69, 70 71, 72, 74, 89, 90	Low	80,000	RL3, 33	Weed control on 163.0 km of waterways.	

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU05-08	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	23	24, 27, 67, 68, 69, 70 71, 72, 74, 89, 90	Medium	161,000	RL10	163.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU05-09	Implement bed and bank stabilisation actions.	Bank erosion Bed instability		67, 68, 89	High	200,000	RL14 ICF8	4.5 km of bed and banks stabilised.	20.0 km of waterway with improved ISC Physical Form sub-index score.
WMU04-10		Bank erosion Bed instability	23	72, 90	Medium	200,000	RL14 ICF8	4.5 km of bed and banks stabilised.	22.5 km of waterway with improved ISC Physical Form sub-index score.
WMU05-11	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	23	24, 67, 68, 69, 70, 71, 72, 74, 89, 90	Low	401,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 1 priority reach by 2020.
WMU05-12	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)		27	High	150,000	EWR23, 25, 26, 27, 30		
WMU05-13	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)		27	High	300,000	EWR51, 52		
WMU05-14	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	23	24, 27, 67, 68, 69, 70, 71, 72, 74, 89, 90	Low	120,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU05-15	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	23		Medium	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage downstream of Reach 23 by 2010.	Targets set by investigation.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU05-16	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability		67, 68, 89	High	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU05-17		Bank erosion Bed instability		72	Medium	25,000			
WMU05-18		Investigate stability of existing erosion control structures and maintain where appropriate	Bank erosion Bed instability		67, 68	Medium			
WMU05-19	Investigate and implement options to return summer flows to the waterways.	Changes to flow (flow deviation)	23	24, 67, 68, 69, 70, 71, 72, 74, 89, 90	Low	125,000	EWR18	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU05-20	Monitor flows and achievement of environmental water requirements.	Changes to flow (flow deviation)	23	24, 67, 68, 69, 70, 71, 72, 74, 89, 90	Low	50,000	EWR9	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU05-21	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)		27	High	10,000	EWR31, 32, 33, 34		
WMU05-22	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow	23	24, 27, 68, 71, 72, 74, 89,90	Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU05-23	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	23	24, 27, 67, 68, 69, 70, 71, 72, 74, 89, 90	High	442,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy Reviews.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU05-24	Increase community understanding of waterway health.	All threats	23	24, 27, 67, 68, 69, 70 71, 72, 74, 89, 90	High	334,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU05-25	Actively engage community and stakeholders in managing waterways.	All threats	23	24, 27, 67, 68, 69, 70, 71, 72, 74, 89, 90	High	48,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	



Waterway Management Unit 5 cost summary

Total Cost of all Actions	\$3,508,000
High Priority Actions	\$1,704,000
Medium Priority Actions	\$801,000
Low Priority Actions	\$1,003,000

5.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 23 ISC score raised from 23 to 28 (maintained at Moderate)</p> <p>Reach 24 ISC score raised from 27 to 31 (Moderate to Good)</p> <p>Reach 27 ISC score raised from 18 to 21 (maintained at Moderate)</p> <p>Reach 67 ISC score raised from 20 to 26 (maintained at Moderate)</p> <p>Reach 68 ISC score raised from 14 to 24 (Poor to Moderate)</p> <p>Reach 69 ISC score raised from 16 to 24 (Poor to Moderate)</p> <p>Reach 70 ISC score raised from 24 to 29 (Moderate to Good)</p> <p>Reach 71 ISC score raised from 25 to 28 (maintained at Moderate)</p> <p>Reach 72 ISC score raised from 26 to 29 (Moderate to Good)</p> <p>Reach 74 ISC score raised from 19 to 26 (maintained at Moderate)</p> <p>Reach 89 ISC score raised from 18 to 22 (maintained at Moderate)</p> <p>Reach 90 ISC score raised from 19 to 24 (maintained at Moderate)</p>	<p>42.0 km (Reaches 24, 70 and 72) raised from Moderate to Good</p> <p>98.0 km (Reaches 23, 27, 67, 71, 74, 89 and 90) maintained at Moderate</p> <p>23.0 km (Reaches 68 and 69) raised from Poor to Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>326.4 ha of riparian land fenced and/or revegetated</p> <p>64.8 ha of priority stream under land management agreements for off-stream watering</p> <p>189.6 ha of influencing stream under land management agreements for off-stream watering</p> <p>Priority weed control on 163.0 km of waterways</p> <p>Weed control on 163.0 km of waterways</p> <p>9.0 km of bed and banks stabilised</p> <p>163.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 1 priority reach</p>	<p>81.5 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 13.5 km raised from 7 to 9 in Reach 23 • 10.0 km raised from 8 to 9 in Reach 24 • 5.0 km raised from 6 to 7 in Reach 27 • 5.0 km raised from 4 to 6 in Reach 67 • 6.0 km raised from 2 to 6 in Reach 68 • 5.5 km raised from 2 to 5 in Reach 69 • 6.5 km raised from 6 to 8 in Reach 70 • 7.5 km raised from 6 to 7 in Reach 71 • 4.5 km raised from 7 to 8 in Reach 72 • 4.5 km raised from 3 to 7 in Reach 74 • 9.0 km raised from 3 to 6 in Reach 89 • 4.5 km raised from 3 to 5 in Reach 90 <p>72.5 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 13.5 km raised from 4 to 6 in Reach 23 • 10.0 km raised from 6 to 8 in Reach 24 • 5.0 km raised from 6 to 8 in Reach 27 • 5.0 km raised from 4 to 7 in Reach 67 • 6.0 km raised from 3 to 5 in Reach 68 • 5.5 km raised from 5 to 6 in Reach 69 • 6.5 km raised from 5 to 7 in Reach 70 • 7.5 km raised from 6 to 7 in Reach 71 • 4.5 km raised from 6 to 7 in Reach 72 • 4.5 km raised from 5 to 6 in Reach 74 • 4.5 km raised from 5 to 6 in Reach 90 <p>Improved flow regime achieving environmental objectives in 1 priority reach</p>

waterway management unit 6. lower mt william creek system

reaches 8, 21, 22, 25, 26, 77 and 78

6.1 waterways and their condition

Waterway Management Unit 6 is located in the central-southern portion of the Wimmera region and includes Mount William Creek downstream of Lake Lonsdale, Golton Creek which flows from the northern Grampians, Sheepwash Creek and a couple of reaches of the Wimmera River itself (Map 4.7). Within this portion of the catchment the Wimmera River and Mount William Creek have an anabranching form. An important feature located within this Management Unit, especially in the context of the catchment, is Huddleston's Weir. It diverts low flows from the Wimmera River, some of which are returned approximately 30 km downstream. The weir has therefore severely interrupted the downstream natural hydrological regime.

↑ legend

□ Waterway Manangement Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

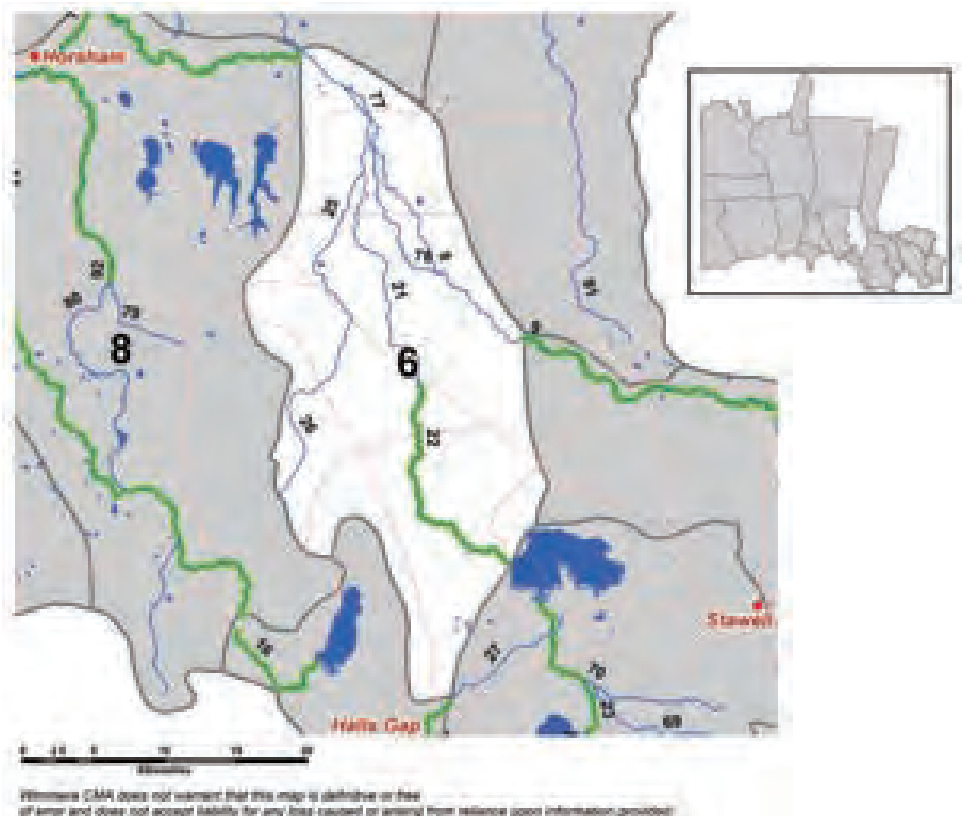
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

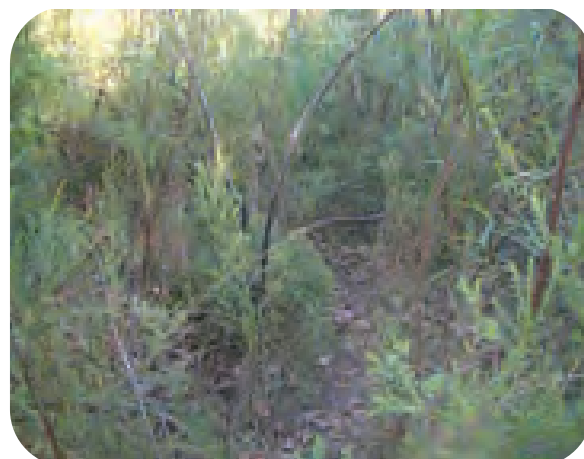
*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.7 waterway management unit 6 and reaches

The banks of Golton Creek were determined to be mostly or completely stable during the ISC 2004 survey. Bank conditions along Mount William Creek and the Wimmera River are also reasonably good, displaying only moderate to limited erosion. Sheepwash Creek, however has undergone more extensive erosion. The ISC 2004 survey scores for Golton Creek show that there are scarce large pieces of wood in the stream channel. Sheepwash Creek, as well as parts of Mount William Creek and the Wimmera River share similar problems. Indigenous fish species are unable to continuously migrate to these reaches, although they are still able to migrate at times of very high flow thereby limiting the impact of artificial barriers on fish migration and the resultant score for this component of the ISC survey.

Upper Golton Creek has the best condition streamside zone in this portion of the catchment. Although it is largely missing coverage of large trees and the longitudinal connectivity they provide, other features such as the recruitment of juvenile tree species, cover of leaf litter, large logs, significant absence of weeds and presence of a largely unmodified understorey meant that it was able to attract a high score for the streamside zone sub-index. The Wimmera River and lower reaches of Mount William Creek had fairly good streamside zones although some parts lacked an adequate amount of longitudinal connectivity of large trees as well as a good understorey. The lower reaches of Golton and Sheepwash creeks both received poor scores. Weed infestation tended to have moderate impact on these waterways.



Golton Creek has a particularly pristine hydrological regime, with no impacts from diversions for other uses. Unfortunately this is not the case for the Wimmera River, Mount William and Sheepwash creeks. The Wimmera River and Sheepwash Creek have moderately stressing flow regimes. Mount William Creek suffers extensively from a heavily altered flow regime due to the influence of Lake Lonsdale. This altered flow regime impacts high and low flows which are both essential contributors to waterway health.

Water quality results from the Victorian Water Quality Monitoring Network site are only available for Sheepwash Creek and show a large drop in pH levels, restoring it to within acceptable environmental water quality objectives since the 1999 ISC survey. However over the same period there have been significant increases in turbidity, salinity and total phosphorous concentrations.

For the ISC 2004 survey, Mount William Creek and the Wimmera River were the only aquatic life sub-index sample locations in this Management Unit. Results from these two locations indicate that there is a very good diversity of aquatic life in these reaches although there was a very slight decrease in the result for the Wimmera River since the ISC 1999 survey.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.15).

TABLE 4.15 significant flora, fauna and EVC recorded in waterway management unit 6

Significant fauna	Barking Owl, Mountain Galaxias, Little Bittern
Significant flora	Buloke, Downy Star-Bush, Grampians Thryptomene, Grampians Trigger-plant, Hairy Correa, Moss, Orange Bell-climber, Rock Wattle, Shiny Tea-tree, Spiral Sun-orchid, Torpedo Arrowgrass, Williamson's Bush-pea
Significant EVC	Creekline Grassy Woodland Drainage Line Woodland Dry Creekline Woodland Plains Grassy Woodland Plains Woodland Plains Woodland/Plains Grassy Wetland Plains Woodland/Plains Sedgy Woodland/Damp Sands Herb-rich Woodland Riparian Woodland Sand Ridge Woodland / Damp Sands Herb-rich Woodland Seasonally Inundated Shrubby Woodland Shallow Sands Woodland

6.2 priority waterways

Priority Reaches in Waterway Management Unit 6 are:

- **Mount William Creek Reach 22** (high economic value in RIVERS).
- **Golton Creek Reach 26** (excellent condition in the 2004 ISC survey).

Priority waterways outside this Waterway Management Unit that are impacted by actions implemented in Waterway Management Unit 6 are:

- Yarriambiack Creek Reaches 18 – 20.
- Wimmera River Reaches 2 – 7.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.



6.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

As the priority reach Mt William Creek Reach 22 is located at the upper end of the Waterway Management Unit, there are no reaches in the Management Unit that directly influence this reach. However, a number of reaches in the Management Unit have an influence on the priority reach in Waterway Management Unit 6, immediately downstream. For this reason, management actions have been identified and prioritised the following reaches in Waterway Management Unit 6:

- Wimmera River Reach 8.
- Mount William Creek Reach 21.
- Golton Creek Reaches 25.
- Anabranh of Wimmera River Reach 77.
- Sheepwash Creek Reach 78.



6.4 primary management objective

The primary waterway health objective for the priority reach in Waterway Management Unit 6 is to:

- Protect the high economic condition of Mount William Creek Reach 22.
- Prevent damage to priority reaches from conditions in influencing reaches.

6.5 risks to waterway health

Risk assessments have been undertaken for the two priority reaches within Waterway Management Unit 6. A summary of the risks for Mount William Creek Reach 22 and Golton Creek Reach 26 is presented in Table 4.16.

TABLE 4.16 risks to significant values in priority reaches in waterway management unit 6

High Economic Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		4	3	5	4	5	2	5	1	4	1	3	3	1	3	4	5
water supply delivery	4	5	3	0	0	0	2	7	2	0	0	0	0	2	0	0	6
water supply collection	5	0	0	0	0	8	2	7	2	0	0	0	0	0	0	0	0
infrastructure	5	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tourism	4	4	0	0	0	4	0	4	0	4	0	0	0	2	3	0	0
power generation	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

MT WILLIAM CREEK REACH 22

Excellent ISC Condition		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	1	1	2	0	0	1	2	3	3	1	4	2	1
riparian width	4	2	0	0	0	0	0	0	0	0	2	3	0	0	6	0	2
riparian continuity	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
riparian intactness	4	2	0	0	0	2	0	0	0	0	2	3	0	0	6	0	2
invertebrate O/E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish O/E	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
native fish proportion	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
fish migration	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

GOLTON CREEK REACH 26

Key: 8 **Very High** risk, high priority for action, 7 **High** 1 risk, high priority for action, 6 **High** 2 risk, high priority for action, 5 **High** 3 risk, high priority for action, 4 **Medium** 1 risk, medium priority for action, 3 **Medium** 2 risk, medium priority for action, 2 **Low** 1 risk, low priority for action, 1 **Low** 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in the priority reaches in Waterway Management Unit 6 include:

- Bank erosion, Flow deviation, Water quality level and Stock access in Mt William Creek Reach 22.
- Degraded streamside vegetation in Golton Creek Reach 26.

Medium risks to significant values in the priority reaches in Waterway Management Unit 6 include:

- Bed instability, Water temperature and Degraded streamside vegetation.
- Exotic fauna in Golton Creek Reach 26.

Potential threats to the priority reach in Waterway Management Unit 6 immediately downstream from the six influencing waterways can be seen in Table 4.17. High and medium threats from bank erosion, bed instability, water quality (nutrients), water temperature, exotic fauna, degraded streamside zone and stock access are found throughout the influencing waterways, particularly in Mt William Creek Reach 21.

TABLE 4.17 threat levels influencing waterways in waterway management unit 6

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Wimmera River Reach 8	1	1	3	2	0	0	4	1	3	1	2	1
Mount William Creek Reach 21	5	5	5	2	0	5	4	2	3	1	2	5
Golton Creek Reach 25	2	1	1	2	0	0	1	2	3	1	2	5
Golton Creek Reach 26	1	1	1	2	0	0	1	2	3	1	4	1
Wimmera R. anabranch Reach 77	2	1	1	2	0	0	4	2	3	1	2	1
Sheepwash Creek Reach 78	1	1	1	2	0	0	1	1	3	1	3	1

Key: 5 or 4 High threat level in reach (High *Wimmera WHS* priority for action), 3 Medium threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 Low threat level in reach (Low *Wimmera WHS* priority for action)

6.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

6.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU06-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	26		High	70,000	RL1, 2	33.6 ha of riparian land revegetated.	7.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 7.0 km of waterway with improved ISC Physical Form sub-index score.
WMU06-02		Bank erosion Degraded riparian vegetation	22	21, 25, 78	Medium	360,000		172.8 ha of riparian land revegetated.	36.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 36.0 km of waterway with improved ISC Physical Form sub-index score.
WMU06-03	Encourage off-stream watering of stock.	Stock access	22	21, 25	High	20,000	RL5	139.2 ha under management for off-stream watering.	Contribute to targets for WMU06-01 to WMU06-02.
WMU06-04	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	22, 26	8, 21, 25, 77, 78	Low	138,000	RL3, 9, 33	Priority weed control on 122.0 km of waterways.	61.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU06-05	Undertake management of other pest plant species where they are having significant impact on waterway health.		22, 26	8, 21, 25, 77, 78	Low	60,000	RL3, 33	Weed control on 122.0 km of waterways.	

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU06-06	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	22, 26	8, 21, 25, 77, 78	Medium	120,000	RL10	122.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU06-07	Implement bed and bank stabilisation actions.	Bank erosion Bed instability	22	21	High	220,000	RL14 ICF8	3.0 km of bed and banks stabilised.	21.5 km of waterway with improved ISC Physical Form sub-index score.
WMU06-08	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	22, 26	8, 21, 25, 77, 78	High	300,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches by 2020.
WMU06-09	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	22	8, 21	High	150,000	EWR23, 25, 26, 27, 30		
WMU06-10	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	22	8, 21	High	300,000	EWR51, 52		
WMU06-11	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	22, 26	8, 21, 25, 77, 78	Low	90,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU06-12	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	22	8, 21	Low	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage downstream of the Management Unit by 2010.	Targets set by investigation.
WMU06-13	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	22	21	High	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU06-14	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability		25, 78	Low	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU06-15	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	22	8, 21	High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU06-16	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	22	21	High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU06-17	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	22, 26	8, 21, 25, 77, 78	Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU06-18	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	22, 26	8, 21, 25, 77, 78	High	331,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU06-19	Increase community understanding of waterway health.	All threats	22, 26	8, 21, 25, 77, 78	High	250,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU06-20	Actively engage community and stakeholders in managing waterways.	All threats	22, 26	8, 21, 25, 77, 78	High	36,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 6 cost summary

Total Cost of all Actions	\$2,592,500
High Priority Actions	\$1,749,500
Medium Priority Actions	\$480,000
Low Priority Actions	\$363,000

6.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 8 ISC score raised from 27 to 31 (Moderate to Good)</p> <p>Reach 21 ISC score raised from 15 to 19 (Poor to Moderate)</p> <p>Reach 22 ISC score raised from 21 to 24 (maintained at Moderate)</p> <p>Reach 25 ISC score raised from 28 to 33 (Moderate to Good)</p> <p>Reach 26 ISC score maintained at 41 (maintained at Excellent)</p> <p>Reach 77 ISC score raised from 26 to 30 (Moderate to Good)</p> <p>Reach 78 ISC score raised from 23 to 28 (maintained at Moderate)</p>	<p>14.0 km (Reach 26) maintained at Excellent</p> <p>51.0 km (Reaches 8, 25 and 77) raised from Moderate to Good</p> <p>33.0 km (Reaches 22 and 78) maintained at Moderate</p> <p>24.0 km (Reach 21) raised from Poor to Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>206.4 ha of riparian land fenced and/or revegetated</p> <p>45.6 ha of priority stream under land management agreement for off-stream watering</p> <p>93.6 km of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 122.0 km of waterways</p> <p>Weed control on 122.0 km of waterways</p> <p>3.0 km of bed and banks stabilised</p> <p>122.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 1 priority reach</p>	<p>54.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> 16.0 km raised from 6 to 8 in Reach 8 12.0 km raised from 6 to 8 in Reach 21 9.5 km raised from 6 to 8 in Reach 22 7.5 km raised from 4 to 6 in Reach 25 2.0 km raised from 6 to 8 in Reach 77 7.0 km raised from 5 to 7 in Reach 78 <p>46.5 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> 16.0 km raised from 6 to 7 in Reach 8 12.0 km raised from 6 to 7 in Reach 21 9.5 km raised from 6 to 8 in Reach 22 2.0 km raised from 7 to 8 in Reach 77 7.0 km raised from 5 to 7 in Reach 78 <p>Aquatic life protected in 60.0 km of river (Reaches 8 and 22) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 1 priority reach</p>

waterway management unit 7. grampians system

reaches 16, 28, 29 and 75

7.1 waterways and their condition

The streams located in Waterway Management Unit 7 are without a doubt the most pristine in the region primarily due to their location within the Grampians National Park (Map 4.8). The upper reaches of Fyans Creek and the MacKenzie River are included in this Management Unit and although in many respects they are untouched, in other ways there remains potential for improvements in their condition. These waterways provide important habitat for a platypus population as well as native fish within the region. It is crucial that these reaches are preserved to ensure that these unique areas of habitat remain intact.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

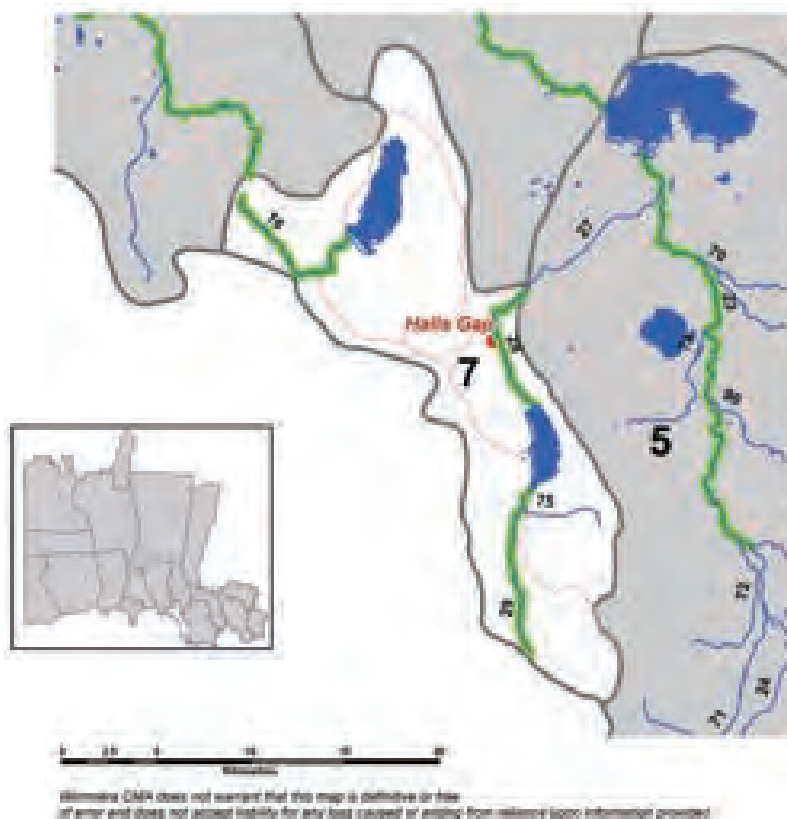
Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.8 waterway management unit 7 and reaches

Mackenzie River is in a virtually unspoiled condition in this portion of the catchment. As it is slowly incising into the local bedrock, there are no issues with bank stability and there is plentiful LWD within the channel. Erosion is only occurring at a natural rate and there is abundant habitat for the aquatic life in the river. The only factor that has reduced the score for the physical form sub-index is the presence of artificial barriers downstream that have limited the opportunities for the migration of indigenous fish species. Fyans Creek's physical form condition is also very good. The ISC 2004 survey bank stability score for Fyans Creek demonstrates that only very limited erosion is taking place.



It could be expected that these reaches would have the best streamside zones in the Wimmera and it was encouraging for them to score very highly for this sub-index. They were in near-reference condition and included virtually intact understoreys. These reaches also scored very well for many other components of a high quality streamside zone. These included an almost unbroken longitudinal continuity of large trees with high percentage of tree cover and resultant significant quantities of large trees, logs and organic litter. There was excellent regeneration of native vegetation species and low levels of weed infestation.

Water quality data was not obtained in this Management Unit for the ISC 2004 survey. Water quality results from the ISC 1999 survey for Fyans Creek indicate that the water is of high quality with relatively low levels of turbidity and salinity, especially when compared with other parts of the Wimmera region. The pH levels were also within environmental water quality objectives.

Fyans Creek is spring-fed and therefore naturally flows throughout the year. On the other hand the MacKenzie River was thought to have cease-to-flow periods during summer, however this has altered as regulated continuous flows come from Lake Wartook. Lake Bellfield diverts a large proportion of Fyans Creek's flow for Stawell's town water supply. Therefore it can be seen that as opposed to the other components of a healthy waterway, the hydrological regimes of Fyans Creek and MacKenzie River have been heavily modified. The effects of the modified hydrology are mostly seen with greatly changed low flow magnitudes as well as impacting on the duration of zero flow periods. These waterways are most stressed in summer although the situation is not greatly improved in winter.

Sampling for the ISC 2004 survey to analyse the diversity and abundance of aquatic life in this area of the catchment has provided valuable information relating to its condition. It showed that there is a great diversity of aquatic life in the upper reach of the MacKenzie River, receiving 9 out of 10. Fyans Creek scored 6 out of 10, indicating that aquatic life in this area is generally very diverse and in a healthy condition.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.18). Although not of formal conservation significance, the presence of platypus in the waterways of the Management Unit is of regional significance.

TABLE 4.18 significant flora, fauna and EVC recorded in waterway management unit 7

Significant fauna	Musk Duck, White-bellied Sea-Eagle
Significant flora	Branched Trymalium, Emerald-lip Greenhood, Grampians Bauera, Grampians Bossiaea, Grampians Grey-gum, Grampians Heath, Grampians Peppermint, Hairy Correa, Nettle Daisy-bush, River Leafless Bossiaea, Slender Swainson-pea
Significant EVC	Grassy Dry Forest Herb-rich Foothill Forest Herb-rich Heathy Forest Riparian Forest Riparian Shrubland Valley Grassy Forest

7.2 priority waterways

Priority Reaches in Waterway Management Unit 7 are:

- **MacKenzie River Reach 16** (near ecologically healthy condition).
- **Fyans Creek Reach 28** (very high economic value in RiVERS).
- **Fyans Creek Reach 29** (high social and high economic value in RiVERS).

Priority waterways outside this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 7:

- MacKenzie River Reach 14.
- MacKenzie River Reach 15.
- Burnt Creek Reach 92.

7.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Barney Creek Reach 75.

7.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 7 are:

- Improve the environmental condition of MacKenzie River Reach 16 from near ecologically healthy status to ecologically healthy status.
- Protect the very high economic values in Fyans Creek Reach 28.
- Protect the high social and economic values in Fyans Creek Reach 29.
- Prevent damage to priority reaches from conditions in influencing reaches.

7.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 7. A summary of the risks for the three priority reaches is presented in Table 4.19.

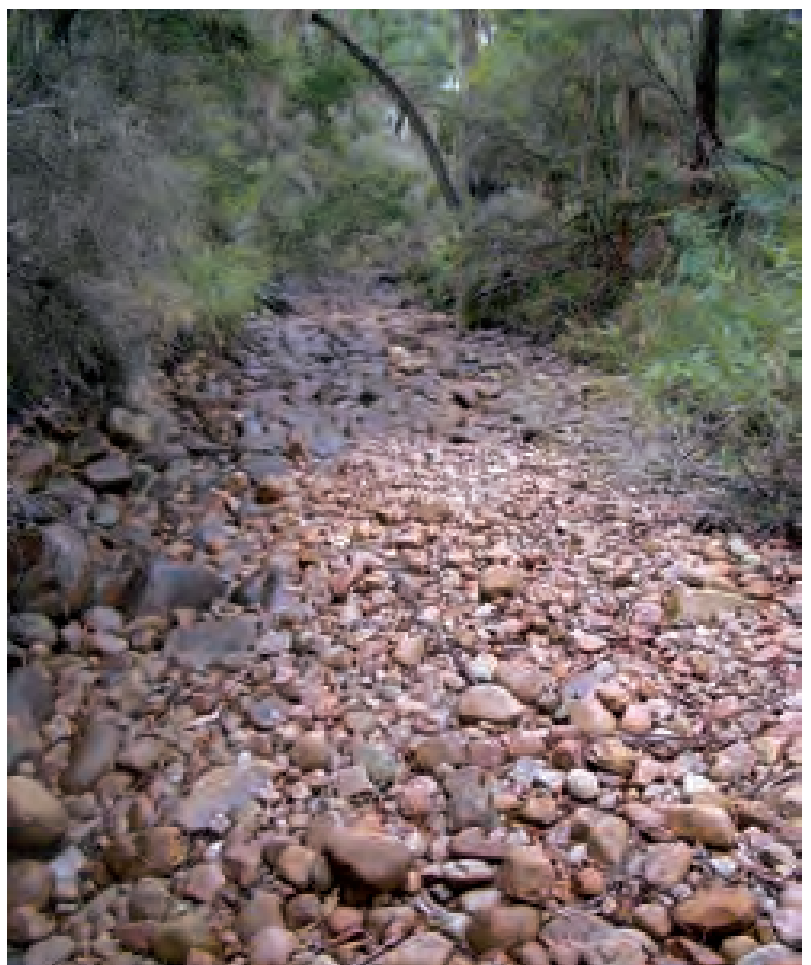


TABLE 4.19 risks to significant values in priority reaches in waterway management unit 7

Near Ecologically Healthy Condition		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	2	5	0	0	3	5	2	3	1	1	4	3	1
significant flora	2	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
significant EVC	4	0	0	0	0	4	0	0	0	0	2	3	0	0	6	3	2
significant fauna	5	0	0	4	0	4	0	0	0	7	2	3	2	2	7	3	0
ecologically healthy	4	2	2	4	2	7	0	0	3	6	2	3	2	2	6	3	2
riparian width	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
riparian continuity	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
riparian intactness	4	2	0	0	0	6	0	0	0	0	2	3	0	0	6	0	2
invertebrate O/E	4	2	2	0	2	4	0	0	3	7	2	0	2	2	6	3	2
native fish O/E	2	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0
native fish proportion	1	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0
fish migration	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0

MACKENZIE RIVER REACH 16

High Economic Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		4	5	5	4	5	2	0	1	5	2	4	1	1	2	1	1
water supply delivery	5	6	7	0	0	0	2	0	2	0	0	0	0	2	0	0	2
water supply collection	5	0	0	0	0	8	2	0	2	0	0	0	0	0	0	0	0
infrastructure	5	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	5	6	4	0	4	0	0	0	0	0	2	0	0	0	0	0	0
tourism	5	4	0	0	0	4	0	0	0	4	0	0	0	2	2	0	0
power generation	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

FYANS CREEK REACH 28

TABLE 4.19 (continued)

Near Ecologically Healthy Condition		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		4	3	5	2	1	2	0	0	1	2	3	1	1	4	2	1
fishing	4	5	3	7	2	2	0	0	0	2	2	3	2	2	4	0	2
sports, non motor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sports, motor	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
camping	5	4	0	0	0	0	0	0	0	0	0	0	0	2	4	0	2
swimming	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
european heritage	5	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	7	3	7	2	2	2	0	0	2	2	3	2	0	6	2	2
passive recreation	5	6	0	0	0	0	0	0	0	0	0	0	0	2	7	0	2
listed landscapes	5	6	0	0	2	0	0	0	0	0	2	0	0	0	6	0	2
water supply delivery	5	6	3	0	0	0	2	0	0	0	0	0	0	2	0	0	2
water supply collection	5	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
infrastructure	5	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tourism	5	4	0	0	0	0	0	0	0	0	0	0	0	2	6	0	0
power generation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FYANS CREEK REACH 29

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book Part 6, Sub-folder 16 – Risk Assessment and Prioritisation*. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 7 include:

- Flow deviation, Water temperature and Degraded streamside vegetation in MacKenzie River Reach 16.
- Bank erosion and Bed instability in Fyans Creek Reach 28. (While Flow deviation is identified as a high risk in Table 4.19, it is not considered a specific risk to the water supply economic values of the reach, but is a medium risk to tourism values).
- Bank erosion, Barriers to fish migration and Degraded streamside vegetation in Fyans Creek Reach 29.

Medium risks to significant values in priority reaches in Waterway Management Unit 7 include:

- Barriers to fish migration, Water quality (nutrients), Exotic fauna and Wetland connectivity in MacKenzie River Reach 16.
- Channel modification, Flow deviation and Water temperature in Fyans Creek Reach 28.
- Bed instability and Exotic fauna in Fyans Creek Reach 29.

Potential threats to priority reaches Fyans Creek Reaches 28 and 29 from the influencing waterway can be seen in Table 4.20. Only the presence of exotic fauna in the reach is considered a medium threat to downstream priority reaches.

TABLE 4.20 threat levels influencing waterways in waterway management unit 7

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Barney Creek Reach 75	2	1	1	2	0	0	1	1	3	1	1	1

Key: 5 or 4 **High** threat level in reach (High *Wimmera WHS* priority for action), 3 **Medium** threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 **Low** threat level in reach (Low *Wimmera WHS* priority for action)



7.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the Wimmera Water Quality Strategy targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

7.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU07-01	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson’s Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	16, 28, 29	75	Low	37,000	RL3, 9, 33	Priority weed control on 33.0 km of waterways.	16.5 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU07-02	Undertake management of other pest plant species where they are having significant impact on waterway health.		16, 28, 29	75	Low	16,000	RL3, 33	Weed control on 33.0 km of waterways.	
WMU07-03	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	16, 28, 29	75	Medium	33,000	RL10	33.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU07-04	Undertake pest animal management (Eg. deer and goats) in priority areas.	Exotic fauna	16, 28, 29	75	Low	500,000	RL10	33.0 km of stream under pest animal management.	Measurable decrease in pest animal populations.
WMU07-05	Implement priority bed and bank stabilisation actions in the MacKenzie River Waterway Action Plan (2004).	Bank erosion Bed instability	16		High	200,000	RL14 ICF8	1.5 km of bed and banks stabilised.	5.0 km of waterway with improved ISC Physical Form sub-index score.
WMU07-06	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	16	28	High	150,000	EWR23, 25, 26, 27, 30	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches by 2020.
WMU07-07	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	16	28	High	300,000	EWR51, 52		

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU07-08	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	16, 29		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage by 2010.	Targets set by investigation.
WMU07-09	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank Erosion Bed instability	28, 29		High	50,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU07-10	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	16		High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU07-11	Monitor platypus populations in the Management Unit.	All threats	16, 28, 29	75	High	15,000	MON7	Monitoring program implemented and actions developed.	Condition target to be set by 2008 after completion of biodiversity surveys.
WMU07-12	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	16, 28, 29	75	High	100,000	WQ12, MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU07-13	Increase community understanding of waterway health.	All threats	16, 28, 29	75	High	68,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU07-14	Actively engage community and stakeholders in managing waterways.	All threats	16, 28, 29	75	High	10,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 7 cost summary

Total Cost of all Actions	\$1,529,000
High Priority Actions	\$959,000
Medium Priority Actions	\$33,000
Low Priority Actions	\$537,000

7.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 16 ISC score raised from 27 to 28 (maintained at Moderate)</p> <p>Reach 28 ISC score raised from 21 to 23 (maintained at Moderate)</p> <p>Reach 29 ISC score maintained at 22 (maintained at Moderate)</p> <p>Reach 75 ISC score maintained at 22 (maintained at Moderate)</p>	<p>33.0 km (Reaches 16, 28, 29 and 75) maintained at Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>Priority weed control on 33.0 km of waterways</p> <p>Weed control on 33.0 km of waterways</p> <p>1.5 km of bed and banks stabilised</p> <p>33.0 km of stream with rabbit control</p> <p>33.0 km of stream under pest animal management</p> <p>Environmental Water Reserve established and implemented in 2 priority reaches</p>	<p>9.0 km of riparian zones with improved ISC Streamside Zone sub-index score</p> <ul style="list-style-type: none"> 5.0 km raised from 9 to 10 in Reach 16 4.0 km raised from 7 to 8 in Reach 28 <p>Aquatic life protected in 12.5 km of river (Reach 16) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 2 priority reaches</p>

waterway management unit 8. mackenzie river and burnt creek system

reaches 7, 14, 15, 79, 80, 81 and 92

8.1 waterways and their condition

The Wimmera's principal regional centre, Horsham, is located within Waterway Management Unit 8 (Map 4.9). Furthermore this part of the region is the site of the confluence of two of the region's major waterways, the Wimmera and MacKenzie rivers. Boggy and Burnt creeks also flow into these rivers within this Management Unit. MacKenzie River and Burnt Creek experience modified flow regimes, impacted by flow abstractions from MacKenzie River and supplementing of flows along part of the length of Burnt Creek. Although all the reaches within this area are important, in terms of their size and location they are classified by the ISC 2004 survey as being in either a very poor, poor or moderate condition.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.9 waterway management unit 8 and reaches

Boggy Creek showed all the hallmarks of a relatively intact streamside zone. However the nearby mid-upper MacKenzie River has a much poorer condition streamside zone. In several cases there was a complete absence of large trees, severely impacting the ISC score. Low numbers of large trees were also seen along several reaches of Burnt Creek. The percentage cover of weeds in this Waterway Management Unit was amongst the highest in the catchment. The streamside zone of the lower MacKenzie River was in a much better condition than the mid-upper reaches. The good condition of the streamside zones along the Wimmera River is an encouraging aspect in looking at this part of the catchment.

Aquatic communities in the Wimmera River within this Management Unit are in excellent condition, scoring 9 out of 10. There is a great diversity of macroinvertebrate families present, including families that are particularly susceptible to water pollution, demonstrating that the water in this part of the river is of a high quality. However the mid-upper reach of MacKenzie River which scored poorly for its streamside zone component also received a low score for the aquatic life sub-index.

Hydrological regimes of the waterways within the region are some of the most modified within the Wimmera. Modifications to the volumes during high and low flows have led to some very poor scores during the 2004 ISC survey, with either a 0 or 1 out of 10. The lower MacKenzie River as well as Boggy Creek are the most affected in this respect. Modifying the timing of the high and low flow volumes to differing times of the year is also an issue, affecting both summer and winter flow regimes.

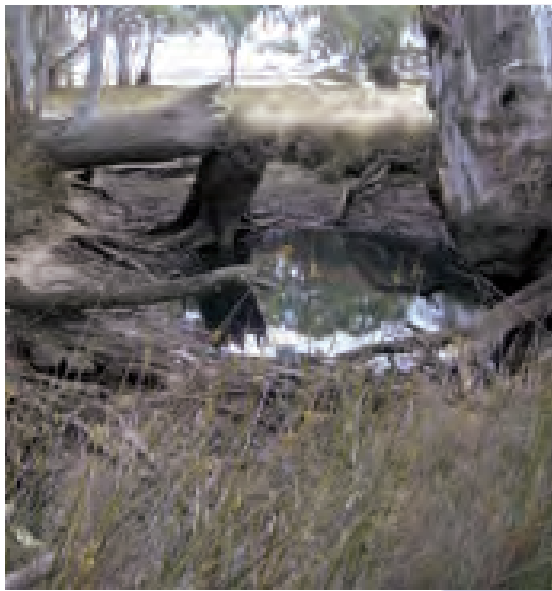
Water quality results for Burnt Creek are very positive in that total phosphorous, salinity and turbidity as well as pH have each decreased since the 1999 ISC survey. Likewise, apart from an increase in total phosphorous, the concentrations of salinity, turbidity and pH have decreased in Boggy Creek.

When looking at the physical form of waterways within the region it is a positive sign that most of the reaches are only undergoing limited erosion, apart from Burnt Creek which is enduring a more moderate rate of erosion. There are concerns associated with the extent of erosion of the Wimmera River at the Horsham weir pool, as well as associated impacts to downstream turbidity levels. The aspect of physical form of these streams that is of most concern in this area of the catchment is the scarcity of woody debris within the waterway channels. The ISC 2004 survey scores for LWD for these reaches only ranged from 0 to 1.7 out of 5, meaning only poor habitat is available for the aquatic communities. Furthermore, indigenous fish species can only intermittently migrate through these waterways as sometimes weirs or other structures are drowned-out in periods of high flow.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.21). Although not of formal conservation significance, the presence of platypus in the waterways of the Management Unit is of regional significance.

TABLE 4.21 significant flora, fauna and EVC recorded in waterway management unit 8

Significant fauna	Musk Duck, Striped Legless Lizard, Diamond Firetail, Intermediate Egret, Little Button-quail, Mountain Galaxias, Brown Treecreeper, Bush Stone-curlew, Macquarie Perch
Significant flora	Annual Buttercup, Buloke, Dark Wire-grass, Grampians Peppermint, Pale Spike-sedge
Significant EVC	Alluvial Terraces Herb-rich Woodland Black Box Chenopod Woodland Creekline Grassy Woodland Creekline Sedgy Woodland Damp Sands Herb-rich Woodland Damp Sands Herb-rich Woodland / Shrubby Woodland Floodplain Riparian Woodland Herb-rich Foothill Forest/Damp Sands Herb-rich Woodland Complex Hills Herb-rich Woodland Plains Grassy Woodland Plains Riparian Shrubby Woodland Plains Sedgy Woodland Plains Woodland Riparian Woodland Riverine Chenopod Woodland Riverine Grassy Woodland / Riverine Sedgy Forest / Aquatic Herbland Sand Ridge Woodland Sand Ridge Woodland / Damp Sands Herb-rich Woodland Shallow Freshwater Marsh Shallow Sands Woodland Shrubby Woodland



8.2 priority waterways

Priority Reaches in Waterway Management Unit 8 are:

- **Wimmera River Reach 7** (very high social values in RiVERS).
- **MacKenzie River Reach 14** (near ecological health).
- **MacKenzie River Reach 15** (near ecological health).
- **Burnt Creek Reach 92** (high economic values in RiVERS).

Priority waterways outside this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 8 are:

- Wimmera River Reaches 2 – 6.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

8.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within the Waterway Management Unit:

- Tributary of Burnt Creek Reach 79.
- Burnt Creek Reach 80.
- Boggy Creek Reach 81.

8.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 8 are:

- Protect the very high social values in Wimmera River Reach 7.
- Improve the environmental condition of MacKenzie River Reach 14 from near ecologically healthy status to ecologically healthy status.
- Improve the environmental condition of MacKenzie River Reach 15 from near ecologically healthy status to ecologically healthy status.
- Protect the high economic values in Burnt Creek Reach 92.
- Prevent damage to priority reaches from conditions in influencing reaches.

8.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 8. A summary of the risks for the four priority reaches is presented in Table 4.22.



TABLE 4.22 risks to significant values in priority reaches in waterway management unit 8

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Social Value		4	3	5	4	5	4	2	1	1	2	3	3	5	4	3	1
fishing	5	6	3	8	6	7	4	2	2	2	2	3	3	7	4	0	2
sports, non motor	5	4	0	0	4	7	0	0	0	0	0	0	0	7	4	0	0
sports, motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0
camping	5	4	0	0	4	4	0	0	0	0	0	0	0	8	4	0	2
swimming	5	4	0	0	4	7	4	2	2	2	0	0	0	8	4	0	2
european heritage	5	4	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	4	6	3	6	5	7	5	2	2	2	2	3	3	4	5	3	2
passive recreation	5	6	0	0	4	4	0	0	0	0	0	0	0	7	7	0	2
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

WIMMERA RIVER REACH 7

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
Near Ecologically Healthy Condition		1	3	5	4	5	4	0	1	1	1	3	1	1	2	1	5
significant flora	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
significant EVC	5	0	0	0	0	4	0	0	0	0	2	3	0	0	2	2	8
significant fauna	5	0	0	4	0	4	0	0	0	2	2	3	2	2	2	2	4
ecologically healthy	4	2	3	4	6	7	5	0	2	2	2	3	2	2	2	2	6
riparian width	5	2	0	0	4	4	0	0	0	0	2	3	0	0	2	0	8
riparian continuity	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
riparian intactness	4	2	0	0	0	6	0	0	0	0	2	3	0	0	2	0	7
invertebrate O/E	5	2	3	0	6	4	6	0	2	2	2	0	2	2	2	2	7
native fish O/E	2	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
native fish proportion	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
fish migration	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1

MACKENZIE RIVER REACH 14

TABLE 4.22 (continued)

Near Ecologically Healthy Condition		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		2	3	5	3	5	0	0	0	1	2	3	2	1	3	1	5
significant flora	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
significant EVC	5	0	0	0	0	4	0	0	0	0	2	3	0	0	3	2	8
significant fauna	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ecologically healthy	4	2	3	4	3	7	0	0	0	2	2	3	2	2	3	2	6
riparian width	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
riparian continuity	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
riparian intactness	4	2	0	0	0	6	0	0	0	0	2	3	0	0	3	0	7
invertebrate O/E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish O/E	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
native fish proportion	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
fish migration	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1

MACKENZIE RIVER REACH 15

High Economic Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	4	4	2	0	0	1	1	3	0	1	0	3	5
water supply delivery	4	2	2	0	0	0	2	0	0	0	0	0	0	2	0	0	6
water supply collection	5	0	0	0	0	7	2	0	0	0	0	0	0	0	0	0	0
infrastructure	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	5	2	0	0	4	0	0	0	0	0	2	0	0	0	0	0	0
tourism	5	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0
power generation	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

BURNT CREEK REACH 92

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 8 include:

- Bank erosion, Barriers to fish migration, Channel modification, Flow deviation, Water quality trend, Algal blooms and Degraded streamside vegetation in Wimmera River Reach 7.
- Channel modification, Flow deviation, Water quality trend and Stock access in MacKenzie River Reach 14.
- Flow deviation and Stock access in MacKenzie River Reach 15.
- Stock access in Burnt Creek Reach 92. (While Flow deviation is identified as a high risk in Table 4.22, it is not considered a specific risk to the water supply economic values of the reach, but is a medium risk to tourism values).

Medium risks to significant values in priority reaches in Waterway Management Unit 8 include:

- Bed instability, Exotic fauna, Loss of in-stream habitat and Wetland connectivity in Wimmera River Reach 7.
- Bed instability, Barrier to fish migration and Exotic fauna in MacKenzie River Reach 14.
- Bed instability, Barrier to fish migration, Channel modification, Exotic fauna and Degraded streamside vegetation in MacKenzie River Reach 15.
- Channel modification and Flow deviation in Burnt Creek Reach 92.

Potential threats to priority reaches from the three influencing waterways can be seen in Table 4.23. High and medium threats from bed instability, flow deviation, exotic fauna, degraded streamside zone and stock access are found in Reaches 79 and/or 80. All threats are at a low level in Reach 81.

TABLE 4.23 threat levels influencing waterways in waterway management unit 8

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Trib. of Burnt Creek Reach 79	2	3	4	2	0	0	1	2	3	1	4	1
Burnt Creek Reach 80	1	1	4	2	0	0	1	1	3	1	3	5
Boggy Creek Reach 81	1	1	1	2	0	0	1	1	2	1	2	1

Key: 5 or 4 High threat level in reach (High *Wimmera WHS* priority for action), 3 Medium threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 Low threat level in reach (Low *Wimmera WHS* priority for action)

8.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

8.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU08-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	7, 92	79	High	200,000	RL1, 2	187.2 ha of riparian land revegetated.	39.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 39.0 km of waterway with improved ISC Physical Form sub-index score.
WMU08-02		Bank erosion Degraded riparian vegetation	15	80	Medium	80,000		79.2 ha of riparian land revegetated.	16.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 16.5 km of waterway with improved ISC Physical Form sub-index score.
WMU08-03		Bank erosion Degraded riparian vegetation	14	81	Low	150,000		141.6 ha of riparian land revegetated.	29.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 29.5 km of waterway with improved ISC Physical Form sub-index score.
WMU08-04	Encourage off-stream watering of stock.	Stock access	14, 15, 92	80	High	20,000	RL5	184.8 ha under management for off-stream watering.	Contribute to targets for WMU08-01 to WMU08-03.
WMU08-05			7		Low	20,000		108.0 ha under management for off-stream watering.	

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU08-06	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	7, 14, 15, 92	79, 80, 81	Low	193,000	RL3, 9, 33	Priority weed control on 170.0 km of waterways.	85.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU08-07	Undertake management of other pest plant species where they are having significant impact on waterway health.		7, 14, 15, 92	79, 80, 81	Low	84,000	RL3, 33	Weed control on 170.0 km of waterways.	
WMU08-08	Re-introduce LWD at priority sites to restore instream habitat.	Bank erosion	7		Medium	85,000	ICF25	2 sites with LWD introduced.	22.5 km of waterway with improved ISC Physical Form sub-index score.
WMU08-09	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	7, 14, 15	79, 80	Medium	167,000	RL10	133.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU08-10	Implement priority bed and bank stabilisation actions in the MacKenzie River Waterway Action Plan (2004).	Bank erosion Bed instability	14, 15	80	High	125,000	RL14 ICF8	4.5 km of bed and banks stabilised.	39.0 km of waterway with improved ISC Physical Form sub-index score.
WMU08-11	Implement priority bed and bank stabilisation actions in the Burnt Creek Waterway Action Plan (2005).	Bank erosion Bed instability	92	79	Medium	250,000	RL14 ICF8	3.0 km of bed and banks stabilised.	16.5 km of waterway with improved ISC Physical Form sub-index score.
WMU08-12	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	7, 14, 15, 92	79, 80, 81	High	100,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 4 priority reaches by 2020.
WMU08-13	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	7, 14, 15, 92	80	High	150,000	EWR23, 25, 26, 27, 30		

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU08-14	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	7, 14, 15, 92	80	High	300,000	EWR51, 52	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 4 priority reaches by 2020.
WMU08-15	Treat stormwater prior to discharge into the Wimmera River as indicated in the Wimmera Region Urban Stormwater Management Plan (2002) actions.	Water quality trends Water quality attainment	7		Medium	Costed in plan.	WQ10	Identified actions implemented.	Contribute to overall regional targets set for the Wimmera Water Quality Strategy.
WMU08-16	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	7, 15		Low	126,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU08-17	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	7		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage within and downstream of the Management Unit by 2010.	Targets set by investigation.
WMU08-18		Barriers to fish migration	14, 15		Medium	40,000	SFF12, 13, 17		
WMU08-19	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	7		High	15,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU08-20		Bank erosion Bed instability	14, 15	79	Medium	30,000			
WMU08-21	Investigate septic tank and greywater leakage near Burnt Creek.	Water quality trend Water quality level	92		Low	50,000	WQ10	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU08-22	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	7, 14, 15, 92	80	High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU08-23	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	7		High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU08-24	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	7, 15		Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU08-25	Monitor platypus populations in the MacKenzie River.	All threats	14, 15		High	15,000	MON7	Monitoring program implemented and actions developed.	Condition target to be set by 2008 after completion of biodiversity surveys.
WMU08-26	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	7, 14, 15, 92	79, 80, 81	High	461,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU08-27	Undertake education related to building site stormwater management as outlined in the Wimmera WQS Communication Action Plan (2002) .	Water quality trend Water quality level	7		Medium	Costed in plan.	WQ9	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU08-28	Increase community understanding of waterway health.	All threats	7, 14, 15, 92	79, 80, 81	High	348,000	RL36, ICF35, EWR56, WQ16, , 7, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU08-29	Actively engage community and stakeholders in managing waterways.	All threats	7, 14, 15, 92	79, 80, 81	High	50,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 8 cost summary

Total Cost of all Actions	\$3,156,500
High Priority Actions	\$1,871,500
Medium Priority Actions	\$652,000
Low Priority Actions	\$633,000

8.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 7 ISC score raised from 22 to 24 (maintained at Moderate)</p> <p>Reach 14 ISC score raised from 16 to 20 (Poor to Moderate)</p> <p>Reach 15 ISC score raised from 12 to 17 (Very Poor to Poor)</p> <p>Reach 79 ISC score raised from 10 to 18 (Very Poor to Poor)</p> <p>Reach 80 ISC score raised from 15 to 20 (Poor to Moderate)</p> <p>Reach 81 ISC score raised from 18 to 19 (maintained at Moderate)</p> <p>Reach 92 ISC score raised from 13 to 20 (Poor to Moderate)</p>	<p>59.0 km (Reaches 7 and 81) maintained at Moderate</p> <p>94.0 km (Reaches 14, 80 and 92) raised from Poor to Moderate</p> <p>17.0 km (Reaches 15 and 79) raised from Very Poor to Poor</p>
Management Action Target summary	Resource Condition Target summary
<p>408.0 ha of riparian land fenced and/or revegetated</p> <p>292.8 ha of priority stream under land management agreement for off-stream watering</p> <p>60.0 ha of influencing reach under land management agreement for off-stream watering</p> <p>Priority weed control on 170.0 km of waterways</p> <p>Weed control on 170.0 km of waterways</p> <p>7.5 km of bed and banks stabilised</p> <p>2 sites with LWD introduced</p> <p>133.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 4 priority reaches</p>	<p>78.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 22.5 km raised from 6 to 7 in Reach 7 • 22.5 km raised from 7 to 9 in Reach 14 • 4.0 km raised from 3 to 6 in Reach 15 • 4.5 km raised from 2 to 6 in Reach 79 • 12.5 km raised from 6 to 7 in Reach 80 • 12.0 km raised from 4 to 7 in Reach 92 <p>85.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 22.5 km raised from 6 to 7 in Reach 7 • 22.5 km raised from 6 to 7 in Reach 14 • 4.0 km raised from 5 to 7 in Reach 15 • 4.5 km raised from 5 to 6 in Reach 79 • 12.5 km raised from 4 to 7 in Reach 80 • 7.0 km raised from 6 to 7 in Reach 81 • 12.0 km raised from 4 to 7 in Reach 92 <p>Aquatic life protected in 25.0 km of river (Reach 7) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 4 priority reaches</p>

waterway management unit 9. norton creek system

reaches 6 and 13

9.1 waterways and their condition

Norton Creek, the primary waterway in Waterway Management Unit 9, is regionally significant in that it is the catchment's largest unregulated waterway, with no flow diversions along its entire length (Map 4.10). It is also important as it helps provide a more natural flow regime to the lower Wimmera River, and is the last major tributary that enters the Wimmera River before Lake Hindmarsh. The location of the Wimmera River and Norton Creek within an important area of rural land use has meant that various components of the health of these waterways, such as their streamside zones, have been moderately impacted upon.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

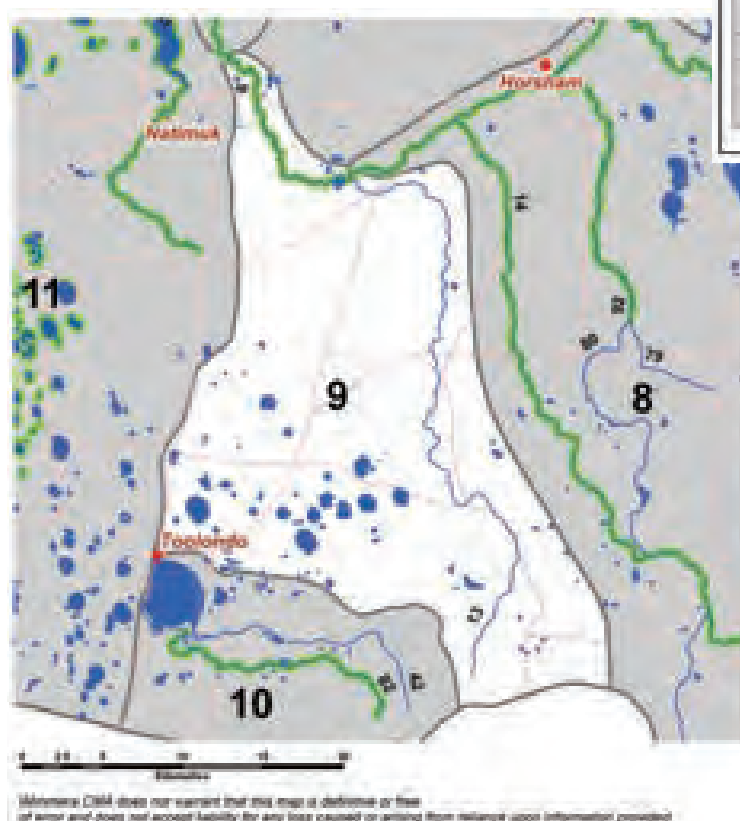
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.10 waterway management unit 9 and reaches

The bank stability of these two waterways is fairly good with only limited erosion taking place in certain areas. The large wood distribution is usually fair within the stream channels of the Wimmera River and Norton Creek and has decreased due to the effects of desnagging and vegetation clearing. Downstream artificial barriers that prevent the migration of native fish species during all but the periods of very high flows have slightly reduced the ISC scores for the physical form sub-index.

Streamside zone results for Norton Creek and the Wimmera River contain some positive aspects in that the number of large trees is almost at a reference condition. This has led to moderate ratings for the quantities of large logs and leaf litter, with tree canopy cover and longitudinal connectivity both in a reasonable condition. It is anticipated that over time these components will increase as the recruitment of immature tree species is quite high. The Wimmera River has a much better condition understorey than Norton Creek as Norton Creek’s understorey was quite poor probably due to stock access. The amount of coverage by weeds was reasonably low along both waterways.

As Norton Creek has an unmodified flow regime, it received a perfect score for the hydrology sub-index. The fact that Norton Creek has an unchanged flow regime means that it can influence the Wimmera River’s heavily modified flow regime. The ISC 2004 survey gave the Wimmera River 1 out of 10 for the hydrology sub-index in this part of the catchment. This is due to the changes in the magnitudes of low and high flows throughout the year as well as modifications to the variability of flows within a monthly period.

Water quality information for the ISC 2004 survey for this part of the catchment is derived from a location on the Wimmera River and shows that the water quality is very good. Of the parameters measured; total phosphorous, turbidity, salinity and pH, only the salinity had increased since the previous ISC survey in 1999. The rest of the parameters had decreased to be within the environmental water quality objectives for this region.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.24).



TABLE 4.24 significant flora, fauna and EVC recorded in waterway management unit 9

Significant fauna	Significant fauna Cape Barren Goose, Freshwater Catfish, Bush Stone-curlew
Significant flora	Thorny Bitter-pea
Significant EVC	Black Box Chenopod Woodland Creekline Sedgy Woodland Grassy Woodland Plains Woodland Riparian Woodland Riverine Grassy Woodland / Riverine Sedgy Forest / Aquatic Herbland

9.2 priority waterways

Priority Reaches in Waterway Management Unit 9 are:

- **Wimmera River Reach 6** (high environmental value from RiVERS).

Priority waterways outside this Waterway Management Unit that are impacted by actions implemented in Waterway Management Unit 9 are:

- Wimmera River Reaches 2 – 5.
- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

9.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

For these reasons, management actions have been identified and prioritised for the following influencing reaches within Waterway Management Unit 9:

- Norton Creek Reach 13.

9.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 9 are:

- Protect the high environmental values in Wimmera River Reach 6.
- Prevent damage to priority reaches from conditions in influencing reaches.

9.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 9. A summary of the risks for the priority reach is presented in Table 4.25.



TABLE 4.25 risks to significant values in priority reaches in waterway management unit 9

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Overall Environmental Value		1	1	5	2	5	4	2	1	1	1	4	3	5	3	3	5
significant flora	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1
significant EVC	5	0	0	0	0	4	0	0	0	0	2	6	0	0	3	3	8
significant fauna	5	0	0	4	0	4	0	0	0	2	2	7	3	8	3	3	4
significant wetland	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1
wetland rarity	5	0	0	0	0	8	6	2	2	0	2	6	0	0	0	3	7
heritage river	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1
sites of significance	5	2	2	0	2	7	4	0	0	0	2	6	3	4	3	3	8
ecologically healthy	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	1
riparian width	5	2	0	0	0	4	0	0	0	0	2	6	0	0	3	0	8
riparian continuity	5	2	0	0	0	4	0	0	0	0	2	7	0	0	3	0	8
riparian intactness	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
invertebrate O/E	5	2	2	0	2	4	6	2	2	2	2	0	3	7	3	3	7
native fish O/E	2	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0
native fish proportion	1	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0
fish migration	4	0	0	7	2	6	4	2	2	2	0	0	3	0	0	3	6

WIMMERA RIVER REACH 6

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the Wimmera WHS and the WHS Resource Book Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to the high environmental value in Wimmera River Reach 6 include:

- Barriers to fish migration, Flow deviation, Water quality trend (mainly salinity), Exotic fauna, Algal blooms and Stock access.

Medium risks to the high environmental value in Wimmera River Reach 6 include:

- Loss of in-stream habitat, Degraded streamside vegetation and Wetland connectivity.

Potential threats to priority reach Wimmera River Reach 6 from the influencing Norton Creek Reach 13 can be seen in Table 4.26. The major threats are from exotic fauna, degraded streamside vegetation and stock access to the creek.

TABLE 4.26 threat levels influencing waterways in waterway management unit 9

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Norton Creek Reach 13	1	1	1	0	0	0	1	1	3	1	4	5

Key: 5 or 4 High threat level in reach (High *Wimmera* WHS priority for action), 3 Medium threat level in reach (Medium *Wimmera* WHS priority for action), 2 or 1 Low threat level in reach (Low *Wimmera* WHS priority for action)

9.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).



9.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU09-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	6	13	High	150,000	RL1, 2	182.4 ha of riparian land revegetated.	38.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 38.0 km of waterway with improved ISC Physical Form sub-index score.
WMU09-02	Encourage off-stream watering of stock.	Stock access	6	13	High	20,000	RL5	182.4 ha under management for off-stream watering.	Contribute to targets for WMU09-01.
WMU09-03	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	6	13	Low	86,000	RL3, 9, 33	Priority weed control on 76.0 km of waterways.	38.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU09-04	Undertake management of other pest plant species where they are having significant impact on waterway health.		6	13	Low	37,000	RL3, 33	Weed control on 76.0 km of waterways.	
WMU09-05	Re-introduce LWD at priority sites to restore instream habitat.	Bank erosion	6		Medium	85,000	ICF25	2 sites with LWD introduced.	14.5 km of waterway with improved ISC Physical Form sub-index score.
WMU09-06	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	6	13	High	75,000	RL10	76.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU09-07	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	6	13	High	187,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 1 priority reach by 2020.
WMU09-08	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	6		High	150,000	EWR23, 25, 26, 27, 30		

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU09-09	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	6		High	300,000	EWR51, 52	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 1 priority reach by 2020.
WMU09-10	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	6		High	56,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU09-11	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	6		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage by 2010.	Targets set by investigation.
WMU09-12	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	6	13	Low	50,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU09-13	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	6		High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU09-14	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	6		Low	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU09-15	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	6		Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU09-16	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	6	13	High	206,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU09-17	Increase community understanding of waterway health.	All threats	6	13	High	156,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU09-18	Actively engage community and stakeholders in managing waterways.	All threats	6	13	High	22,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 9 cost summary

Total Cost of all Actions	\$1,677,500
High Priority Actions	\$1,372,000
Medium Priority Actions	\$85,000
Low Priority Actions	\$220,500

9.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 6 ISC score raised from 21 to 25 (maintained at Moderate)</p> <p>Reach 13 ISC score raised from 31 to 40 (Good to Excellent)</p>	<p>29.0 km (Reach 13) raised from Good to Excellent</p> <p>47.0 km (Reach 6) maintained at Moderate</p>
Management Action Target summary	Resource Condition Target summary
<p>182.4 ha of riparian land fenced and/or revegetated</p> <p>69.6 ha of priority stream under land management agreement for off-stream watering</p> <p>112.8 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 76.0 km of waterways</p> <p>Weed control on 76.0 km of waterways</p> <p>2 sites with LWD introduced</p> <p>76.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 1 priority reach</p>	<p>38.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> 14.5 km raised to 7 in Reach 6 (not calculated in 2004 ISC) 23.5 km raised from 6 to 8 in Reach 13 <p>38.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> 14.5 km raised from 6 to 8 in Reach 6 23.5 km raised from 5 to 7 in Reach 13 <p>Improved flow regime achieving environmental objectives in 1 priority reach</p>

waterway management unit 10. lake toolondo creek system

reaches 42 and 82

10.1 waterways and their condition

Mount Talbot Creek as well as several other smaller ephemeral waterways including Station Creek flow from the western side of the Black Range into Toolondo Reservoir which is located near the southern boundary of the Wimmera CMA region (Map 4.11). There are issues associated with erosion in the lower reach of Mount Talbot Creek where it is used as an irrigation flow carrier. Rural drainage activities have also extensively altered flow regimes causing associated problems with water quality. There are also a notable number of wetlands (freshwater meadows) within this Management Unit.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

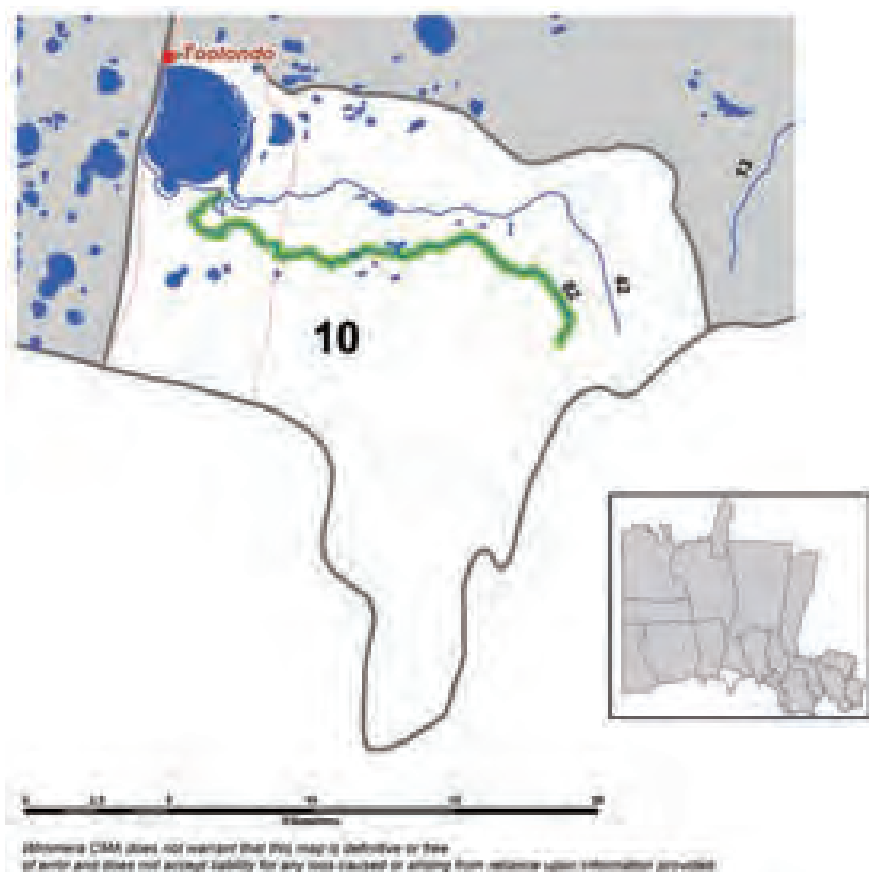
Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.11 waterway management unit 10 and reaches

Streamside zones for these creeks are fairly typical when compared to many others within the Wimmera region. The ISC 2004 survey score for Mount Talbot Creek streamside zone indicates that it is in a moderate condition, with a smaller number of large trees compared to the benchmark amount. This has had a resultant effect on the extent of tree canopy cover and longitudinal connectivity, despite low numbers of large trees. There is a decent quantity of logs and leaf litter but they are not quite in a reference condition. The two most important aspects concerning future health of the streamside zone are the understorey and recruitment of immature tree species, which are both in a fair state. Impact of weed coverage along the streamside zone is also not too extensive except for a moderate coverage of groundcover weeds. Another tributary of Toolondo Reservoir has streamside vegetation that is in a slightly worse condition, mostly due to lack of large trees that has in turn affected the longitudinal connectivity. This has also impacted on quantities of large logs and leaf litter in the area, scoring very poorly for these features during the ISC 2004 survey.

The extent of erosion in this area of the catchment is generally moderate to limited. Where a waterway flows through completely cleared land such as when it is used as an irrigation flow carrier, the banks have been victims of accelerated erosion. The fact that there are no barriers to indigenous fish migration in this area of the catchment improved the physical form sub-index scores.

Depleted streamside zone tree coverage has impacted on the quantity of LWD observed in these reaches. One of Toolondo Reservoir's tributaries was observed to have enough wood to provide only very poor habitat for aquatic life. Increased complexity of habitat through the provision of quantities of LWD benefits the aquatic life forms during times of flow.

There is no data on the hydrology available for the waterways in this Management Unit, however it can be assumed that flow regimes have been modified due to rural drainage activities taking place on these waterways as well as the use of some parts of the channels as an irrigation flow carrier.

Little is currently known about the condition of the wetlands within this Management Unit, although future index of wetland condition surveys will improve the current levels of knowledge. Preliminary studies of several of the Wimmera's wetlands revealed that changes to localised drainage have had a profound impact on the condition of the wetlands. Other important components affecting a waterway's health including coverage of weeds and presence of feral animals will also be looked at in future projects involving these wetlands.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.27).

TABLE 4.27 significant flora, fauna and EVC recorded in waterway management unit 10

Significant fauna	None recorded
Significant flora	Mt. Byron Bush-pea, Tufted Grass-tree
Significant EVC	Creekline Sedgy Woodland Damp Sands Herb-rich Woodland / Shrubby Woodland Dry Creekline Woodland Grassy Dry Forest Lateritic Woodland Low Rises Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic Plains Grassy Woodland Plains Woodland Sedgy Riparian Woodland

10.2 priority waterways

Priority Reaches in Waterway Management Unit 10 are:

- **Tributary of Toolondo Reach 82** (very high social values and high economic values in RiVERS).

Priority waterways outside this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 10:

- Lake Toolondo.

10.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

There are no influencing waterways draining directly into the priority Reach 82. However, one additional reach in the Management Unit has the potential to influence a downstream priority reach (Lake Toolondo). For this reason, management actions have been identified and prioritised the following reach in Waterway Management Unit 10:

- Mt Talbot Creek Reach 42.

10.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 10 are:

- Protect the very high social values in Tributary of Toolondo Reach 82.
- Protect the high economic values in Tributary of Toolondo Reach 82.
- Prevent damage to priority reaches from conditions in influencing reaches.

10.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 10. A summary of the risks for the priority reach is presented in Table 4.28 below.

TABLE 4.28 risks to significant values in priority reaches in waterway management unit 10

High Social and Economic Value		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	4	1	2	0	0	1	1	4	3	1	1	4	1
fishing	5	2	2	8	6	2	0	0	0	2	2	6	3	2	0	4	2
sports, non motor	5	0	0	0	4	2	0	0	0	0	0	0	0	2	0	0	0
sports, motor	5	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0
camping	5	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	2
swimming	5	0	0	0	4	2	0	0	0	2	0	0	0	2	0	0	2
european heritage	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
passive recreation	5	2	0	0	4	0	0	0	0	0	0	0	0	2	2	0	2
listed landscapes	5	2	0	0	6	0	0	0	0	0	2	0	0	0	2	4	2
water supply delivery	5	2	2	0	0	0	2	0	0	0	0	0	0	2	0	0	2
water supply collection	5	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
infrastructure	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
land value	4	2	0	0	4	0	0	0	0	0	2	0	0	0	0	0	0
tourism	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
power generation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TRIBUTARY OF TOOLONDO REACH 82

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book Part 6, Sub-folder 16 – Risk Assessment and Prioritisation*. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in Tributary of Toolondo Reach 82 include:

- Barriers to fish migration, Channel modification and Exotic fauna.

Medium risks to significant values in Tributary of Toolondo Reach 82 include:

- Loss of in-stream habitat and Wetland connectivity.

Potential threats to downstream Lake Toolondo from Mt Talbot Creek Reach 42 can be seen in Table 4.29. High threats are from exotic fauna and stock access to the creek, with medium threats from bed instability.

TABLE 4.29 threat levels influencing waterways in waterway management unit 10

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Mt Talbot Creek Reach 42	2	3	1	2	0	0	1	1	4	1	2	5
Key: 5 or 4 High threat level in reach (High <i>Wimmera WHS</i> priority for action), 3 Medium threat level in reach (Medium <i>Wimmera WHS</i> priority for action), 2 or 1 Low threat level in reach (Low <i>Wimmera WHS</i> priority for action)												

10.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways and 50% of upper Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

10.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU10-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	82	42	Low	85,000	RL1, 2	88.8 ha of riparian land revegetated.	18.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 18.5 km of waterway with improved ISC Physical Form sub-index score.
WMU10-02	Encourage off-stream watering of stock.	Stock Access		42	High	10,000	RL5	40.8 ha under management for off-stream watering.	Contribute to targets for WMU10-01.
WMU10-03	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	82	42	Low	42,000	RL3, 9, 33	Priority weed control on 37.0 km of waterways.	18.5 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU10-04	Undertake management of other pest plant species where they are having significant impact on waterway health.		82	42	Low	18,000	RL3, 33	Weed control on 37.0 km of waterways.	
WMU10-05	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	82	42	High	36,000	RL10	37.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU10-06	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	82	42	Low	91,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 1 priority reach by 2020.
WMU10-07	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	82	42	Low	27,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU10-08	Investigate impact of rural drainage on flow regimes of waterways.	Changes to flow (flow deviation)	82		High	50,000	WE2, 4, 8, 14, 15, 20	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU10-09		Changes to flow (flow deviation)		42	Medium	50,000		Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU10-10	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	82	42	Low	15,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU10-11	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	82	42	Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU10-12	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	82	42	High	100,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU10-13	Increase community understanding of waterway health.	All threats	82	42	High	76,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU10-14	Actively engage community and stakeholders in managing waterways.	All threats	82	42	High	11,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 10 cost summary

Total Cost of all Actions	\$621,000
High Priority Actions	\$283,000
Medium Priority Actions	\$50,000
Low Priority Actions	\$288,000

10.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
Insufficient data to determine ISC score for either reach (only 2 sub-indices measured)	Insufficient data to determine changes to ISC ratings for either reach
Management Action Target summary	Resource Condition Target summary
<p>88.8 ha of riparian land fenced and/or revegetated</p> <p>40.8 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 37.0 km of waterways</p> <p>Weed control on 37.0 km of waterways</p> <p>37.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 1 priority reach</p>	<p>18.5 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> 8.5 km raised from 5 to 6 in Reach 42 10.0 km raised from 3 to 6 in Reach 82 <p>18.5 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> 8.5 km raised from 7 to 9 in Reach 42 10.0 km raised from 7 to 8 in Reach 82 <p>Improved flow regime achieving environmental objectives in 1 priority reach</p>

waterway management unit 11. natimuk creek system

reach 41

11.1 waterways and their condition

The only significant waterway in Waterway Management Unit 11 is Natimuk Creek which flows northwards and initially empties into Natimuk Lake before continuing further to Lake Wyn Wyn (Map 4.12). Natimuk Creek has been significantly affected by drainage modifications and changing land uses. Natimuk Lake and Lake Wyn Wyn are part of the Natimuk-Douglas chain-of-lakes which is significant for a variety of reasons including their important fauna (especially waterbird) and flora populations as well as their unique hydrogeology.

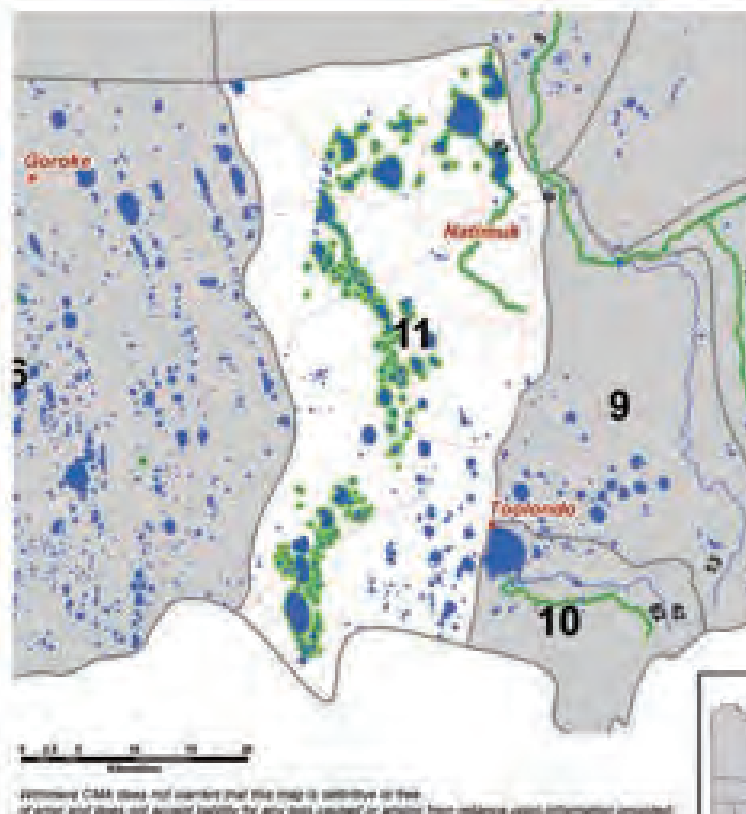
Approximately 80-90 wetlands exist in this Waterway Management Unit, just under half are located on Crown Land. Changes to drainage caused by modified land uses have disrupted the flows of water across land and into wetlands. Saline groundwater, pest plants and animals, fire, pollution and primary recreation are also seen as threats to this valuable wetland system. Future implementation of Index of Wetland Condition (IWC) surveys will help to better classify their state and to identify issues facing specific wetlands. Wimmera CMA is conducting additional research to better understand the condition of these wetlands.

Natimuk Creek has generally very good bank stability. The ISC 2004 survey results indicate that there is only limited erosion taking place along some portions of the reach, with most parts being quite stable, especially at the base of banks. This is mainly due to vegetation coverage, particularly woody vegetation that has helped to prevent the acceleration of erosion.

↑ legend

-  Waterway Management Units
- 18** Waterway Management Unit Number
-  River Reaches
-  Wetlands*
-  Waterways*
-  Priority Wetlands
-  Priority Waterways
-  Major Towns*
-  Major Roads*
-  Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.12 waterway management unit 11 and reaches

Only small quantities of large wood are located in Natimuk Creek channel, presenting an issue on the amount of habitat available for aquatic life during times of stream flow. There is also the ability for native fish species to migrate without interference from artificial barriers along Natimuk Creek.

The results for the ISC 2004 survey indicate that the streamside zones along Natimuk Creek have been heavily modified. Apart from the quantity of large trees, of which there are generally a benchmark number, the other components of the streamside zone show significant alteration from a pristine state. There is little longitudinal connectivity and tree canopy cover provided by smaller and medium-sized trees. The impacts to the streamside zone are also seen in limited regeneration of immature tree species. The amounts of leaf litter and quantities of large logs along Natimuk Creek are also a lot less than benchmark condition. There is usually a lack of a native understorey in many areas and often a fair coverage of weeds has taken its place.

Hydrological data is not available for Natimuk Creek however impacts of drainage works on the flow regime of Natimuk Creek are currently believed to be pronounced.

The monitoring for aquatic life undertaken as part of the ISC 2004 survey shows that it is in a poorer condition than most other waterways in the Wimmera region. There was a low diversity of macroinvertebrate families detected compared to what might be expected, with most found during the sampling not sensitive to the effects of water pollution. The effects of heavily modified streamside zones and flow regimes can perhaps be seen as important influences on this.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.29).

TABLE 4.29 significant flora, fauna and EVC recorded in waterway management unit 11

Significant fauna	Australasian Shoveler, Blue-billed Duck, Caspian Tern, Freckled Duck, Glossy Ibis, Great Egret, Hardhead, Little Egret, Musk Duck, Nankeen Night Heron, Pied Cormorant, Royal Spoonbill, Whiskered Tern
Significant flora	Native Orache
Significant EVC	Drainage Line Woodland Plains Woodland

11.2 priority waterways

Priority Reaches in Waterway Management Unit 11 are:

- **Natimuk Creek Reach 41** (support for high value wetlands, very high social values in RIVERS).

Twelve wetlands or wetland complexes are also considered a priority as Wetlands of National Importance:

- Heards Lake
- Mitre Lake
- White Lake
- Saint Mary's Lake
- Natimuk Lake
- Lake Wyn Wyn
- Natimuk-Douglas Wetlands
- Bitter Swamp
- Friedman's Salt Lake
- Grass Flat (Telfer's) Swamp
- Hately's Lake
- Oliver's Swamp

11.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

There are no influencing reaches in Waterway Management Unit 11. However, conditions in priority wetlands in the Management Unit may be affected by conditions in surrounding or nearby non-priority wetlands, particularly as a source of exotic plants and animals. Additionally, changes to the water regime in one wetland may affect surrounding wetlands. Therefore, actions have been developed for non-priority wetlands with the view of protecting gains made in priority wetlands.

11.4 primary management objectives

The primary waterway health objectives for the priority reach and wetlands in Waterway Management Unit 11 are:

- Protect the very high social values in Natimuk Creek Reach 41.
- Protect the high values of priority wetlands in the Management Unit.
- Prevent damage to priority wetlands from conditions in influencing wetlands.

11.5 risks to waterway health

Risk assessments have been undertaken for social values in Natimuk Creek Reach 41. A summary of the risks is presented in Table 4.30 below.

High and Very High risks to significant values in Natimuk Creek Reach 41 include:

- Exotic fauna, Algal blooms and Stock access.

Medium risks to significant values in Natimuk Creek Reach 41 include:

- Bank erosion, Bed instability, Channel modification, Loss of in-stream habitat and Degraded streamside vegetation.

TABLE 4.30 risks to significant values in priority reaches in waterway management unit 11

High Social Value	bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
	3	3	1	3	1	2	0	0	1	2	4	3	5	3	3	5
fishing	5	3	3	2	3	2	0	0	0	2	2	6	3	7	0	7
sports, non motor	5	0	0	0	0	2	0	0	0	0	0	0	7	0	0	4
sports, motor	5	0	0	0	0	2	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	0	0	0	0	0	0	0	0	8	0	0	7
swimming	5	0	0	0	0	2	0	0	2	0	0	0	8	0	0	7
european heritage	5	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
species of significance	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
passive recreation	5	3	0	0	0	0	0	0	0	0	0	0	7	3	0	7
listed landscapes	5	3	0	0	3	0	0	0	0	2	0	0	0	3	0	7

NATIMUK CREEK REACH 41

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

No formal risk assessment has been conducted for the priority wetlands in the Management Unit. Actions for protecting the values in priority lakes and influencing wetlands have been identified in previous studies, including the *Geomorphic Investigation of Wetlands in the Wimmera CMA section of the Millicent Coast Basin* (2004), which includes the Natimuk-Douglas chain-of-lakes, and the *Wimmera Wetland Condition Assessment Project* (2005).

11.6 additional benefits

Actions developed to achieve objectives in the priority reach will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

11.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU11-01	Implement priority wetland management actions in the Geomorphic Investigation of Wetlands in the Wimmera CMA section of the Millicent Coast Basin (2004) (including the Natimuk-Douglas lakes).	All threats	Priority and influencing wetlands		High	125,000	WE15	Identified actions implemented.	Wetland condition targets to be developed progressively for internationally, nationally and regionally significant wetlands, commencing with interim targets for internationally and nationally listed wetlands by 2010.
WMU11-02	Implement priority wetland management actions in the Wimmera Wetland Condition Assessment Project (2005) report and the Natimuk Lake Salinity Management Plan (2004).	All threats	Priority and influencing wetlands		High	125,000	WE16	Identified actions implemented.	
WMU11-03	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	41		Medium	50,000	RL1, 2	60.0 ha of riparian land revegetated.	12.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 12.5 km of waterway with improved ISC Physical Form sub-index score.
WMU11-04	Encourage off-stream watering of stock.	Stock access	41		High	20,000	RL5	60.0 ha under management for off-stream watering.	Contribute to targets for WMU11-03.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU11-05	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	41		Low	28,000	RL3, 9, 33	Priority weed control on 25.0 km of waterways.	12.5 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU11-06	Undertake management of other pest plant species where they are having significant impact on waterway health.		41		Low	12,000	RL3, 33	Weed control on 25.0 km of waterways.	
WMU11-07	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	41		High	25,000	RL10	25.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU11-08	Implement priority bed and bank stabilisation actions in the Natimuk Lake Salinity Management Plan (2004).	Bank erosion Bed instability	41		Medium	50,000	RL8 WQ6	1.5 km of bed and banks stabilised.	12.5 km of waterway with improved ISC Physical Form sub-index score.
WMU11-09	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	41		Low	62,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 1 priority reach by 2020.
WMU11-10	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	41		Low	18,000	RL8 WQ6	Planting and groundwater pumping actions implemented.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU11-11	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	41		Medium	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU11-12	Investigate impact of rural drainage on flow regimes of waterways.	Changes to flow (flow deviation)	41		Low	50,000	WE2, 4, 8, 14, 15, 20	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU11-13	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	41		Low	10,000	RL8, WQ6, WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU11-14	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	41		High	68,000	WQ12, MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy Reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU11-15	Increase community understanding of waterway health.	All threats	41		High	51,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU11-16	Actively engage community and stakeholders in managing waterways.	All threats	41		High	7,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 11 cost summary

Total Cost of all Actions	\$726,000
High Priority Actions	\$421,000
Medium Priority Actions	\$125,000
Low Priority Actions	\$180,000

11.8 overall ISC condition, management action and resource condition targets

Wetland targets

Wetland condition targets to be developed progressively for internationally, nationally and regionally significant wetlands, commencing with interim targets for internationally and nationally listed wetlands by 2010.

Overall ISC and condition (all actions implemented)

Contribution to regional and Statewide condition targets

Reach 41 ISC score raised from 20 to 24 (maintained at Moderate)

25.0 km (Reach 41) maintained at Moderate

Management Action Target summary

Resource Condition Target summary

60.0 ha of riparian land fenced and/or revegetated

60.0 ha of priority stream under land management agreement for off-stream watering

Priority weed control on 25.0 km of waterways

Weed control on 25.0 km of waterways

1.5 km of bed and banks stabilised

25.0 km of stream with rabbit control

Environmental Water Reserve established and implemented in 1 priority reach

12.5 km of riparian zones with improved ISC Streamside Zone sub-index score:

- 12.5 km raised from 3 to 6 in Reach 41

12.5 km of waterway with improved ISC Physical Form sub-index score:

- 12.5 km raised from 7 to 8 in Reach 41

Improved flow regime achieving environmental objectives in 1 priority reach

waterway management unit 12. heritage river system

reaches 2, 3, 4, 5 and 86

12.1 waterways and their condition

The Wimmera River in Waterway Management Unit 12 has been designated as the Wimmera Heritage River under the *Heritage Rivers Act, 1992* (Map 4.13). Heritage River classification commences at Polkemmet Bridge downstream to where it flows into Lake Hindmarsh and includes reaches that flow through the Little Desert National Park as well as the townships of Dimboola and Jeparit. The Heritage River status of the riverine corridor is based on significant cultural heritage, sites of botanical significance, water-bird habitat, scenic landscapes and fishing opportunities. Heritage values of the terminal lakes and Outlet Creek are included in Waterway Management Unit 13.

The river has a natural anabranching character and is bound by public land water frontage and streamside reserves. Yanac Creek is a small stream that is located further west and does not flow into the Wimmera River which is also included in this Management Unit.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

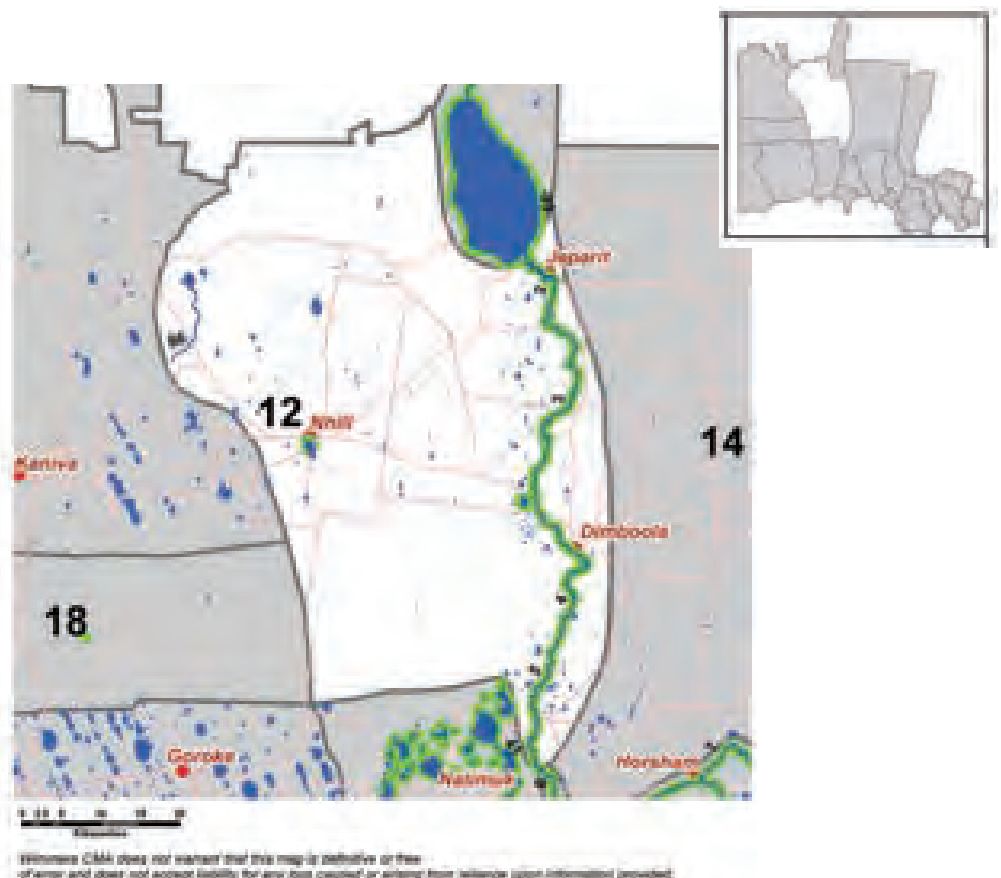
Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.13 waterway management unit 12 and reaches

The water quality measurements used in the ISC 2004 survey were taken from the Wimmera River downstream of Dimboola. Results contained many pleasing aspects such as those for total phosphorous and turbidity which had decreased since the ISC 1999 survey. There was a slight increase in pH. Most transported sediments in this section of the Wimmera River are from localised erosion, limiting the turbidity levels. The intrusion of saline groundwater occurs mostly downstream of Dimboola.

The sampling of aquatic communities was undertaken in the Wimmera River from the reaches above and below Dimboola for the ISC 2004 survey. It demonstrated that there is only a slight difference in the condition of aquatic life between the two reaches with the downstream reach achieving a slightly better score for the aquatic life sub-index. The results from the ISC 1999 survey for the reach of the Wimmera River near Jeparit also show that it had a good range of macroinvertebrate families. However this is likely to have changed as recent years of low-flow volumes in this part of the catchment have had a detrimental effect on the water quality and aquatic communities in the lower reaches of the Wimmera River.

Waterway bank stability along the Wimmera River in this area of the catchment has been affected by limited or moderate erosion that is taking place. Yanac Creek is generally in very good condition with the banks showing few signs of erosion. However in the Wimmera River and Yanac Creek, LWD is unfortunately either absent or present in very low quantities. Indigenous fish migration has been limited to certain periods during the year along the Wimmera River, due to the presence of artificial downstream barriers such as Jeparit Weir.

Results for streamside vegetation, obtained during the ISC 2004 survey, show it is in a good condition along this section of the Wimmera River. Distribution of large trees is sometimes variable along the streamside zone therefore affecting the longitudinal continuity and tree canopy cover along the Wimmera River, with some areas receiving particularly good scores for this. Yanac Creek, although having numerous large trees located in the streamside zone was lacking in other areas such as the longitudinal continuity of tree cover and the quantity of leaf litter and logs on the ground.

The Wimmera River has been greatly affected by modifications to its flow regime in its Heritage River reaches, particularly downstream of Dimboola, where duration of zero flows and low flow volumes have been greatly changed. Modifications to flow volumes within each month and across the entire year have also played a role in its deteriorating health. Increased volumes and variability of flows would help improve the immense stresses placed on the Wimmera River due to this severe lack of water.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.33).

TABLE 4.33 significant flora, fauna and EVC recorded in waterway management unit 12

Significant fauna	Diamond Firetail, Freshwater Catfish, Golden Perch, Great Egret, Hooded Robin, Nankeen Night Heron, Regent Parrot, Tree Goanna
Significant flora	Floodplain Rustyhood, Inland Pomaderris, Wimmera Mallee-box
Significant EVC	Low Rises Woodland Parilla Mallee Plains Savannah Plains Woodland Red Gum Wetland/Lignum Swampy Woodland Mosaic Ridged Plains Mallee

12.2 priority waterways

Priority reaches in Waterway Management Unit 12 are:

- **Wimmera River Reach 2** (Heritage River, high environmental value and very high social values in RiVERS).
- **Wimmera River Reach 3** (Heritage River, high social values in RiVERS).
- **Wimmera River Reach 4** (Heritage River, high environmental value and very high social values in RiVERS).
- **Wimmera River Reach 5** (Heritage River, high environmental value in RiVERS).

Two wetlands in the Management Unit are also considered a priority are:

- **Pink Lake (Lochiel)** (Wetland of National Importance).
- **Nhill Lake** (high social value).

Priority waterways outside this Waterway Management Unit that may be affected by actions implemented in Waterway Management Unit 12:

- Lake Hindmarsh and Lake Albacutya.
- Outlet Creek Reaches 1 and 53.

12.3 influencing waterways

Influencing reaches are those where there are risks to waterway health that are threatening priority reaches. As there are no tributaries to the Wimmera River reaches, there are no influencing reaches in Waterway Management Unit 12.

12.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 12 are:

- Protect the Heritage River, environmental and social values in Wimmera River Reach 2.
- Protect the Heritage River and social values in Wimmera River Reach 3.
- Protect the Heritage River, environmental and social values in Wimmera River Reach 4.
- Protect the Heritage River and environmental values in Wimmera River Reach 5.
- Protect the environmental and social values of priority wetlands in the Management Unit.

12.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 12. A summary of the risks for the four priority reaches is presented in Table 4.34.

Because the reaches are part of the Heritage River, the risk assessment has been conducted on significant environmental values and the social values in the reaches.

TABLE 4.34 risks to significant values in priority reaches in waterway management unit 12

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Environmental and Social Value, Heritage River		1	1	5	2	5	2	0	1	1	1	3	3	5	3	3	1
significant flora	4	2	0	0	2	6	0	0	0	0	2	3	3	0	3	3	2
significant EVC	4	0	0	0	0	4	0	0	0	0	2	3	0	0	3	3	2
significant fauna	5	0	0	4	0	4	0	0	0	2	2	3	3	8	3	3	0
significant wetland	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wetland rarity	5	0	0	0	0	8	2	0	2	0	2	3	0	0	0	3	2
heritage river	5	2	2	0	2	8	0	0	0	0	2	3	3	4	3	3	2
sites of significance	5	2	2	0	2	7	0	0	0	0	2	3	3	4	3	3	2
fishing	5	2	2	8	2	7	0	0	2	2	2	3	3	7	0	0	2
sports, non motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0
sports, motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	0	4	0	0	0	0	0	0	0	8	0	0	2
swimming	5	0	0	0	0	7	0	0	2	2	0	0	0	8	0	0	2
european heritage	5	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	2	8	2	0	2	2	2	3	3	4	3	3	2
passive recreation	5	2	0	0	0	4	0	0	0	0	0	0	0	7	3	0	2
listed landscapes	5	2	0	0	2	4	0	0	0	0	2	0	0	0	3	0	2

WIMMERA RIVER REACH 2

TABLE 4.34 (continued)

High Environmental and Social Value, Heritage River		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		2	3	5	3	5	5	2	3	1	2	3	2	5	2	3	1
significant flora	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
significant EVC	4	0	0	0	0	4	0	0	0	0	2	3	0	0	2	3	2
significant fauna	5	0	0	4	0	4	0	0	0	2	2	3	2	8	2	3	0
significant wetland	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
wetland rarity	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
heritage river	5	2	3	0	3	8	0	0	0	0	2	3	2	4	2	3	2
sites of significance	5	2	3	0	3	7	4	0	0	0	2	3	2	4	2	3	2
fishing	5	2	3	8	3	7	4	2	3	2	2	3	2	7	0	0	2
sports, non motor	4	0	0	0	0	6	0	0	0	0	0	0	0	6	0	0	0
sports, motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0
camping	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
swimming	5	0	0	0	0	7	4	2	3	2	0	0	0	8	0	0	2
european heritage	5	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	3	7	3	8	7	2	3	2	2	3	2	4	2	3	2
passive recreation	5	2	0	0	0	4	0	0	0	0	0	0	0	7	2	0	2
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

WIMMERA RIVER REACH 3

High Environmental and Social Value, Heritage River		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	2	5	2	0	0	1	1	3	3	5	2	3	5
significant flora	5	2	0	0	2	7	0	0	0	0	2	3	3	0	2	3	8
significant EVC	4	0	0	0	0	4	0	0	0	0	2	3	0	0	2	3	7
significant fauna	5	0	0	4	0	4	0	0	0	2	2	3	3	8	2	3	4
significant wetland	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wetland rarity	5	0	0	0	0	8	2	0	0	0	2	3	0	0	0	3	7
heritage river	5	2	2	0	2	8	0	0	0	0	2	3	3	4	2	3	8
sites of significance	5	2	2	0	2	7	0	0	0	0	2	3	3	4	2	3	8
fishing	5	2	2	8	2	7	0	0	0	2	2	3	3	7	0	0	7
sports, non motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	4
sports, motor	5	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	0	4	0	0	0	0	0	0	0	8	0	0	7
swimming	5	0	0	0	0	7	0	0	0	2	0	0	0	8	0	0	7
european heritage	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	2	8	2	0	0	2	2	3	3	4	2	3	7
passive recreation	5	2	0	0	0	4	0	0	0	0	0	0	0	7	2	0	7
listed landscapes	5	2	0	0	2	4	0	0	0	0	2	0	0	0	2	0	7

WIMMERA RIVER REACH 4

TABLE 4.34 (continued)

High Environmental and Social Value, Heritage River		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	2	5	2	0	5	1	1	3	2	5	3	3	5
significant flora	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
significant EVC	4	0	0	0	0	4	0	0	0	0	2	3	0	0	3	3	7
significant fauna	5	0	0	4	0	4	0	0	0	2	2	3	2	8	3	3	4
significant wetland	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
wetland rarity	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
heritage river	5	2	2	0	2	8	0	0	0	0	2	3	2	4	3	3	8
sites of significance	5	2	2	0	2	7	0	0	4	0	2	3	2	4	3	3	8
fishing	4	2	2	7	2	6	0	0	6	2	2	3	2	6	0	0	6
sports, non motor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sports, motor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
camping	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
swimming	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
european heritage	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	2	8	2	0	7	2	2	3	2	4	3	3	7
passive recreation	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

WIMMERA RIVER REACH 5

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 12 include:

- Barriers to fish migration, Flow deviation and Algal blooms in Wimmera River Reach 2.
- Barriers to fish migration, Flow deviation, Water quality trend and Algal blooms in Wimmera River Reach 3.
- Barriers to fish migration, Flow deviation, Algal blooms and Stock access in Wimmera River Reach 4.
- Barriers to fish migration, Flow deviation, Water quality (nutrients), Algal blooms and Stock access in Wimmera River Reach 5.

Medium risks to significant values in priority reaches in Waterway Management Unit 12 include:

- Exotic fauna, Loss of in-stream habitat, Degraded streamside vegetation and Wetland connectivity in Wimmera River Reach 2.
- Bed instability, Channel modification, Water quality (nutrients), Exotic fauna and Wetland connectivity in Wimmera River Reach 3.
- Exotic fauna, Loss of in-stream habitat and Wetland connectivity in Wimmera River Reach 4.
- Exotic fauna, Degraded streamside vegetation and Wetland connectivity in Wimmera River Reach 2.

12.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to the *Wimmera Water Quality Strategy* targets of:
 - a greater than 10% reduction in salt loads from 2004 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2025 (RCT33).
 - a 28% increase in the number of sites meeting the SEPP (WoV) targets for salinity from 2005 levels by 2020 (RCT 34).
 - a 33% reduction in total phosphorous levels from 2003 levels in the Wimmera River (measured at Tarranyurk gauging station) by 2030 (RCT27).
 - a 60% reduction in the frequency of algal blooms from 2002 levels in the Wimmera River Basin waterways by 2030 (RCT 28).
 - no decrease in the number of sites within SEPP (WoV) guidelines for nutrients and turbidity by 2025 (RCT29 and RCT31).
 - all lower Wimmera River Basin waterways within SEPP (WoV) guidelines for turbidity by 2025 (RCT30).
- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

12.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU12-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	2, 5		Medium	87,500	RL1, 2	132.0 ha of riparian land revegetated.	27.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 27.5 km of waterway with improved ISC Physical Form sub-index score.
WMU12-02		Bank erosion Degraded riparian vegetation	3, 4		Low	87,500		122.4 ha of riparian land revegetated.	25.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 25.5 km of waterway with improved ISC Physical Form sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU12-03	Encourage off-stream watering of stock.	Stock access	4, 5		High	20,000	RL5	105.6 ha under management for off-stream watering.	Contribute to targets for WMU12-01 to WMU12-02.
WMU12-04			2, 3		Low	20,000		148.8 ha under management for off-stream watering.	
WMU12-05	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	2, 3, 4, 5		High	133,000	RL3, 9, 33	Priority weed control on 106.0 km of waterways.	53.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU12-06	Undertake management of other pest plant species where they are having significant impact on waterway health.		2, 3, 4, 5		High	58,000	RL3, 33	Weed control on 106.0 km of waterways.	
WMU12-07	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	2, 3, 4, 5		High	115,000	RL10	106.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU12-08	Implement priority bed and bank stabilisation actions in the Wimmera Heritage River Waterway Action Plan (2005).	Bank erosion Bed instability	2, 3, 4, 5		High	175,000	RL23 ICF17	6.0 km of bed and banks stabilised.	53.0 km of waterway with improved ISC Physical Form sub-index score.
WMU12-09	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	2, 3, 4, 5		High	288,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 4 priority reaches by 2020.
WMU12-10	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	2, 3, 4, 5		High	150,000	EWR23, 25, 26, 27, 30		
WMU12-11	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	2, 3, 4, 5		High	25,000	EWR51, 52		

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU12-12	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	2, 3, 4, 5		Low	500,000	RL8 WQ6	Planting and ground-water pumping actions implemented.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU12-13	Identify potential barriers to fish migration, identify if there is an environmental need to create fish passage, and implement actions where necessary.	Barriers to fish migration	2, 3, 4, 5		High	40,000	SFF12, 13, 17	Investigate the cost-benefit of the removal of barriers to fish passage in the Management Unit by 2010.	Targets set by investigation.
WMU12-14	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank Erosion Bed instability	2, 3 4, 5		Medium	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU12-15	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	2, 3, 4, 5		High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU12-16	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	2, 3, 4, 5		High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU12-17	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	2, 3, 4, 5		High	10,000	RL8, WQ6, WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU12-18	Monitor platypus populations in the Wimmera River.	All threats	2, 3, 4, 5		High	15,000	MON7	Monitoring program implemented.	Targets set by Adaptive Management Framework.
WMU12-19	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	2, 3, 4, 5		High	317,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
COMMUNITY COMMUNITCATION, EDUCATION AND ENGAGEMENT									
WMU12-20	Increase community understanding of waterway health.	All threats	2, 3, 4, 5		High	240,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU12-21	Actively engage community and stakeholders in managing waterways.	All threats	2, 3, 4, 5		High	34,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 12 cost summary

Total Cost of all Actions	\$2,387,500
High Priority Actions	\$1,667,500
Medium Priority Actions	\$112,500
Low Priority Actions	\$607,500



12.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 2 ISC score raised from 14 to 19 (Poor to Moderate)</p> <p>Reach 3 ISC score raised from 18 to 22 (maintained at Moderate)</p> <p>Reach 4 ISC score raised from 18 to 22 (maintained at Moderate)</p> <p>Reach 5 ISC score raised from 20 to 22 (maintained at Moderate)</p> <p>Insufficient data to determine ISC rating for Reach 86</p>	<p>74.0 km (Reaches 3, 4 and 5) maintained at Moderate</p> <p>32.0 km (Reach 2) raised from Poor to Moderate</p> <p>Insufficient data to determine ISC rating change for Reach 86</p>
Management Action Target summary	Resource Condition Target summary
<p>254.4 ha of riparian land fenced and/or revegetated</p> <p>254.4 ha of priority stream under land management agreement for off-stream watering</p> <p>Priority weed control on 106.0 km of waterways</p> <p>Weed control on 106.0 km of waterways</p> <p>6.0 km of bed and banks stabilised</p> <p>2 sites with LWD introduced</p> <p>106.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 4 priority reaches</p>	<p>All Heritage River values maintained (Reaches 2, 3, 4 and 5)</p> <p>53.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 16.0 km raised from 6 to 8 in Reach 2 • 15.0 km raised from 5 to 7 in Reach 3 • 10.5 km raised from 7 to 8 in Reach 4 • 11.5 km raised from 6 to 8 in Reach 5 <p>53.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 16.0 km raised from 5 to 7 in Reach 2 • 15.0 km raised from 5 to 7 in Reach 3 • 10.5 km raised from 4 to 7 in Reach 4 • 11.5 km raised from 6 to 7 in Reach 5 <p>Aquatic life protected in 30.0 km of river (Reach 3) as measured by the ISC Aquatic Life sub-index</p> <p>Improved flow regime achieving environmental objectives in 4 priority reaches</p>

waterway management unit 13. terminal lakes system

reaches 1 and 53

13.1 waterways and their condition

The focus of Waterway Management Unit 13 is the Terminal Lakes of the Wimmera River (Map 4.14).

The Wimmera River completes its journey through the region when it empties into the vast expanse of Lake Hindmarsh, Victoria's largest freshwater lake. In times of plentiful rainfall and run-off when the Wimmera River is draining huge volumes of water, Lake Hindmarsh fills and overflows into Outlet Creek which in turn fills Ross Lakes and Lake Albacutya. On rare occasions when Lake Albacutya fills, water flows down another reach of Outlet Creek into the porous sediments of the northern Wimmera.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.14 waterway management unit 13 and reaches

The condition of the physical form of Outlet Creek is amongst the best in the catchment. There is little to no erosion taking place due to a number of reasons such as the infrequent flows and the sometimes shallow gradient of the stream banks. The reach of Outlet Creek to the north of Lake Albacutya has a good distribution of large wood. However, the reach of Outlet Creek in between Lake Hindmarsh and Lake Albacutya has a fairly low quantity of LWD, due to a lack of streamside vegetation, supply from upstream and perhaps channel clearing activities. There are no artificial structures that could hinder the migration of indigenous fish species when Outlet Creek is flowing.

For the reach of Outlet Creek in between Lake Albacutya and Lake Hindmarsh, the streamside zone is in a very good condition. Although the longitudinal connectivity of large trees along the edge of this reach of Outlet Creek was quite low, there were many other signs of a very healthy streamside zone. This includes an almost intact understorey with great numbers of large trees that are regenerating very well. The large trees have also led to the provision of significant amounts of large logs to provide adequate habitat for species that inhabit the riparian zones.

Outlet Creek to the north of Lake Albacutya is a different story. Although the longitudinal connectivity of trees along its edge was better than the southern reach and there was an increase in the amount of leaf litter present, the understorey was in a poor condition as well having reduced amounts of regeneration and large trees. The amount of tree canopy and weed coverage was roughly equivalent in both portions of Outlet Creek and fairly typical for the Wimmera region.

The hydrology sub-index score of Outlet Creek was not calculated for the ISC 2004 survey.

It is uncertain what effects the altered flow regimes in the Wimmera River have had on Outlet Creek however it can be assumed that there have been some deleterious effects due to alterations to the timing and magnitude of flows in the Wimmera River.

The conditions of the aquatic communities on Outlet Creek were not surveyed as part of the ISC 2004 survey. However as part of the ISC 1999 survey, the aquatic life was sampled in Outlet Creek to the north of Lake Albacutya. The results showed that the condition of aquatic life is excellent, with expected number of macroinvertebrate families found, including those that are affected by poor water quality.

The beds of Lakes Hindmarsh and Albacutya and the Ross Lakes are important as they support vast expanses of grassy and shrubby vegetation as well as the Black Box and Red Gum woodlands that grow at the fringing flood levels. When full these lakes can be up to several metres deep and can hold approximately 608 gigalitres (GL). The lakes are also important groundwater recharge points.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.35).

TABLE 4.35 significant flora, fauna and EVC recorded in waterway management unit 13

Significant fauna	Regent Parrot, Brolga, Mountain Galaxias, River Blackfish, Yarra Pigmy Perch
Significant flora	Native Peppercreess
Significant EVC	None recorded

Note: significant flora, fauna and EVC records are associated with the riverine waterways in the Management Unit.

13.2 priority waterways

Priority Reaches in Waterway Management Unit 13 are:

- **Outlet Creek Reach 1** (Heritage River, high environmental value in RIVERS).
- **Outlet Creek Reach 53** (Heritage River, high environmental value in RIVERS).

Two wetlands in the Management Unit are also considered a priority:

- **Lake Albacutya** (Ramsar wetland, Site of significance, Heritage River).
- **Lake Hindmarsh** (Site of significance, Heritage River).

13.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

There are no influencing reaches in Waterway Management Unit 13.

Conditions in priority wetlands in the Waterway Management Unit may be affected by conditions in surrounding or nearby wetlands, particularly as a source of exotic plants and animals. Additionally, changes to the water regime in one wetland may affect surrounding wetlands. While there are no non-priority wetlands in the Management Unit, actions have been developed for non-priority wetlands in surrounding Management Units with the view of protecting gains made in the priority terminal lakes.

13.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 13 are:

- Protect the Heritage River and environmental values in Outlet Creek Reach 1.
- Protect the Heritage River and environmental values in Outlet Creek Reach 53.
- Protect the Heritage River and environmental values of the priority terminal lake wetlands in the Management Unit.

13.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 13. A summary of the risks for the two Outlet Creek priority reaches is presented in Table 4.36 below. Only one table is shown for both reaches as the value and threat ratings are identical for both reaches (and hence the risks).

TABLE 4.36 risks to significant values in priority reaches in waterway management unit 13

High Environmental Value, Heritage River		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WG signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
		1	1	5	3	1	2	0	0	1	2	3	4	5	3	3	1
significant flora	5	2	0	0	3	2	0	0	0	0	2	3	6	0	3	3	2
significant EVC	4	0	0	0	0	0	0	0	0	0	2	3	4	0	3	3	2
significant fauna	5	0	0	4	0	0	0	0	0	2	2	3	7	8	3	3	0
significant wetland	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wetland rarity	5	0	0	0	0	2	2	0	0	0	2	3	0	0	0	3	2
heritage river	5	2	2	0	3	2	0	0	0	0	2	3	6	4	3	3	2
sites of significance	5	2	2	0	3	2	0	0	0	0	2	3	6	4	3	3	2
fishing	4	2	2	7	3	2	0	0	0	2	2	3	6	6	0	0	2
sports, non motor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sports, motor	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
camping	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
swimming	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
european heritage	5	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	3	2	2	0	0	2	2	3	7	4	3	3	2
passive recreation	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
listed landscapes	5	2	0	0	3	0	0	0	0	0	2	0	0	0	3	0	2

OUTLET CREEK REACHES 1 AND 53

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

Because the waterway reaches are part of the Heritage River, the risk assessment has been conducted on significant environmental values and the social values in the reaches.

High and Very High risks to significant values in Outlet Creek Reaches 1 and 53 include:

- Barriers to fish migration, Loss of in-stream habitat and Algal blooms.

Medium risks to significant values in priority reaches in Outlet Creek Reaches 1 and 53 include:

- Channel modification, Exotic fauna, Degraded streamside vegetation and Wetland connectivity.

13.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

13.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU13-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	1, 53		Medium	175,000	RL1, 2	240.0 ha of riparian land revegetated.	50.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 50.0 km of waterway with improved ISC Physical Form sub-index score.
WMU13-02	Encourage off-stream watering of stock.	Stock access	1, 53		Low	20,000	RL5	240.0 ha under management for off-stream watering.	Contribute to targets for WMU13-01.
WMU13-03	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	1		Low	113,000	RL3, 9, 33	Priority weed control on 28.0 km of waterways.	14.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU13-04	Undertake management of other pest plant species where they are having significant impact on waterway health.		1		Low	49,000	RL3, 33	Weed control on 28.0 km of waterways.	

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU13-05	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	1		Medium	99,000	RL10	28.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU13-06	Implement priority bed and bank stabilisation actions in the Wimmera Heritage River Waterway Action Plan (2005).	Bank erosion Bed instability	1		High	200,000	RL14 ICF8	1.5 km of bed and banks stabilised.	14.0 km of waterway with improved ISC Physical Form sub-index score.
WMU13-07	Implement Lake Albacutya Ramsar Site Strategic Management Plan (2005).	Bank erosion Bed instability	Priority wetlands		High	500,000	WE19, ICF21	Identified actions implemented.	Targets set by Management Plan.
WMU13-08	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation)	1, 53		High	246,000	EW4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 priority reaches by 2020.
WMU13-09	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation)	1, 53		High	150,000	EW23, 25, 26, 27, 30		
WMU13-10	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.	Changes to flow (flow deviation)	1, 53		High	300,000	EW51, 52		
WMU13-11	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	1, 53		High	74,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU13-12	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	1		Low	25,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU13-13	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	1, 53		High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU13-14	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level	1		High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU13-15	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	1, 53		Low	10,000	RL8, WQ6	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU13-16	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	1, 53		High	271,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy Reviews.
COMMUNITY COMMUNITCATION, EDUCATION AND ENGAGEMENT									
WMU13-17	Increase community understanding of waterway health.	All threats	1, 53		High	205,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU13-18	Actively engage community and stakeholders in managing waterways.	All threats	1, 53		High	29,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 13 cost summary	
Total Cost of all Actions	\$2,513,500
High Priority Actions	\$2,022,500
Medium Priority Actions	\$274,000
Low Priority Actions	\$217,000

13.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
Insufficient data to determine ISC score for either reach (only two sub-indices measured)	Insufficient data to determine changes to ISC ratings for either reach
Management Action Target summary	Resource Condition Target summary
<p>240.0 ha of riparian land fenced and/or revegetated</p> <p>240.0 km of priority stream under land management agreement for off-stream watering</p> <p>Priority weed control on 28.0 km of waterways</p> <p>Weed control on 28.0 km of waterways</p> <p>1.5 km of bed and banks stabilised</p> <p>28.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 2 priority reaches</p>	<p>All social and environmental Heritage River values maintained</p> <p>50.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 14.0 km raised from 7 to 8 in Reach 1 • 36.0 km raised from 3 to 7 in Reach 53 <p>14.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 14.0 km raised from 7 to 8 in Reach 1 <p>Improved flow regime achieving environmental objectives in 2 priority reaches</p>

waterway management unit 14. yarriambiack creek system

reaches 17, 18, 19 and 20

14.1 waterways and their condition

Waterway Management Unit 14 is centred around Yarriambiack Creek, a natural distributary of the Wimmera River that flows northwards after diverging from the Wimmera River near Longerenong (Map 4.15). It flows north approximately 120 km through the townships of Warracknabeal and Beulah before extending out of the Wimmera and into the Mallee, finally terminating in Lakes Coorong Lascelles near Hopetoun.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

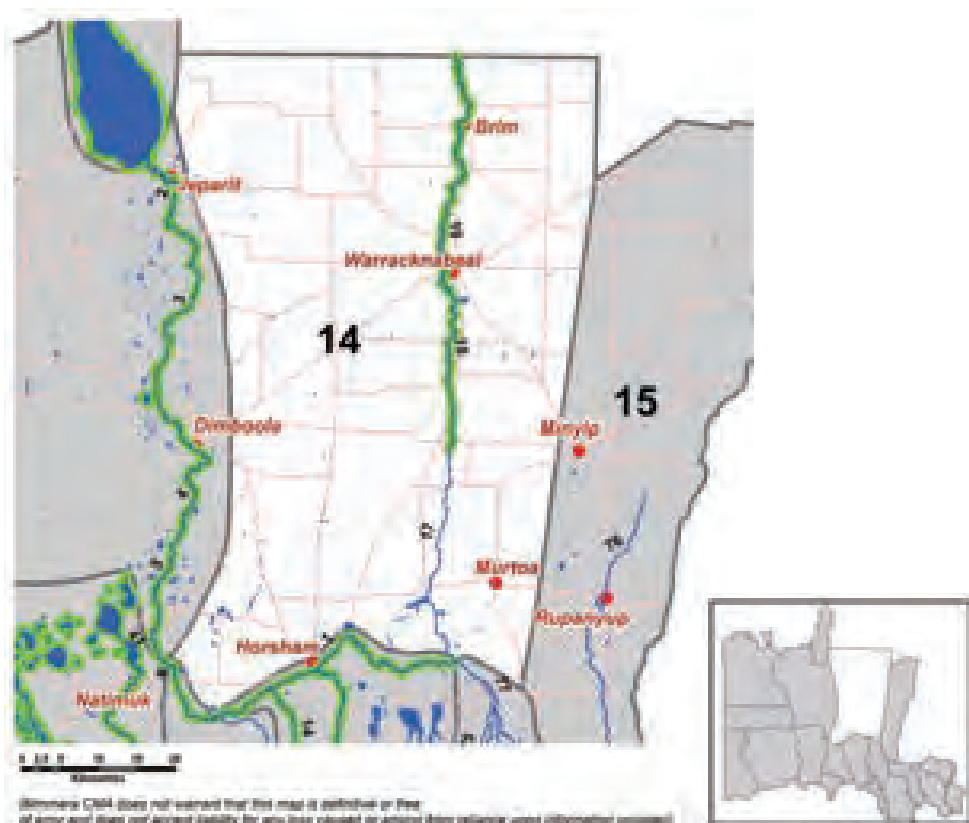
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.15 waterway management unit 14 and reaches

The physical form of Yarriambiack Creek has been relatively unaffected by changes to land uses over time, with banks remaining in a very stable condition. There is a gentle batter and few exposed roots. In contrast to the good condition of Yarriambiack Creek's stable channel, the channel only contains relatively poor amounts of LWD. These quantities were very low when compared to other waterways in the Wimmera. This is potentially due to the low number of streamside trees as well as limited contributions from upstream sources. In times of streamflow, the absence of LWD means that there is only limited habitat available for the aquatic lifeforms that inhabit Yarriambiack Creek.

As Yarriambiack Creek is a distributary of the Wimmera River, the artificial structures that limit the migration of native fish species in the Wimmera River except in times of very high flow, also have an impact on fish migration in Yarriambiack Creek.

The ISC 2004 survey indicated that the streamside zone for Yarriambiack Creek is in a relatively consistent condition throughout its length. The quantities of large trees and the associated effects of tree canopy cover and longitudinal connectivity were around the moderate mark which had a limiting effect on the coverage of logs and leaf litter.

Regeneration of native trees was good in several locations, indicating that there should be some future improvements in the streamside zones. While understorey coverage was poor in the southern reach of Yarriambiack Creek near where it leaves the Wimmera River, there was a noticeably strong increase in understorey vegetation in the northern reaches. This also coincided with a slight decrease in the extent of groundcover weeds.

The presence of a good condition streamside zone is extremely important in this part of the catchment as it provides a vital corridor for native flora and fauna amidst a vast area that has been cleared for agriculture.

Data on the flow regimes along Yarriambiack Creek was only obtained for its upper two reaches for the ISC 2004 survey. It appears that the seasonality of flows has been modified, indicating a change in the periods in the year when Yarriambiack Creek is at levels of high, low or zero flows. The proportion of time the creek is in high or zero flow has also been marginally altered and as a result Yarriambiack Creek is slightly stressed in summer, through the limiting of the amount of habitat and connectivity within it.

Data was not obtained for the water quality and aquatic life sub-indices for the ISC 2004 survey. However due to the fact that Yarriambiack Creek sources some of its flows from the Wimmera River, the good condition of the water quality along this portion of the river means that it would not negatively impact on the water quality in Yarriambiack Creek.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.37).

TABLE 4.37 significant flora, fauna and EVC recorded in waterway management unit 14

Significant fauna	Australasian Bittern, Freckled Duck, Nankeen Night Heron, Great Egret, Curl Snake
Significant flora	Pale Spike-sedge, Spurred Spear-grass, Weeping Myall
Significant EVC	Black Box Chenopod Woodland Black Box Lignum Woodland Riparian Woodland

14.2 priority waterways

Priority Reaches in Waterway Management Unit 14 are:

- **Yarriambiack Creek Reach 18** (very high social values in RiVERS).
- **Yarriambiack Creek Reach 19** (very high social values in RiVERS).
- **Yarriambiack Creek Reach 20** (very high social values in RiVERS).

As a distributary, there are no downstream priority waterways outside the Waterway Management Unit that may be impacted by actions implemented in Waterway Management Unit 14.

14.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

Management actions have been identified and prioritised for the following influencing reach within the Waterway Management Unit:

- Yarriambiack Creek Reach 17.

14.4 primary management objectives

The primary waterway health objectives for priority reaches in Waterway Management Unit 14 are:

- Protect the very high social values in Yarriambiack Creek Reach 18.
- Protect the very high social values in Yarriambiack Creek Reach 19.
- Protect the very high social values in Yarriambiack Creek Reach 20.
- Prevent damage to priority reaches from conditions in the influencing reach.

14.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 14. A summary of the risks for the three priority reaches is presented in Table 4.38.

High and Very High risks to significant values in priority reaches in Waterway Management Unit 14 include:

- Barriers to fish migration, Channel modification, Loss of in-stream habitat, Algal blooms and Stock access in Yarriambiack Creek Reach 18.
- Barriers to fish migration, Channel modification, Water quality (nutrients), Loss of in-stream habitat and Algal blooms in Yarriambiack Creek Reach 19.
- Barriers to fish migration, Channel modification, Loss of in-stream habitat, Algal blooms, Degraded streamside vegetation and Stock access in Yarriambiack Creek Reach 20.

Medium risks to significant values in priority reaches in Waterway Management Unit 14 include:

- Exotic fauna and Wetland connectivity in Yarriambiack Creek Reach 18.
- Bank erosion, Exotic fauna and Wetland connectivity in Yarriambiack Creek Reach 19.
- Exotic fauna and Wetland connectivity in Yarriambiack Creek Reach 20.

TABLE 4.38 risks to significant values in priority reaches in waterway management unit 14

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Social Value		1	2	5	4	1	2	0	0	1	2	3	4	5	2	3	5
fishing	5	2	2	8	6	2	0	0	0	2	2	3	7	7	0	0	7
sports, non motor	4	0	0	0	4	2	0	0	0	0	0	0	0	6	0	0	4
sports, motor	5	0	0	0	0	2	0	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	4	0	0	0	0	0	0	0	0	8	0	0	7
swimming	5	0	0	0	4	2	0	0	0	2	0	0	0	8	0	0	7
european heritage	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	6	2	2	0	0	2	2	3	7	4	2	3	7
passive recreation	5	2	0	0	4	0	0	0	0	0	0	0	0	7	2	0	7
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

YARRIAMBIACK CREEK REACH 18

TABLE 4.38 (continued)

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Social Value		3	1	5	4	1	2	0	5	1	2	3	4	5	2	3	1
fishing	5	3	2	8	6	2	0	0	7	2	2	3	7	7	0	0	2
sports, non motor	4	0	0	0	4	2	0	0	0	0	0	0	0	6	0	0	0
sports, motor	5	0	0	0	0	2	0	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	4	0	0	0	0	0	0	0	0	8	0	0	2
swimming	5	0	0	0	4	2	0	0	8	2	0	0	0	8	0	0	2
european heritage	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	3	2	7	6	2	2	0	7	2	2	3	7	4	2	3	2
passive recreation	5	3	0	0	4	0	0	0	0	0	0	0	0	7	2	0	2
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

YARRIAMBIACK CREEK REACH 19

		bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
High Social Value		1	1	5	4	1	2	0	0	1	2	3	5	5	4	3	5
fishing	5	2	2	8	6	2	0	0	0	2	2	3	8	7	4	0	7
sports, non motor	5	0	0	0	4	2	0	0	0	0	0	0	0	7	4	0	4
sports, motor	5	0	0	0	0	2	0	0	0	0	0	0	0	7	0	0	0
camping	5	0	0	0	4	0	0	0	0	0	0	0	0	8	4	0	7
swimming	5	0	0	0	4	2	0	0	0	2	0	0	0	8	4	0	7
european heritage	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
species of significance	5	2	2	7	6	2	2	0	0	2	2	3	8	4	6	3	7
passive recreation	5	2	0	0	4	0	0	0	0	0	0	0	0	7	7	0	7
listed landscapes	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

YARRIAMBIACK CREEK REACH 20

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

Potential threats to priority reaches from the influencing reach can be seen in Table 4.39. In particular, there are high and medium threats from Bed instability, Exotic fauna, Algal blooms, Degraded streamside vegetation and Stock access in Yarriambiack Creek Reach 17.

TABLE 4.39 threat levels influencing waterways in waterway management unit 14



14.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

14.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU14-01	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	20		High	25,000	RL1, 2	96.0 ha of riparian land revegetated.	20.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 20.0 km of waterway with improved ISC Physical Form sub-index score.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU14-02	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	18, 19	17	Medium	75,000	RL1, 2	247.2 ha of riparian land revegetated.	51.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 51.5 km of waterway with improved ISC Physical Form sub-index score.
WMU14-03	Encourage off-stream watering of stock.	Stock access	18, 20	17	High	20,000	RL5	254.4 ha under management for off-stream watering.	Contribute to targets for WMU14-01 to WMU14-02
WMU14-04	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	18, 19, 20	17	Low	162,000	RL3, 9, 33	Priority weed control on 143.0 km of waterways.	71.5 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU14-05	Undertake management of other pest plant species where they are having significant impact on waterway health.		18, 19, 20	17	Low	70,000	RL3, 33	Weed control on 143.0 km of waterways.	
WMU14-06	Re-introduce LWD at priority sites to restore instream habitat.	Loss of in-stream habitat	18, 19, 20	17	High	85,000	ICF25	4 sites with LWD introduced.	71.5 km of waterway with improved ISC Physical Form sub-index score.
WMU14-07	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	18, 19, 20	17	Medium	141,000	RL10	143.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU14-08	Implement priority bed and bank stabilisation actions in the Yarriambiack Creek Management Plan (2004).	Bank erosion Bed instability	18, 19, 20	17	Medium	90,000	RL14 ICF8	6.0 of bed and banks stabilised.	71.5 km of waterway with improved ISC Physical Form sub-index score.
WMU14-09	Implement sound water resource management in regulated and unregulated waterways.	Changes to flow (flow deviation) Algal blooms Wetland connectivity	18, 19, 20	17	High	352,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 3 priority reaches by 2020.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU14-10	Manage environmental water releases to achieve improvements in waterway health in priority waterways.	Changes to flow (flow deviation) Algal blooms Wetland connectivity	18, 19, 20	17	High	150,000	EWR23, 25, 26, 27, 30	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 3 priority reaches by 2020.
WMU14-11	Address physical and operational constraints to the delivery of environmental water releases and the achievement of environmental objectives for priority waterways.		18, 19, 20	17	High	300,000	EWR51, 52		
WMU14-12	Treat stormwater prior to discharge into Yarriambiack Creek as in the Wimmera Region Urban Stormwater Management Plan (2002)	Water quality trends Water quality attainment Algal blooms	18		Low	Costed in Plan	WQ7, 8	Identified actions implemented.	Targets as per Management Plan.
WMU14-13	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	18, 19, 20	17	Low	106,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU14-14	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	18, 19, 20	17	Low	10,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU14-15	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)	18, 19, 20	17	High	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU14-16	Undertake research into nutrient sources and waterway health sensitivities to nutrient input.	Water quality trend Water quality level Algal blooms	18, 19, 20	17	High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU14-17	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	18, 19, 20	17	High	387,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU14-18	Increase community understanding of waterway health.	All threats	18, 19, 20	1	High	293,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU14-19	Actively engage community and stakeholders in managing waterways.	All threats	18, 19, 20	17	High	42,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 14 cost summary	
Total Cost of all Actions	\$2,355,500
High Priority Actions	\$1,701,500
Medium Priority Actions	\$306,000
Low Priority Actions	\$348,000



14.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
<p>Reach 17 ISC score raised from 24 to 28 (maintained at Good)</p> <p>Reach 18 ISC score raised from 24 to 27 (maintained at Good)</p> <p>Reach 19 has insufficient data to determine ISC score</p> <p>Reach 20 has insufficient data to determine ISC score</p>	<p>66.0 km (Reaches 17 and 18) maintained at Moderate</p> <p>Insufficient data to determine condition changes in Reaches 19 and 20</p>
Management Action Target summary	Resource Condition Target summary
<p>343.2 ha of riparian land fenced and/or revegetated</p> <p>172.6 km of priority stream under land management agreement for off-stream watering</p> <p>81.6 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 143.0 km of waterways</p> <p>Weed control on 143.0 km of waterways</p> <p>7.5 km of bed and banks stabilised</p> <p>4 sites with LWD introduced</p> <p>143.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 3 priority reaches</p>	<p>71.5 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 17.0 km raised from 5 to 8 in Reach 17 • 16.0 km raised from 5 to 7 in Reach 18 • 18.5 km raised from 6 to 7 in Reach 19 • 20.0 km raised from 6 to 7 in Reach 20 <p>53.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 17.0 km raised from 6 to 8 in Reach 17 • 16.0 km raised from 6 to 8 in Reach 18 • 20.0 km raised from 6 to 7 in Reach 20 <p>Improved flow regime achieving environmental objectives in 3 priority reaches</p>

waterway management unit 15. dunmunkle creek system

reaches 76 and 91

15.1 waterways and their condition

Dunmunkle Creek, the primary waterway of Waterway Management Unit 15, is a distributary of the Wimmera River, a rare feature within south-eastern Australia (Map 4.16). It infrequently flows northwards in times of high flows in the Wimmera River near Glenorchy. Dunmunkle Creek flows through Rupanyup as it makes its way towards the southern Mallee. The channel gradually becomes less defined the further it moves towards its northern extent.

↑ legend

Waterway Management Units

18 Waterway Management Unit Number

River Reaches

Wetlands*

Waterways*

Priority Wetlands

Priority Waterways

Major Towns*

Major Roads*

Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.16 waterway management unit 15 and reaches

There are several parallels between Dunmunkle Creek and another regional distributary, Yarriambiack Creek, including very good condition of the stream channel in terms of little or no erosion taking place along its very stable banks. Gently sloping banks with few bare patches of exposed roots are evidence of this. The infrequent flow regime is unlikely to cause any major changes to this in the immediate future. Dunmunkle Creek's physical form has also been extensively modified through channelisation works, affecting many other components of its health.

Dunmunkle Creek is also similar to Yarriambiack Creek in that it appears to be lacking LWD. This is especially the case in its upper reach, where almost no pieces of large wood are evident in the stream channel. This is a significant change from reference condition and indicates that Dunmunkle Creek has been extensively modified in this respect. The stream channel has been left with a scarce habitat for the aquatic life forms that inhabit the creek when it flows. Clearing of native trees and the removal of LWD from the channel are the primary causes. Dunmunkle Creek is also fairly typical among the Wimmera's waterways as indigenous fish migration is affected by the presence of downstream artificial barriers that are located on the Wimmera River.

The streamside zone of Dunmunkle Creek has been heavily modified by historical and current land uses, particularly in its northern reach. There are many positive signs that the condition of the southern reach will improve, with plentiful large trees as well as very good rates of regeneration. The coverage of leaf litter is also near a benchmark level. A high percentage of tree canopy cover and low coverage of invasive weeds are also positives in this part of the catchment. It is anticipated that this will lead to some future improvements in the understorey vegetation as well as the amount of large logs and extent of longitudinal connectivity.

In contrast, the northern reaches of Dunmunkle Creek have a much poorer condition streamside zone. Their best attribute is the reasonable amount of large trees throughout most of the reach. Some parts were completely cleared of streamside vegetation, thereby severely limiting the scores that could be obtained for the streamside zone sub-index.

There was not as much recruitment of native species, leaf litter, logs, tree canopy cover and longitudinal connectivity when compared to most other reaches within the catchment. There was a moderate coverage of groundcover weeds along this reach.

Measurement of the water quality, hydrology and aquatic life sub-indices were not undertaken on Dunmunkle Creek for the ISC 2004 survey. The infrequent flows of Dunmunkle Creek often makes the taking of such measurements impractical.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.40).

TABLE 4.40 significant flora, fauna and EVC recorded in waterway management unit 15

Significant fauna	Bush Stone-curlew
Significant flora	None recorded
Significant EVC	Plains Savannah Plains Woodland Riverine Chenopod Woodland

15.2 priority waterways

There are no priority reaches identified in Waterway Management Unit 15.

As a distributary, there are no downstream priority waterways outside the Waterway Management Unit that may be impacted by actions implemented in Waterway Management Unit 15.

15.3 influencing waterways

Influencing reaches are those where there are risks to waterway health that are threatening priority reaches. As a distributary stream, with no downstream priority reaches, only the presence of pest plants and animals may affect nearby priority reaches (particularly the Wimmera River Reach 9 and Yarriambiack Creek in the adjacent Management Unit).

The influencing reaches in Waterway Management Unit 15 are:

- Dunmunkle Creek Reach 76.
- Dunmunkle Creek Reach 91.

15.4 primary management objectives

The primary waterway health objectives for influencing reaches in Waterway Management Unit 15 are:

- Protect significant values in nearby priority waterways by reducing the threat of spread from exotic flora and fauna.

15.5 risks to waterway health

Potential threats to nearby priority reaches from the two influencing waterways can be seen in Table 4.41. In particular, the potential for exotic fauna to spread is considered a high threat, while the potential for exotic flora is low.

While the focus in the two reaches is on exotic flora and fauna, additional actions are proposed to improve the in-stream and riparian habitats, although these are a low priority in the context of the *Wimmera WHS*. Other actions that contribute to region wide investigations, monitoring and understanding are also included.

TABLE 4.41 threat levels influencing waterways in waterway management unit 15

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Dunmunkle Creek Reach 76	1	1	3	2	0	0	1	2	4	1	4	1
Dunmunkle Creek Reach 91	1	1	3	2	0	0	1	2	4	1	3	1

Key: 5 or 4 High threat level in reach (High *Wimmera WHS* priority for action), 3 Medium threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 Low threat level in reach (Low *Wimmera WHS* priority for action)

15.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Wimmera River Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

15.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU15-01	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna		76, 91	High	57,000	RL10	58.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU15-02	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation		76, 91	Low	66,000	RL3, 9, 33	Priority weed control on 58.0 km of waterways.	29.0 km of riparian zone with improved ISC Streamside Zone sub-index score.
WMU15-03	Undertake management of other pest plant species where they are having significant impact on waterway health.			76, 91	Low	29,000	RL3, 33	Weed control on 58.0 km of waterways.	
WMU15-04	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation		76, 91	Low	300,000	RL1, 2	139.2 ha of riparian land revegetated.	29.0 km of riparian zone with improved ISC Streamside Zone sub-index score. 29.0 km of waterway with improved ISC Physical Form sub-index score.
WMU15-05	Encourage off-stream watering of stock.	Stock access		76, 91	Low	20,000	RL5	139.2 ha under management for off-stream watering.	Contribute to targets for WMU15-04.
WMU15-06	Implement sound water resource management in unregulated waterways.	Changes to flow (flow deviation)		76, 91	Low	143,000	EWR4, 5, 6, 11, 12, 13, 15, 16, 17	Environmental Water Reserve established and implemented.	Improved flow regime achieving environmental objectives in 2 reaches by 2020.
WMU15-07	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment		76, 91	Low	43,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU15-08	Investigate and where necessary address active erosion (bed, bank, gully).	Bank erosion Bed instability		76, 91	Low	500,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU15-09	Monitor and report on the effectiveness of environmental water releases in achieving environmental objectives.	Changes to flow (flow deviation)		76, 91	Low	10,000	EWR31, 32, 33, 34	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU15-10	Undertake research into nutrient sources and waterway health sensitivities to nutrients.	Water quality trend Water quality level		76, 91	High	37,500	WQ10	Research plan developed and implemented.	Site specific nutrient targets to be set by 2007.
WMU15-11	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats		76, 91	High	157,000	WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU15-12	Increase community understanding of waterway health.	All threats		76, 91	High	119,000	RL36, ICF35, EWR56, WQ16, 17, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU15-13	Actively engage community and stakeholders in managing waterways.	All threats		76, 91	High	17,000	RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 15 cost summary

Total Cost of all Actions	\$1,498,500
High Priority Actions	\$387,500
Medium Priority Actions	\$0
Low Priority Actions	\$1,111,000

15.8 overall ISC condition, management action and resource condition targets

Overall ISC and condition (all actions implemented)	Contribution to regional and Statewide condition targets
Insufficient data to determine ISC scores for each reach	Insufficient data to determine condition changes for each reach
Management Action Target summary	Resource Condition Target summary
<p>139.2 ha of riparian land fenced and/or revegetated</p> <p>139.2 ha of influencing stream under land management agreement for off-stream watering</p> <p>Priority weed control on 58.0 km of waterways</p> <p>Weed control on 58.0 km of waterways</p> <p>58.0 km of stream with rabbit control</p> <p>Environmental Water Reserve established and implemented in 2 reaches</p>	<p>29.0 km of riparian zones with improved ISC Streamside Zone sub-index score:</p> <ul style="list-style-type: none"> • 22.0 km raised from 4 to 7 in Reach 76 • 7.0 km raised from 5 to 8 in Reach 91 <p>7.0 km of waterway with improved ISC Physical Form sub-index score:</p> <ul style="list-style-type: none"> • 7.0 km raised from 6 to 7 in Reach 91 <p>Improved flow regime achieving environmental objectives in 2 priority reaches</p>

waterway management unit 16. millicent coast lakes system

no waterway reaches in waterway management unit 16

16.1 waterways and the condition

Waterway Management Unit 16 is dominated by strings of wetlands (Map 4.17).

The Millicent Coast Lakes System consists of a significant number of wetlands located to the west of the smaller Natimuk-Douglas chain-of-lakes system. Approximately 25% (3000) of Victoria's wetlands are located within the Millicent Coast Basin portion of the Wimmera CMA region, many of which are contained within this Management Unit. The wetlands are ecologically significant as well as possessing values for heritage, tourism and recreational purposes. No waterway reaches are located within this Management Unit.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

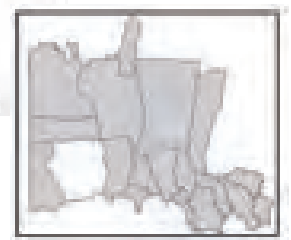
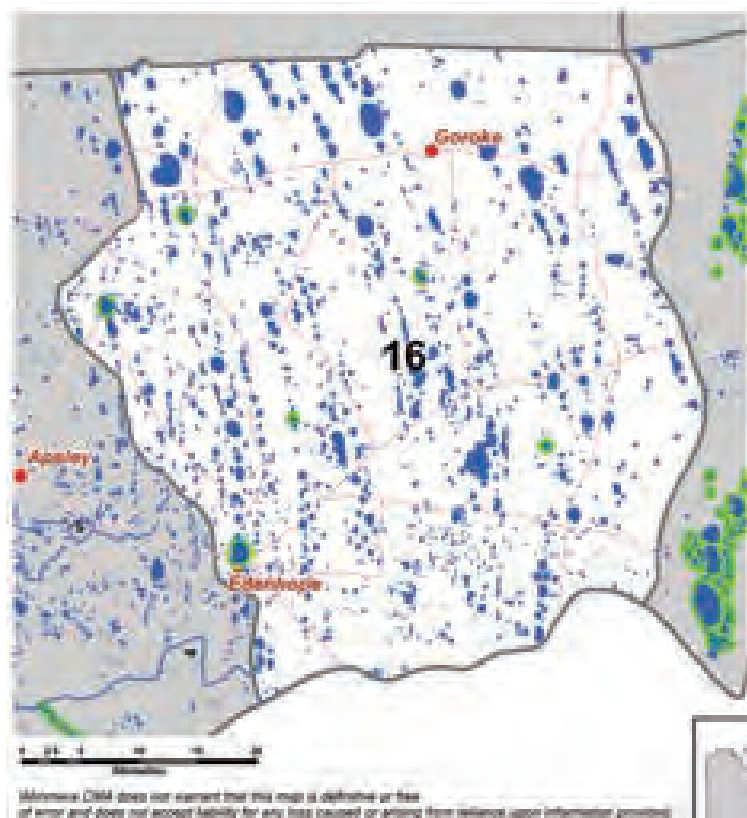
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.17 waterway management unit 16 and reaches

Many wetlands are controlled by complex groundwater and surface water interactions. They are mostly located in the former swales between the stranded beach dune deposits of the Parilla Sands. They are heavily influenced by regional groundwater, which tends to be saline, however they can also be affected by fresher local groundwater from the smaller, more recent Aeolian deposits of the Lowan Sands.

Larger wetlands are usually located within Crown Land allotments while the smaller, often more ephemeral wetlands tend to be situated on private land. It is believed that changes to the distribution of vegetation (especially tree species) within this management unit have led to issues with increasing salinity and nutrient levels. Alterations to groundwater and surface water interactions through increased drainage and irrigation activities have also led to similar problems.

The Department of Sustainability and Environment (DSE) is in the process of finalising the Index of Wetland Condition (IWC) methodology which will serve a similar purpose to the ISC. When IWC surveys are completed for the wetlands in the Millicent Coast Lakes System Waterway Management Unit, it will enable an initial benchmarking of their condition. Wimmera CMA is in the process of looking at other ways of gaining a better understanding of the condition of these wetlands, such as detailed wetland health assessments.

16.2 priority waterways

Priority wetlands in Waterway Management Unit 16 have been identified due to their high social value:

- **Lake Wallace**
- **Lake Charlegrark**
- **Lake Ratzcastle**
- **Lake Bringalbert**
- **Broughton's Swamp**

16.3 influencing waterways

There are no influencing reaches in Waterway Management Unit 16. However, the condition of non-priority wetlands in the Management Unit will have an impact on the priority wetlands (particularly invasive species and water regime changes).

16.4 primary management objective

The primary waterway health objective for priority wetlands in Waterway Management Unit 16 are:

- Manage wetlands and wetland systems in Waterway Management Unit 16 of the Millicent Coast Basin to achieve a balance between economic, social and environmental values.

16.5 risks to waterway health

As there are no waterway reaches within Waterway Management Unit 16, risks to waterway health were not assessed using RIVERS.

Knowledge obtained from the *Wimmera Wetland Condition Assessment Project* (2005) indicates that risks to waterway health in priority wetlands in Waterway Management Unit 16 include:

- Bed and bank erosion.
- Altered drainage and flow regimes.
- Water quality.
- Exotic flora.
- Exotic fauna.
- Loss of wetland habitat.
- Degraded riparian vegetation.
- Stock access.
- Changing land use.

16.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Millicent Coast Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

16.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU16-01	Implement priority wetland management actions in the Geomorphic Investigation of Wetlands in the Wimmera CMA section of the Millicent Coast Basin (2004) (including the Natimuk-Douglas Lakes).	All threats	Wetlands		High	125,000	WE15	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU16-02	Implement priority wetland management actions in the Wimmera Wetland Condition Assessment Project (2005) report.	All threats	Wetlands		High	125,000	WE16	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.
WMU16-03	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	Wetlands		High	500,000	WE22, RL1, RL2	Targets to be determined.	Targets to be determined following benchmarking by IWC project.
WMU16-04	Encourage alternative watering sources for stock.	Stock access	Wetlands		High	20,000	WE22, RL5	Targets to be determined.	
WMU16-05	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	Wetlands		Medium	100,000	WE27	Targets to be determined.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU16-06	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	Wetlands		Low	115,000	WE25, 27	Targets to be determined.	Reduced impact on wetlands by invasive species by a level to be determined by 2010.
WMU16-07	Undertake management of other pest plant species where they are having significant impact on waterway health.		Wetlands		Low	50,000	WE25, 27	Targets to be determined.	
WMU16-08	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	Wetlands		Medium	75,000	WE17, WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU16-09	Identify high priority wetlands and the respective management actions required.	All threats	Wetlands		High	50,000	WE1, 2, 3, 4	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU16-10	Monitor wetland extent	All threats	Wetlands		High	35,000	WE8	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU16-11	Investigate impact of rural drainage on flow regimes of waterways.	Changes to flow (flow deviation)	Wetlands		High	50,000	WE2, 4, 8, 14, 15, 20	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU16-12	Investigate and demonstrate best practice management options for grazing of wetlands to ensure that impacts on wetland health are minimised.	Stock access	Wetlands		High	75,000	WE22	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU16-13	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Changes to flow (flow deviation)	Wetlands		High	10,000	WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU16-14	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	Wetlands		High	275,000	WE9, 10, 12, 13 WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU16-15	Increase community understanding of waterway health.	All threats	Wetlands		High	54,000	WE30, 31 CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU16-16	Actively engage community and stakeholders in managing waterways.	All threats	Wetlands		High	16,000	WE32, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 16 cost summary

Total Cost of all Actions	\$1,675,000
High Priority Actions	\$1,335,000
Medium Priority Actions	\$175,000
Low Priority Actions	\$165,000

16.8 overall ISC condition, management action and resource condition targets

Wetland Targets

- No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020 (RCT 4).
- 10 % of wetlands on private land in the Millicent Coast Basin are in excellent condition (as assessed by the IWC) by 2025 (RCT 5).
- Reduced impact on wetlands by invasive species by a level to be determined by 2010 (RCT 6).
- 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020 (RCT 7).

waterway management unit 17. millicent coast west flowing system

reaches 1, 2, 3, 4, 5 in the millicent coast basin

17.1 waterways and their condition

Waterway Management Unit 17 is the location of plentiful and diverse wetland systems as well as several west-flowing creeks (Map 4.18). There has been a recent escalation of erosion rates along creeks due to flood protection and rural drainage works. Increasing rural land uses within the region has placed further pressures on these wetlands and waterways in terms of preserving their vegetation and physical form. Rising groundwater levels and the intrusion of saline groundwater into the wetlands and waterways are also threats to their health. Mosquito Creek crosses into South Australia, as does the regional groundwater flow system so these factors need to be considered when looking at this Management Unit.

↑ legend

□ Waterway Manangement Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

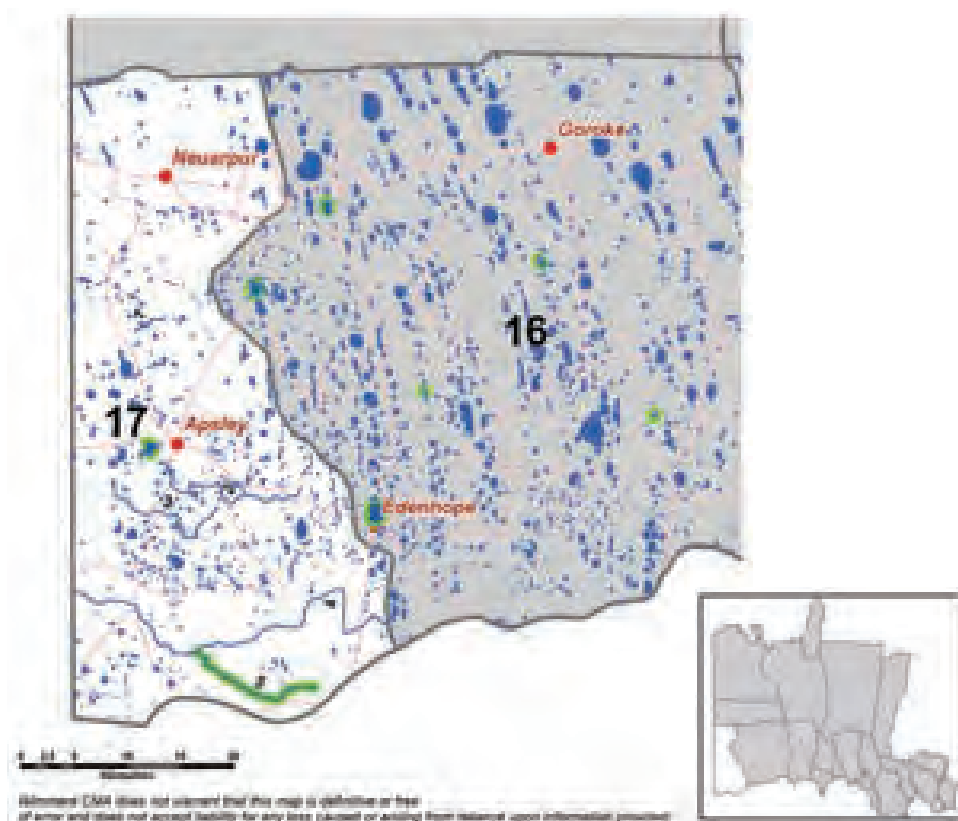
— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.18 waterway management unit 17 and reaches

The large numbers of wetlands within this Waterway Management Unit are also important for their recreational, cultural and tourism values. They are threatened by changes to vegetation and drainage activities as well as pest plants and animals. Conducting IWC surveys that are currently in the final stages of development will give a good indication of their condition and the threats that face them. This will be used for future management with other wetland studies conducted by Wimmera CMA into the physical and chemical attributes of wetland waters as well as their vegetation condition.

The condition of the waterways in this Management Unit shows Thompson Creek's bank stability is currently in an excellent condition. The gentle batter of its banks indicates that erosion is only taking place at a natural rate.

Mosquito and Yalla creeks were observed to only be in fractionally worse condition with several areas of exposed roots and a lack of continuous woody vegetation demonstrating that only limited erosion is taking place. Koijak Creek was seen to have several areas where extensive erosion has taken place. Unfortunately, this is the case in many lowland ephemeral creeks in the Wimmera, distribution of woody debris within each channel is quite sparse. The amount of in-stream habitat provided in these waterways during times of flow is poor or in some cases almost non-existent.

Waterways of the Millicent Coast Basin have fairly modified streamside zones due to changing land uses, resulting in dwindling levels of several important components of each streamside zone. In particular the longitudinal continuity of tree cover was very poor, with potential for problems in the distribution and movement of plant and animal species along the length of the reaches due to breaks in vegetation cover. This has also impacted on the extent of tree canopy cover that aids aquatic ecosystems through limiting excessive energy inputs from sunlight and trees providing leaf litter and logs as another energy source.

There was limited regeneration in each of the streamside zones of these waterways which is an important factor in the maintenance and improvement the health of these creeks. The understorey levels, whilst present to a certain extent, could certainly be increased in their diversity and abundance. Of the two determinants of the ground-level habitat status, the coverage of leaves and logs, the amount of leaf litter was usually quite good although the length of large logs was substantially less than benchmark condition.

The hydrology of these waterways is seen to be unaffected by diversions for agricultural use, therefore they received maximum scores for the hydrology sub-index for the ISC 2004 survey. Creeks in the Millicent Coast west flowing Management Unit did not have their water quality and aquatic life sub-indices calculated for the ISC 2004 survey.

A number of species and communities of conservation significance have been recorded near waterways in the Management Unit (Table 4.42).

TABLE 4.42 significant flora, fauna and EVC recorded in waterway management unit 17

Significant fauna	Brolga, Mountain Galaxias, River Blackfish, Yarra Pigmy Perch
Significant flora	Pink Gum
Significant EVC	Creekline Sedgy Woodland Plains Woodland Riparian Woodland Shallow Sands Woodland/Plains Sedgy Woodland/Seasonally Inundated

17.2 priority waterways

Priority Reaches in Waterway Management Unit 17 are:

- **Mosquito Creek Reach 5** (excellent condition in the 2004 ISC survey).

Priority waterways outside the Waterway Management Unit that are impacted by actions implemented in Waterway Management Unit 17 are:

- Bool Lagoon (SA).
- Lake Wallace.
- Newlands Lake.
- Mosquito Creek Reach 4.
- Non-priority wetlands.

17.3 influencing waterways

Influencing reaches are those where there are risks that threaten downstream or nearby priority reaches. The types of threats occurring in influencing reaches that have an impact on priority reaches include:

- Bed, bank and gully erosion contributing nutrients and turbidity to priority waterways.
- Poor water quality.
- Pest plants and animals that provide a source that can invade priority waterways.
- Water harvesting altering downstream flows.
- Degraded riparian zones and stock access, leading to a decline in water quality in downstream priority waterways.

Conditions in priority wetlands outside the Management Unit may be affected by conditions in non-priority wetlands within this Management Unit, particularly as a source of exotic plants and animals. Additionally, changes to the water regime in one wetland may affect surrounding wetlands.

For these reasons, management actions have been identified and prioritised for the following influencing reaches and wetlands within the Waterway Management Unit:

- Thompson Creek Reach 1.
- Kojak Creek Reach 2.
- Yalla Creek Reach 3.

17.4 primary management objectives

The primary waterway health objectives for Waterway Management Unit 17 are:

- Protect the excellent environmental condition in Mosquito Creek Reach 5.
- Prevent damage to priority wetlands from conditions in influencing wetlands and reaches.

17.5 risks to waterway health

Risk assessments have been undertaken for all waterway reaches within Waterway Management Unit 17. A summary of the risks for the priority reach is presented in Table 4.43.

High and Very High risks to significant values in Mosquito Creek Reach 5 are:

- Stock access.

Medium risks to significant values in Mosquito Creek Reach 5 are:

- Bank erosion, Exotic fauna and Degraded streamside vegetation.

In addition, knowledge obtained from the *Wimmera Wetland Condition Assessment Project* (2005) indicates that risks to waterway health in wetlands in Waterway Management Unit 17 include:

- Bed and bank erosion.
- Altered drainage and flow regimes.
- Water quality.
- Exotic flora.
- Exotic fauna.
- Loss of wetland habitat.
- Degraded riparian vegetation.
- Stock access.
- Changing land use.

TABLE 4.43 risks to significant values in priority reaches in waterway management unit 17

Excellent ISC Condition	bank erosion	bed instability	barrier to migration	channel modification	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	loss of in-stream habitat	agal blooms	degraded stream-side	wetland connectivity	stock access
	3	3	1	3	1	0	0	0	1	2	3	0	1	3	3	5
riparian width	5	3	0	0	0	0	0	0	0	2	3	0	0	3	0	8
riparian continuity	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
riparian intactness	5	3	0	0	2	0	0	0	0	2	3	0	0	3	0	8
invertebrate O/E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish O/E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
native fish proportion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
fish migration	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

MOSQUITO CREEK REACH 5

Key: 8 Very High risk, high priority for action, 7 High 1 risk, high priority for action, 6 High 2 risk, high priority for action, 5 High 3 risk, high priority for action, 4 Medium 1 risk, medium priority for action, 3 Medium 2 risk, medium priority for action, 2 Low 1 risk, low priority for action, 1 Low 2 risk, low priority for action.

For more detail on the Risk Assessment Procedure, see Part 1 Development of the *Wimmera WHS* and the *WHS Resource Book* Part 6, Sub-folder 16 – Risk Assessment and Prioritisation. Note: Additional actions have been included on the basis of other studies, local knowledge and community input.

Potential threats from the four influencing waterways can be seen in Table 4.44. High and medium threats from Bank erosion, Bed instability, Exotic fauna, Degraded streamside zone and Stock access are common throughout the influencing waterways.

TABLE 4.44 threat levels influencing waterways in waterway management unit 17

	bank erosion	bed instability	flow deviation	WQ trend	WQ level	WQ signal	temperature	exotic flora	exotic fauna	agal blooms	degraded stream-side	stock access
Thompson Creek Reach 1	3	3	1	0	0	0	1	2	3	1	3	5
Kojak Creek Reach 2	3	4	1	0	0	0	1	2	3	1	3	5
Yalla Creek Reach 3	3	4	1	0	0	0	1	2	3	1	3	5
Mosquito Creek Reach 4	3	3	1	0	0	0	1	2	3	1	3	5

Key: 5 or 4 **High** threat level in reach (High *Wimmera WHS* priority for action), 3 **Medium** threat level in reach (Medium *Wimmera WHS* priority for action), 2 or 1 **Low** threat level in reach (Low *Wimmera WHS* priority for action)

17.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Millicent Coast Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to streams and rivers of the Wimmera region having adequate environmental water releases to sustain ecosystem functions and processes (AT6).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

17.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU17-01	Implement priority wetland management actions in the Geomorphic Investigation of Wetlands in the Wimmera CMA section of the Millicent Coast Basin (2004) (including the Natimuk-Douglas Lakes).	All threats		Wetlands	High	125,000	WE15	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU17-02	Implement priority wetland management actions in the Wimmera Wetland Condition Assessment Project (2005) report.	All threats	Wetlands		High	125,000	WE16	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.
WMU17-03	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	5	1, 2, 3, 4, Wetlands	Medium	500,000	WE22 RL1, 2	199.2 ha of riparian land revegetated.	41.5 km of riparian zone with improved ISC Streamside Zone sub-index score. 41.5 km of waterway with improved ISC Physical Form sub-index score.
WMU17-04	Encourage off-stream watering of stock.	Stock access	5	1, 2, 3, 4, Wetlands	High	20,000	WE22 RL5	199.2 ha under management for off-stream watering.	Contribute to targets for WMU17-03.
WMU17-05	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan.	Exotic flora Degraded riparian vegetation	5	1, 2, 3, 4, Wetlands	Low	94,000	WE25 RL3, 9, 33	Priority weed control on 83.0 km of waterways.	41.5 km of riparian zone with improved ISC Streamside Zone sub-index score. Wetland targets to be determined following benchmarking by IWC project.
WMU17-06	Undertake management of other pest plant species where they are having significant impact on waterway health.		5	1, 2, 3, 4, Wetlands	Low	41,000	WE25 RL3, 33	Weed control on 83.0 km of waterways.	
WMU17-07	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	5	1, 2, 3, 4, Wetlands	Medium	82,000	WE25, RL10	83.0 km of stream with rabbit control.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU17-08	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	5	1, 2, 3, 4	Medium	61,000	RL8 WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU17-09	Identify high priority wetlands and the respective management actions required.	All threats	Wetlands		High	50,000	WE1, 2, 3, 4	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU17-10	Investigate and where necessary address active erosion (bed, bank and/or gully).	Bank erosion Bed instability	5	1, 2, 3, 4	Low	500,000	RL11, 12 ICF5, 6, 29, 30	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU17-11	Investigate impact of rural drainage on flow regimes of waterways.	Changes to flow (flow deviation)	5	1, 2, 3, 4 Wetlands	High	50,000	WE2, 4, 8, 14, 15, 20	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU17-12	Investigate and demonstrate best practice management options for grazing of wetlands to ensure impacts on wetland health are minimised.	Degraded riparian vegetation Stock access	Wetlands		High	75,000	WE22	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU17-13	Monitor wetland extent.	All threats	Wetlands		High	35,000	WE8	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU17-14	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Water quality trend Water quality level Changes to flow (flow deviation)	5	1, 2, 3, 4 Wetlands	High	10,000	RL8, WQ6, WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU17-15	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	5	1, 2, 3, 4 Wetlands	High	275,000	WE9, 10, 12, 13 WQ12 MON3-6, 8-10, 13-16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU17-16	Increase community understanding of waterway health.	All threats	5	1, 2, 3, 4 Wetlands	High	170,000	WE30, 31, RL36, ICF35, EWR56, WQ16, 17, CEE1-3	Contribute to targets set by Communication, Education and Engagement Program 8.	

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU17-17	Actively engage community and stakeholders in managing waterways.	All threats	5	1, 2, 3, 4 Wetlands	High	24,000	WE32, RL37, ICF38, WQ14, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 17 cost summary	
Total Cost of all Actions	\$2,237,000
High Priority Actions	\$959,000
Medium Priority Actions	\$643,000
Low Priority Actions	\$635,000



17.8 overall ISC condition, management action and resource condition targets

Wetland Targets

- No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020 (RCT 4).
- 10 % of wetlands on private land in the Millicent Coast Basin are in excellent condition (as assessed by the IWC) by 2025 (RCT 5).
- Reduced impact on wetlands by invasive species by a level to be determined by 2010 (RCT 6).
- 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020 (RCT 7).

Overall ISC and condition (all actions implemented)

Contribution to regional and Statewide condition targets

Reach 1 ISC score raised from 32 to 40 (Good to Excellent)
 Reach 2 ISC score raised from 29 to 40 (Good to Excellent)
 Reach 3 ISC score raised from 27 to 37 (from Moderate to Good)
 Reach 4 ISC score raised from 26 to 37 (from Moderate to Good)
 Reach 5 ISC score raised from 37 to 42 (maintained at Excellent)

13.0 km (Reach 5) maintained at Excellent
 17.0 km (Reaches 1 and 2) raised from Good to Excellent
 53.0 km (Reaches 3 and 4) raised from Moderate to Excellent

Management Action Target summary

Resource Condition Target summary

199.2 ha of riparian land fenced and/or revegetated
 31.2 ha of priority stream under land management agreement for off-stream watering
 168.0 km of influencing stream under land management agreement for off-stream watering
 Priority weed control on 83.0 km of waterways
 Weed control on 83.0 km of waterways
 83.0 km of stream with rabbit control

41.5 km of riparian zones with improved ISC Streamside Zone sub-index score:

- 1.5 km raised from 4 to 7 in Reach 1
- 7.0 km raised from 5 to 7 in Reach 2
- 7.0 km raised from 3 to 6 in Reach 3
- 19.5 km raised from 2 to 6 in Reach 4
- 6.5 km raised from 6 to 8 in Reach 5

33.5 km of waterway with improved ISC Physical Form sub-index score:

- 7.0 km raised from 5 to 8 in Reach 2
- 7.0 km raised from 6 to 8 in Reach 3
- 19.5 km raised from 7 to 8 in Reach 4

waterway management unit 18. little desert national park system

no waterway reaches in waterway management unit 18

18.1 waterways and their condition

Waterway Management Unit 18, the Little Desert National Park System, contains no waterway reaches and only a small handful of wetlands (Map 4.18). The Little Desert is located on the fine Aeolian Lowan Sand deposits in an area of low precipitation, therefore the limited rainfall tends to run-off these non-wetting sands before infiltrating in localised depressions.

Little is known about this Waterway Management Unit in terms of the condition of the surface water and groundwater. However, Wimmera CMA aims to improve this as the Management Unit is located adjacent to the Heritage River section of the Wimmera River to the east and numerous wetlands to the south. Therefore the responsible management of the Little Desert National Park system will have far-reaching effects on nearby areas, especially in relation to its groundwater. The classification of much of this Management Unit as a national park helps in this regard.

↑ legend

□ Waterway Management Units

18 Waterway Management Unit Number

— River Reaches

■ Wetlands*

— Waterways*

● Priority Wetlands

— Priority Waterways

● Major Towns*

— Major Roads*

□ Wimmera CMA Boundary*

*This data was obtained from the Department of Sustainability and Environment's (DSE) Corporate Library Database.



MAP 4.19 waterway management unit 18 and reaches

18.2 priority waterways

Priority Reaches in Waterway Management Unit 18 are:

- **Broughton's waterholes** (high economic and social values).

There are no priority waterways outside this Waterway Management Unit that are likely to be affected by actions implemented in this Waterway Management Unit.

18.3 influencing waterways

There are no influencing waterway reaches within the Management Unit. However, the condition of non-priority wetlands may affect the priority wetland within the Management Unit, particularly as a source of exotic plants and animals or changes to the water regime.

18.4 primary management objective

The primary waterway health objective for Waterway Management Unit 18 is:

- Protect the social and economic values of the Broughton's waterholes to achieve a balance between economic, social and environmental values.

18.5 risks to waterway health

As there are no waterway reaches within Waterway Management Unit 18, risks to waterway health were not assessed using RIVERS.

Knowledge obtained from the *Wimmera Wetland Condition Assessment Project* (2005) indicates that risks to waterway health in wetlands in Waterway Management Unit 18 include:

- Bed and bank erosion.
- Altered drainage and flow regimes.
- Water quality.
- Exotic flora.
- Exotic fauna.
- Loss of wetland habitat.
- Degraded riparian vegetation.
- Stock access.

18.6 additional benefits

Actions developed to achieve objectives in priority reaches and influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Millicent Coast Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

18.7 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU18-01	Monitor wetland extent.	All threats	Wetlands		High	35,000	WE8	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU18-02	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Changes to flow (flow deviation)	Wetlands		High	10,000	WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU18-03	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	Wetlands		High	275,000	WE9, 10, 12, 13 WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU18-04	Increase community understanding of waterway health.	All threats	Wetlands		High	54,000	WE30, 31, CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8	
WMU18-05	Actively engage community and stakeholders in managing waterways.	All threats	Wetlands		High	16,000	WE32, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8	

Waterway Management Unit 18 cost summary

Total Cost of all Actions	\$390,000
High Priority Actions	\$390,000
Medium Priority Actions	\$0
Low Priority Actions	\$0

18.8 overall ISC condition, management action and resource condition targets

Wetland Targets

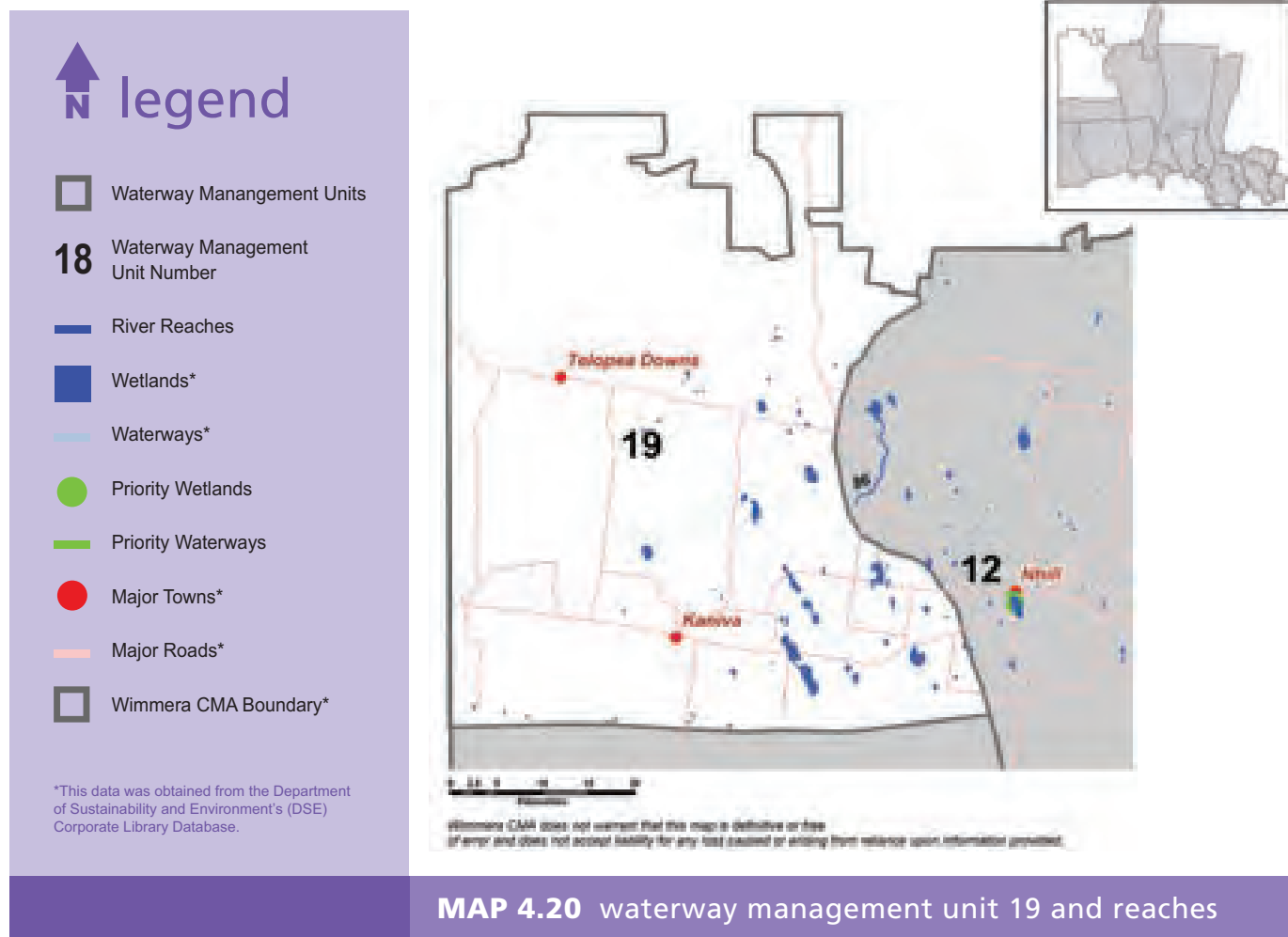
- No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020 (RCT 4).
- Reduced impact on wetlands by invasive species by a level to be determined by 2010 (RCT 6).
- 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020 (RCT 7).

waterway management unit 19. north from the little desert national park

no waterway reaches in waterway management unit 19

19.2 waterways and their condition

The area to the north of the Little Desert National Park and west of Yanac Creek includes the townships of Kaniva and Telopea Downs and is an arid, flat area that contains no waterway reaches. However there are several wetlands located within the southern and eastern portions of Waterway Management Unit 19 (Map 4.20). The wetlands are influenced by the interactions of localised fresh groundwater through the Aeolian Lowan Sands deposit and regional saline groundwater through stranded beach dune formations of the Parilla Sands deposit. Fresher groundwater is found in areas in the west of this Management Unit which are underlain by the Murray Group Limestones.



As this Management Unit comprises part of the Millicent Coast Basin, groundwater flows out of this Management Unit to the north and west, it is important to manage the influences on groundwater quality in this area.

The few wetlands in this part of the catchment are relatively dispersed and isolated, therefore they are particularly vulnerable to the impacts caused by changing land uses. Threats to these fragile systems are posed by salinity, fires, pest plants and animals as well as their use for recreational purposes. Drainage works have altered the condition of several wetlands, in some cases drying out small, ephemeral wetlands and in other cases increasing the volumes of water to create more permanent wetlands. Wimmera CMA continues to conduct research and monitoring activities to investigate and classify the health of these wetlands. This will be increased in time with the completion of projects that are designed to assess the condition of the Wimmera's wetlands.

DSE is currently in the latter stages of developing the IWC. When IWC surveys take place on the wetlands within this Management Unit, Wimmera CMA will be able to obtain a better understanding on their current condition. This benchmarking of wetland conditions will lead to the progressive development of appropriate management techniques.

19.3 priority waterways

There are no Priority Reaches in Waterway Management Unit 19.

There are no priority waterways outside this Waterway Management Unit that are likely to be affected by actions implemented in the Waterway Management Unit.

19.4 influencing waterways

There are no influencing reaches within the Waterway Management Unit. However, the condition of non-priority wetlands in the Management Unit will have an impact on nearby priority wetlands (particularly invasive species and water regime changes).

19.5 primary management objective

The primary waterway health objective for priority wetlands in Waterway Management Unit 19 are:

- Manage wetlands and wetland systems in Waterway Management Unit 19 of the Millicent Coast Basin to achieve a balance between economic, social and environmental values.

19.6 risks to waterway health

As there are no waterway reaches within Waterway Management Unit 19, risks to waterway health were not assessed using RIVERS.

Knowledge obtained from the *Wimmera Wetland Condition Assessment Project* (2005) indicates that risks to waterway health in priority and influencing reaches in Waterway Management Unit 19 include:

- Bed and bank erosion.
- Altered drainage and flow regimes.
- Water quality.
- Exotic flora.
- Exotic fauna.
- Loss of wetland habitat.
- Degraded riparian vegetation.
- Stock access.
- Changing land use.

19.7 additional benefits

Actions developed to achieve objectives in influencing reaches will also assist in achieving a number of other targets for the reaches, the Waterway Management Unit and/or the Millicent Coast Basin:

- Contribute to preserving reaches/waterways in geomorphologically pristine condition, restoring high value reaches/waterways and rehabilitating degraded reaches (AT5).
- Contribute to the conservation, restoration and management of linked natural ecosystems, habitats and landscapes to provide increased viability for significant native species and communities (AT9).
- Contribute to an informed and engaged community actively participating in waterway management in the Wimmera CMA region (AT10).

19.8 actions

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU19-01	Implement priority wetland management actions in the Geomorphic Investigation of Wetlands in the Wimmera CMA section of the Millicent Coast Basin (2004) (including the Natimuk-Douglas Lakes).	All threats	Wetlands		High	125,000	WE15	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
ON-GROUND ACTIONS									
WMU19-02	Implement priority wetland management actions in the Wimmera Wetland Condition Assessment Project (2005) report.	All threats	Wetlands		High	125,000	WE16	Identified actions completed.	No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020.
WMU19-03	Undertake fencing and/or revegetation of riparian land.	Bank erosion Degraded riparian vegetation	Wetlands		High	500,000	WE22, RL1, RL2	Targets to be determined.	Targets to be determined following benchmarking by IWC project.
WMU19-04	Encourage alternative watering sources for stock.	Stock access	Wetlands		High	20,000	WE22, RL5	Targets to be determined.	
WMU19-05	Undertake rabbit control in priority areas as per the Wimmera Rabbit Action Plan (2000-2005).	Exotic fauna	Wetlands		Medium	100,000	WE27	Targets to be determined.	Resource Condition Targets as per Wimmera Rabbit Action Plan (2000-2005).
WMU19-06	Undertake management of priority weed species (Eg. Bridal Creeper, Patterson's Curse, St Johns Wort, Chilean Needle Grass and Serrated Tussock) as defined in the Wimmera Weed Action Plan (2000-2005).	Exotic flora Degraded riparian vegetation	Wetlands		Low	115,000	WE25, 27	Targets to be determined.	Reduced impact on wetlands by invasive species by a level to be determined by 2010.
WMU19-07	Undertake management of other pest plant species where they are having significant impact on waterway health.		Wetlands		Low	50,000	WE25, 27	Targets to be determined.	
WMU19-08	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) to reduce the impact of groundwater intrusion on waterway health.	Water quality trends Water quality attainment	Wetlands		Medium	75,000	WE17, WQ6	Planting and groundwater pumping actions implemented as identified.	Site specific salinity targets to be set by 2010.

Ref.	Action	Threats	Priority Reaches	Influencing Reaches	Priority	Indicative Cost \$	Link to Action in Part 5	Contribution to Targets	
								MAT	2025 RCT
INVESTIGATIONS, RESEARCH AND MONITORING									
WMU19-09	Identify high priority wetlands and the respective management actions required.	All threats	Wetlands		High	50,000	WE1, 2, 3, 4	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU19-10	Monitor wetland extent.	All threats	Wetlands		High	35,000	WE8	Monitoring program implemented and actions developed.	Targets set by Adaptive Management Framework.
WMU19-11	Investigate impact of rural drainage on flow regimes of waterways.	Changes to flow (flow deviation)	Wetlands		High	50,000	WE2, 4, 8, 14, 15, 20	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU19-12	Investigate and demonstrate best practice management options for grazing of wetlands to ensure that impacts on wetland health are minimised.	Stock access	Wetlands		High	75,000	WE22	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU19-13	Gain a sound understanding of groundwater flow systems, the interaction between surface and groundwater and groundwater impacts on waterway health.	Changes to flow (flow deviation)	Wetlands		High	10,000	WE21	Investigation completed and actions developed.	Targets set by Adaptive Management Framework.
WMU19-14	Undertake water health monitoring at priority sites to establish condition and trend in waterway health.	All threats	Wetlands		High	275,000	WE9, 10, 12, 13 WQ12 MON3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16	Monitoring program implemented.	Targets to be set in subsequent Waterway Health Strategy reviews.
COMMUNITY COMMUNICATION, EDUCATION AND ENGAGEMENT									
WMU19-15	Increase community understanding of waterway health.	All threats	Wetlands		High	54,000	WE30, 31 CEE1, 2, 3	Contribute to targets set by Communication, Education and Engagement Program 8.	
WMU19-16	Actively engage community and stakeholders in managing waterways.	All threats	Wetlands		High	16,000	WE32, CEE4	Contribute to targets set by Communication, Education and Engagement Program 8.	

Waterway Management Unit 19 cost summary

Total Cost of all Actions	\$1,675,000
High Priority Actions	\$1,335,000
Medium Priority Actions	\$175,000
Low Priority Actions	\$165,000

19.9 overall ISC condition, management action and resource condition targets

Wetland Targets

- No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020 (RCT 4).
- 10 % of wetlands on private land in the Millicent Coast Basin are in excellent condition (as assessed by the IWC) by 2025 (RCT 5).
- Reduced impact on wetlands by invasive species by a level to be determined by 2010 (RCT 6).
- 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the IWC) by the year 2020 (RCT 7).

cost summary

The total indicative cost of implementing the priority actions in priority and influencing waterways under the *Wimmera WHS* is \$55,367,500 (Table 4.45).

It is also important to note that these costs are indicative and will be refined through the development of more detailed action plans for specific sub-catchments or issues/threats.

target summary

Overall regional Resource Condition Targets and Management Action Targets for priority waterways, reaches and actions were developed by adding the targets for the individual management units described above.

Targets are reported in Table 4.46 and Table 4.47 against the implementation and Resource Condition Target requirements of the *VRHS*. Further targets are developed and incorporated into the Waterway Management Programs detailed in Part 5 of the Strategy.



TABLE 4.45 indicative costs for implementing actions in priority and influencing reaches in the 19 waterway management units

waterway management unit		indicative cost (\$)
01	Upper Wimmera River system	5,008,500
02	Mt Cole Creek system	12,073,500
03	Wattle Creek system	5,965,500
04	Concongella Creek system	3,777,500
05	Upper Mt William Creek system	3,508,000
06	Lower Mt William Creek system	2,592,500
07	Grampians system	1,529,000
08	MacKenzie River and Burnt Creek system	3,156,500
09	Norton Creek system	1,677,500
10	Lake Toolondo Creek system	621,000
11	Natimuk Creek system	726,000
12	Heritage River system	2,387,500
13	Terminal Lakes system	2,923,500
14	Yarriambiack Creek system	2,355,500
15	Dunmunkle Creek system	1,498,500
16	Millicent Coast Lakes system	1,675,000
17	Millicent Coast west-flowing system	2,237,000
18	Little Desert National Park system	390,000
19	North from the Little Desert National Park	1,675,000
TOTAL		\$55,367,500

Of the total indicative cost, \$33,878,000 is allocated for actions with a High priority, \$11,147,500 are considered for Medium priority actions, and \$10,342,000 are associated with Low priority actions.



TABLE 4.46 management action targets for priority waterways, reaches and actions

implementation requirements under the VRHS	regional targets for priority waterways and reaches
Area of riparian land revegetated	3,583.2 ha of riparian land revegetated and/or fenced (note: 1,223.4 ha as High priority and 1,260.8 ha as Medium priority – remainder as Low priority).
Area of riparian land under management agreements	3,126.9 ha of riparian land under management agreement, mainly for off-stream watering (note: 2,292.0 ha as high priority and 84.0 ha as Medium priority – remainder as Low priority).
Length of river subjected to riparian weed control	1,376.8 km of river subjected to riparian weed control (note: 112.0 km as High priority and 7.2 km as Medium priority – remainder as Low priority).
Number of rivers with negotiated environmental flow regimes	13 waterways with Environmental Water Reserve established.
Number of rivers with improvements made to environmental flow regimes	13 waterways (27 priority reaches) with improved environmental flow regime.
Length of river where instream habitat has been restored	100 km of river with improved instream habitat by reintroduction of woody debris at 18 sites.
Number of barriers where fish passage restored	Potential barriers to fish migration evaluated for 7 Waterway Management Units where identified as a high risk.
Increase in river length made accessible for fish movement	Target to be determined by investigations of potential barriers.
Level of reduction in nutrient loads from priority sources within catchment	A 33% reduction in total phosphorous levels from priority sources within the Wimmera Basin.
Number of plans developed for areas of high social value	No new plans identified, but existing plans (e.g. Wimmera Heritage River Waterway Action Plan 2005 and other Waterway Action Plans) implemented.

TABLE 4.47 resource condition targets for priority waterways, reaches and actions

resource condition target requirements under the VRHS	regional targets for priority waterways and reaches
Length of river in Excellent or Good condition (as measured by the ISC).	534.0 km of river in Excellent or Good condition: <ul style="list-style-type: none"> - 27.0 km maintained in Excellent condition - 130.0 km raised from Good or Moderate to Excellent condition - 76.0 km maintained in Good condition - 301.0 km raised from Moderate or Poor to Good condition.
Establishment of Environmental Water Reserve and improved flow regimes achieving environmental flow objectives.	Environmental Water Reserve established and improved flow regimes achieving environmental water release objectives in 27 high priority reaches.
Reduction/improvement in nutrient loads/concentrations at key monitoring sites.	A 33% reduction in total phosphorous loads from 2003 levels in the Wimmera Basin (measured at Tarranyurk gauging station).
Reduction/improvement in salinity loads/concentrations at key monitoring sites.	A 10% reduction in total salinity loads from 2003 levels in the Wimmera Basin (measured at Tarranyurk gauging station).
Reduction/improvement in sediment loads/concentrations at key monitoring sites.	No specific load or concentration target has been set.
Length of river protection/improvement in riparian condition (ISC Streamside Zone sub-index).	786.0 km of river with improved riparian condition (increased ISC Streamside Zone sub-index).
Length of river protection/improvement of ISC Physical Form sub-index.	645.5 km of river with improved physical form (increased ISC Physical Form sub-index).
Representative and Ecologically Healthy Waterways in Good or Excellent condition (as measured by the ISC).	No Representative or Ecologically Healthy Waterways in Good or Excellent condition.
Value of Heritage Rivers maintained.	All identified environmental and social values of Heritage River Management Unit 12 maintained.
% or relevant SEPP (WoV) objectives met for key monitoring sites.	No specific target set.
Protection/improvement of aquatic life (as measured by the ISC Aquatic Life sub-index) at key monitoring sites.	Aquatic life protected in 180.0 km of rivers as measured by the ISC Aquatic Life sub-index.

part five

waterway health programs

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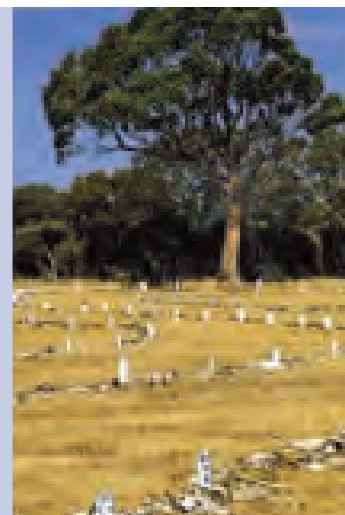
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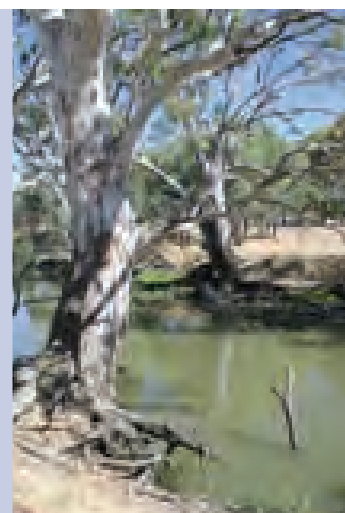
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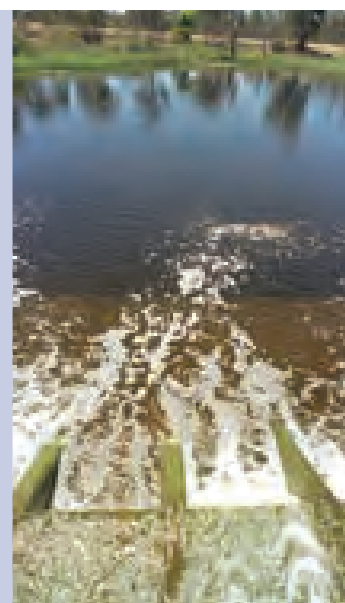
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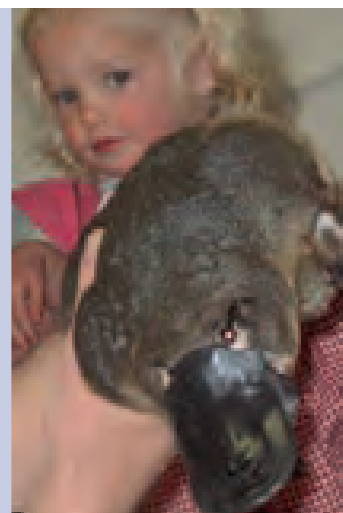
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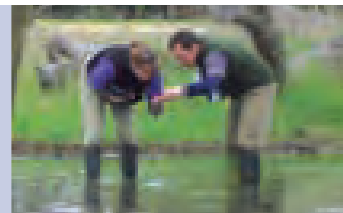
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introduction

wimmera waterway health strategy

The *Wimmera WHS* has been designed to be delivered in eight programs targeting the key areas of waterway management (floodplains, wetlands, riparian land, instream habitat and channel form, Environmental Water Reserve management, water quality and significant flora and fauna) with a further two focusing on communication, education and engagement and adaptive management (monitoring and evaluation).

Wimmera CMA has developed programs to address waterway health issues. These programs can be considered to be an expression of the body of knowledge that exists on an issue. It is intended that this part be read as being applicable in multiple Waterway Management Units and waterways.

The programs of the Wimmera WHS (in no priority order) are:

- Floodplain Management.
- Wetland Management.
- Riparian Land Management.
- Instream Habitat and Channel-form Management.
- Environmental Water Reserve Management.
- Water Quality Management.
- Significant Flora and Fauna.
- Communication, Education and Engagement.
- Adaptive Management Framework.

Wetland management is included as a program of the *Wimmera WHS* because the region is home to a significant portion of Victoria's wetlands. The strategic actions in the wetland management program have been determined from current knowledge. Although many of the processes underway in wetlands are similar to those underway in streams throughout the region, more research and understanding is needed before wetlands can be discussed with the same confidence as streams. As such, when wetlands are mentioned specifically, it should be noted that the particular discussion does not then apply across the whole region, but only to wetland areas.

This part of the *Wimmera WHS* identifies resource condition and management action targets, as well as strategic actions to achieve these targets. The individual programs contained within this part of the Strategy can be read separately, however there are links to other sections of the Strategy, so as to avoid unnecessary duplication.

While most of the programs deal with on-ground actions, two additional key programs are communication, education and engagement and adaptive management framework.

The communication, education and engagement section focuses on achieving a common picture of a healthy waterway through long-term change in behaviour by all agencies and the community.

The goal of the communication, education and engagement actions in the *Wimmera WHS* is to bring about this change in behaviour. Changed behaviour will result in a fundamental shift in the way waterways are managed by all agencies and the community.

The core elements of communication, education and engagement activities in the Wimmera WHS are:

- Establishing partnerships with stakeholders.
- Establishing the transfer of information between stakeholders.
- Increasing the knowledge base, and therefore the abilities, of stakeholders to improve waterway health.

The adaptive management framework for the Strategy is intended to be a learning and reporting mechanism on the success of the actions contained in the Strategy, as well as of their implementation. The adaptive management framework will provide the information necessary when undertaking a review of the *Wimmera WHS* in years to come.

program 1 floodplain management

wimmera waterway health strategy

1.1 introduction

Floodplains provide natural overland flow paths and storage areas where floodwaters remain for slow release as stream heights recede; thereby reducing the potential for channel erosion from high energy flows. Nutrients, debris and sediment settle out during this process, protecting waterways from high sediment and nutrient loads and contributing to floodplain productivity. Floodplain swamps and billabongs support wetland communities, which have environmental, recreational and tourism values.

One of the major natural functions of floodplains is to convey flood flows and provide temporary natural storages of flood waters. There is also increasing recognition of the ecological significance of floodplains and the interdependence of the health of waterways and floodplains and the role periodic flooding plays in maintaining this connection.

Flood management is a subset of floodplain management, and is focused mainly on activities that control flooding and limit damage to properties caused by flooding.

The aim in flood management is to minimise the risk from flooding, and promote the sustainable use of floodplains in the region through community involvement and best management practice. Effective flood management also requires coordinated involvement of landholders, property developers, communities, local authorities and Local, State and Australian Governments.



The *Wimmera Floodplain Management Strategy* (2001) sets the strategic direction for floodplain management in the Wimmera. It provides Wimmera CMA with its planning framework for future flood-related studies and projects within the region. It is the key document that clarifies and defines roles, responsibilities and cost-sharing arrangements for agencies, authorities and other stakeholders in floodplain management.

Wimmera CMA aims to minimise flood risk and promote sustainable use of floodplains in the region through community involvement and best management practice. To achieve this aim, Wimmera CMA has developed a number of programs that apply across the region.

1.2 assets

Key assets for floodplain management strategic actions are the:

- Floodplains and floodplain wetlands of the Wimmera River Basin.

1.3 values

Environmental, social and economic values of floodplains and floodplain wetlands of the Wimmera River Basin include:

environmental	social	economic
Significant flora Ecological Vegetation Class Significant fauna Width of riparian vegetation Longitudinal continuity of riparian Structural intactness of riparian vegetation Wetland significance Wetland rarity and depletion Heritage River or representative river Sites of significance	Camping Passive recreation European heritage Listed landscape Flagship species	Water supply – irrigation Water supply - proclaimed catchment Infrastructure Land value Tourism

1.4 threats

The key threats to the floodplains and floodplain wetlands of the Wimmera are:

- Altered drainage and flow regimes.
- Loss of native biodiversity.
- Changed channel form.
- Deficient floodplain management.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Earthworks that alter the flow of water.
- Ageing and poorly-managed structures.
- Inappropriate development on floodplains.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge
- Planning deficiencies.
- Lack of adequate/appropriate community knowledge.

1.5 current status

The current status of floodplain management is:

- Current ecological condition of the floodplains of the Wimmera Basin is not known.
- Detailed flood mapping is complete for Horsham, Dimboola and Glenorchy and inundation predictions can be accurately determined in these areas.
- Floodplain mapping for other areas within the Wimmera River Basin is yet to be completed.
- Outputs of flood studies and mapping are yet to be incorporated into planning scheme controls.

1.6 key issues

Loss of biodiversity

The cycle of flooding and drying of floodplains is important to both wetlands and riverine flora and fauna. Certain species of flora and fauna depend on periodic inundation for germination/spawning. The river red gum, one of the region's main riparian species, is one of these. This species dominates a number of Ecological Vegetation Classes (EVCs) in the region.

With biodiversity management in the Wimmera CMA region based around the management of native vegetation - seeking the retention and enhancement of significant EVCs - ensuring the germination of the dominant species is an important step in achieving the goals of biodiversity management.



The conservation value and status of the streams in the Wimmera River catchment have been assessed by Kunert and Macmillan (1988). This study indicates that although the majority of the Wimmera River system stream frontage and floodplain environments are greatly modified, there are still areas with significant values. The most significant values of the Wimmera River identified are the riparian zones of the waterways.

Difficulties arise in maintaining biodiversity on floodplains due to conflicting management arrangements stemming from the stated aims of reducing risk associated with flooding, the aim of maintaining and enhancing the region's biodiversity assets, and the level of agricultural development.

An example of this is fish restocking programs where the lack of access to native grassland areas for spawning, due to that land being under agricultural production, reduces the opportunity for native fish to spawn in the river.

Resolution of these potentially conflicting priorities may lie in the management of floodplain land, in that the current program of fencing off riparian land and undertaking a revegetation program is the accepted approach to balancing the competing priorities of agricultural use and biodiversity management. Specific programs will need to be relied upon to overcome the lack of processes that naturally occur on floodplains.

Built-asset management

Built assets are structures that can impact upon flooding characteristics. They can be channel banks, culverts, drop structures, levees, regulators, roads, railway lines, banks and weirs. Built assets also include buildings such as houses and sheds.

Public built assets will be funded and managed by the relevant authority. Management is to include design, construction, operation, maintenance, emergency planning, monitoring of performance and coordination with adjacent built assets. Regular liaison with public authorities is needed to ensure that appropriate consideration is made when designing new built assets or when alterations are made to existing built assets. This is because of the potential that a lack of information and/or knowledge of floodplain issues may heighten risks associated with flooding events.

The intention is to control new private built assets or upgrades to existing private built assets through municipal planning schemes, by applying a Land Subject to Inundation Overlay (LSIO) or a Floodway Overlay (FO) where applicable. It is noted that this is not currently possible across the whole Wimmera CMA region because there are gaps in the application of these overlays along some waterways. Over time it is anticipated that these gaps will be addressed.

Maintenance of private built assets should be managed by the individual or by community groups where the asset crosses more than one property. Wimmera CMA will help individuals and community groups develop appropriate standards for future management.

Information gaps

Access to readily-available and useable information is important to the functioning of Wimmera CMA and Local Government with respect to floodplain management. At present, flood information is collected by various organisations such as Local Government, water authorities, the Bureau of Meteorology and Wimmera CMA.

A number of flood studies have been completed in the Wimmera CMA region, including *Horsham Flood Study* (2003), *Dimboola Flood Study* (2003), *Glenorchy Flood Study* (2005) and *Lake Bellfield Flood Study* (2001). Information is now available for the areas covered by these studies that allow the extent of inundation associated with different flooding events to be accurately determined. Similar studies are underway for Jeparit, Warracknabeal and Halls Gap.

Further to these studies, Wimmera CMA has also undertaken a project to produce detailed elevation information for the Wimmera River floodplain. With this information, future flood-modelling projects will be able to be prepared more quickly and with consistent base information.

It is important to have a clear understanding of the responsibilities of each organisation in relation to collecting and enhancing flood data to ensure there are no gaps or overlaps. To achieve this, Wimmera CMA will pursue opportunities for sharing flood information with the various organisations and authorities.

Statutory planning processes

A number of recent flood studies have been completed or are in draft form, but are yet to be translated into planning scheme controls. Flood mapping has been completed as a component of these studies, and more accurately delineates flood-prone land. Maps include information about existing data, land subject to inundation, flood depth and floodways. This best available information should be incorporated into planning schemes in a timely manner.

Flood studies need to be translated into planning scheme controls so they have statutory weight and effect. As more flood studies are completed, further planning scheme amendments will be required. In the interim, Local Government is required to review part of its planning scheme known as the Municipal Strategic Statement (MSS) every three years. This review process is an opportunity to identify future work required to achieve a high level of knowledge and understanding of floodplain management issues.

1.7 objectives

Floodplain management objectives are to:

- Manage floodplains to minimise flood risk and damage to people and property.
- Enhance the ecological values of floodplain environs of the Wimmera.
- Improve our knowledge of Wimmera floodplains and their flood characteristics.
- Achieve a balance between economic, social and environmental values on Wimmera floodplains.

1.8 targets

Aspirational Targets

- AT1. Floodplains of the Wimmera River Basin managed to maintain their ecosystem services while protecting social, cultural and economic assets.
- AT2. Utilise flow savings from the Wimmera Mallee Pipeline to fulfill the environmental water requirements of floodplains in the Wimmera River Basin.

Resource Condition Target (10-20 years)

- RCT1. The provision of adequate flow regimes to maintain or re-establish lateral connectivity and appropriate inundation of floodplains to ensure adequate environmental water provisions for floodplain productivity and ecological function for seven waterways by 2020.
- RCT2. Net gain in the extent and condition of floodplain EVCs (from the 1999 benchmark) in the Wimmera River Basin by 2020.
- RCT3. A 20% reduction in average annual flood damages by 2020, based on 2002 levels (RCS target).

Management Action Target (1-5 years)

- MAT1. Inventory of extent and condition of floodplain systems in the Wimmera River Basin by 2006.
- MAT2. Develop appropriate Resource Condition Indicators (RCIs) for assessing floodplain ecological condition for the Wimmera River Basin by 2008.



- MAT3. Develop and implement a floodplain monitoring program targeted at floodplain ecological condition by 2010.
- MAT4. Develop and implement a community awareness program for floodplains and their role in biodiversity conservation by 2010.
- MAT5. Complete a Digital Elevation Model for the Wimmera River Basin, including floodplains (to the one-in-100 year flood mark) by 2007.
- MAT6. Adopt DSE Victoria Flood Database outputs in all local planning schemes by 2007 (RCS target).
- MAT7. All planning schemes incorporating best available flood mapping into LSIO, FO and urban floodway zones by 2007 (RCS target).
- MAT8. Complete flood studies for Jeparit, Glenorchy and Warracknabeal by 2006.
- MAT9. Complete floodplain management plans for Jeparit and Glenorchy by 2006.
- MAT10. Incorporate floodplain ecosystem health into the flood decision support system by 2010.

Target Assumptions

Assumptions made during the development of the targets are:

- ISC scores are reflective of mainly the in-channel zones and limited assessment of riparian zone (up to 40 m) of the rivers and streams of the Wimmera River Basin, and as such do not provide information on floodplain health.
- The return of more natural flooding and overbank flows will contribute to the improvement and maintenance of floodplain ecosystem health.
- Floodplain EVCs reflect the nature and extent of native floodplain vegetation.
- Floodplain mapping and digital elevation models will provide adequate information for predicting floods and managing assets on floodplains.
- Floodplain ecosystem health and flood damage can be managed in a compatible manner.

1.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- Resource Condition Indicators (RCIs) for floodplain ecosystem health will be determined in the next five years. In the interim, extent (area in hectares) of floodplain EVCs will be utilised as a RCI.
- Average annual damages from flooding, weighted for climatic conditions such as drought.

1.10 priority waterway management units and reaches

Priority Waterway Management Units and Reaches for floodplain management are:

- Wimmera River Basin Management Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 12 and 14, with priority given to the Wimmera River from Glenorchy to Horsham and Horsham to Jeparit.

1.11 reference documents

Key reference documents for floodplain management are:

- | | |
|---|---|
| • Horsham Flood Study (2003) | • Wimmera Rural Drainage Strategy (2001) |
| • Dimboola Flood Study (2003) | • Victoria Flood Management Strategy (1998) |
| • Glenorchy Flood Study (2005) | • Wimmera River (Glenorchy to Horsham) Flood Scoping Study (2003) |
| • Horsham Floodplain Management Plan (2005) | • Yarriambiack Creek Flood Investigation Study (2003) |
| • Dimboola Floodplain Management Plan (2005) | • Lake Bellfield Flood Study (2001) |
| • Glenorchy Floodplain Management Plan (2006) | • The Victorian Flood Data Transfer Project (2000) |
| • Wimmera Floodplain Management Strategy (2001) | |

1.12 floodplain management strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
FM1	Undertake floodplain management statutory responsibilities under the Water Act 1989.	Wimmera CMA	750,000	RCT3	
FM2	Establish and maintain effective partnerships with the key authorities responsible for flood and floodplain management.	Wimmera CMA, Local Gov't, DSE, GWMWater, BoM, Landholders		RCT3	
FM3	Develop and maintain a sound understanding of flood risk in priority areas of the floodplains of the Wimmera.	Local Gov't, Wimmera CMA		RCT3	MAT5
FM4	Develop and maintain planning scheme mechanisms to allow development and land use practices to be compatible with flood risk on floodplains of the Wimmera.	Local Gov't, Wimmera CMA	50,000	RCT3	MAT7
FM5	Complete flood studies for Jeparit, Warracknabeal, Halls Gap, Landsborough, Natimuk, Great Western, Rupanyup and Navarre.	Local Gov't, Wimmera CMA	500,000	RCT3	MAT8
FM6	Develop and implement floodplain management plans for Jeparit, Warracknabeal, Halls Gap, Landsborough, Natimuk, Great Western, Rupanyup and Navarre.	Local Gov't, Wimmera CMA, BoM, landholders, VicSES	800,000	RCT3	MAT9
FM7	Implement priority structural and non-structural flood mitigation measures that reduce the impacts of flooding on people and property (as identified in flood studies and floodplain management plans).	Local Gov't, Wimmera CMA, BoM, landholders, VicSES	1,000,000	RCT3	
FM8	Facilitate sustainable management of strategic floodplain mitigation structures (levees etc.) on the Wimmera floodplains.	Local Gov't, Wimmera CMA, landholders	500,000	RCT3	
FM9	Develop and implement a program for maintaining and updating flood knowledge and flood mapping along priority waterways.	Wimmera CMA	200,000	RCT3	
FM10	Develop and implement a GIS-based information management system for administering planning permit referrals and flood advice requests.	Wimmera CMA	50,000	RCT3	
FM11	Develop a GIS-based information management system for flood data, establishing a standard for all flood data.	Wimmera CMA	50,000	RCT3	
FM12	Engage the Wimmera community in floodplain management decision-making.	Wimmera CMA, Local Gov't	100,000	RCT3	
FM13	Provide information and learning opportunities to the Wimmera community to develop a sound understanding of best-practice floodplain management.	Wimmera CMA, Local Gov't		RCT3	
FM14	Incorporate new and revised flood maps (from flood studies) into planning schemes.	Local Gov't, Wimmera CMA, DSE	100,000	RCT3, RCT1, RCT2	
FM15	Develop and implement planning controls in planning schemes to minimise the impacts of floodplain development on the health of waterways.	Local Gov't, Wimmera CMA, DSE		RCT1, RCT2	
FM16	Regularly review planning schemes to ensure the appropriate controls are in place to achieve best-practice floodplain management.	Local Gov't, Wimmera CMA		RCT3	
FM17	Prepare planning scheme amendments to give force and effect to the results and recommendations from completed flood studies.	Local Gov't, Wimmera CMA		RCT3	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
FM18	Designate, under the Water Act 1989, new/revised 1% flood levels that have been developed from completed flood studies.	Wimmera CMA	50,000	RCT3	
FM19	Ensure all designated flood levels are up-to-date.	Wimmera CMA		RCT3	
FM20	Upgrade and maintain the flood warning system for the Wimmera.	BoM , DSE, Wimmera CMA, Local Gov't, GWMWater, VicSES	500,000	RCT3	
FM21	Collect real-time information on significant flood events.	Wimmera CMA , Local Gov't, VicSES	500,000	RCT3	
FM22	Develop and maintain community-based flood monitoring networks.	Wimmera CMA , Local Gov't, BoM	50,000	RCT3	
FM23	Develop and maintain detailed flood response sub-plans as part of the Municipal Emergency Response Plans.	Local Gov't , Wimmera CMA, VicSES	50,000		
FM24	Maintain the Wimmera CMA Flood Response Action Plan (2006).	Wimmera CMA	15,000	RCT3	
FM25	Review the Wimmera Floodplain Management Strategy (2001).	Wimmera CMA , Local Gov't, DSE, BoM, GWMWater, VicSES	250,000	RCT1, RCT2, RCT3	
FM26	Undertake an inventory of the current extent and condition of floodplain ecosystems in the Wimmera.	Wimmera CMA , DSE	250,000	RCT1, RCT2	MAT1
FM27	Establish the ecological links between floodplains and waterways of the Wimmera.	Wimmera CMA , DSE			
FM28	Develop appropriate RCIs for assessing floodplain ecological condition in the Wimmera.	Wimmera CMA , DSE	50,000	RCT1, RCT2	MAT2
FM29	Develop and implement a floodplain monitoring program targeted at floodplain ecological condition.	Wimmera CMA , DSE	500,000	RCT1, RCT2	MAT3
FM30	Incorporate floodplain ecosystem health into floodplain management decision making.	Wimmera CMA , Local Gov't, DSE	0	RCT1, RCT2	MAT10
FM31	Develop environmental water requirements for floodplains of the Wimmera.	Wimmera CMA , DSE, GWMWater	100,000	RCT1, RCT2	
FM32	Develop and implement a community awareness program for floodplains and their role in biodiversity conservation.	Wimmera CMA , DSE	100,000	RCT1, RCT2	MAT4
Total Program Cost			\$ 6,515,000		

* The bold name in the responsibility column indicates the lead authority

program 2 wetland management

wimmera waterway health strategy

2.1 introduction

Wetlands in the Wimmera CMA region are an extremely important element of the waterway system. Wetlands are freshwater, brackish or saline, and vary widely in depth, size and shape. Definitions and classifications of wetlands are different at the state, national and international level. At the national level, the Ramsar Convention on Wetlands of International Importance and the Australian Directory of Important Wetlands are used to determine wetland importance.

Surveys of Victorian wetlands began in 1975 with the intention of providing information on wetland distributions, water bird usage and threats. A classification system was developed for Victoria with seven main categories of wetlands identified, based on hydrology and salinity. These categories, known as the Corrick Classification system, are Freshwater Meadows, Shallow Freshwater Marshes, Deep Freshwater Marshes, Permanent Open Freshwater, Semi-permanent Saline Wetlands, Permanent Saline Wetlands and Man-made wetlands. Under these categories, a total of 15 sub-categories based on vegetation have been developed.

The section of the Millicent Coast Basin in the Wimmera CMA region contains the Wimmera's most extensive system of wetlands.

In this area, Wimmera CMA has added another dimension to the classification of wetlands by classifying wetlands based on their geomorphology.

Other wetland systems in the Wimmera River Basin, such as the Natimuk-Douglas Saline Wetland System, are also significant in the region. Also significant are lakes Albacutya and Hindmarsh (also known as the Terminal Lakes) and numerous other wetlands associated with Wimmera River system including Darlot Swamp and Dooen Swamp.

Most, if not all, issues relevant to rivers and streams also apply to wetlands. Although there are obvious differences that distinguish wetlands from rivers and streams, for example, the geomorphology or the biota, of wetlands is still subject to similar risks and threats.

2.2 assets

Key assets for wetland management strategic actions are the:

- Wetlands of the Wimmera River Basin.
- Wetlands of the Millicent Coast Basin.
- Terminal Lakes of the Wimmera River.

2.3 values

Environmental, social and economic values of the assets include:

environmental	social	economic
Significant flora	Fishing	Infrastructure
Ecological Vegetation Class	Non-motor boating	Land value
Significant fauna	Motor boating	Tourism
Invertebrates	Camping	
Width of riparian vegetation	Swimming	
Longitudinal continuity of riparian vegetation	Passive recreation	
Structural intactness of riparian vegetation	European heritage	
Native fish observed/expected	Listed landscape	
Proportion of fish introduced	Flagship species	
Native fish migration		
Wetland significance		
Wetland rarity and depletion		
Sites of significance		

2.4 threats

The key threats to the wetlands of the Wimmera River and Millicent Coast basins are:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Loss of native biodiversity.
- Changed channel form.
- Deficient floodplain management.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Drainage of wetlands and of paddocks to wetlands.
- Unsustainable water harvesting from our waterways.
- Increased runoff from urban areas.

- Point-source and diffuse-source pollution.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Accelerated bed and bank erosion through increased runoff from cleared catchments, changes in hydraulics as a result of road crossings, channel modifications, etc.
- Earthworks that alter the flow of water.
- Weirs and other instream structures creating flow barriers.
- Ageing and poorly-managed structures.
- Inadequate data/knowledge, limited availability and or currency of data/knowledge.
- Planning deficiencies.
- Lack of adequate/appropriate community knowledge.

2.5 current status

The current condition and extent of wetlands is:

- WETLAND_1994 GIS layer is the statewide geospatial database on which wetland inventory data is stored. Information stored on the layer is based on the classification detailed by Norman and Corrick (1980).

Table 2.1 details wetlands in the Wimmera CMA region.

TABLE 2.1 wetlands in the Wimmera CMA region

wetland type	number	area (ha)
Freshwater meadow	1,463	10,954
Shallow freshwater marsh	510	6,938
Deep freshwater marsh	178	4,043
Permanent open freshwater	216	29,182
Semi-permanent saline	189	5,564
Permanent saline	17	489
TOTAL	2,573	57,170

- **Millicent Coast Basin:**

- Condition of the wetlands of the Millicent Coast Basin is generally good based on recent findings. Further assessment through state monitoring programs for the State of the Environment will extend understanding of wetland ecosystem condition in the region. To date, less than 1% of wetlands in the basin have been assessed (Butcher, 2005).

- **Wimmera River Basin:**

- Condition of majority of wetlands in the Wimmera River Basin is not known. The exception is the Natimuk-Douglas Saline Wetland System which has a significant proportion of the state's naturally saline wetlands, the condition of which is generally good (Butcher, 2005).

- **Terminal Lakes:**

- Lake Albacutya suffers from the effects of altered water regime, increased salinity from rising groundwater, grazing pressure and large populations of pest animals and plants. The red gum communities are suffering from dieback.
- Lake Hindmarsh suffers from the effects of an altered water regime and increased salinity from rising groundwater. This has impacted on the vegetation and biodiversity values of the wetland.

2.6 key issues

Altered flow regimes

Earthworks affect the natural drainage; this alteration has the follow-on effect of altering the flooding and drying regimes of wetlands that are fed by this altered flow. This manifests itself in either the wetland being drier for longer or being flooded more regularly and/or for longer. Both situations have the potential to modify the ecology and extent of the wetlands. Flow regimes can also be altered by changes in vegetation cover. Land clearing and other alterations to vegetation cover, particularly in riparian zones, can increase runoff. This can cause changes in water quality and modification of the wetland.



Rural drainage

Rural drainage relates to surface water management, covering all earthmoving activities that alter or impact on water movement. Some aspects include excavated drains, alterations to natural streams, channels, roads, railways and land forming. Rural drainage has the ability to affect water quality of waterways, wetlands and groundwater systems. It also has the ability to alter the biological, chemical and physical attributes of wetlands, which can adversely affect the diversity of aquatic flora and fauna.

Grazing

Managing stock access and grazing pressure to wetlands is critical issue. In areas where restoration is needed to overcome problems created by uncontrolled livestock on wetlands, removing or controlling stock access during the regeneration period is the first and most important step. Long-term management should strive for sustainable grazing that does not cause direct damage to the vegetation cover or wetland integrity. It is critical to closely monitor and manage grazing if it is to be used as a management tool.

Community education and awareness

Community education and engagement is now a key role for most agencies involved in natural resource management. Raising community awareness is a key element in ensuring the community becomes engaged in implementation of actions that address waterway health issues. Wimmera Community Waterwatch and Landcare are examples of programs where members of the community are utilised to undertake waterway management actions while increasing their level of understanding and knowledge of waterway management issues.

Other programs include preparing resource material such as brochures, providing demonstrations at field days, producing field guides and activities with school children such as Wild Games in the West.

2.7 objectives

Wetland management objectives are to:

- Protect the high value wetlands of the Millicent Coast Basin.
- Manage wetlands and wetland systems of the Millicent Coast Basin to achieve a balance between economic, social and environmental values.

2.8 targets

Aspirational

AT3. Wetlands of the Wimmera CMA region in an ecologically healthy condition with no loss of wetland type or extent from 1994 GIS layer.

Resource Condition Target (10-20 years)

RCT4. No net loss in the extent and distribution of wetlands (based on 2005 GIS Layer) in the Millicent Coast Basin by 2020 (RCS target).

RCT5. 10% of wetlands on private land in the Millicent Coast Basin are in excellent condition (as assessed by the Index of Wetland Condition) by 2025 (RCS target).

- RCT6. Reduced impact on wetlands by invasive species by a level to be determined by 2010 (RCS target).
- RCT7. 80% of wetlands in the Millicent Coast Basin are considered to be in good condition (as assessed by the Index of Wetland Condition) by the year 2020.
- RCT8. No net loss of native biodiversity in the Terminal Lakes by 2020 (RCS target).

Management Action Target (1-5 years)

- MAT11. Identify extent and condition of internationally, nationally and regionally-significant floodplain wetlands by 2010.
- MAT12. Investigate the impact of drainage on flow regimes of priority wetlands by 2008.
- MAT13. Develop an ongoing monitoring program to measure the extent of wetlands and wetland types in the Millicent Coast Basin by 2008.
- MAT14. Management plans completed and implementation commenced for two internationally, nationally and regionally-significant wetlands per year by 2010.
- MAT15. Minimum of two field days per year, each year until 2010, aimed at informing on sustainable management of wetlands so as to reduce changes in extent of wetland types through hydrological change and conversion to other uses.
- MAT16. Establish acceptable ranges of variation in key parameters used to measure water quality for shallow inland wetlands by 2010.
- MAT17. By 2010, undertake rapid assessment of wetland condition at 10% of wetlands in the Millicent Coast Basin.
- MAT18. Establish long-term sentinel sites with a representative coverage of wetland type by 2010.
- MAT19. Increase in monitoring of water quality in Millicent Coast Basin wetlands from <1% to 5%. This equates to around 120 sites which can be assessed over a five-year period (not all sites for five years, total of 120 over five years).
- MAT20. Increase monitoring of water quality and condition assessment in Wimmera River Basin to 5% of wetlands by 2010.
- MAT21. Lake Albacutya: undertake a review of the description of ecological character and current management plan by 2010.
- MAT22. Terminal Lakes: No net loss of biodiversity or values for which the systems were listed as important national and international wetlands.
- MAT23. Ensure priority wetlands are considered in planning schemes (e.g. environmental significance overlays) at each municipalities planning review.
- MAT24. Measure condition and extent of wetlands and streams in the Millicent Coast Basin by 2007 (dependant on seasonal conditions).
- MAT25. Implement plan to manage invasive plant and animal species that threaten biological diversity at priority sites by 2010.
- MAT26. Identify invasive species not identified in above plans requiring further research or management by 2007.
- MAT27. Determine mechanisms to control invasive species to protect wetlands by 2007.
- MAT28. Establish threat profile for 80% of wetlands and develop a plan to address these threats by 2010.
- MAT29. Identify priority wetlands across the Wimmera CMA region by 2007.
- MAT30. Wetland condition targets to be developed progressively for internationally, nationally and regionally significant wetlands, commencing with interim targets for internationally and nationally listed wetlands by 2010.

Target assumptions

Assumptions made during the development of the targets are:

- The WETLANDS_2000 layer reflects the current extent and type of wetlands in the Wimmera CMA region.
- The Wimmera Wetland Information System (WWIS) is enhanced to allow sites of international, national and regional importance to be identified.
- The Wetland Condition Report will provide an assessment methodology for continued wetland condition assessment.
- The National Matters for Targets indicators of wetland health will reflect the ecological condition of wetlands in the Wimmera region
- Community education on the ecological values of wetlands will result in improved wetland management on private land, as will targeted extension services to promote sustainable use of wetlands.

2.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- Extent and distribution of wetlands (comparison of pre-European, 1994 layer and recent mapping outputs).
- Ecological character of wetlands based on the RCIs for wetland ecosystem condition:
 - Water colour.
 - Dissolved oxygen and temperature.
 - Extent of inundation.
 - Macroinvertebrate diversity and community composition.
 - Nutrients.
 - Water transparency.
 - Vegetation.
 - Phytoplankton.
- For internationally-recognised (Ramsar) sites, condition indicators to be determined by description of ecological character contained in the relevant site management plan.

Note that upon completion of the DSE Index of Wetland Condition (IWC), the RCI described above will be reassessed and adapted.

2.10 priority waterway management units and reaches

Priority management units and reaches for floodplain management are:

- Wimmera River Basin Management Units 8, 11 and 14 (Darlot Swamp and Doon Swamp).
- Millicent Coast Basin Management Units 16, 17 and 19.
- Terminal Lakes Management Unit 13.

2.11 reference documents

Key reference documents for wetland management are:

- Wimmera Wetland Condition Assessment Project (2005)
- Lake Albacutya Ramsar Site: Strategic Management Plan, Parks Victoria (2005)
- The Environmental Water Needs of the Wimmera Terminal Lakes (2004)
- Directory of Nationally Important Wetlands (2001)
- Geomorphic Investigation of Wetlands in the Wimmera CMA Section of the Millicent Coast Basin Wetland (2004)

2.12 wetland management strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
WE1	Establish threat profile for wetlands.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	250,000	RCT4, RCT5, RCT6, RCT7, RCT8	MAT28
WE2	Identify priority wetlands and their management requirements across the Wimmera CMA region.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders		RCT4, RCT5, RCT6, RCT7, RCT8	MAT29
WE3	Develop a strategic plan for wetland management in the Wimmera.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders		RCT4, RCT5, RCT6, RCT7, RCT8	MAT28, MAT29, MAT30
WE4	Develop and implement management plans for internationally, nationally and regionally significant wetlands.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	MAT14
WE5	Develop wetland condition targets for priority wetlands.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	50,000		MAT30
WE6	Ensure priority wetlands are considered in planning schemes (e.g. environmental significance overlays) at planning review of each municipality.	Wimmera CMA, Local Gov't	50,000	RCT5	MAT23
WE7	Maintain an inventory of all existing data on wetlands.	Wimmera CMA, DSE, DPI, Parks Vic	50,000	RCT4, RCT5, RCT7	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
WE8	Map the current natural and man-made drainage lines and extent of wetlands in the Wimmera.	Wimmera CMA	100,000	RCT4	MAT11
WE9	Develop and implement a monitoring program to monitor wetland extent.	Wimmera CMA , DSE, Parks Vic, Local Gov't	100,000	RCT7	MAT11, MAT13, MAT24
WE10	Undertake the state-wide Index of Wetland Condition assessment on a five yearly basis.	Wimmera CMA , DSE	100,000	RCT7	MAT11, MAT13, MAT17, MAT24
WE11	Develop acceptable ranges of variation for key parameters used to measure water quality for shallow inland wetlands.	Wimmera CMA	20,000		MAT13, MAT16, MAT30
WE12	Establish and monitor (annually) long-term sentinel sites with a representative coverage of wetland types across the Wimmera.	Wimmera CMA	100,000	RCT7	MAT13, MAT18
WE13	Undertake monitoring of water quality in wetlands.	Wimmera CMA	120,000	RCT7	MAT19, MAT20
WE14	Implement the recommendations of the Wimmera Wetland Condition Assessment Project (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE15	Implement the recommendations of the Geomorphic Investigation of Waterways in the Wimmera CMA section of the Millicent Coast Basin (2004) report.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE16	Implement relevant actions in the Land Conservation Council Final Recommendation reports.	Wimmera CMA, DSE , DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE17	Implement relevant actions in the Wimmera Regional Salinity Action Plan (2005) (Wimmera SAP).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE18	Undertake a review of the description of ecological character of Lake Albacutya and the current management plan.	Parks Vic , Wimmera CMA	250,000	RCT8	MAT21
WE19	Implement the wetland management actions in the Lake Albacutya Ramsar Site Strategic Management Plan (2005).	Parks Vic , Wimmera CMA Wimmera CMA, DSE, DPI, Local Gov't	500,000	RCT8	MAT22
WE20	Investigate the impact of artificial drainage activities on flow regimes of priority wetlands.	Wimmera CMA , DSE, GWMWater, Parks Vic, Local Gov't	100,000	RCT4, RCT5	MAT12
WE21	Gain a sound understanding of the relationships between surface and groundwater at priority wetland sites.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, Landholders	200,000	RCT4, RCT5	
WE22	Investigate and demonstrate best-practice management options for grazing of wetlands to ensure that impacts on wetland health are minimised.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, Landholders	200,000	RCT4, RCT5, RCT6, RCT7 RCT8	
WE23	Investigate and develop strategies for emerging pest plants and animals in wetlands of the Wimmera.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, Landholders	100,000	RCT6, RCT7	MAT26
WE24	Map the extent of priority terrestrial and aquatic pest plants and animals that are impacting on the health of wetlands, prioritise sites and target onground action.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	200,000	RCT6, RCT7	MAT26

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
WE25	Identify invasive pest plant and animal species which require further research or management.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	20,000	RCT6, RCT7	MAT26
WE26	Determine mechanisms to control invasive pest plant and animal species to protect wetlands.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	50,000	RCT6, RCT7	MAT27
WE27	Implement management of invasive priority pest plant and animal species that threaten biological diversity of wetlands.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	500,000	RCT6, RCT7	MAT25
WE28	Identify and protect high priority native flora and fauna species that are at risk and/or are on the Victorian rare or threatened species list.	Wimmera CMA, DSE , DPI, Parks Vic, Local Gov't	500,000	RCT8	
WE29	Establish and maintain partnerships with key stakeholders, community groups and individuals.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	50,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE30	Raise awareness of the environmental, social and economic values of wetlands.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE31	Provide information, pathways and resources to assist land managers to address wetland management issues on their individual wetlands.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	200,000	RCT4, RCT5, RCT6, RCT7, RCT8	
WE32	Conduct field days on best-practice wetland management to share information and knowledge between land managers on sound management practices to protect wetlands.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	100,000	RCT4, RCT5, RCT6, RCT7, RCT8	MAT15
WE33	Develop and implement market-based incentives for the provision of environmental services on private land, which benefit the broader community.	Wimmera CMA	500,000	RCT4, RCT5, RCT6, RCT7, RCT8	
Total Program Cost			\$ 7,410,000		

* The bold name in the responsibility column indicates the lead authority

program 3 riparian land management

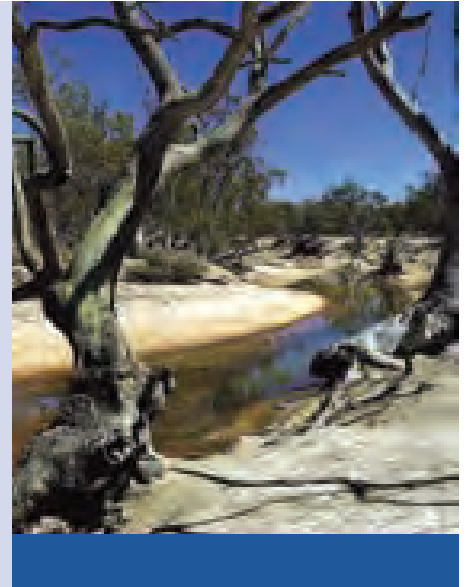
wimmera waterway health strategy

3.1 introduction

Riparian land is any land that adjoins or directly influences a body of water. It includes:

- The land immediately alongside creeks and rivers, including the riverbank itself.
- Gullies and dips which sometimes run with surface water.
- Areas surrounding lakes and wetlands.
- Wetlands on floodplains that interact with the river in times of flood.

It is important not to think of riparian land as just a narrow strip along or around the banks of streams and wetlands. Depending on the nature of the land and the surrounding land use, the width of riparian land that needs special management will vary. Riparian land is often more productive than other land, with better, more moist soils. Riparian land also plays an important role in the life cycle of many native animals and plants. By its very nature, riparian land is fragile, and overuse can cause it to deteriorate.



In the Wimmera, most impacts on riparian land emerge from agricultural use of land for cropping and stock grazing. Using riparian land for recreational purposes also has a significant impact on this land system.

Managing riparian land revolves mainly around managing the vegetation present in this land system. In maintaining a constant cover of vegetation, a number of objectives relevant to waterway health can be achieved such as maintain biodiversity assets, reduced sediment loads in the waterway and increased water quality. The pursuit of these objectives does not mean riparian land needs to be taken out of production, but it does mean that, due to its fragile nature, the land needs much more careful management. The exact nature of this management will depend on a range of factors that will differ from place to place; being highly dependant on the soil type, vegetation type and adjoining land use.

Good reasons to better manage riparian land include:

- Decreased erosion.
- Improved water quality.
- Healthy ecosystems.
- Maintaining river courses.
- Easier to manage stock.
- Decrease in insect pests.
- Increase in capital values.
- Shelter effects.
- Opportunities for diversification.
- Retained nutrients.
- Lowered watertables.
- Increased fish numbers.
- Landscape refuge.
- Decreased algal growth.
- Ecotourism.

Key management practices currently underway that address protection of riparian land centre on fencing and revegetating the riparian zone.

Fencing off riparian land ensures that access to the land is controlled. Uncontrolled stock access to riparian land can lead to excessive runoff, bank erosion, loss of productive land, habitat loss, reduced water quality and damage to instream ecosystems. Maintaining native vegetation in riparian areas is the preferred method for addressing these issues.

3.2 assets

Key assets for riparian land management strategic actions are the:

- Wetlands and streams of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.
- Terminal Lakes of the Wimmera River.

3.3 values

Environmental, social and economic values of the assets include:

environmental	social	economic
Significant flora	Camping	Water supply - proclaimed
Ecological Vegetation Class	Passive recreation	catchment
Significant fauna	European heritage	Infrastructure
Width of riparian vegetation	Listed landscape	Land value
Longitudinal continuity of riparian vegetation	Flagship species	Tourism
Structural intactness of riparian vegetation		
Wetland significance		
Wetland rarity and depletion		
Heritage River or representative river		
Sites of significance		
Ecological river health		

3.4 threats

The key threats to the riparian zones of Wetlands and Streams of the Wimmera River and Millicent Coast basins and the Terminal Lakes of the Wimmera River are:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Loss of native biodiversity.
- Changed channel form.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Accelerated bed and bank erosion through increased runoff from cleared catchments, changes in hydraulics as a result of road crossings, channel modifications, etc.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge.
- Lack of adequate/appropriate community knowledge.

3.5 current status

The current condition of riparian land is:

- **Wimmera River Basin:**
 - ISC Scores (2004) for streamside vegetation – average score of 4.8 out of 10. The highest scores were for the streams that flow through the Grampians National Park. The lowest scores were for the upper tributaries of the Wimmera River that have their headwaters in the Great Dividing Range and Black Range.

- **Millicent Coast Basin:**

- ISC Scores (2004) for streamside vegetation – average score of 4.0 out of 10. The streamside vegetation condition ranged from poor to moderate.
- There is currently no standard measure of riparian vegetation for wetlands.

- **Heritage River:**

- ISC Scores (2004) for streamside vegetation – average score 6.0 out of 10. Moderate to good condition streamside vegetation was observed along many parts with numerous large trees and a decent understorey.

- **Terminal Lakes:**

- ISC Scores (2004) for streamside vegetation – average score 5.0 out of 10. Outlet Creek was observed to have reasonably intact streamside zone.
- Severe dieback of river red gum and black box communities of Lake Albacutya.
- Degradation of riparian zone at Lake Hindmarsh.

3.6 key issues

Loss of biodiversity

Loss of biodiversity in our riparian zones is a key issue for waterway health. The causes of loss of biodiversity in waterways are:

- Degradation of riparian zones.
- A lack of technical knowledge of environmental requirements of the waterways.
- Pest plants and animals displacing native flora and fauna.
- Deficiencies in institutional and planning arrangements while functioning plans are developed.
- A lack of community knowledge about the importance of riparian land and how to conduct recreation activities to minimise environmental impact.
- Decline of key fauna species.
- Reduced/altered flow regime.
- Degradation of water quality.

Pest plants and animals

Pest plants and animals are a significant threat to the waterway assets of the Wimmera CMA region. The *Wimmera Weed Action Plan* (2000-2005) details priority species for investment and management. However, the problems associated with other weed species should not be underestimated. The *Wimmera Rabbit Management Action Plan* (2000-2005) details priority areas for rabbit control.

While pest plant and animal management efforts in the Wimmera concentrate on priority weeds and rabbits, there are a number of species that may have a significant impact on waterway health. For example, water hyacinth has been previously recorded in the Wimmera although it is not present now.

Red gum dieback

The viability of the riparian vegetation, particularly the river red gum community, is threatened. Severe dieback is now apparent in the river red gum and black box communities along waterways in the Wimmera. The most likely factors behind this are extended period of low rainfall, rising groundwater levels, increasing saline groundwater intrusion and reduced occurrence of floods.

Firewood collection

The decomposition of tree wood adds to the nutrient content of riparian soils and the water in waterways. Although removing wood from riparian areas is not permitted without a permit, the combination of the size of the region, the length of its waterways, land tenure, and the remoteness of much of the region, makes it hard to effectively regulate firewood removal. The permit system for removing firewood, administered by DSE, is an attempt to regulate the removal of wood. Difficulties are present in administering this system due to a lack of knowledge surrounding the legality of removal, and in the enforcement of the regulation.

Fencing off riparian land may help retain fallen timber (woody habitat) in some locations by making access more difficult, but this alone will not resolve the issue. Investigating best management practice for woody habitat management will help in developing a strategy for the long-term management of this issue.

Stock access

Animals tend to prefer riparian frontages, and if not managed, will spend much of their time along stream banks. Uncontrolled stock access to riparian land can lead to excessive runoff, bank erosion, loss of productive land, habitat loss, reduced water quality and damage to instream ecosystems. Fencing is the simplest way of managing stock access to riparian land, and there are several methods that can be employed, depending on the management objective.

Recreational pressures

Waterways can also be the focus for many social and recreational activities by which people may measure, consciously or unconsciously, their quality of life. Results from community consultation conducted using the Wimmera RIVERS database show that for every reach in the region at least one social value achieves the highest possible score. This demonstrates quite clearly that regardless of the waterway type or the condition it is in, there is always some attribute of the waterway that people can strongly identify with.

Introducing the community to waterways via a social or a recreational activity is a good way of developing an appreciation of the value of waterways. This then can lead to engagement of the community in the broader process of waterway health planning and priority-setting.

Risks associated with recreational use of waterways include trampling native vegetation and site-hardening in the riparian zone, subsequent erosion resulting from this site-hardening and litter being left by users.

Different forms of recreation will have differing levels of impact. For example, motor sports such as motorcycles and four-wheel drives will have greater impacts on vegetation and stream bed and banks than bicycles and/or walkers. Similarly, the impacts of people accessing waterways for fishing will tend to focus on particular places. As such, differing management regimes will be required to control these activities. Individual park management plans, Crown land reserve management plans, and Crown land lease agreements are the vehicles to address this issue.

3.7 objectives

Riparian land management objectives are to:

- Establish a regional network of protected and maintained riparian zones with high environmental value through fencing, revegetation along with grazing and pest plant and animal management.
- Protect and enhance riparian land and vegetation according to current best practice.

3.8 targets

Aspirational

AT4. To retain or re-establish natural riparian vegetation along all significant waterways and wetlands of the Wimmera region.

Resource Condition Target (10–20 years)

RCT9. Net gain of native instream and riparian biodiversity in the Wimmera River Basin by 2015 (RCS target).

RCT10. 106 km of the Wimmera Heritage River (Reaches 2-5 Wimmera Basin) with improved riparian vegetation (over the 2004 ISC stream side zone scores) by 2025.

RCT11. 539.5 km of waterways of the Wimmera River Basin outside the Heritage River with improved riparian vegetation (over the 2004 ISC stream side zone scores) by 2025.

RCT12. An increase in the extent and health of riparian vegetation of the Wimmera River Terminal Lakes (as assessed by the Index of Wetland Condition) by 2025.

RCT13. A 10% decrease in the current extent of priority weed species in riparian zones of wetlands and streams by 2010.

RCT14. A 10% decrease in current damage caused by rabbits in riparian zones of wetlands and streams by 2010.

RCT15. 593 km of riparian zones in the Wimmera River Basin with an ISC Streamside Zone sub-index score of 7-10 by 2025.

Management Action Target (1–5 years)

- MAT31. Fencing to protect 40 km of waterway frontage from grazing annually in the Wimmera River Basin (RCS target).
- MAT32. Restore former native vegetation along 5 km of waterways annually.
- MAT33. Measure and monitor condition and extent of native aquatic and riparian flora and fauna in the Terminal Lakes by 2007 (RCS target).
- MAT34. Implement the high priority recommendations of the Assessment and Review of Crown Water Frontages in the Wimmera Region (1999) by 2010.
- MAT35. Implement the high priority actions detailed in the *Wimmera Weed Action Plan* (2000) for the control of weed species in riparian zones by 2010.
- MAT36. Implement the actions detailed in the *Wimmera Rabbit Management Action Plan* (2000) by 2010.
- MAT37. 30 ha of riparian land under management agreements annually.
- MAT38. 60 ha of high priority riparian land revegetated annually.
- MAT39. Priority weed control on 5 km of waterways subjected to riparian weed control annually.

Target assumptions

Assumptions made during the development of the targets are:

- Fencing of riparian zones will result in an improvement in riparian vegetation extent and condition.
- Restoring native vegetation will contribute to improved instream health and biodiversity generally.
- ISC scores for streamside vegetation are a true and accurate indicator of the riparian vegetation condition.
- Control of rabbit populations in riparian zones will result in decreased erosion, decreased spread of weed plant species and an improvement in native vegetation extent and health.
- Control of weed species will increase the extent and health of native in the riparian zones of wetlands and streams.
- Implementation of the recommendations of the *Crown Water Frontages in the Wimmera Region* report will result in increased extent and health of native riparian vegetation on private land.

3.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- ISC streamside condition scores for streams and rivers.
- Extent of pest plants and animals in riparian zones.
- Indicators developed in the current DSE Wetland Condition Index.

3.10 priority waterway management units and reaches

Priority management units and reaches for riparian land management are:

- Wimmera River Basin Management Units 1, 2, 3, 4, 5, 6 and 11.
- Millicent Coast Basin Management Units 16, 17 and 19.
- Terminal Lakes Management Unit 13.



3.11 reference documents

Key reference documents for riparian land management are:

- Assessment and Review of Crown Water Frontages in the Wimmera Region (1999)
- The Index of Stream Condition (1999, 2004)
- Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)
- The Environmental Water Needs of the Wimmera Terminal Lakes (2004)
- Biodiversity Actions Plans for the Wimmera Bioregion (NRE, 2002)
- Wimmera River Geomorphic Investigation: Sediment Sources, Transport and Fate (2001)
- Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)
- Burnt Creek Waterway Action Plan (2005)
- Concongella Creek Waterway Action Plan (2003)
- Glendhu Creek Waterway Action Plan (2004)
- Glenlofty Creek Waterway Action Plan (2002)
- MacKenzie River Waterway Action Plan (2004)
- Mt Cole Creek Waterway Action Plan (2005)
- Seven Mile Creek Waterway Action Plan (2003)
- Six Mile Creek Waterway Action Plan (2003)
- Shays Creek Waterway Action Plan (2004)
- Wattle Creek Waterway Action Plan (2005)
- Wimmera River Reach 2 Waterway Action Plan (2003)
- Wimmera River Reach 6.2 Waterway Action Plan (2002)
- Wimmera Heritage River Waterway Action Plan (2005)
- Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan (in prep)
- Spring/Tuckers Creeks Waterway Action Plan (in prep)
- Glenpatrick/Nowhere Creeks Waterway Action Plan (in prep)

3.12 riparian land management strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
RL1	Undertake fencing of riparian land to enable best practice management.	Wimmera CMA	750,000	RCT9, RCT10, RCT11, RCT12, RCT15	MAT32 MAT37
RL2	Revegetate riparian land according to EVC specifications.	Wimmera CMA	500,000	RCT9, RCT10, RCT11, RCT12, RCT15	MAT32 MAT38
RL3	Manage priority weed species that impact on waterway health.	DPI, Wimmera CMA, Landholders	1,250,000	RCT9, RCT10, RCT11, RCT12, RCT13, RCT15	MAT35 MAT39
RL4	Manage rabbits on priority waterways to minimise the impact on waterway health.	DPI, Wimmera CMA, Landholders	1,250,000	RCT9, RCT10, RCT11, RCT12, RCT14, RCT15	MAT36
RL5	Encourage off-stream watering of stock.	Wimmera CMA, DPI, GWMWater, Landholders	320,000	RCT9, RCT10, RCT11, RCT12, RCT15	MAT32
RL6	Implement recommendations of the Assessment and Review of Crown Water Frontages in the Wimmera Region (1999).	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, Landholders	500,000	RCT9, RCT10, RCT11, RCT12, RCT13, RCT14, RCT15	MAT34
RL7	Implement priority riparian management actions in the Land Conservation Council Final Recommendation reports.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT9, RCT10, RCT11, RCT12, RCT13, RCT14, RCT15	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
RL8	Implement relevant actions in the Wimmera SAP (2005) eg. Groundwater pumping near river revegetation.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	
RL9	Implement weed managements on riparian land actions in the Wimmera Weed Action Plan (2000-2005).	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	5,000,000	RCT13	MAT35
RL10	Implement rabbit management on riparian land actions in the Wimmera Rabbit Action Plan (2000).	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	2,000,000	RCT14	MAT35
RL11	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Glenlofty Creek Waterway Action Plan (2002).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL12	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Wimmera River Reach 2 Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL13	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Wimmera River Reach 6.2 Waterway Action Plan (2002).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	200,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL14	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Concongella Creek Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL15	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Seven Mile Creek Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL16	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Six Mile Creek Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL17	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Glendhu Creek Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	250,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL18	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Shays Creek Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	300,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL19	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the MacKenzie River Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	300,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL20	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Burnt Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders,	200,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
RL21	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Wattle Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL22	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Mount Cole Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL23	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Wimmera Heritage River Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	250,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL24	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Spring/Tuckers Creek Waterway Action Plan.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL25	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL26	Implement priority remnant vegetation protection, revegetation, grazing and weed and rabbit management actions in the Glenpatrick/Nowhere Creek Waterway Action Plan.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT9, RCT10, RCT11,RCT12, RCT13,RCT14, RCT15	MAT32 MAT37
RL27	Investigate and demonstrate best-practice management options for grazing of riparian land to ensure that impacts on waterway health are minimised.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, Landholders	200,000	RCT9, RCT15	MAT32, MAT32 MAT34
RL28	Investigate and demonstrate the water quality benefits of sound riparian land management.	Wimmera CMA	500,000	RCT9, RCT15	
RL29	Investigate and develop strategies for emerging pest plants and animals on riparian land of the Wimmera.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, Landholders	100,000	RCT13, RCT14	MAT35, MAT36
RL30	Map the extent of priority terrestrial and aquatic pest plants and animals that are impacting on the health of riparian land, prioritise sites and target onground action.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	200,000	RCT13, RCT14	MAT35, MAT36
RL31	Identify invasive pest plant and animal species which require further research or management.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	20,000	RCT13, RCT14	MAT35, MAT36
RL32	Determine mechanisms to control invasive pest plant and animal species to protect riparian land.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	50,000	RCT13, RCT14	MAT35, MAT36
RL33	Implement management of invasive priority pest plant and animal species that threaten biological diversity of riparian land.	Wimmera CMA, DSE, DPI , Parks Vic, Local Gov't, Landholders	500,000	RCT13, RCT14	MAT35, MAT36
RL34	Identify and protect high priority native flora and fauna species that are at risk and/or are on the Victorian rare or threatened species list.	Wimmera CMA, DSE , DPI, Parks Vic, Local Gov't	500,000	RCT9, RCT12 RCT15	MAT33

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
RL35	Establish and maintain partnerships with key stakeholders, community groups and individuals.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	50,000	RCT9, RCT15	
RL36	Raise awareness of the environmental, social and economic values of riparian land.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT9, RCT15	
RL37	Provide information, pathways and resources to help land managers address riparian land management issues on their individual waterways.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	200,000	RCT9, RCT15	
RL38	Conduct field days on best-practice riparian land management to share information and knowledge between land managers on sound management practices to protect waterways.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	100,000	RCT9, RCT15	
RL39	Develop and implement market-based incentives for the provision of environmental services on private land, which benefit the broader community.	Wimmera CMA	500,000	RCT9, RCT15	
Total Program Cost			\$ 23,490,000		

* The bold name in the responsibility column indicates the lead authority

program 4 instream habitat and channel-form management

wimmera waterway health strategy

4.1 introduction

Each waterway type has particular characteristics, which in turn support different ecological communities and have different nutrient and sediment movements. Understanding the processes occurring in each stream requires an understanding of the geomorphology, or the shape and form of a waterway as influenced by underlying geology and land form, of the waterway. This knowledge then allows management actions that are considerate of the individual characteristics of a waterway.

The Wimmera CMA region has been subject to substantial post-European changes. Such changes have included water harvesting and catchment clearing for agriculture, mining and settlement. The Wimmera River Basin also contains some of Victoria's highest densities of active gully erosion.

Gully erosion is primarily located within the upper catchment and contributes sediment to the waterways. Sediment accumulations within waterways adversely affect river values. In addition, landholders adjacent to waterways have raised concerns regarding sediment accumulations within the river that may increase the occurrence of flooding of their properties.

A number of processes can combine to alter the natural occurrence of sediment transport in the region's waterways. This can mean either the transport of increased sediment, or the lack of transport of sediment. Both situations occur in the Wimmera, and both require management actions to ensure they do not become problematic. Instream management actions are intended to rehabilitate waterways from the effects of direct excavation and incision processes such as headward erosion or gullyng.

Wimmera CMA has completed two geomorphic investigations: *Wimmera River Geomorphic Investigation: Sediment Sources, Transport and Fate* (2001) and *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003). These reports provide guidance on management actions to address instream habitat and channel-form issues in priority waterways.

Stemming from these investigations are Waterway Actions Plans which have been developed, or are in the process of being developed, for a number of priority waterways. These plans contain detailed actions to address the issues of instream habitat and channel-form management.

4.2 assets

Key assets for instream habitat and channel-form management strategic actions are the:

- Streams of the Wimmera River Basin.
- Streams of the Millicent Coast Basin.

4.3 values

Environmental, social and economic values of the streams of the Wimmera River and Millicent Coast basins include:

environmental	social	economic
Significant flora	Fishing	Water supply – irrigation
Ecological Vegetation Class	Non-motor boating	Water supply - proclaimed catchment
Significant fauna	Motor boating	Infrastructure
Invertebrates observed/expected	Camping	Land value
Native fish observed/expected	Swimming	Tourism
Proportion of fish introduced	Passive recreation	
Native fish migration	European heritage	
Heritage River or representative river	Listed landscape	
Sites of significance	Flagship species	
Ecological river health		

4.4 threats

The key threats to the instream habitat and channel form of waterways in the Wimmera River and Millicent Coast basins and the Terminal Lakes of the Wimmera River are:

- Altered drainage and flow regimes.
- Loss of native biodiversity.
- Changed channel form.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Weirs and other instream structures creating flow barriers.
- Ageing and poorly-managed structures.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge currency and availability.
- Lack of adequate/appropriate community knowledge.

4.5 current status

The current condition of instream habitat and channel form of waterways in the Wimmera is:

- **Wimmera River Basin:**
 - Upper Wimmera rivers and streams suffer from extensive gully erosion
 - ISC scores (2004) for physical form average 5.2 out of 10. ISC scores reflect other studies that have identified problems with stream bank and bed stability in the upper Wimmera catchment.
 - ISC scores (2004) for instream habitat (large woody debris) average 1.2 out of 5. Many streams have poor quantities of instream habitat, especially the smaller creeks.
- **Wimmera Heritage River:**
 - ISC scores (2004) for physical form average 5.0 out of 10. Stream banks are generally in a fairly good condition along the Wimmera Heritage River.
 - ISC scores (2004) for instream habitat (large woody debris) average 2.1 out of 5.
- **Millicent Coast Basin:**
 - ISC scores (2004) for physical form average 6.8 out of 10. Mostly very good scores were obtained for the physical form, only affected by low amounts large woody debris.
 - ISC scores (2004) for instream habitat (large woody debris) average 0.7 out of 5. All creeks have very poor instream habitat due to very limited large woody debris (LWD).

4.6 key issues

Changed channel form

Changed channel form in itself is not a management issue because stream channels are naturally dynamic parts of the landscape. However, changes within the catchment have given rise to unnaturally high rates of channel change that threaten adjacent land, built assets on floodplains or habitat values. The main causes of changed channel form are:

- Accelerated bed and bank erosion and deposition.
- Town weirs and other structures that alter natural flow paths.

Determining whether a natural rate of change is occurring and ways to maintain the natural rate has been addressed through a 2001 geomorphic study of the catchment (*Wimmera River Geomorphic Investigation, Sediment Sources, Transport and Fate* (2001)). Onground management actions are necessary to affect the channel protection required to reduce the rate of channel change to natural levels.

Other actions will investigate options to manage weir pools and instream vegetation along the Wimmera River.

Land clearing

Land clearing, or the removal of native vegetation, can result in decreased water infiltration into the soil and increased velocity of water runoff, which can lead to increased bank and bed erosion as there is nothing to bind or hold the soil together. It can also lead to increased sheet erosion from unprotected slopes.

Eighty percent of the Wimmera's native vegetation has been cleared since European settlement. Today, most remaining native vegetation is in parks, reserves and state forests but many examples of the region's forests, woodlands, grasslands and seasonal wetlands occur as isolated remnants.

In many areas, vegetation remnants on private land and roadsides represent the last vestiges of the original vegetation community.

Instream vegetation

Instream vegetation is a natural part of waterway ecosystems, providing much in the way of aquatic habitat and nutrients. Instream vegetation has responded to the changes in water flow and subsequent changes in stream geomorphology resulting from the alterations in flow regimes. It is acknowledged that reed species in the Wimmera such as *Phragmites australis* and *Typha spp.* have expanded their distribution in recent years. This is most likely due to a combination of factors such as increased nutrients, increased salinity, reduced flows, reduced sediment migration, reduced shading from riparian vegetation and restriction of grazing in riparian zones. Managing instream vegetation is only necessary where there is likely to be a significant impact on streamflows, or vegetation is causing additional (i.e. unnatural) rates of bed and bank erosion.

Altered flow regimes

Altered flow regimes have resulted in a significant change in the natural flow regimes of waterways. This has resulted in increased stress on these environments. Depending on whether the flow regime is increased or decreased, erosion (in the case of increased flow) and sedimentation (in the case of decreased flow) will begin to alter the geomorphology of the waterway. Once a waterway has been altered by either of these two processes it is very difficult to return the waterway to its original condition. At this point, the objective becomes to rehabilitate the waterway rather than restore the waterway's natural state.

Excavation

The perception of landholders is that instream vegetation is increasing, thus causing a restriction of flow and leading to increased flooding. Altered flow regimes are reducing flows, causing the channel to respond naturally by constricting; leading to larger areas suitable for instream vegetation growth. In this way it can be seen that increased vegetation growth in a waterway is a symptom of reduced flows, not a cause.

Macrophytes such as *P. australis* do not have significant impacts on flooding, as these plants streamline and provide very little resistance in large flow events. As such, excavation of waterways to remove sediment and thus reduce the opportunity for colonisation by reed species is considered to be a less strategic action compared with erosion control and restoration of more 'natural' flow regimes.

Infrastructure crossings

Road and rail crossings of waterways, in their various forms, have the ability to concentrate the flow of water, leading to gully erosion on the downstream side of the structure/work. These structures may also constrict the flow of water, leading to creation of a backwater effect that may cause increased flooding and sediment deposition upstream.

Removal of fallen timber (woody habitat)

Fallen timber (woody habitat) is an essential component of the natural ecosystem in Australian waterways. Logs that are both in and out of the water can provide nesting places for birds and habitat for many species of vertebrate and invertebrate species. They also provide spawning and hatching sites for native fish. Woody habitat in waterways also acts to increase the aeration of water and provide differential flow velocities along the creek, which is important for promoting opportunities for different plant and animal communities to establish in the waterway.

Common knowledge and understanding

A common knowledge and understanding of waterways and their functions by the community is one of the key impediments to waterway management in the Wimmera CMA region. A lack of knowledge can lead to incorrect assumptions about the best course of action to address issues, resulting in misspent resources. It is important to ensure that decision-making on resource allocation is based on soundly-researched evidence.

The *Wimmera RCS* identifies a strong link between community knowledge and adopting new practices in natural resource management. The *Wimmera RCS* identifies a number of key actions that attempt to overcome issues that emerge from lack of information and knowledge.

Declining water quality

Declining water quality is a key issue in waterway health. Increased sedimentation and turbidity in waterways is of particular concern in instream habitat and channel-form management.

Water with high turbidity levels has poor light penetration, which affects the ecological structure of water bodies because plants require light for photosynthesis. When particulate matters settle, it reduces aquatic fauna habitat and decreases the depth and definition of a waterway. This increases minor flooding possibilities. The potential for pollutants and nutrients entering the water is also increased, as they are often transported attached to sediment.

4.7 objectives

Instream habitat and channel-form management objectives are to:

- Undertake on-ground management actions targeting bed and bank erosion, sedimentation and gully erosion.
- Restore diversity, habitats, connectivity and movement of instream material, through stabilisation and the restoration of channels, banks, substrate and riparian vegetation.

4.8 targets

Aspirational

AT5. Preserve reaches/waterways in geomorphologically pristine condition, restore high value reaches/waterways and rehabilitate degraded reaches through stability assessment, grade control, maintenance of structures, vegetation and stock management.

Resource Condition Target (10–20 years)

RCT16. Improvement in the 'stability condition' of high value streams reaches rated as moderate by the 2004 ISC by 2025 (RCS target).

RCT17. No degradation of high priority reaches from 2004 ISC levels (using the overall ISC score for measurement).

RCT18. 645.5 km of stream with improved ISC Physical form sub-index (over 2004 scores) by 2025.

RCT19. No net loss of woody debris habitat in the Wimmera Heritage River by 2025.

RCT20. 534.0 km of waterway in good to excellent condition (ISC Overall score of 29 or greater) by 2025.

RCT21. 451.0 km of waterway channel in the Wimmera River Basin with an ISC Physical Form sub-index score of 7 -10 by 2025.

RCT22. Nine river reaches in excellent condition (ISC Overall score of 37 or greater) by 2025.

RCT23. All social and environmental values of the Wimmera Heritage River are maintained (from levels assessed when the river was declared a heritage river).

Management Action Target (1–5 years)

MAT40. Implement high priority actions from completed Waterway Action Plans by 2010.

MAT41. Develop, implement and/or review one Waterway Action Plan per year from 2005 to 2010 for priority waterways as identified in the *Wimmera River Geomorphic Investigation Sediment Sources, Transport and Fate* (2002).

MAT42. Implement the recommendations of the *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment* (2003) by 2010.

MAT43. Maintain asset database and repair damaged high priority structures as identified annually in the assets planning process.

MAT44. Develop and implement a community awareness and education program to increase the understanding of instream habitat and channel form by 2010.

MAT45. 15 km of waterway bed and banks stabilised annually.

MAT46. 1 km of instream waterway habitat reinstated annually.

MAT47. 30 km of gully erosion stabilised annually.

Target Assumptions

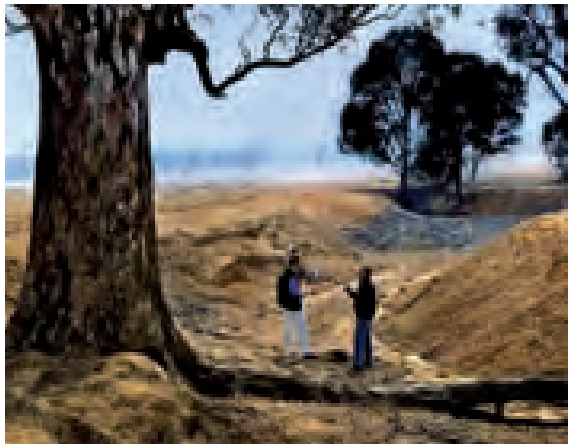
Assumptions made during the development of the targets are:

- Current measures for dealing with gully erosion are effective in reducing turbidity and suspended sediments.
- Waterway Action Plans, once developed and implemented, will significantly reduce degradation of high priority reaches.
- Maintenance and reintroduction of LWD will improve the habitat values of streams within the Wimmera region.
- There are no native, indigenous species of migratory fish within the Wimmera region and as such, there is no obligation to provide passage for fish populations.
- An increase in community awareness of the value of instream habitat and management techniques will result in improved channel form.

4.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- ISC scores for physical form.
- Aerial photography interpretation of vegetation cover.
- Mapping of gully erosion.



4.10 priority waterway management units and reaches

Priority management units and reaches for instream and channel-form management are:

- Wimmera River Basin Management Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14 and 15.
- Terminal Lakes Management Unit 13.
- Millicent Coast Basin Management Unit 17.

4.11 reference documents

Key reference documents for instream and channel-form management are:

- Wimmera River Geomorphic Investigation: Sediment Sources, Transport and Fate (2001)
- Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003)
- Burnt Creek Waterway Action Plan (2005)
- Concongella Creek Waterway Action Plan (2003)
- Glendhu Creek Waterway Action Plan (2004)
- Glenlofty Creek Waterway Action Plan (2002)
- MacKenzie River Waterway Action Plan (2004)
- Mt Cole Creek Waterway Action Plan (2005)
- Seven Mile Creek Waterway Action Plan (2003)
- Six Mile Creek Waterway Action Plan (2003)
- Shays Creek Waterway Action Plan (2004)
- Wattle Creek Waterway Action Plan (2005)
- Wimmera River Reach 2 Waterway Action Plan (2003)
- Wimmera River Reach 6.2 Waterway Action Plan (2002)
- Wimmera Heritage River Waterway Action Plan (2005)
- Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan (in prep)
- Spring/Tuckers Creeks Waterway Action Plan (in prep)
- Glenpatrick/Nowhere Creeks Waterway Action Plan (in prep)

4.12 instream habitat and channel-form management strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
ICF1	Undertake the works on waterways statutory responsibilities under the Water Act 1989.	Wimmera CMA	175,000	RCT16,RCT17, RCT20	
ICF2	Raise awareness and understanding of the need for approval to undertake works on a waterway.	Wimmera CMA	125,000	RCT16,RCT17, RCT20	MAT44
ICF3	Develop Waterway Action Plans for high-priority waterways and sub-catchments.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	240,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40 MAT41
ICF4	Review Waterway Action Plans (after three years).	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	320,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT41

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
ICF5	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Glenlofty Creek Waterway Action Plan (2002).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	250,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF6	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Wimmera River Reach 2 Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF7	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Wimmera River Reach 6.2 Waterway Action Plan (2002).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF8	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Concongella Creek Waterway Action Plan (2003)	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF9	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Seven Mile Creek Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF10	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Six Mile Creek Waterway Action Plan (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF11	Implement priority gully erosion control, bed and bank stabilisation and instream habitat action actions in the Glendhu Creek Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF12	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Shays Creek Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF13	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the MacKenzie River Waterway Action Plan (2004).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	200,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF14	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Burnt Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	300,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF15	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Wattle Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	3,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF16	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Mount Cole Creek Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	600,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
ICF17	Implement priority gully erosion control, bed and bank stabilisation and instream habitat actions in the Wimmera Heritage River Waterway Action Plan (2005).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT19, RCT20,RCT21, RCT23	MAT40, MAT45 MAT46, MAT47
ICF18	Develop Spring/Tuckers Waterway Action Plan and implement priority gully erosion control, bed and bank stabilisation and instream habitat actions.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	1,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF19	Develop Wimmera River Reaches 3, 4, 5 and 6.1 Waterway Action Plan and implement priority gully erosion control, bed and bank stabilisation and instream habitat actions.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	750,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF20	Develop Glenpatrick/Nowhere Creek Waterway Action Plan and implement priority gully erosion control, bed and bank stabilisation and instream habitat actions.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT40, MAT45 MAT46, MAT47
ICF21	Implement key bed and bank stabilisation and instream habitat actions from the Lake Albacutya Ramsar Site Strategic Management Plan (2005).	Parks Vic , Wimmera CMA, Landholders, Local Gov't	250,000	RCT16,RCT17, RCT18,RCT19, RCT20,RCT21, RCT23	MAT40
ICF22	Implement waterway management actions from the Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment (2003).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT19, RCT20,RCT21, RCT23	MAT42
ICF 23	Implement sediment management actions from the Wimmera River Geomorphic Investigation-Sediment Sources, Transport and Fate (2001).	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders, Landcare Groups	500,000	RCT16,RCT17, RCT18,RCT19, RCT20,RCT21, RCT23	MAT41
ICF24	Investigate alternative erosion control techniques.	Wimmera CMA , DPI	100,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT45,MAT47
ICF25	Re-introduce LWD to priority waterways.	Wimmera CMA , Parks Vic, Local Gov't, Landholders	500,000	RCT18,RCT19	MAT46
ICF26	Define template reaches for Wimmera waterways using representative rivers as a basis.	Wimmera CMA	100,000	RCT22	
ICF27	Monitor the movement of existing instream sediment slugs within the Wimmera River.	Wimmera CMA	100,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT45
ICF28	Monitor the stability and condition of existing erosion control structures.	Wimmera CMA , DPI, Local Gov't, Landholders	50,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT43
ICF29	Investigate and where necessary address active erosion (bed, bank and/or gully) in waterways outside Waterway Action Plan areas.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	1,000,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT45, MAT47
ICF30	Maintain and repair priority erosion control structures.	Wimmera CMA , DPI, Local Gov't, Landholders	500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT43

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
ICF31	Map gully erosion in the upper Wimmera region.	Wimmera CMA	250,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT47
ICF32	Monitor and evaluate the process of Waterway Action Plans in achieving improvements in waterway health.	Wimmera CMA	50,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT41
ICF33	Develop and implement a monitoring program for instream habitat, channel form, bed and bank stabilisation and gully erosion control works.	Wimmera CMA	300,000	RCT16,RCT17, RCT18,RCT20, RCT21	
ICF34	Establish and maintain partnerships with key stakeholders, community groups and individuals.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	50,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT44
ICF35	Raise awareness of the environmental, social and economic values of riparian land.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	500,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT44
ICF36	Provide information, pathways and resources to help land managers address riparian land management issues on their individual waterways.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	200,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT44
ICF37	Conduct field days on best-practice riparian land management to share information and knowledge between land managers on sound management practices to protect waterways.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, GWMWater, Landholders	100,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT44
ICF38	Engage members of the community in waterway management through Waterway Action Plans and onground management actions.	Wimmera CMA	100,000	RCT16,RCT17, RCT18,RCT20, RCT21	MAT44
Total Program Cost			\$ 20,110,000		

* The bold name in the responsibility column indicates the lead authority

program 5 environmental water reserve management

wimmera waterway health strategy

5.1 introduction

Private water harvesting from the Wimmera River Basin, combined with developing and operating the Wimmera Mallee Stock and Domestic Supply System (WMSDSS) have combined to significantly-altered natural flow regimes of Wimmera waterways. This altered flow regime has had significant effects on the health of waterways in the region.

The Victorian Government sees maintaining the health of rivers and groundwater as vital in securing Victoria's water for the future. One of the key initiatives from the June 2004 action plan, *Our Water Our Future*, is the establishment of a legal share of water for the environment.

This share of water draws a line on the amount of water we can remove from waterways, maintaining as many features of natural flow patterns as possible.

The environment's share of water is called an Environmental Water Reserve (EWR).

The EWR is not a separate physical construction like a dam. It can be held in existing water supply storages and released into a waterway or it can be run-of-river flow.

Water in the EWR has been legally protected under the *Water (Resource Management) Act 2005*.

In establishing or enhancing the EWR, the Victorian Government will ensure existing water entitlement holders are recognised. In priority catchments, the Government will assess the adequacy of the EWR and in consultation with the community, improve it where necessary.

The EWR will be used to:

- Maintain the environmental values of the water system and the other water services that depend on environmental condition.
- Sustain biodiversity, ecological functioning and water quality.
- Have legal status and be held by the Crown.

Within the Wimmera CMA region there are regulated and unregulated waterways. EWR management covers both regulated and unregulated waterways with differing arrangements in place for their management.

The regulated waterways of the Wimmera include the Wimmera River downstream of Glenorchy, MacKenzie River and Mount William, Burnt, Yarriambiack and Dunmunkle creeks.

In June 2004 the Bulk Entitlement (Wimmera and Glenelg Rivers) Conversion Order was gazetted. The order includes an allocation for the environments of waterways in the Wimmera and Glenelg river catchments. The water allocated to the environment was saved in the Northern Mallee Pipeline Project.

The primary objective for management of the Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order 2004 is to achieve maximum benefits for biodiversity conservation in the rivers, streams and wetlands of the Wimmera and Glenelg basins affected by the WMSDSS. Environmental water is released as individual, or sets of recommended flow components to meet specific waterway and environmental objectives.

Environmental water releases are used to:

- Protect existing high value areas, or areas in good condition.
- Restore areas where the highest environmental benefit will be achieved for the resource invested and there is strong community commitment towards long-term improvement in waterway health.

The Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order 2004 is for the purpose of achieving ecological outcomes. Other types of bulk entitlement allocations are for economic and social outcomes (urban supplies, stock and domestic, irrigation, recreation lakes and compensation flow).

It is expected that some of the water savings achieved from the completion of the Wimmera Mallee Pipeline Project will be passed onto the environment. These allocations will, over time, play a pivotal role in the rehabilitation of the region's biodiversity, and assist in reversing the demonstrable and unsustainable decline in waterway health.

Unregulated waterways of the Wimmera are also flow stressed. Environmental water needs have been determined for each waterway in the Wimmera River catchment and management of harvesting from the waterway needs to take into condition the environmental requirements of the waterway. The *Wimmera WHS* also includes strategic actions to achieve environmental water requirements in the unregulated waterways of the Wimmera.

5.2 assets

Key assets for EWR management strategic actions are the:

- Wetlands and Streams of the Wimmera River Basin.
- Terminal Lakes of the Wimmera River.

5.3 values

Environmental, social and economic values of the assets include:

environmental	social	economic
Significant flora	Fishing	Water supply – irrigation
Ecological Vegetation Class	Non-motor boating	Water supply - proclaimed catchment
Significant fauna	Motor boating	Infrastructure
Invertebrates observed/expected	Camping	Land value
Width of riparian vegetation	Swimming	Tourism
Longitudinal continuity of riparian vegetation	Passive recreation	
Structural intactness of riparian vegetation	European heritage	
Native fish observed/expected	Listed landscape	
Proportion of fish introduced	Flagship species	
Native fish migration		
Wetland significance		
Wetland rarity and depletion		
Heritage River or representative river		
Sites of significance		
Ecological river health		

5.4 threats

The key threats to EWR management in the waterways of the Wimmera River Basin and the Terminal Lakes of the Wimmera River are:

- Altered drainage and flow regimes.
- Loss of native biodiversity.
- Changed channel form.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Unsustainable water harvesting by catchment dams.
- Unsustainable water harvesting from our waterways.
- Weirs and other instream structures creating flow barriers.
- Ageing and poorly-managed structures.
- Inadequate data currency and availability.
- Limited water resource management planning.
- Lack of adequate/appropriate community knowledge.

5.5 current status

The current condition of Wimmera waterways with respect to flows is:

- **Wimmera River Basin:**
 - Flow regimes determined for 27 high priority reaches in the *Bulk Entitlement Conversion: Environmental Flows Study* (SKM, 2003).
 - Provision of 25–50% of these recommended flows in three reaches in the past four years.

- ISC scores (2004) for hydrology average 4.3 out of 10. The lower Wimmera River, Mount William Creek, MacKenzie River and Fyans Creek have been the most impacted by changes to their natural flow regimes.
- ISC scores (2004) for hydrology average 0.5 out of 10 for the Wimmera Heritage River. These very poor scores are attributable to large volumes of water that have been diverted further upstream and show that the natural flow regime has been extremely modified.
- **Millicent Coast Basin:**
 - ISC scores (2004) for hydrology – each reach received 10 out of 10. These scores indicate that the flow regimes are in a pristine state with no water diverted from these creeks.
- **Terminal Lakes:**
 - Lake Hindmarsh and Lake Albacutya (Ramsar site) experience reduced flooding that has impacted on native flora and fauna and thus the ecological character of the site, contrary to Ramsar, environment protection and biodiversity conservation requirements. Lake Hindmarsh has a 39% reduction in fill events compared to natural with a 58% reduction in average fill duration. Lake Albacutya experiences a 90% reduction in fill events with a 42% reduction in average duration (Environmental Water Requirements of the Terminal Lakes, Ecological Associates 2004).

5.6 key issues

Regulation and water harvesting – Wimmera Mallee Stock and Domestic Supply System (WMSDSS)

Regulation and water harvesting through the WMSDSS have significantly altered the flow regime of the Wimmera River and its tributaries. This has had differing effects on the aquatic and riparian environments of the river system. Restoring flow regimes that allow natural stream processes to continue is the preferred outcome from the allocations of water.

Since the construction of the Northern Mallee Pipeline, a total volume of 40,563ML of water is available for allocation to the Wimmera and Glenelg River catchments for environmental purposes. Schedule 2 of the Bulk Entitlement Conversion Order sets out the relative shares of available water. Restoring flow regimes that mimic natural conditions has begun using the environment's allocation of water savings from the Northern Mallee Pipeline. Savings generated through the Wimmera Mallee Pipeline Project will allow further improvements in the environmental health of regulated waterways in the Wimmera.

Water harvesting and catchment dams

Water harvesting in the upper Wimmera, via catchment dams, has had a significant impact on many of the waterways and their tributaries. Many of the waterways in the upper Wimmera are identified as being flow stressed.

Environmental water needs of the Terminal Lakes of the Wimmera River

Studies have shown that the Terminal Lakes flood in a one-in-25-year cycle under natural conditions, however, since water harvesting has been introduced, this has been reduced to a one-in-100-year cycle. The reduced flooding regimes for the Terminal Lakes has resulted in changes to native plant communities and their ability to provide the environmental values for which they have become known.

The Land Conservation Council (LCC) raised concerns about the changed flow conditions in the Heritage River section of the Wimmera River that has led to a reduced frequency of flooding of the Terminal Lakes (Hindmarsh and Albacutya) and Wyperfeld National Park.

The LCC recommended that water savings, such as those anticipated from the Wimmera Mallee Pipeline, be used for the environment. The *Heritage Rivers Act* 1992 formalised the LCC concerns about flooding in Wyperfeld National Park, and states that:

“...on completion of studies of the means of providing environmental water requirements along the Wimmera River and Outlet Creek to the terminal lakes, an adequate proportion of water savings is to be allocated to these requirements.”

The decrease in flow has resulted in a number of environmental, social, and economic consequences. The viability of the riparian vegetation, particularly the river red gum community, is threatened. Severe dieback is now apparent in the river red gum and black box communities of Lake Albacutya and Wyperfeld National Park. The most likely factors behind this are rising groundwater levels, increasing saline groundwater intrusion and reduced occurrence of floods. Other changes occurring within this ecosystem include lake-bed herb fields being replaced by annual weeds, principally as a result of infrequent flooding. Instream barriers such as weirs also impede the passage of instream fauna.

Physical constraints to delivery of environmental water releases

As the Wimmera River is a regulated river for the purposes of the WMSDSS there are built-in constraints to delivering environmental water releases to waterways. These constraints are both physical and operational.

The physical constraints on delivering environmental water releases arise from the design of the various flow control devices that have been constructed within the WMSDSS. These include the:

- Actual size of the outlet from the storage being able to reach a predetermined maximum.
- Physical capacity of the channel that takes the water from the storage to the river.
- Size of, and ability to manipulate, weir pool heights.

Saline groundwater intrusion

Groundwater intrusion into rivers is a naturally-occurring process where the flow of water is derived from groundwater sources. This process is exacerbated by land clearing. Groundwater intrusion into waterways is becoming more of an issue as watertables rise and become increasingly saline, resulting in saline pools forming in the waterway. The term 'saline pool' is used to describe situations where saline water has accumulated in scour depressions in the channel bed, forming a stratified high-density bottom layer or pool characterised by surface-to-bottom conductivity gradients in excess of 1,000 EC. Typically, saline discharge from groundwater, or saline groundwater intrusion, occurs in waterways due to the lower topography bringing the groundwater table closer to the surface. The saline water in these pools can then be transported downstream during periods of higher flow.

As the Wimmera River system is a closed system, it is impossible to remove the salt from the system via naturally-occurring processes, although wind erosion may redistribute salt accumulated in the lakes during dry periods. As such, there is evidence of salt re-entering the Parilla Groundwater system from Lake Hindmarsh via leeching. Increased flow regimes as a component of environmental water releases may act to mix fresh water with the salt water, thus reducing the local effects of the saline pools but causing sudden increases in stream salinity that may be detrimental for aquatic organisms.

Community awareness and understanding

The monitoring of community perception undertaken by Wimmera CMA in 2005 has indicated that the understanding and acceptance of the need for environmental water releases is not widespread throughout the community. To address this issue, Wimmera CMA, together with partner agencies GWMWater, DSE and Glenelg-Hopkins CMA, is implementing a number of community education and awareness programs during the release periods of environmental water releases. These programs aim to highlight the benefits of environmental water releases and the EWR to waterway health in a way that is accessible to the general community.

5.7 objectives

EWR management objectives are to:

- Manage the Wimmera EWR to improve waterway health.
- Achieve minimum environmental water needs of priority rivers and creeks through implementing bulk entitlements, EWR management, recognition of ecological stress, risk-based approaches, and developing the Sustainable Water Strategy for the Wimmera-Mallee.
- Provide environmental water releases to: improve water quality; enable diversity of aquatic and water-dependent flora and fauna ecosystems; and maintain channel form.
- Improve efficiency of consumptive water use to reduce the pressure on waterways through water harvesting.
- Realise savings from the Wimmera Mallee Pipeline to achieve minimum environmental water needs of priority rivers and creeks.

5.8 targets

Aspirational

AT6. Streams and rivers of the Wimmera system to have adequate environmental water release regimes to sustain ecosystem functions, processes and services.

AT7. To utilise the water savings from the Northern Mallee and Wimmera Mallee pipelines to meet environmental water requirements for waterways of the Wimmera region.

Resource Condition Target (10–20 years)

RCT24. Lakes Albacutya (Ramsar site) and Hindmarsh gain appropriate flows to retain their ecological character by 2020.

RCT25. The Wimmera River no longer classified as a stressed river by 2020 (using the flow stress ranking methodology).

RCT26. Establishment of EWR and improved flow regimes achieving environmental water requirements in 13 waterways (27 priority reaches) by 2020.

Management Action Target (1–5 years)

- MAT48. Implement the environmental water requirement recommendations of the Bulk Entitlement Conversion: Environmental Flows Study by 2020.
- MAT49. Diversions in unregulated waterways in the Wimmera River Basin are managed to achieve minimum environmental water needs by 2010.
- MAT50. Wimmera Mallee Stock and Domestic Supply System will be piped by 2015 (RCS target).
- MAT51. Bulk entitlement orders for flora and fauna and consumptive uses to be implemented by 2005 (RCS target).
- MAT52. Implementation of the environmental water requirements identified for the Terminal Lakes by 2025.
- MAT53. Implementation of the Environmental Water Releases Monitoring Program by 2006.
- MAT54. Seven waterways with negotiated environmental water requirements.
- MAT55. Seven waterways with minimum environmental water needs met by 2020.

Target Assumptions

Assumptions made during the development of the targets are:

- That the recommended environmental water releases will have the desired ecological and environmental effects.
- Sufficient rainfall will allow storages in the GWMWater system to allow for adequate environmental water releases.
- Following the completion of the Wimmera Mallee Pipeline, operating/harvesting rules will enable the passing of natural flows that will contribute to meeting environmental water needs of waterways.
- That sharing arrangements between Wimmera and Glenelg rivers will be aimed at producing maximum environmental benefits.
- That the selected monitoring variables (water quality, fish, macroinvertebrates, fish, platypus, vegetation and channel form) will provide the best assessment of the effectiveness of environmental water releases at achieving environmental objectives.
- That the current recommended environmental water releases are sufficient to produce a change in waterway health.
- That the recommended flows are capable of achieving the stated objectives.
- Recommended monitoring will detect changes in waterway health from environmental water releases.
- The delivery, monitoring and adaptive management of environmental water releases will result in improvements in water quality.

5.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- Percentage of high priority reaches with flow regimes in accordance with the *Bulk Entitlement Flows Study* (SKM, 2002).

5.10 priority waterway management units and reaches

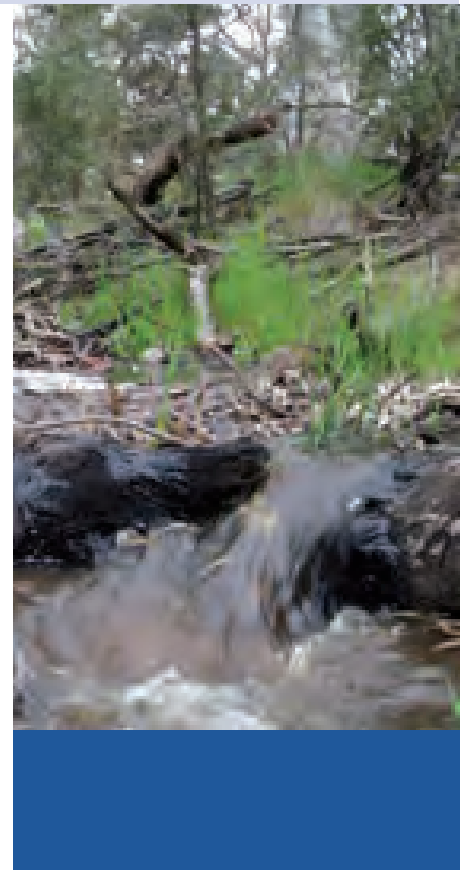
Priority management units and reaches for EWR management are:

- Wimmera River Basin Management Units 4, 6, 7 8, 9, 12, 14.
- Terminal Lakes Management Unit 13.

5.11 reference documents

Key reference documents for EWR management are:

- Stressed rivers project – Environmental flow study Wimmera River system (2002)
- Assessment of environmental water release requirements - Wimmera, Glenelg Hopkins, North Central and Mallee CMAs (2004)
- The Environmental Water Needs of the Wimmera Terminal Lakes (2004)
- Monitoring Environmental Flows in the Wimmera and Glenelg Rivers (2004)
- Wimmera Bulk Entitlement Conversion Environmental Flows Study (2003)
- Environmental Flow Recommendations for Mt William Creek (2005)



5.12 environmental water reserve management strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
EW1	Implement the Wimmera Mallee Pipeline Project.	GWMWater , DSE, Local Gov't, Wimmera CMA, GHCA, NCCMA, MCMA, Landholders	#	RCT24,RCT26	MAT50
EW2	Support the implementation of the Wimmera Mallee Pipeline Project with advice on environmental needs of waterways in the Wimmera.	Wimmera CMA	250,000	RCT24,RCT26	MAT50
EW3	Negotiate operating rules as part of the Wimmera Mallee Pipeline Project that achieve the best possible results for the environment and the Wimmera community.	Wimmera CMA , GHCA, NCCMA, MCMA, GWMWater, DSE, Local Gov't,		RCT24,RCT26	MAT50
EW4	Implement state-wide management rules for water resource management in unregulated waterways of the Wimmera.	GWMWater , DSE, Wimmera CMA	50,000	RCT25	MAT49
EW5	Develop local area management rules for water resource management in unregulated waterways of the Wimmera.	GWMWater , DSE, Wimmera CMA	200,000	RCT25	MAT49
EW6	Undertake statutory responsibilities for water resource management under the Water Act 1989.	Wimmera CMA , GWMWater, DSE	175,000	RCT25	MAT49
EW7	Undertake a detailed monitoring program into the efficacy of bypass mechanisms to pass all summer flows and winter low flows.	Wimmera CMA , DSE, GWMWater, Melbourne Water, Goulburn Murray Water	500,000	RCT25	MAT49
EW8	Develop guidelines for the sizing, design, installation and operation of bypass mechanisms.	Wimmera CMA , DSE, GWMWater, Melbourne Water, Goulburn Murray Water	100,000	RCT25	MAT49
EW9	Monitor streamflows in unregulated waterways of the Wimmera to ensure environmental water requirements are being met.	Wimmera CMA , GWMWater, DSE	250,000	RCT25	MAT49
EW10	Report on meeting environmental water requirements as part of the state-wide annual report.	Wimmera CMA , GWMWater, DSE	50,000	RCT25	MAT49
EW11	Ensure that all new commercial and irrigation dams with a capacity of greater than 20 ML have environmental impact assessments undertaken.	GWMWater , DSE, Wimmera CMA		RCT25	MAT49
EW12	Use best available information on environmental water needs of the waterway when assessing a new commercial/irrigation licence.	GWMWater , DSE, Wimmera CMA		RCT25	MAT49
EW13	Environmental impact assessments conducted for dams greater than 20 ML.	Landholder , GWMWater, DSE, Wimmera CMA	100,000	RCT25	MAT49
EW14	Undertake environmental water requirement assessments for waterways upstream of Glynwylln on the Wimmera River.	Wimmera CMA , DSE, GWMWater	50,000	RCT25	MAT49
EW15	Monitor compliance of surface water diversion licences.	GWMWater , Wimmera CMA, landholders	250,000	RCT25	MAT49
EW16	Implement the sustainable diversion limits for unregulated waterways of the Wimmera.	GWMWater , DSE, Wimmera CMA, landholders		RCT25	MAT49
EW17	Develop detailed trading rules for the waterways of the Wimmera.	GWMWater , DSE, Wimmera CMA	100,000	RCT25	MAT49

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
EW18	Investigate and implement options to return flows during the summer flow period to Heifer Station, Howard and Mt Cole creeks and the Wimmera River at Eversley.	Wimmera CMA , DSE, GWMWater, Landholders	500,000	RCT25	MAT49
EW19	Undertake continuous improvement of the Wimmera-Mallee Resource Allocation Model (REALM) model.	GWMWater , DSE, Wimmera CMA	500,000	RCT24,RCT26	MAT48, MAT51
EW20	Utilise the Wimmera-Mallee REALM model to inform decision making regarding optimum operating rules for the Wimmera Mallee Stock and Domestic Supply System and the Wimmera Mallee Pipeline. The rules should optimise water availability for stock and domestic and environmental uses.	GWMWater , DSE, Wimmera CMA, GHCMA	250,000	RCT24,RCT26	MAT48, MAT51
EW21	Investigate the potential for a more detailed and complex hydrological model with a daily time-step.	GWMWater , DSE, Wimmera CMA, GHCMA	100,000	RCT24,RCT26	MAT48, MAT51
EW22	Develop a daily time-step hydrological model that incorporates water quantity and quality.	GWMWater , DSE, Wimmera CMA, GHCMA	500,000	RCT24,RCT26	MAT48, MAT51
EW23	Implement the Bulk Entitlement (Wimmera and Glenelg Rivers–Flora and Fauna) Conversion Order (2004).	GWMWater , DSE, Wimmera CMA, GHCMA	500,000	RCT24,RCT26	MAT48, MAT51 MAT54, MAT55
EW24	As further savings are made, amend the (Wimmera and Glenelg Rivers–Flora and Fauna) Conversion Order (2004).	GWMWater, DSE , Wimmera CMA, GHCMA	200,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW25	Implement the Wimmera-Glenelg Environmental Operating Strategy 2004-2007.	GWMWater, DSE, Wimmera CMA , GHCMA	300,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW26	Develop and implement the Wimmera-Glenelg Environmental Operating Strategy 2008-2011.	GWMWater, DSE, Wimmera CMA , GHCMA	200,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW27	Develop and implement an Annual Watering Plan for environmental water releases in Wimmera and Glenelg waterways.	GWMWater, DSE, Wimmera CMA , GHCMA	500,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW28	Identify waterways that require detailed environmental water releases recommendations.	Wimmera CMA	10,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW29	Develop environmental water releases recommendations for identified waterways.	Wimmera CMA	50,000	RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW30	Implement environmental water releases recommendations from the Stressed rivers project – Environmental flow study Wimmera River system (2002) and the Bulk Entitlement Conversion: Environmental Flows Study (2003) when water is available.	Wimmera CMA , GWMWater		RCT24,RCT26	MAT48, MAT51, MAT54, MAT55
EW31	Monitor the ecological response to environmental water releases and apply knowledge to improving future environmental water releases.	Wimmera CMA , GWMWater		RCT24,RCT26	MAT53
EW32	Monitor the delivery of environmental water releases and apply knowledge to improving future environmental water releases.	Wimmera CMA , GWMWater		RCT24,RCT26	MAT53
EW33	Report annually to the Minister on environmental water releases.	GWMWater, DSE, Wimmera CMA , GHCMA	50,000	RCT24,RCT26	MAT48
EW34	Report to the Wimmera community on the effectiveness of environmental water releases.	GWMWater, DSE, Wimmera CMA , GHCMA	50,000	RCT24,RCT26	MAT48

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
EW35	Develop a monitoring program that can be implemented during flood events to describe and test the hydrological and ecological responses of the Terminal Lakes to water.	Wimmera CMA	50,000	RCT24,RCT26	MAT53
EW36	Develop a monitoring program to monitor the effects of environmental water releases on groundwater levels along the Wimmera River.	Wimmera CMA	30,000	RCT24,RCT26	MAT53
EW37	Monitor the effects of environmental water releases on groundwater levels along the Wimmera River.	Wimmera CMA	250,000	RCT24,RCT26	MAT53
EW38	Monitor the effects of environmental water releases on water quality.	Wimmera CMA, DSE, GWMWater	500,000	RCT24,RCT26	MAT53
EW39	Monitor the effects of environmental water releases on macroinvertebrates.	Wimmera CMA, Waterwatch Volunteers	500,000	RCT24,RCT26	MAT53
EW40	Monitor the effects of environmental water releases on fish.	Wimmera CMA, DPI, Fishcare Volunteers	500,000	RCT24,RCT26	MAT53
EW41	Monitor the effects of environmental water releases on platypus.	Wimmera CMA, Australian Platypus Conservancy, Landholders, Volunteers	75,000	RCT24,RCT26	MAT53
EW42	Monitor the effects of environmental water releases on birds.	Wimmera CMA, Landholders, Volunteers	250,000	RCT24,RCT26	MAT53
EW43	Monitor the effects of environmental water releases on aquatic and riparian vegetation health and extent.	Wimmera CMA	250,000	RCT24,RCT26	MAT53
EW44	Monitor the effects of environmental water releases on channel form.	Wimmera CMA	375,000	RCT24,RCT26	MAT53
EW45	Ensure that monitoring informs better management and use of environmental water in achieving environmental objectives of priority waterways.	Wimmera CMA	50,000	RCT24,RCT26	MAT53
EW46	Investigate the impacts of environmental water releases on mixing of salinity in pools in the lower Wimmera River.	Wimmera CMA, EPA, Universities	500,000	RCT24,RCT26	
EW47	Conduct a longitudinal physical survey of Outlet Creek, with occasional cross-sections, to better describe the capacity of the flow path and nature of any flow restrictions.	Wimmera CMA, Parks Vic, DSE	50,000	RCT24,RCT26	MAT52
EW48	Conduct a study into the most efficient and effective means of transferring water from the Wimmera Mallee Stock and Domestic Supply System headworks through the Terminal Lakes system while maximising environmental benefits.	Wimmera CMA, GWMWater, Parks Vic	100,000	RCT24,RCT26	MAT52
EW49	Implement the recommendations from the Environmental Water Requirements of the Terminal Lakes Report.	Wimmera CMA	500,000	RCT24,RCT26	MAT52
EW50	Implement priority actions in the Wimmera River Stressed River Report.	Wimmera CMA	500,000	RCT24,RCT26	MAT48, MAT51
EW51	Address priority physical constraints to delivery of environmental water releases.	Wimmera CMA, GWMWater, DSE	2,000,000	RCT24,RCT26	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
EW52	Address priority operation constraints to the delivery of environmental water releases.	Wimmera CMA , GWMWater, DSE	1,000,000	RCT24,RCT26	
EW53	Develop and implement a sustainable water strategy for the Wimmera-Mallee region.	DSE , GWMWater, Wimmera CMA, GHCMA, Local Gov't	500,000	RCT24,RCT26	
EW54	Establish and maintain partnerships with key stakeholders, community groups and individuals.	Wimmera CMA	50,000	RCT24,RCT26	
EW55	Empower community to take ownership of environmental water releases.	Wimmera CMA	100,000	RCT24,RCT26	
EW56	Raise community awareness of the importance and benefits of environmental water releases and the EWR.	Wimmera CMA	250,000	RCT24,RCT26	
Total Program Cost			\$ 14,165,000		

* The bold name in the responsibility column indicates the lead authority

The cost of implementing the Wimmera Mallee Pipeline Project is not included in the implementation of the Wimmera WHS.

program 6 water quality

wimmera waterway health strategy

6.1 introduction

The quality of water in a waterway is a crucial determinant of the overall health of that waterway. Water quality can be described as the condition of water relevant to the measures of a number of parameters compared against their naturally-occurring condition. EC, dissolved oxygen, litter, pathogens, chemicals, pH, temperature, turbidity, macroinvertebrates, salinity and nutrients are the usual parameters used to give an overall indication of water quality.

Wimmera CMA has prepared a *Wimmera Water Quality Strategy* (2002) to address the issue of nutrient inputs to waterways, and a *Wimmera Regional Salinity Action Plan* (2005) to address salinity.

The main causes of water quality problems are:

- Increased runoff from urban areas.
- Point and diffuse pollution sources.
- Salinity and rising watertables.
- Planning and knowledge deficiencies.
- Limited community understanding and awareness of water quality issues and management.

These issues are also exacerbated by a lack of water. Improved water quality is required to ensure the beneficial uses of water can be sustained; yet the Wimmera community believes the attainment of naturally-occurring levels of nutrients is unachievable (*Wimmera WQS*). This divergence demonstrates why a robust planning framework and community understanding is required to address the causes of water quality decline.

The actions identified in the *Wimmera RCS* and the *Wimmera WQS* canvas a range of mechanisms to control point and diffuse sources of pollution in urban and rural settings. In addition, the *Wimmera SAP* identifies key actions to manage the impact of groundwater on water quality of waterways in the region. Turbidity and sediment is primarily addressed via the implementation of Waterway Action Plans.

6.2 assets

Key assets for water quality management strategic actions are the:

- Wetlands and Streams of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.
- Terminal Lakes of the Wimmera River.

6.3 values

Environmental, social and economic values of the assets include:

environmental	social	economic
Significant flora Ecological Vegetation Class Significant fauna Invertebrates observed/expected Width of riparian vegetation Longitudinal continuity of riparian vegetation Structural intactness of riparian vegetation Native fish observed/expected Proportion of fish introduced Native fish migration Wetland significance Wetland rarity and depletion Heritage River or representative river Sites of significance Ecological river health	Fishing Non-motor boating Motor boating Camping Swimming Passive recreation European heritage Listed landscape Flagship species	Water supply – irrigation Water supply - proclaimed catchment Infrastructure Land value Tourism

6.4 threats

The key threats to the water quality in the Wetlands and Streams of the Wimmera River and Millicent Coast basins and the Terminal Lakes of the Wimmera River are:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Changed channel form.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Drainage of wetlands and of paddocks to wetlands.
- Unsustainable water harvesting from our waterways.
- Increased runoff from urban areas.
- Point-source and diffuse-source pollution.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Accelerated bed and bank erosion through increased runoff from cleared catchments, changes in hydraulics as a result of road crossings, channel modifications, etc.
- Inefficient water use – urban and rural.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge.
- Lack of adequate/appropriate community knowledge.

6.5 current status

The current condition of water quality is:

- **Wimmera River Basin:**
 - None of the sites measured in the lower Wimmera region are within *SEPP (WoV)* guidelines.
 - There is currently no physical or chemical water quality criteria for wetlands so status cannot be determined.
 - In 2004, 50% of measured reaches were within the *SEPP (WoV)* guideline of <10 NTU (75th percentile).
 - In 2004 all sites along the Heritage River section of the Lower Wimmera were within *SEPP (WoV)* guidelines for turbidity.
 - Average flow-related stream salinity of 488–680 μ S/cm; mean daily salinity of 1,425–16,189 μ S/cm and total annual salt flow of 184,000 tonnes (*Wimmera SAP*).
 - 25% of sites meet lower Wimmera *SEPP (WoV)* target.
 - 2004 ISC scores for water quality average 6.0 out of 10. The water quality results, though usually good were only obtained from a relatively few locations. The salinity and total phosphorous results were often the limiting factors in calculating these scores.
 - There is limited data on the salinity of wetlands in the Wimmera River Basin.
- **Millicent Coast Basin:**
 - There is currently no nutrient criteria for wetlands so status can not be determined.
 - Turbidity was listed as a concern for Millicent Coast Basin wetlands, however, further work is required to state actual status of turbidity in the region's wetlands. Median values for turbidity during the 2004 wetland condition project were all less than 50NTU, but as these were based on single site visits further data collection is required. There are no turbidity criteria for shallow inland wetlands.
 - Some naturally-saline wetlands and other fresh wetlands are at risk from rising groundwater. Insufficient data for exact figures.
- **Terminal Lakes:**
 - There is no recent information on nutrient status of the Terminal Lakes, nor are there nutrient criteria suitable for such systems (Permanent Open Freshwater.)
 - There is no recent information on turbidity status of the Terminal Lakes.
 - When Lake Hindmarsh last contained water, salinity levels of up to 7,906 μ S/cm were recorded.
 - At the time of writing, the Terminal Lakes are dry.

6.6 key issues

Agricultural development

The major land use within the Wimmera region is agriculture. As such, much of the original vegetation cover of the region has been cleared to make way for agricultural development.

Land clearing, or the removal of native vegetation, can result in decreased water infiltration into the soil and increased velocity of water runoff, which can lead to increased bank and bed erosion as there is nothing to bind or hold the soil together. It can also lead to increased sheet erosion from unprotected slopes.

The removal of native vegetation has resulted in changes in runoff patterns for waterways, thus altering the natural flow regimes.

Rural drainage and earthworks

Rural drainage relates to surface water management, covering all activities that alter or impact water movement across the landscape. Some aspects include excavated drains, alterations to natural streams, channels, roads, railways and land-forming for agricultural development. Rural drainage has the ability to affect the quality of waterways, wetlands and groundwater systems. It has the ability to affect the nutrient, salinity, agrochemical, pH and heavy metal composition of the water, which can adversely affect the diversity of aquatic flora and fauna.

Earthworks associated with agricultural development and ongoing use has the ability to alter the natural drainage of an area, which in turn can have the effect of reducing/increasing the water flow along natural drainage lines, and directing water flow to other areas. It is important that landowners are able to utilise their properties to maximise the productivity of the land and the region, however, they must accept their responsibility when undertaking drainage works and not disadvantage their neighbours or the region in general.

Changes to natural drainage lines have the ability to transport soils, causing an increase in nutrient and turbidity levels in waterways. The increased levels of nutrients and turbidity have the capacity to change the available habitat for the biota of the region's waterways.

Urban development

Water runoff from urban areas has unique characteristics, when compared to natural and agricultural areas. Firstly, runoff occurs faster. Secondly, water quality is reduced by its contamination with detergents, oils and other chemicals, as well as various solids such as litter. Management of urban water runoff therefore needs to be handled separately to ensure it is valued as a resource, rather than being perceived as being part of the waste stream.

Urban waters may include wastewater, stormwater, septic overflow and sewerage. Each of these waters have the ability to adversely affect the quality of specific water bodies by altering the natural levels of nutrients, salt, solids, and various chemicals. It is estimated that the average annual total phosphorous load would be reduced by 5.8 tonnes as a result of implementing actions relating to urban water identified in the *Wimmera WQS*.

Water-sensitive urban design addresses management of runoff from urban areas. Various techniques are available such as constructed wetlands, swale drains, maximising permeable surfaces and rainwater harvesting. The *Wimmera RCS* encourages the introduction of water-sensitive urban design.

Groundwater intrusion

When this saline groundwater enters waterways, as it will do in areas where the watertable is close to the land surface, the salt concentrations in the surface water will increase. This decreases the water quality and impacts on the ability of fauna and flora to survive in the waterway. It may also lead to degraded riparian vegetation, and in turn, impacts on the overall health of the waterway.

Salt content of water is a major consideration in the quality of the region's water. The quality of surface water in Wimmera waterways with respect to salinity is generally rated as fair to poor. The consequences of not taking action include:

- An increased loss of agricultural production.
- Significant public and private infrastructure damage.
- Major environmental degradation.
- The loss of flora and fauna.

Wimmera CMA has developed the *Wimmera SAP*, which focuses on groundwater intrusion as a key issue, to provide the strategic direction in addressing groundwater intrusion issues in waterways.

The main objective of salinity management is to improve water quality and protect the agricultural, environmental and social values of the catchment. This is done by:

- Increasing community awareness and understanding of the salinity control measures.
- Implementing improved land and water management practices.
- Reclaiming salt-affected areas.

Water harvesting

With groundwater resources of very poor quality, having salinity levels well in excess of those suitable for human or stock consumption, development in the Wimmera-Mallee east and north of the Wimmera River must depend almost entirely on surface water supplies from the WMSDSS.

The effect of this water harvesting is to reduce flow rates of waterways below extraction sites. This effect is compounded by instream structures, such as weirs that restrict flow. The overall effects of this is felt most strongly in the lower Wimmera River reaches where reduced flow has increased the occurrence of the river becoming a series of unconnected pools. These pools are affected by saline groundwater intrusion to such an extent that they become as salty as seawater.

Education, awareness, and engagement

Everyday activities and management can adversely affect water quality. These activities can range from washing cars in the street to using waterways for recreational purposes.

The affects can include litter, sediment, agrochemical inputs as well as altering pH, flow and temperature. Changes to these physical and chemical aspects of water quality can adversely affect fauna and flora. These affects can be reduced through knowledge about the impact of our actions on water quality.

Numerous studies have shown that achievements can be made just by undertaking education and awareness programs. As such, communication, education and awareness programs are included as a component of all actions identified in the *Wimmera WQS*.

6.7 objectives

Water quality management objectives are to:

- Coordinate water quality management projects to improve the quality of water in the region's waterways.
- Provide information on the trends in waterway health in relation to water quality.
- Implement priority waterway and catchment land management activities to improve water quality in the region's waterways.
- Work towards meeting *SEPP (WoV)* criteria for water quality.
- Limit nutrients and sediments entering waterways by reducing soil loss from dryland and agricultural areas, and reducing the impact of urban wastewater, stormwater, irrigation and intensive animal industries on receiving waters.
- Reduce the frequency of algal blooms in waterways.
- Reduce stream salinities and the impact of salinity on waterway health.

6.8 targets

Aspirational

AT8. A net increase in water quality across the Wimmera CMA region, with appropriate water quality standards met at all high priority reaches and wetlands.

Resource Condition Target (10–20 years)

RCT27. A 33% reduction in total phosphorus levels from 2003 levels by 2030 (measured at Tarranyurk gauging station 415247).

RCT28. A 60% reduction in algal blooms (from 2003 levels) in the Wimmera River Basin waterways by 2030.

RCT29. No decrease (from 2005 75th percentiles) in the number of sites within *SEPP (WoV)* guidelines for nutrients in waterways of the Wimmera River Basin by 2025 (measured at sites 415246, 415251, 415200, 415207, 415237, 415201 and 415203).

RCT30. Turbidity in all lower Wimmera River Basin waterways (measured at sites 415246, 415251 and 415200) and 50% of upper Wimmera River Basin waterways (measured at sites 415207, 415237, 415201 and 415203) to be within *SEPP (WoV)* guidelines for rivers and streams by 2025.

RCT31. No decrease (from 2005 75th percentiles) in the number of sites within *SEPP (WoV)* guidelines for turbidity in waterways of the Wimmera River Basin by 2025 (measured at sites 415246, 415251, 415200, 415207, 415237, 415201 and 415203).

RCT32. Turbidity of wetlands in the Millicent Coast Basin to conform to site-specific targets (to be developed by 2010) by 2020.

RCT33. Greater than 10% reduction in salt load in the Wimmera River (from 2004 levels in the Salinity Action Plan) by 2025 (measured at Tarranyurk gauging station 415247). *Note that in the event of the Wimmera Mallee Pipeline delivering additional water to the system, this target may have to be revised to reflect concentration of salts, rather than load.

RCT34. A 28% increase in the number of sites meeting the *SEPP (WoV)* targets for salinity (from 2005 levels) by 2020 (measured at sites 415246, 415251, 415200, 415207, 415237, 415201 and 415203).

RCT35. Aquatic life protected in 180 km of waterways in the Wimmera River Basin (ISC aquatic life sub-index score of 7 - 10) by 2025.

Note that RCTs resulting from maintaining or improving the riparian land, reducing erosion and providing more natural flow events, will also contribute to the reduction of nutrients, salinity and sediments in waterways. The specific RCTs are:

- Program 3: Riparian Land Management - RCT10, RCT11, RCT12, RCT13 and RCT14.
- Program 4: Instream Habitat and Channel Form - RCT18.

Management Action Target (1–5 years)

MAT56. Develop nutrient targets by 2007 and conform to these standards by 2010.

MAT57. Establish benchmark ranges of variation in nutrients for wetlands of the region.

MAT58. Monitor water quality in a statistically-valid number of sites in streams and wetlands across the system by 2010.

MAT59. Develop turbidity targets for Wetlands and Streams of the Wimmera River Basin and Millicent Coast Basin by 2010.

MAT60. Establish benchmark ranges of variation in turbidity for wetlands of the region.

MAT61. Develop salinity targets for Wetlands and Streams of the Wimmera River Basin and Millicent Coast Basin by 2010.

MAT62. Revegetation – 500 ha of trees and native vegetation by 2010 and 5,000 ha by 2025.

MAT63. Fully implement the *Wimmera SAP* by 2010.

MAT64. Conduct a minimum of one workshop in each sub-region every two years.

MAT65. Review current monitoring plans by December 2006.

MAT66. Develop site specific salinity targets (EC and/or load) by 2010.

Note that MATs from maintaining or improving the riparian land, reducing erosion and providing more natural flow events, will also contribute to the reduction of nutrients, salinity and sediments in waterways. The specific MATs are:

- Program 3: Riparian Land Management - MAT31, MAT32, MAT34 and MAT36.
- Program 4: Instream Habitat and Channel Form Management - MAT40, MAT41 and MAT42.
- Program 5: Environmental Water Reserve Management - MAT48, MAT49 and MAT52.

Target Assumptions

Assumptions made during the development of the targets are:

- *SEPP (WoV)* guidelines provide a reasonable interim target for salinity, nutrients and turbidity in flowing systems.
- Sufficient water quality data can be collected to allow for accurate, achievable catchment specific water quality targets to be determined (for flowing waters).
- Implementation of environmental water releases will result in improved water quality and habitat in rivers and streams.
- Current measures for the prevention of gully erosion will result in a reduction in sediment and associated nutrient loads.
- Current best practice measures for agriculture will result in reduced salinity and nutrient inputs to aquatic ecosystems.
- Mechanisms to increase bed and bank stability will also have a positive effect on water quality.
- Protection and restoration of riparian vegetation will contribute to decreased salinity, turbidity and nutrient concentrations in wetlands and streams.
- Community-based water quality monitoring will result in improved knowledge of participants and contribute valuable data to inform decision making.
- Catchment Management Support System (CMSS) modelling undertaken to determine nutrient targets, reflects the true and accurate situation in the Wimmera region.
- The Bayesian Belief Network currently being developed by DPI will result in improved management of water quality and salinity in the Wimmera River Basin.

6.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- Total nitrogen and total phosphorus concentrations expressed as 75th percentile of monthly samples over a 12 month period for rivers and streams.
- A measure of load instead of concentration for wetlands (to account for concentrating effects during the drying phase).
- Turbidity expressed as 75th percentile of monthly samples over a 12 month period for rivers and streams.
- Salinity as indicated by EC.
- A measure of load instead of concentration for wetlands (to account for concentrating effects during the drying phase).
- Quantity and quality of water quality data collected across the Wimmera system.
- Number of participating schools and community groups.

6.10 priority waterway management units and reaches

Priority management units and reaches for water quality management are:

- Wimmera River Basin Management Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12 and 14.
- Millicent Coast Basin Management Units 16, 17 and 19.
- Terminal Lakes Management Unit 13.

6.11 reference documents

Key reference documents for water quality management are:

- Wimmera Water Quality Strategy (2002)
- Wimmera Rural Drainage Strategy (2001)
- State Environmental Protection Policy (Waters of Victoria) (2004)
- Wimmera Salinity Action Plan (2005)
- Water Quality Scoping Study for the Millicent Coast Basin in Victoria (2002)
- Wimmera Regional Urban Stormwater Management Plan (2002)
- Wimmera Community Waterwatch Annual Report (2004)
- Wimmera Community Waterwatch Strategy (2005)



6.12 water quality strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
WQ1	Develop nutrient targets for waterways in the Wimmera.	Wimmera CMA, DSE, EPA	50,000	RCT27,RCT28, RCT29	MAT56
WQ2	Develop turbidity targets for wetlands and streams of the Wimmera.	Wimmera CMA, DSE, EPA	50,000	RCT28,RCT30, RCT31,RCT32	MAT59
WQ3	Develop salinity targets by for wetlands and streams of the Wimmera.	Wimmera CMA, DSE, EPA	50,000	RCT33,RCT34	MAT61, MAT66
WQ4	Establish benchmark ranges of variation in nutrients for wetlands of the region.	Wimmera CMA, DSE, EPA	50,000	RCT27,RCT28, RCT29	MAT57
WQ5	Establish benchmark ranges of variation in turbidity for wetlands of the region.	Wimmera CMA, DSE, EPA	50,000	RCT28,RCT30, RCT31,RCT32	MAT60
WQ6	Implement priority actions in the Wimmera SAP that address the adverse impacts of groundwater on water quality in Wimmera waterways.	Wimmera CMA, DSE, DPI, EPA, GWMWater, Local Gov't, Landholders	1,000,000	RCT27,RCT28, RCT29	MAT63
WQ7	Implement priority actions in the Wimmera WQS to improve water quality in Wimmera waterways.	Wimmera CMA, DSE, DPI, EPA, GWMWater, Local Gov't, Landholders	5,000,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33,RCT34	
WQ8	Implement priority stormwater management actions in the Wimmera Region Urban Stormwater Management Plan (2002) to reduce the impact of stormwater on water quality in Wimmera waterways.	Local Gov't, Wimmera CMA, DSE, EPA, GWMWater, Landholders	1,000,000	RCT28,RCT29, RCT30,RCT31, RCT32,RCT33, RCT34	
WQ9	Implement priority communication and education actions in the Wimmera WQS Communication Action Plan (2002).	Wimmera CMA, DSE, EPA, GWMWater, Local Gov't, Landholders	500,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33,RCT34	MAT64
WQ10	Investigate nutrient sources and waterway health sensitivities to nutrients in the Wimmera.	Wimmera CMA	450,000	RCT27,RCT28, RCT29	
WQ11	Review and revise current water quality monitoring.	Wimmera CMA, DSE, EPA, GWMWater	100,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32 RCT33,RCT34	MAT65
WQ12	Monitoring of water quality, at priority sites in streams and wetlands of the Wimmera.	Wimmera CMA, DSE, EPA	600,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	MAT58
WQ13	Involve the community in catchment monitoring so they gain a greater understanding of water quality issues.	Wimmera CMA	750,000		MAT78, MAT79, MAT80
WQ14	Empower the community to take ownership of their local waterways and waterway health issues.	Wimmera CMA	100,000		MAT78, MAT79, MAT80
WQ15	Establish and maintain partnerships with key stakeholders, community groups and individuals.	Wimmera CMA, DSE, DPI, Parks Vic, Local Gov't, EPA, GWMWater, Landholders	50,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
WQ16	Raise awareness of water quality and catchment-related issues through onground education in schools, field days, tours, community monitoring, media, special events, signage and demonstration sites.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, EPA, GWMWater, Landholders	500,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
WQ17	Provide information, pathways and resources to help land managers address land management activities that impact on water quality of Wimmera waterways.	Wimmera CMA , DSE, DPI, Parks Vic, Local Gov't, EPA, GWMWater, Landholders	200,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	MAT76
WQ18	Undertake urban stormwater education activities in Horsham, Dimboola, Jeparit, Glenorchy, Warracknabeal, Brim and Stawell.	Local Gov't , Wimmera CMA,	250,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
WQ19	Develop, test and disseminate education and awareness packages highlighting the link between rural drainage and water quality in the waterways of the Wimmera.	Wimmera CMA , Local Gov't, EPA	250,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
WQ20	Develop, test and disseminate education and awareness activities to promote best management practice land management for grazing and cropping.	Wimmera CMA , Local Gov't, DPI, EPA	250,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
WQ21	Undertake urban stormwater best management practice promotion and training as per the Wimmera Region Urban Stormwater Management Plan (2002) priorities.	Local Gov't , Wimmera CMA, EPA	100,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
WQ22	Explore partnerships with agencies for water-sensitive urban design.	Local Gov't , Wimmera CMA, EPA, GWMWater	50,000	RCT27,RCT28, RCT29,RCT30, RCT31,RCT32, RCT33	
Total Program Cost			\$ 11,400,000		

* The bold name in the responsibility column indicates the lead authority

program 7 significant flora and fauna

wimmera waterway health strategy

7.1 introduction

Biodiversity includes the variety of all life forms; the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part. For the most part, biodiversity is protected, enhanced and restored through the Wimmera's native vegetation program, riparian land management, EWR management, instream habitat and channel-form management, wetland management and water quality.

Habitat management activities focus on protecting the best quality remnants, enhancing other remnants and restoring EVCs. In a highly-cleared landscape, protecting habitat and improving management is the most efficient way of achieving the highest positive impact on a broad range of species that are not well known.

The *National Strategy for the Conservation of Australia's Biological Diversity* (1996), the *National Strategy for Ecologically Sustainable Development* (1992), the *Victorian Biodiversity Strategy* (1997), and the *Flora and Fauna Guarantee Act 1988* all provide overarching objectives for the conservation and management of biodiversity. The Wimmera CMA region also contains a Ramsar-listed wetland (Lake Albacutya), listed threatened species and communities, and migratory species which are protected under JAMBA, CAMBA and the Convention on the Conservation of Migratory Species of Wild Animals (called the Bonn Convention or CMS) (1983).

The Wimmera boasts 1,900 plant species and 440 animal species including 58 mammal species, 66 reptile species and over 280 bird species. Of these, 84 are rare, 60 are vulnerable and 29 are endangered (listed under the *Environment Protection and Biodiversity Conservation Act 1999*). Sixty-one of these are listed under *Flora and Fauna Guarantee Act 1998* (see Table 5.1 at end of this program). Habitats for these species occur across the landscape, in the parks and reserve system, state forests, on private land and in the region's waterways.

The significant flora and fauna of the Wimmera waterways include native indigenous fish species such as river blackfish, the iconic platypus, rare and threatened vegetation, pest plants such as blackberry and gorse and pest animals such as foxes, rabbits, and carp. The actions identified in the *Wimmera WHS* aim to protect and restore habitats and manage pest plants and animals.



7.2 assets

Key assets for significant flora and fauna management strategic actions are the:

- Wetlands and Streams of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.
- Terminal Lakes of the Wimmera River

7.3 values

Environmental, social and economic values of the assets include:

environmental	social	economic
Significant flora	Fishing	Tourism
Ecological Vegetation Class	Passive recreation	
Significant fauna	Listed landscape	
Invertebrates observed/expected	Flagship species	
Width of riparian vegetation		
Longitudinal continuity of riparian vegetation		
Structural intactness of riparian vegetation		
Native fish observed/expected		
Proportion of fish introduced		
Native fish migration		
Wetland significance		
Wetland rarity and depletion		
Heritage River or representative river		
Sites of significance		
Ecological river health		

7.4 threats

The key threats to the significant flora and fauna of the Wimmera River and Millicent Coast basins and the Terminal Lakes of the Wimmera River are:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Loss of native biodiversity.
- Changed channel form.
- Deficient floodplain management.

The causes of these threats are:

- Water harvesting and river regulation for stock and domestic and irrigation/commercial use.
- Drainage of wetlands and of paddocks to wetlands.
- Unsustainable water harvesting from our waterways.
- Point-source and diffuse-source pollution.
- Increasing salinity and rising watertables.
- Riparian degradation – grazing, firewood collection, clearing for agricultural purposes.
- Pest plants and animals.
- Recreational pressures.
- Accelerated bed and bank erosion through increased runoff from cleared catchments, changes in hydraulics as a result of road crossings, channel modifications, etc.
- Weirs and other instream structures creating flow barriers.
- Inadequate data/knowledge, limited availability and/or currency of data/knowledge.
- Lack of adequate/appropriate community knowledge.

7.5 current status

The current condition of significant flora and fauna is:

- **Fish:**

- There are six threatened species of native fish in the Wimmera River Basin (Yarra pigmy perch, Murray cod, golden perch, silver perch, freshwater catfish and flat-headed galaxias) however only the Yarra pigmy perch is locally endemic.
- Yarra pigmy perch, Murray cod, silver perch and freshwater catfish are also listed as protected species under the *Victoria Flora and Fauna Guarantee Act 1988*.
- Five of the six species are listed under the *Flora and Fauna Guarantee Act 1988*.
- There are currently no indigenous migratory species of fish in the waterways of the Wimmera River Basin.
- Australian smelt and flat-headed gudgeon are the only native indigenous species found in the Wimmera Heritage River.
- Most wetlands in the Millicent Coast Basin are shallow and do not support large numbers of fish. Fish stocking does occur in some systems.
- Freshwater catfish have been recorded from Lake Albacutya; however, they are introduced to the region. But they are still considered a significant species. Without stocking they may not return to Albacutya; this depends on the filling cycle of the lake and their ability to enter from Lake Hindmarsh.

- **Waterbirds:**

- There are 11 species of waterbirds (including terrestrial birds that rely on riparian vegetation habitat) listed under the *Flora and Fauna Guarantee Act 1988* in the Wimmera Bioregion.
- Lake Albacutya (Ramsar site) has 16 fauna listed under the *Flora and Fauna Guarantee Act 1988*.
- Natimuk Douglas Chain of Lakes is significant for many nationally and internationally recognised birds.
- Migratory birds recorded from Lake Albacutya include four under JAMBA, seven under CAMBA (four common to both) and seven under the Bonn Convention.

- **Frogs:**

- The warty bell frog is listed under the *Flora and Fauna Guarantee Act 1988*.

- **Platypus:**

- There is a viable populations of platypus in the MacKenzie River and upper Wimmera River.

- **Macroinvertebrates:**

- 2004 ISC scores for aquatic life (macroinvertebrates using a combination of SIGNAL and AUSRIVAS assessments) – average of 7.0 out of 10. Many high scores were given for this sub-index, particularly along the Wimmera River, with the lower scores obtained from streams with limited streamside and instream habitat.

- **Listed aquatic and riparian vegetation:**

- There are five species of aquatic or riparian flora species listed under the *Flora and Fauna Guarantee Act 1988* in the Wimmera bioregion.
- There are significant patches of riparian vegetation (red gum and black box communities) in the Terminal Lakes or the Wimmera River system and along the streams of the Wimmera River Basin.

7.6 key issues

Native vegetation retention

All native vegetation has value is one of the major themes in Victoria's approach to native vegetation. This includes both aquatic and terrestrial vegetation.

This approach is detailed in the *Wimmera Native Vegetation Plan-revised draft (2004) (NVP)*.

Key actions in the plan are to:

- Protect the best quality remnants of vegetation to maintain a representative sample of many EVCs for future generations and to provide habitat for native plants and animals now.

- Enhance existing native vegetation through supplementary planting, buffering and linking thus improving habitat quality, patch size and connectivity, which are important aspects of native vegetation management.
- Revegetate cleared land to re-create, as closely as possible, representative examples of EVCs that have been significantly cleared from the landscape.

While it is important to protect the best, biggest, highest quality, most intact remnant vegetation, even the scraggiest, isolated old tree in the middle of a paddock may have significant biodiversity values for a broad range of species.

In some cases, land management practices result in the need to remove native vegetation from the landscape. Victoria's *Native Vegetation Management – A Framework for Action* (2002) and the Wimmera NVP spell out the processes in assessing applications. Clearing should be assessed against the criteria of avoiding clearing in the first place, minimising the amount of clearing to occur, and off-setting whatever clearing is approved. In practice, most applications for clearing will result in a mixture of these criteria.

Agencies in the Wimmera CMA region strongly support the notion that all native vegetation has value, while accepting that some losses are necessary as part of land management. It is the responsibility of all landholders to seek advice, understand the processes and follow the rules when considering clearing native vegetation. In cases where illegal clearing is detected, the responsible authority must take action to fix the situation.

Threatened flora and fauna

Protecting and enhancing habitat for all native plants and animals, especially those listed under the *Flora and Fauna Guarantee Act 1988* and the *Environment Protection and Biodiversity Conservation Act 1999*, is a high priority in the Wimmera CMA region. Significant investment into a range of monitoring and onground management actions for a broad range of orchid and plant species and a number of animals including the Red-tailed Black Cockatoo is required.

While the Red-tailed Black Cockatoo is clearly the highest priority in the Wimmera as a threatened animal, due to State and Australian Government listing, iconic and flagship nature and public opinion, many other species are less well known. For this reason, the *Wimmera WHS* concentrates habitat management activities on protecting the best quality remnants, enhancing other remnants and restoring EVCs. In a highly-cleared landscape, protecting habitat and improving management is the most efficient way of having the highest positive impact on a broad range of species that are not well known.

Pest plants and animals

Pest plants and animals are a significant threat to the natural and productive assets of the Wimmera CMA region. The *Wimmera Weed Action Plan* (2000-2005) details priority species for investment and management. However, the problems associated with other weed species should not be underestimated. The *Wimmera Rabbit Management Action Plan* (2000-2005) details priority areas for rabbit control.

While pest plant and animal management efforts in the Wimmera concentrate on priority weeds and rabbits, there are a number of species that may have a significant impact on waterway health. For example, water hyacinth has been previously recorded in the Wimmera although it is not present now. Also, European carp is widespread in Wimmera waterways and may have an impact on turbidity.

Fish

Issues of fish management are intrinsically linked with other areas of waterway management, including water quality management and environmental water releases. As such, many of the actions that are intended to address those issues will affect fish stocks in waterways. In this, it can be seen that the status of fish stocks act as an indicator of the overall health of waterways. However, fish stocks themselves may not be an effective indicator depending on the balance between exotic and native species, native and indigenous species, and community desires. In addition, fish populations are not always easy to assess and there may be no readily-applicable environmental quality objectives for fish populations in the Wimmera CMA region.



7.7 objectives

Significant flora and fauna management objectives are to:

- Enhance the diversity and populations of native aquatic flora and fauna.
- Protect and enhance threatened flora and fauna species and communities that rely on healthy waterways, floodplains and wetland systems.

7.8 targets

Aspirational

AT9. Natural ecosystems, habitats and landscapes are conserved, restored, linked and managed to provide increased viability for significant flora and fauna and regional biodiversity.

Resource Condition Target (10–20 years)

RCT36. 100 km of river reaches (18 sites) rehabilitated through re-snagging for native fish (from 2004 ISC Woody Debris score) by 2025.

RCT37. 30% increase in native fish numbers from 2005 levels by 2025.

RCT38. 10% reduction in 2005 carp populations through direct interventions by 2025.

RCT39. Condition target for significant taxa and communities, and potentially threatened species and ecological communities, to be set by 2008 after completion of biodiversity surveys.

RCT40. No decrease in extent and conservation status of threatened native species and ecological communities as measured against benchmarks.

RCT41. Maintenance of habitat and appropriate flooding regime to support migratory bird species at identified key sites, including the Ramsar-listed Lake Albacutya.

Note that RCTs resulting from Programs 1 to 6 will also contribute to the protection of significant flora and fauna populations. The specific RCTs are:

- Program 1: Floodplain Management - RCT1, RCT2.
- Program 2: Wetlands Management - RCT4, RCT5 and RCT6.
- Program 3: Riparian Land Management - RCT9, RCT12 and RCT14.
- Program 4: Instream Habitat and Channel Form - RCT18 and RCT19.
- Program 5: Environmental Water Reserve Management - RCT24.
- Program 6: Water Quality Management - RCT33.

Management Action Target (1–5 years)

MAT67. Develop a policy for the management of indigenous, non-indigenous native fish and pest fish species by 2007.

MAT68. Investigate the pros and cons of the removal of barriers to fish passage in the Wimmera River Basin by 2010.

MAT69. Identify priority reaches for rehabilitation of the physical habitat for native fish, by 2010 and undertake 5 km of this rehabilitation per year.

MAT70. Identify locations for direct interventions to reduce to carp numbers (wetlands during breeding times, weir pools etc) and undertake such interventions by 2010.

MAT71. Criteria identified for significant taxa and communities by 2006 and surveys undertaken to locate all such taxa and communities.

MAT72. Regional monitoring system for significant taxa and communities in place and linked to state and national systems by 2007.

MAT73. Management plans developed for those areas where significant taxa and communities are found; two plans per year to be developed and implemented. As appropriate, move to have these sites Ramsar-listed on the basis of the significant biota they support.

Note that MATs from Programs 1 to 6 will also contribute to the protection of significant flora and fauna populations.

The specific MATs are:

- Program 1: Floodplain Management - MAT4.
- Program 2: Wetland Management - MAT12, MAT18 and MAT22.
- Program 3: Riparian Land Management - MAT31, MAT32, MAT35 and MAT36.
- Program 4: Instream Habitat and Channel-form Management - MAT44.
- Program 5: Environmental Water Reserve Management - MAT48, MAT51 and MAT52.
- Program 6: Water Quality Management - MAT61.

Target Assumptions

Assumptions made during the development of the targets are:

- Implementation of the *Native Fish Strategy for the Murray-Darling Basin* 2003-2013 (2004) will be undertaken at national and state levels.
- Responsibility for the management of significant flora and fauna is a state responsibility designated to DSE.
- Implementation of agreed environmental water releases regimes will result in improved fish breeding, lateral and longitudinal connectivity.
- Habitat rehabilitation and the reduction in carp numbers will all assist the recovery of native fish populations.
- There are no indigenous migratory fish species in the Wimmera system, and the current barriers serve an important purpose of limiting the spread of carp.
- Documenting the presence of threatened biota and ecological communities will allow appropriate actions to be targeted at these sites, including possible Ramsar listing in some situations.
- The protection and restoration of significant flora and fauna will result in protection and restoration of the wider biodiversity of the region.
- Actions developed in biodiversity action plans will result in protection and restoration of native flora, fauna and ecological communities.

7.9 resource condition indicators

Indicators of resource condition that should be monitored include:

- Kilometres and sites with physical habitat reinstated.
- Improvement of native fish communities as demonstrated by surveys and fish catch data toward achieving above target.
- No declines in the populations of significant taxa and communities.

7.10 priority waterway management units and reaches

Priority management units and reaches for significant flora and fauna management are:

- Wimmera River Management Units 1, 2, 4, 6, 8, 9, 11 and 12.
- Millicent Coast Basin Management Units 16, 17 and 19.
- Terminal Lakes Management Unit 13.

7.11 reference documents

Key reference documents for significant flora and fauna management are:

- Fisheries Management Act 1995
- Native Fish Strategy for the Murray-Darling Basin 2003-2013 (2004)
- Integrating Biodiversity into Regional Planning – the Wimmera Catchment Management Authority Pilot Program (2003)
- Victoria's Biodiversity: Directions in Management (1997)
- Wimmera Native Vegetation Plan (Draft 2004)
- Results of Platypus Population Surveys in the MacKenzie River Catchment (2002)
- Movement of native and introduced fish species in the Wimmera CMA Region: A Discussion of Issues (2001)
- Guidelines for Assessing Translocations of Live Aquatic Organisms in Victoria (2003)
- Protocol for the Translocation of Fish in Victorian Inland Public Waters (2005)



7.12 significant flora and fauna strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
SFF1	Protect, enhance and restore habitat for threatened flora and fauna that are waterway dependent.	DSE, Parks Vic, Wimmera CMA	500,000	RCT36, RCT40, RCT41	MAT69
SFF2	Implement native fish and habitat management related actions in the Native Fish Strategy for the Murray-Darling Basin (2003-2013).	MDBC, DSE, DPI, Wimmera CMA	500,000	RCT37	MAT67
SFF3	Develop and implement a Fishery Management Plan for the waterways of the Wimmera CMA region.	DPI, DSE, Wimmera CMA	100,000	RCT37	MAT69
SFF4	Establish demonstration reaches to demonstrate to the community the cumulative benefits of applying a number of interventions to improve river health (particularly relating to native fish populations).	MDBC, DSE, DPI, Wimmera CMA	500,000	RCT37	MAT69
SFF5	Establish river blackfish as a Wimmera flagship species to highlight conservation and rehabilitation activities in the upper reaches of the Wimmera.	Wimmera CMA, DPI	50,000	RCT37	
SFF6	Monitor and maintain populations of river blackfish, focusing on protecting areas of key habitat and providing suitable flows.	Wimmera CMA, DPI, Fishcare Volunteers	200,000	RCT37	MAT69
SFF7	Monitor and maintain freshwater catfish populations in Wimmera waterways.	Wimmera CMA, DPI, Fishcare Volunteers	200,000	RCT37	MAT67
SFF8	Undertake habitat restoration and re-snagging of priority waterway reaches.	Wimmera CMA	500,000	RCT36	MAT69
SFF9	Manage pest fish species in priority waterways.	Wimmera CMA, DPI, DSE	1,000,000	RCT36, RCT37, RCT38	MAT70
SFF10	Control and manage carp populations in Wimmera waterways. Follow recommendations of the National Management Strategy for Carp Control (2003-2005).	Wimmera CMA, DPI, DSE	1,000,000	RCT38	MAT70
SFF11	Control carp use of floodplain and wetlands as spawning and nursery areas.	Wimmera CMA, DPI, DSE		RCT38	MAT70
SFF12	Support state-wide and national initiatives for the management of carp.	Wimmera CMA, DPI, DSE	50,000	RCT38	MAT70
SFF13	Investigate requirements of native and native indigenous species for fish passage in waterways of the Wimmera.	Wimmera CMA, DPI, Fishing Groups	100,000	RCT36, RCT37	MAT68
SFF14	Provide fish passage at key obstructions where recommended.	Wimmera CMA, DPI, GWMWater, Local Gov't	1,000,000	RCT36, RCT37	MAT68
SFF15	Fish stocking in Wimmera region to be undertaken in accordance with the Guidelines for Assessing Translocations of Live Aquatic Organisms in Victoria (December 2003). When required, conduct risk assessments in accordance with these guidelines to consider the possible impacts of fish stocking on local fish populations that may be vulnerable.	DPI, Wimmera CMA	100,000	RCT37	
SFF16	Survey native fish use of wetlands in the Wimmera.	Wimmera CMA, DPI	100,000	RCT37	
SFF17	Investigate the barriers to fish passage within the Wimmera River and Terminal Lakes and any structures identified as barriers should be further investigated for retrofitting to provide fish passage.	Wimmera CMA, DPI, GWMWater, Local Gov't	100,000	RCT36, RCT37	MAT68

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
SFF18	Wimmera CMA to liaise with stakeholders to identify projects of benefit to recreational fishing that may be funded from monies distributed by the Fishery Revenue Allocation Committee.	Wimmera CMA , DPI, VRFish, Anglers Associations, Fishcare	100,000	RCT36, RCT37	MAT 68
SFF19	Continue angler and community education activities.	Wimmera CMA , DPI, VRFish, Anglers Associations, Fishcare	50,000	RCT37	
SFF20	Establish condition targets for significant taxa and communities and potentially threatened species and ecological communities that rely on waterways.	DSE , Wimmera CMA	250,000	RCT37	
SFF21	Undertake biodiversity surveys to monitor the health of significant taxa and communities and potentially threatened species and ecological communities.	DSE , Wimmera CMA	250,000	RCT39, RCT40	
SFF22	Undertake biodiversity surveys to monitor the health of significant taxa and communities and potentially threatened species and ecological communities.	DSE , Wimmera CMA	250,000	RCT39, RCT40	MAT72
Total Program Cost			\$ 6,900,000		

* The bold name in the responsibility column indicates the lead authority

TABLE 5.1 rare or threatened flora and fauna species of the Wimmera CMA region

FAUNA		
status	common name	scientific name
Mammals		
I	Little Pygmy-possum	Cercartetus lepidus
v	Brush-tailed Phascogale	Phascogale tapoatafa
i	Common Dunnart	Sminthopsis murina
i	Fat-tailed Dunnart	Sminthopsis crassicaudata
I	Mallee Ningau	Ningau yvonneae
Vc	Brush-tailed Rock-wallaby	Petrogale penicillata
VI	Heath Mouse	Pseudomys shortridgei
I	Mitchell's Hopping-mouse	Notomys mitchelli
I	Silky Mouse	Pseudomys apodemoides
e	Squirrel Glider	Petaurus norfolcensis
v	Grey-headed Flying-fox	Pteropus poliocephalus
v	Greater Long-eared Bat	Nyctophilus timoriensis
Birds		
I	Grey Goshawk	Accipiter novaehollandiae
e	Square-tailed Kite	Lophoictinia isura
e	White-bellied Sea-Eagle	Haliaeetus leucogaster

LEGEND

Australian Rare or Threatened Species

C = Critically endangered
 E = Endangered
 I = Insufficiently known in Victoria
 K = Poorly known
 L = Lower risk (in Victoria)
 R = Rare
 V = Vulnerable
 X = Presumed extinct

Victorian Rare or Threatened Species

c = Critically endangered
 e = Endangered
 i = Insufficiently known in Victoria
 k = Poorly known
 l = Lower risk (in Victoria)
 r = Rare
 v = Vulnerable
 x = Presumed extinct

Other

= Dual origin

FAUNA		
status	common name	scientific name
Birds		
v	Australasian Shoveler	Anas rhynchos
v	Blue-billed Duck	Oxyura australis
v	Cape Barren Goose	Cereopsis novaehollandiae
e	Freckled Duck	Stictonetta naevosa
v	Hardhead	Aythya australis
v	Musk Duck	Biziura lobata
e	Magpie Goose	Anseranas semipalmata
e	Australasian Bittern	Botaurus poiciloptilus
e	Great Egret	Ardea alba
c	Intermediate Egret	Ardea intermedia
e	Little Bittern	Ixobrychus minutus
c	Little Egret	Egretta garzetta
v	Nankeen Night Heron	Nycticorax caledonicus
e	Bush Stone-curlew	Burhinus grallarius
v	Major Mitchell's Cockatoo	Cacatua leadbeateri
Ee	Red-tailed Black-Cockatoo	Calyptorhynchus banksi
Vi	Western Whipbird	Psophodes nigrogularis
v	Diamond Dove	Geopelia cuneata
e	Black Falcon	Falco subniger
c	Grey Falcon	Falco hypoleucos
v	Brolga	Grus rubicunda
v	Red-backed Kingfisher	Todiramphus pyrrhopygia
v	Caspian Tern	Sterna caspia
e	Gull-billed Tern	Sterna nilotica
l	Whiskered Tern	Chlidonias hybridus
Vv	Mallee Emu-wren	Stipiturus mallee
Ve	Malleefowl	Leipoa ocellata
Ec	Black-eared Miner	Manorina melanotis
V	Painted Honeyeater	Grantiella picta
Ec	Regent Honeyeater	Xanthomyza phrygia
c	Australian Bustard	Ardeotis australis
Vv	Red-lored Whistler	Pachycephala rufogularis
i	Chestnut-rumped Heathwren	Hylacola pyrrhopygia
l	Slender-billed Thornbill	Acanthiza iredalei
v	Speckled Warbler	Chthonicola sagittata
Ve	Plains-wanderer	Pedionomus torquatus
l	Pied Cormorant	Phalacrocorax varius
i	Brown Quail	Coturnix ypsilophora
e	Grey-crowned Babbler	Pomatostomus temporalis
Vv	Regent Parrot	Polytelis anthopeplus

FAUNA		
status	common name	scientific name
Ee	Swift Parrot	Lathamus discolor
v	Baillon's Crake	Porzana pusilla
e	Lewin's Rail	Rallus pectoralis
i	Pectoral Sandpiper	Calidris melanotos
e	Barking Owl	Ninox connivens
e	Powerful Owl	Ninox strenua
v	Glossy Ibis	Plegadis falcinellus
v	Royal Spoonbill	Platalea regia
i	Little Button-quail	Turnix velox
v	Red-chested Button-quail	Turnix pyrrhorthorax
e	Masked Owl	Tyto novaehollandiae
Reptiles		
l	Bandy Bandy	Vermicella annulata
v	Bardick	Echiopsis curta
Ve	Striped Legless Lizard	Delma impar
l	Striped Worm-Lizard	Aprasia striolata
l	Four-toed Skink	Hemiergis peronii
e	Samphire Skink	Morethia adelaidensis
v	Swamp Skink	Egernia coventryi
l	Western Blue-tongued Lizard	Tiliqua occipitalis
v	Rosenberg's Goanna	Varanus rosenbergi
i	Tree Goanna	Varanus varius
Frogs		
Vv	Warty Bell Frog	Litoria raniformis
Fish		
i	River Blackfish	Gadopsis marmoratus
VI	Dwarf Galaxias	Galaxiella pusilla
i	Mountain Galaxias	Galaxias olidus
v	Golden Perch	Macquaria ambigua
v	Murray Cod	Maccullochella peelii peelii
v	Freshwater Catfish	Tandanus tandanus
Invertebrates		
r	Sciron Skipper	Trapezites sciron eremicola
v	Eltham Copper	Paralucia pyrodiscus lucida
r	Large Ant Blue	Acrodipsas brisbanensis
v	Bullant	Myrmecia sp. 17
e	Golden Sun Moth	Synemon plana
e	Sun Moth (5091)	Synemon sp c.f. selene

FLORA		
status	common name	scientific name
Mosses		
k	Swan-neck Moss	Campylopus incrassatus
r	Common Extinguisher-moss	Encalypta vulgaris
Ferns and Fern-like Plants		
r	Skeleton Fork-fern	Psilotum nudum
Monocotyledons		
k	Small Chocolate-lily	Arthropodium sp. 3 (aff. strictum)
Ee	Grampians Pincushion-lily	Borya mirabilis
r	One-flower Early Nancy	Wurmbea uniflora
r	Slender Twist-rush	Caustis restiacea
e	Curly Flat-sedge	Cyperus rigidellus
v	Pointed Flat-sedge	Cyperus subulatus
v	Striate Spike-sedge	Eleocharis obicis
v	Pale Spike-sedge	Eleocharis pallens
r	Veiled Fringe-sedge	Fimbristylis velata
r	Slender Saw-sedge	Gahnia microstachya
k	Inland Club-sedge	Isolepis australiensis
v	Slender Club-sedge	Isolepis congrua
k	Victorian Club-sedge	Isolepis victoriensis
r	Tufted Club-sedge	Isolepis wakefieldiana
v	Button Rush	Lipocarpa microcephala
e	Blunt Club-sedge	Schoenoplectus dissachanthus
k	Short-leaf Bog-sedge	Schoenus laevigatus
k	Tiny Bog-sedge	Schoenus nanus
r	Gimlet Bog-sedge	Schoenus sculptus
Ee	Southern Pipewort	Eriocaulon australasicum
r	Slender Water-ribbons	Triglochin dubium
v	Six-point Arrowgrass	Triglochin hexagonum
r	Tiny Arrowgrass	Triglochin minutissimum
r	Prickly Arrowgrass	Triglochin mucronatum
e	Torpedo Arrowgrass	Triglochin trichophorum
Ee	McIvor Spider-orchid	Arachnorchis audasii
Vv	Elegant Spider-orchid	Arachnorchis formosa
Ee	Tawny Spider-orchid	Arachnorchis fulva
Ee	Wimmera Spider-orchid	Arachnorchis lowanensis
Kx	Magnificent Spider-orchid	Arachnorchis magnifica
v	Veined Spider-orchid	Arachnorchis reticulata s.s.
v	Upright Spider-orchid	Arachnorchis stricta
Ev	Rigid Spider-orchid	Arachnorchis tensa
v	Bow-lip Spider-orchid	Arachnorchis toxochila
Rr	Large White Spider-orchid	Arachnorchis venusta
Ve	Candy Spider-orchid	Arachnorchis versicolor

FLORA		
status	common name	scientific name
Ee	Yellow-lip Spider-orchid	Arachnorchis xanthochila
Rr	Lizard Orchid	Burnettia cuneata
k	Slender Beard-orchid	Calochilus gracillimus
k	Fringed Midge-orchid	Corunastylis ciliata
Ke	Bell-flower Hyacinth-orchid	Dipodium campanulatum
v	Golden Cowslips	Diuris behrii
v	Swamp Diuris	Diuris palustris
v	Purple Diuris	Diuris punctata var. punctata
v	Swamp Onion-orchid	Hydorchis orbicularis
Vr	Ornate Pink-fingers	Petalochilus ornatus
r	Slender Pink-fingers	Petalochilus vulgaris
k	Tawny Leek-orchid	Prasophyllum constrictum s.s.
e	Fitzgerald's Leek-orchid	Prasophyllum fitzgeraldii
v	Green Leek-orchid	Prasophyllum lindleyanum
v	Western Leek-orchid	Prasophyllum occidentale
r	Broad-lip Leek-orchid	Prasophyllum patens
Ee	Fragrant Leek-orchid	Prasophyllum suaveolens
Ee	Pomonal Leek-orchid	Prasophyllum subbisectum
k	Slender Ruddyhood	Pterostylis aciculiformis
Vv	Floodplain Rustyhood	Pterostylis cheraphila
r	Long-tongue Shell-orchid	Pterostylis dolichochila
k	Flat Rustyhood	Pterostylis planulata s.l.
r	Grampians Rustyhood	Pterostylis planulata s.s.
Rr	Emerald-lip Greenhood	Pterostylis smaragdyna
k	Crowded Greenhood	Pterostylis sp. aff. longifolia (Stawell)
r	Woodland Plume-orchid	Pterostylis sp. aff. plumosa (Woodland)
v	Globe-hood Sun-orchid	Thelymitra X chasmogama
v	Crimson Sun-orchid	Thelymitra X macmillanii
v	Azure Sun-orchid	Thelymitra azurea
v	Blotched Sun-orchid	Thelymitra benthamiana
Ee	Metallic Sun-orchid	Thelymitra epipactoides
r	Fringed Sun-orchid	Thelymitra luteocilium
Ve	Brilliant Sun-orchid	Thelymitra mackibbinii
Vv	Spiral Sun-orchid	Thelymitra matthewsii
v	Plum Orchid	Thelymitra mucida
k	Pale Grass-lily	Caesia parviflora var. minor
r	Swamp Flax-lily	Dianella callicarpa
v	Glaucous Flax-lily	Dianella longifolia var. grandis
Vk	River Swamp Wallaby-grass	Amphibromus fluitans
r	Dark Wire-grass	Aristida calycina var. calycina

FLORA		
status	common name	scientific name
k	Leafy Wallaby-grass	Austrodanthonia bipartita s.s.
r	Small-flower Wallaby-grass	Austrodanthonia monticola
v	Straw Wallaby-grass	Austrodanthonia richardsonii
r	Half-bearded Spear-grass	Austrostipa hemipogon
r	Annual Spear-grass	Austrostipa macalpinei
r	Neat Spear-grass	Austrostipa mundula
r	Fine-hairy Spear-grass	Austrostipa puberula
r	Corkscrew Spear-grass	Austrostipa setacea
r	Spear-grass	Austrostipa trichophylla
e	Silky-heads	Cymbopogon obtectus
v	Bent-grass	Deyeuxia imbricata
v	Silky Umbrella-grass	Digitaria ammophila
k	Cotton Panic-grass	Digitaria brownii
v	Umbrella Grass	Digitaria divaricatissima
v	Cane Grass	Eragrostis australasica
e	Slender Love-grass	Eragrostis exigua
v	Purple Love-grass	Eragrostis lacunaria
r	Silky Browntop	Eulalia aurea
Ev	Adamson's Blown-grass	Lachnagrostis adamsonii
k	Wetland Blown-grass	Lachnagrostis filiformis (perennial variety)
r	Purple Blown-grass	Lachnagrostis punicea ssp. Filifolia
r	Purple Blown-grass	Lachnagrostis punicea ssp. Punicea
r	Ruddy Blown-grass	Lachnagrostis rudis
r	Knotted Poa	Poa drummondiana
r	Scaly Poa	Poa fax
k	Forde Poa	Poa fordeana
r	Tasmanian Wallaby-grass	Rytidosperma dimidiatum
r	Yakka Grass	Sporobolus caroli
r	Needle Grass	Triraphis mollis
r	Tufted Grass-tree	Xanthorrhoea caespitosa
r	Yacca	Xanthorrhoea semiplana ssp. Semiplana
v	Spreading Water-mat	Lepilaena patentifolia

Dicotyledons

e	Long Tails	Ptilotus polystachyus var. polystachyus
v	Long Eryngium	Eryngium paludosum
r	Parsley Xanthosia	Xanthosia leiophylla
r	Grampians Star-hair	Astrotricha sp. 1 ssp. 1
v	Yellow-tongue Daisy	Brachyscome chrysoglossa

FLORA		
status	common name	scientific name
k	Wedge-leaf Daisy	Brachyscome cuneifolia
v	Weak Daisy	Brachyscome debilis
r	Reader's Daisy	Brachyscome readeri
r	Burr-daisy	Calotis cymbacantha
v	Swamp Billy-buttons	Craspedia paludicola
r	Slender Cup-flower	Gnephosis drummondii
Kv	Small Nut-heads	Haegiela tatei
v	Fleshy Minuria	Kippistia suaedifolia
r	Woolly Buttons	Leiocarpa panaetioides
e	Lanky Buttons	Leptorhynchos elongatus
e	Annual Buttons	Leptorhynchos scaber
v	Button Immortelle	Leptorhynchos waitzia
r	Large-fruited Millotia	Millotia macrocarpa
r	Smooth Minuria	Minuria integerrima
r	Heath Daisy-bush	Olearia minor
e	Wimmera Daisy-bush	Olearia sp. 1
k	Netted Daisy-bush	Olearia speciosa
r	Rayless Daisy-bush	Olearia tubuliflora
r	Squat Picris	Picris squarrosa
r	Grey Podolepis	Podolepis canescens
r	Quinetia	Quinetia urvillei
Ee	Stiff Groundsel	Senecio behrianus
k	Branching Groundsel	Senecio cunninghamii var. cunninghamii
v	Pale Groundsel	Senecio hypoleucus
Ve	Large-fruit Fireweed	Senecio macrocarpus
v	Tall Yellow-top	Senecio magnificus
x	Murray Groundsel	Senecio murrayanus
Vv	Dwarf Yellow-heads	Trichanthodium baraccianum
r	Club-hair New Holland Daisy	Vittadinia condyloides
k	Fuzzy New Holland Daisy	Vittadinia cuneata var. morrisii
v	Giant New Holland Daisy	Vittadinia megacephala
v	Winged New Holland Daisy	Vittadinia pterochaeta
v	Western Bitter-cress	Cardamine lineariloba
r	Riverina Bitter-cress	Cardamine moirensis
k	Slender Bitter-cress	Cardamine tenuifolia
Ee	Basalt Peppercress	Lepidium hyssopifolium
Ee	Winged Peppercress	Lepidium monoplocoides
k	Warty Peppercress	Lepidium papillosum
k	Native Peppercress	Lepidium pseudohyssopifolium
Ve	Erect Peppercress	Lepidium pseudopapillosum
Vv	Western Water-starwort	Callitriche cyclocarpa

FLORA		
status	common name	scientific name
r	Grampians Sheoak	Allocasuarina grampiana
k	Western Sheoak	Allocasuarina mackliniana
r	Western Sheoak	Allocasuarina mackliniana ssp. hirtilinea
k	Western Sheoak	Allocasuarina mackliniana ssp. xerophila
e	Swamp Sheoak	Casuarina obesa
k	Native Orache	Atriplex australasica
r	Coral Saltbush	Atriplex papillata
r#	Mealy Saltbush	Atriplex pseudocampanulata
Ve	Bead Glasswort	Halosarcia flabelliformis
v	Fused Glasswort	Halosarcia syncarpa
v	Leafless Bluebush	Maireana aphylla
Vv	Chariot Wheels	Maireana cheelii
Ee	Turnip Copperburr	Sclerolaena napiformis
r	Grampians Bauera	Bauera sessiliflora
r	Rock Rose Guinea-flower	Hibbertia cistiflora ssp. rostrata
Rr	Rising Star Guinea-flower	Hibbertia humifusa
Rr	Rising Star Guinea-flower	Hibbertia humifusa ssp. humifusa
r	Silky Guinea-flower	Hibbertia sericea var. scabrifolia
r	Spreading Brachyloma	Brachyloma depressum
r	Grampians Heath	Epacris impressa var. grandiflora
r	Twiggy Beard-heath	Leucopogon costatus
Rr	Veined Beard-heath	Leucopogon neurophyllus
r	Thyme Beard-heath	Leucopogon thymifolius
r	Common Beard-heath	Leucopogon virgatus var. brevifolius
r	Nodding Beard-heath	Leucopogon woodsii
Rr	Grampians Broom-heath	Monotoca billawinica
r	Currant-wood	Monotoca glauca
r	Desert Styphelia	Styphelia exarrhena
v	Coast Bitter-bush	Adriana quadripartita
v	Coast Bitter-bush	Adriana quadripartita (pubescent form)
r	Clustered Poranthera	Poranthera corymbosa
r	Oval-leaf Pseudanthus	Pseudanthus ovalifolius
r	River Leafless Bossiaea	Bossiaea riparia
r	Grampians Bossiaea	Bossiaea rosmarinifolia
e	Native Scurf-pea	Cullen australasicum
Vv	Grampians Bitter-pea	Daviesia laevis
Rr	Thorny Bitter-pea	Daviesia pectinata
r	Grampians Parrot-pea	Dillwynia oreodoxa

FLORA		
status	common name	scientific name
r	Silky Parrot-pea	Dillwynia uncinata
Vv	Clover Glycine	Glycine latrobeana
r	Silky Golden-tip	Goodia lotifolia var. pubescens
r	Western Golden-tip	Goodia medicaginea
k	Austral Trefoil	Lotus australis
r	Slender Phyllota	Phyllota remota
Rr	Victorian Flat-pea	Platylobium alternifolium
r	Bentham's Bush-pea	Pultenaea benthamii
Rr	Ribbed Bush-pea	Pultenaea costata
r	Hoary Bush-pea	Pultenaea daltonii
v	Scented Bush-pea	Pultenaea graveolens
r	Pungent Bush-pea	Pultenaea juniperina s.s.
Rr	Mt. Byron Bush-pea	Pultenaea patellifolia
Rr	Rosy Bush-pea	Pultenaea subalpina
v	Feather Bush-pea	Pultenaea vestita
Vv	Williamson's Bush-pea	Pultenaea williamsoniana
Rr	Grampians Globe-pea	Sphaerolobium acanthos
r	Southern Swainson-pea	Swainsona behriana
v	Slender Swainson-pea	Swainsona brachycarpa
Ve	Slender Darling-pea	Swainsona murrayana
v	Kneed Swainson-pea	Swainsona reticulata
v	Silky Swainson-pea	Swainsona sericea
e	Downy Swainson-pea	Swainsona swainsonioides
r	Leafy Templetonia	Templetonia stenophylla
r	Flat Templetonia	Templetonia sulcata
r	Small-leaf Sea-heath	Frankenia sessilis
r	Pale-flower Cranesbill	Geranium sp. 3
k	Coast Stork's-bill	Pelargonium littorale
r	Small-leaf Goodenia	Goodenia benthamiana
r	Grampians Goodenia	Goodenia lineata
r	Grassland Velleia	Velleia arguta
r	Hairy Raspwort	Gonocarpus mezianus
Vv	Ridged Water-milfoil	Myriophyllum porcatum
r	Spiny Mint-bush	Prostanthera spinosa
k	Scurfy Germander	Teucrium albicaule
Ee	Whipstick Westringia	Westringia crassifolia
k	Single Bladderwort	Utricularia uniflora
r	Violet Bladderwort	Utricularia violacea
v	Buloke Mistletoe	Amyema linophylla ssp. orientale
r	Narrow-leaf Sida	Sida trichopoda
r	Wedderburn Wattle	Acacia X grayana

FLORA		
status	common name	scientific name
v	Dwarf Myall	Acacia ancistrophylla var. lissophylla
x	Silver Mulga	Acacia argyrophylla
r	Cup Wattle	Acacia cupularis
r	Deane's Wattle	Acacia deanei
Ee	Jumping-jack Wattle	Acacia enterocarpa
k	Mealy Wattle	Acacia farinosa
Vv	Hairy-pod Wattle	Acacia glandulicarpa
x	Needle Wattle	Acacia havilandiorum
r	Streaked Wattle	Acacia lineata
v	Myall	Acacia melvillei
v	Umbrella Wattle	Acacia oswaldii
e#	Weeping Myall	Acacia pendula
r#	Rock Wattle	Acacia rupicola
v	Three-nerve Wattle	Acacia trineura
r	Bramble Wattle	Acacia victoriae ssp. victoriae
r	Coccid Emu-bush	Eremophila gibbifolia
v	Small Darwinia	Darwinia micropetala
k	Mt William Stringybark	Eucalyptus aff. serraensis (Mt William)
r	Grampians Grey-gum	Eucalyptus alaticaulis
v	Pink Gum	Eucalyptus fasciculosa
Rr	Kamarooka Mallee	Eucalyptus froggattii
v	Scaly-cap Mallee	Eucalyptus macmahonii
e	Little Desert Peppermint	Eucalyptus molyneuxii
r	Grampians Sally	Eucalyptus pauciflora ssp. parvifructa
r	Green-leaf Mallee	Eucalyptus phenax
r	Wimmera Scentbark	Eucalyptus sabulosa
r	Grampians Stringybark	Eucalyptus serraensis
v	Woodland Box	Eucalyptus silvestris
r	Mt Abrupt Stringybark	Eucalyptus verrucata
r	Victoria Range Stringybark	Eucalyptus victoriana
r	Grampians Peppermint	Eucalyptus willisii ssp. falciformis
r	Wimmera Mallee-box	Eucalyptus wimmerensis
r#	Shiny Tea-tree	Leptospermum turbinatum
r#	Giant Honey-myrtle	Melaleuca armillaris ssp. armillaris
v	Salt Paperbark	Melaleuca halmaturorum ssp. halmaturorum
r	Grampians Thryptomene	Thryptomene calycina
r	Orange Bell-climber	Billardiera bignoniacea
v	Small Milkwort	Comesperma polygaloides

FLORA		
status	common name	scientific name
k	Spiny Lignum	Muehlenbeckia horrida ssp. horrida
r	Rock Banksia	Banksia saxicola
Rr	Grampians Grevillea	Grevillea confertifolia
r	Flame Grevillea	Grevillea dimorpha
r	Goldfields Grevillea	Grevillea dryophylla
k	Gariwerd Grevillea	Grevillea gariwerdensis
Rr	Mt Cassell Grevillea	Grevillea microstegia
Rr	Mount Cole Grevillea	Grevillea montis-cole
Vv	Langi Ghiran Grevillea	Grevillea montis-cole ssp. Brevistyla
Rr	Mount Cole Grevillea	Grevillea montis-cole ssp. montis-cole
v	Silver Needlewood	Hakea leucoptera ssp. Leucoptera
v	Hooked Needlewood	Hakea tephrosperma
k	Large River Buttercup	Ranunculus papulentus
k	Ferny Small-flower Buttercup	Ranunculus pumilio var. politus
k	Annual Buttercup	Ranunculus sessiliflorus var. pilulifer
v	Swamp Buttercup	Ranunculus undosus
r	Tainui Pomaderris	Pomaderris apetala
r	Grampians Pomaderris	Pomaderris apetala ssp. apetala
v	Inland Pomaderris	Pomaderris paniculosa ssp. Paniculosa
Rv	Tiny Spyridium	Spyridium cinereum
Re	Shining Spyridium	Spyridium nitidum
Ee	Forked Spyridium	Spyridium sp. 1
Rr	Branched Trymalium	Trymalium X ramosissimum
r	Narrow-leaf Trymalium	Trymalium daltonii
r	Mossy Woodruff	Asperula minima
r	Tight Bedstraw	Galium curvihirtum
Vv	Downy Star-Bush	Asterolasia phebalioides
v	Slender Boronia	Boronia filifolia
Rr	Grampians Boronia	Boronia latipinna
r	Dwarf Boronia	Boronia nana var. nana
r	Dwarf Boronia	Boronia nana var. pubescens
r	Hairy Correa	Correa aemula
r	Mountain Correa	Correa lawrenceana var. grampiana
r	Grampians Correa	Correa reflexa var. angustifolia
r	Truncate Leonema	Leonema bilobum ssp. 1
Rx	Spreading Leonema	Leonema microphyllum
v	Red Microcybe	Microcybe multiflora ssp. Multiflora

FLORA		
status	common name	scientific name
Vv	Lowan Phebalium	Phebalium lowanense
r	Narrow-leaf Phebalium	Phebalium stenophyllum
v	Narrow-leaf Wax-flower	Philotheca angustifolia ssp. montana
r	Grampians Zieria	Zieria sp. 1
r	Pink Zieria	Zieria veronicea
r	Common Sour-bush	Choretrum glomeratum
r	Common Sour-bush	Choretrum glomeratum var. glomeratum
r	Spiked Sour-bush	Choretrum spicatum
r	Hairy Hop-bush	Dodonaea boroniifolia
x	Maple-fruited Hop-bush	Dodonaea heteromorpha
Vv	Trailing Hop-bush	Dodonaea procumbens
Ee	Purple Eyebright	Euphrasia collina ssp. muelleri
r	Purple Eyebright	Euphrasia collina ssp. tetragona
Ke	Rough Eyebright	Euphrasia scabra
r	Small-flower Mud-mat	Glossostigma cleistanthum
k	Desert Mud-mat	Glossostigma drummondii

FLORA		
status	common name	scientific name
Kr	Dwarf Brooklime	Gratiola pumilo
r	Small Monkey-flower	Mimulus prostratus
Rr	Large-leaf Ray-flower	Cyphanthera anthocercidea
e	Coast Tobacco	Nicotiana maritima
k	Rough-nut Stackhousia	Stackhousia aspericocca
r	Paper Flower	Thomasia petalocalyx
v	Midget Stylewort	Levenhookia pusilla
r	Grampians Trigger-plant	Stylidium soboliferum
k	Curved Rice-flower	Pimelea curviflora var. aff. subglabrata
r	Diosma Rice-flower	Pimelea flava ssp. dichotoma
r	Forked Rice-flower	Pimelea hewardiana
e	Spiny Rice-flower	Pimelea spinescens
Xx	Spiny Rice-flower	Pimelea spinescens ssp. pubiflora
Ve	Spiny Rice-flower	Pimelea spinescens ssp. spinescens
r	Tiny Violet	Viola seppeltiana

program 8 communication, education and engagement

wimmera waterway health strategy

8.1 introduction

To increase community education and awareness, two key issues need to be simultaneously addressed. The first, at an institutional level, is organisational barriers to effective waterway management. The second, at a community level, is limited community participation in waterway management. Each issue occurs for a variety of causes.

The delivery and approach to waterway management must involve the community. Involvement must extend beyond traditional approaches of engagement and awareness-raising. Involving the community from planning to implementation stage, with adequate celebrations along the journey so the community develops a sense of ownership and understanding and thus are more inclined to participate in implementation, is considered a priority for successful community engagement. Adequate initial and ongoing support for onground management actions, flexible approaches to program delivery and well-structured community support programs are essential to meet the changing needs of the Wimmera community.

A common challenge for managing each of the Wimmera's natural assets is to overcome institutional and social barriers. Wimmera CMA recognises the importance of institutional reform and community capacity building and will take a lead role, through the *Wimmera RCS* and the *Wimmera WHS*, in addressing these issues.

The vision the *Wimmera WHS* seeks for all stakeholders (agencies and community) to share a common picture of a healthy waterway. Achieving this vision requires meaningful long-term change in behaviour by all.

The goal of the communication, education and engagement strategic actions is to bring about this change in behaviour. Changed behaviour will result in a fundamental shift in the way waterways are managed by all stakeholders. This will require an investment in people's skills, and ensuring that management decisions and strategic actions are based on improved knowledge.

8.2 objectives

Objectives are considered to be the key milestones in achieving the goal and ultimate vision for waterway health. Objectives for communication, education and engagement in the *Wimmera WHS* are to:

- Increase knowledge and awareness of waterway health issues within our regional community.
- Develop and maintain an effective Waterwatch program that is dedicated to community education and community-based monitoring of the Wimmera waterway environments.
- Engage the community in planning, and participating in actions to improve the health of waterways, floodplains and wetland systems. The community includes everyone who lives and works in the Wimmera CMA region, visitors and those otherwise connected.
- Achieve common goals throughout the community for waterway health.
- Establish partnerships between all stakeholders.
- Ensure all stakeholders increase their knowledge of waterway health.
- Facilitate knowledge-transfer between stakeholders.
- Ensure all stakeholders have ownership of waterways and issues affecting waterway health.
- Ensure all stakeholders accept responsibility for waterway health and waterway management issues.
- Achieve a common belief/acceptance that waterway health issues need to be addressed by all stakeholders.
- Ensure all stakeholders understand links between land management and waterway health issues.
- Achieve an understanding of, and commitment to, compromise and tradeoffs between the often-competing needs of economic, social and environmental concerns.
- Achieve a good understanding of floodplain management, wetland management and water-sensitive urban design by key stakeholders such as Local Government and state partnership agencies.
- Reduce the number of referrals on waterway health issues between key stakeholders such as Local Government and state partnership agencies.

8.3 core elements

The three core elements of communication, education and engagement are:

1. Establishing partnerships with stakeholders (agencies and community).
2. Establishing the transfer of information between stakeholders.
3. Increasing the knowledge base, and therefore the abilities, of stakeholders to improve waterway health.

Partnerships with stakeholders

The term 'partnership' is used in this context because it best suits the model of a shared vision for waterway health. It is acknowledged that the stakeholders will gain in skills and knowledge from participating in these partnerships.

Throughout the life of the *Wimmera WHS*, partnerships with key stakeholders will be established and maintained while working towards improvements in waterway health. Partnerships will embody joint operations, management actions and/or strategy development as required.

Some of these partnerships will be based on clear administrative and legislative arrangements, in the case of the various government agencies. But they will also include various waterway user groups, Indigenous people and groups, and the general public. Establishing and maintaining relationships between stakeholders is critical to the success of the partnerships element of the communications strategy.

Transfer of data and information between stakeholders

Information exchange between stakeholders will be a key to ensuring that management decisions and strategies are based on an improved knowledge base.

The transfer of information will need to be cognisant of the abilities of the individual stakeholder to access, store and use that information. This will become more critical when involving individual people; more so than when dealing with government agencies. Although it should be acknowledged that different government agencies have differing abilities to transfer and store information. As such, all stakeholders will need to ensure that information they supply to other agencies is in a format that can be accessed, and that sufficient skills exist within the organisation for it to be used effectively.

Increasing the knowledge-base, and therefore the abilities, of stakeholders

The above section dealt with the transfer of data and information between stakeholders; this section considers developing this data and information into knowledge on which decisions can be based.

It is considered that increased knowledge of waterway health will lead to the change in behaviour that this communications strategy aims to achieve. As such, a key for the success of this communications strategy is that the partnerships and information transfer are translated into increased knowledge. It is also assumed that the different stakeholders accept this knowledge; with changed behaviours following this acceptance.

8.4 current education and engagement programs

Wimmera Community Waterwatch and Landcare are good examples of partnerships with the community. These projects demonstrate the two-way flow of information between stakeholders, in that:

- Each stakeholder benefits from the relationship by receiving data, information, and experience of the real world; and
- The community gains experience in managing land and water resources.

8.5 target audiences

Communication, education and engagement activities need to be tailored to meet the needs of different audiences. Each target audience will have its own specific capabilities and needs that will impact on its ability and willingness to participate in improving waterway health.

Partnership agencies

Delivery partners are the agencies integrally involved with waterway management in the Wimmera. As well as Wimmera CMA, they are:

- GWMWater.
- Government departments of DSE, DPI, EPA and Parks Victoria.
- Local Government.
- Greening Australia.

River user groups

The river user groups are centred on community groups that use the Wimmera River and have a stake in its management (See Appendix 2 for a complete list of river user groups). This includes the following broadly-defined groups:

- Angling clubs.
- Rowing clubs.
- Other recreational user groups.
- Indigenous groups.
- Residents who live next to the river.
- Wimmera Community Waterwatch groups and members who monitor waterways.
- CMA Functional Committees.
- Licensed water users.
- Recreation/hobby groups.
- 4WD and motorbikes.
- Bird observers.
- Water authority community groups.
- Local area consultation groups.

Indigenous people

Modern Aboriginal people place a high social value on the comparatively few sites that have survived the impact of European settlement, as they collectively help the community preserve knowledge of the Indigenous community's traditional mode of existence. Given the pace of land clearance in the 19th Century, the dispossession of Aboriginal people from their land and the subsequent natural and human erosion processes, every occurrence of cultural material can be seen as a unique and irreplaceable element of their heritage, which should not be undervalued.

Aboriginal cultural values can frequently be integrated with natural values; hence undeveloped reserve land represents the survival of both important cultural sites and the resources essential for continuation of traditional life. This is understandably viewed by Aboriginal people as an ancestral inheritance, as demonstrated by the number of claims made throughout Victoria under the *Native Title Act* 1993.

It is important to protect Aboriginal heritage cultural sites, as they are an unrenovable source of both scientific information about traditional culture, and spiritual and cultural value to Indigenous Australians.

A number of cultural heritage studies have been done across the Wimmera that make recommendations for managing sites of Aboriginal cultural heritage. These studies have been completed for Yarriambiack Creek and the upper and middle Wimmera River basins. Over 2,000 sites of Aboriginal archaeological significance have been recorded in the Wimmera. The Grampians National Park contains the most important Koori art site in southeast Australia from Aboriginal occupation of the area that dates back more than 5,000 years.

The *Wimmera RCS* recognises Indigenous communities and their perspectives of landscapes and tradition and interests and rights in the land in the region. Wimmera CMA is committed to involving the Wimmera Indigenous community in natural resource management. To assist, Wimmera CMA has created a position of Indigenous Landcare Facilitator to facilitate greater involvement of Aboriginal communities in Landcare and natural resource management issues.

Wimmera CMA is currently developing the basic protocols for engaging Indigenous communities, and developing networks for ongoing liaison with local Aboriginal communities.

Community groups

The term 'community' is very broad and can encompass many different groups of people who have differing levels of interest in waterway health matters. When considering communications with the general community it is important to identify how their interest is manifest. For the purpose of the *Wimmera WHS*, the general community includes:

- Landcare groups.
- Landholders.
- Farming groups.
- Stock and station agents and rural suppliers who are excellent distribution points for printed information.
- Service groups such as Rotary, Lions, Apex and Country Women's Association.
- Local members of Parliament.
- Industry and commodity groups.
- Education sector (primary and secondary school teachers via Wimmera Community Waterwatch and Saltwatch programs, Wimmera teacher networks, adult education and learning centres).

8.6 targets

Aspirational

AT10. An informed and engaged community actively participating in waterway management in the Wimmera CMA region.

Resource Condition Target (10–20 years)

Nil.

Management Action Targets (1–5 years)

MAT74. Conduct a minimum of one workshop in each sub-region every two years.

MAT75. Review current monitoring plans by December 2006.

MAT76. Continued presence at local shows and Wimmera Machinery Field Days.

MAT77. Invitation to all schools in the Wimmera CMA region to participate in Waterwatch annually.

MAT78. 10% growth per year in Waterwatch program participant numbers by 2010.

MAT79. 10% increase in the number of Waterwatch sites monitored by 2010.

MAT80. 80% of Waterwatch monitors to achieve agreed QA and QC standards by 2010.

Target Assumptions

Assumptions made during the development of the targets are:

- Wimmera community is interested in being involved in Waterwatch.
- Waterwatch activities increase community and individual understanding of the values of waterways.

8.7 priority waterway management units and reaches

Communication, education and engagement activities are a priority for all Waterway Management Units and waterways (reaches and wetlands) across the Wimmera CMA region.

8.8 reference documents

Key reference documents for communication, education and engagement activities are:

- Wimmera Community Waterwatch Annual Report (2004)
- Wimmera Community Waterwatch Strategy (2005)
- Wimmera Water Quality Strategy Communication Action Plan (2002)
- Wimmera CMA Communication Strategy (2004)

8.9 communication, education and engagement strategic actions

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
CEE1	Implement communication and education activities that increase community knowledge and common understanding of the issues affecting waterway health.	Wimmera CMA , DSE, EPA, Local Gov't	1,000,000		MAT74, MAT76
CEE2	Develop and implement effective mechanisms for enabling the community to raise emerging issues with Wimmera CMA.	Wimmera CMA	50,000		MAT74, MAT76
CEE3	Undertake regular communication activities on the broad range of waterway health issues and initiatives.	Wimmera CMA	1,000,000		MAT74, MAT76
CEE4	Ensure extension activities are designed to incorporate adult learning principles and utilise effective engagement mechanisms e.g. utilise a range of media, undertake targeted demonstrations and offer a range of incentives.	Wimmera CMA	50,000		MAT74, MAT76
CEE5	Prioritise natural resource management information to be communicated for capacity building in the community.	Wimmera CMA	50,000		MAT74, MAT76
CEE6	Develop and implement best-practice waterway management training for community and school groups through extensive consultation with community members.	Wimmera CMA	500,000		MAT74, MAT76
CEE7	Investigate improved techniques to evaluate the uptake of practices and refine extension activities.	Wimmera CMA	100,000		MAT74, MAT76
CEE8	Implement a volunteer and community involvement plan that provides practical and skill-based outcomes to a broad spectrum of the community and interest groups in implementing priority onground waterway health projects.	Wimmera CMA	500,000		MAT74, MAT76
CEE9	Further investigate barriers to landholder adoption of best-practice waterway management.	Wimmera CMA	200,000		MAT74, MAT76
CEE10	Implement the Wimmera Community Waterwatch Review and Strategic Plan (2004-2007).	Wimmera CMA , GWMWater, Local Gov't, Waterwatch Volunteers	1,000,000		MAT77, MAT78, MAT79, MAT80
CEE11	Implement the relevant recommendations and actions contained in the Wimmera Landcare Support Strategy (2006).	Wimmera CMA , DPI, Landcare Groups	500,000		MAT74, MAT76
Total Program Cost			\$ 4,950,000		

* The bold name in the responsibility column indicates the lead authority

program 9 adaptive management framework

wimmera waterway health strategy

9.1 introduction

The framework for managing waterway health must be adaptive. Adaptive management is about learning and applying what has been learnt to improve the management of operational or investment programs and is often referred to as 'learning by doing' (Schreiber et al. 2004). As with most terms, the actual definition can vary depending on its use, and there are two main types; passive and active. Both approaches synthesize existing information about the system, monitor responses, and adjust future actions and objectives.

Active adaptive management involves comparing possible alternatives by designing management interventions as experiments. Passive adaptive management relies on implementing a single management policy or practice, based on existing understanding of the ecosystem.

The Adaptive Management Framework for the *Wimmera WHS* includes both active and passive adaptive management.

As described in Part 3, an effective adaptive management framework, as shown in Figure 5.1, should include:

- Clearly-stated goals and targets.
- Sound baseline/reference conditions.
- An effective process for learning from management actions.
- A transparent and explicit process for refining and improving future management actions.



The *National NRM Monitoring and Evaluation Framework* (Figure 5.2), together with the *VRHS*, have been used as the basis for the adaptive management framework of the *Wimmera WHS*.

Adaptive management frameworks include monitoring, evaluating and reporting.

Monitoring is the systematic collection of data. Baseline monitoring provides the baseline social, economic or environmental data necessary for evaluating and reporting on catchment health. Targeted monitoring allows for the measurement of trends or changes that may be direct or indirect results of activities.

Evaluation is conducted to assess the efficiency, effectiveness and appropriateness of actions. Evaluation may be based on qualitative or quantitative data.

Reporting involves the documentation of results of monitoring and evaluation. Key purposes of reporting may include accounting for expended funds or feeding data into decision-making processes.

FIGURE 5.1 general adaptive management framework (schreiber et al. 2004)

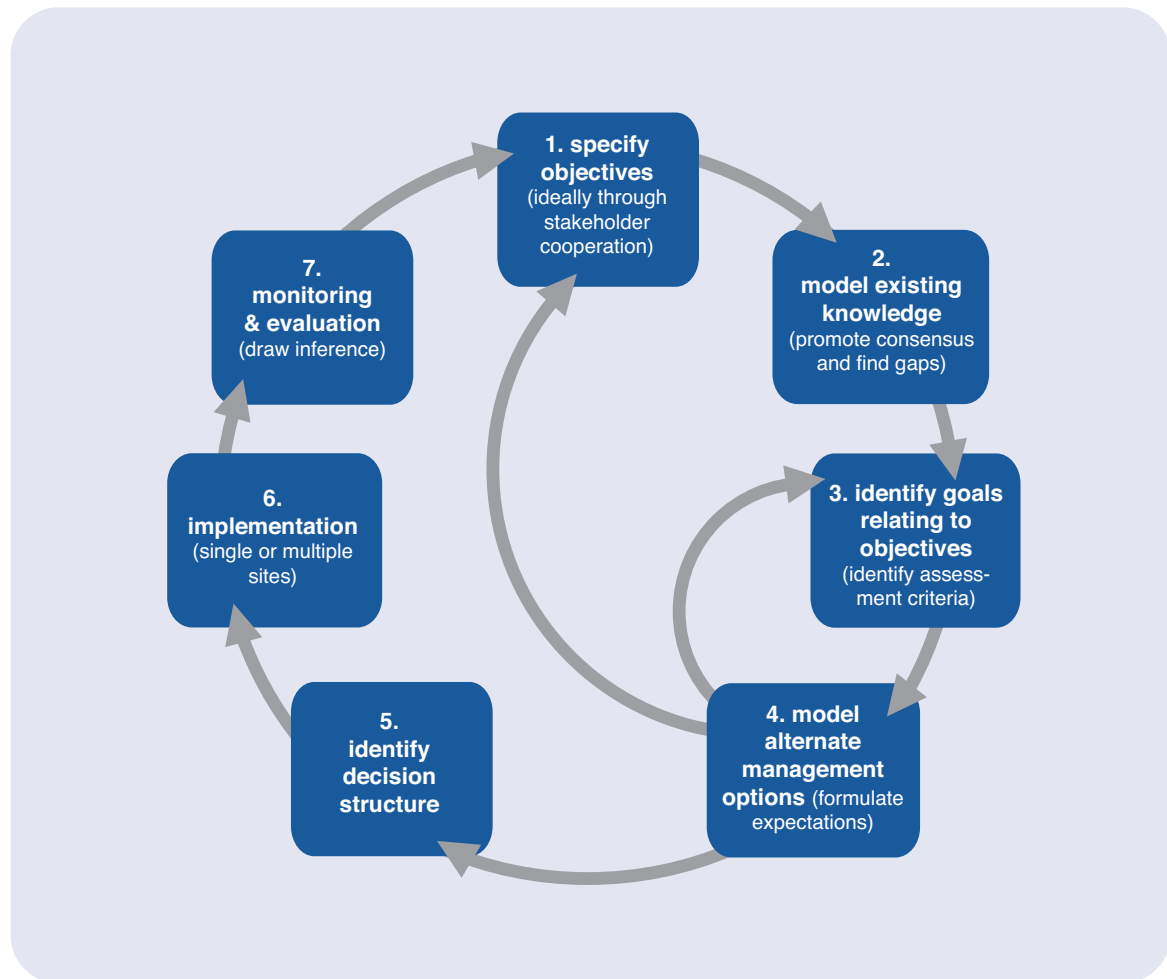
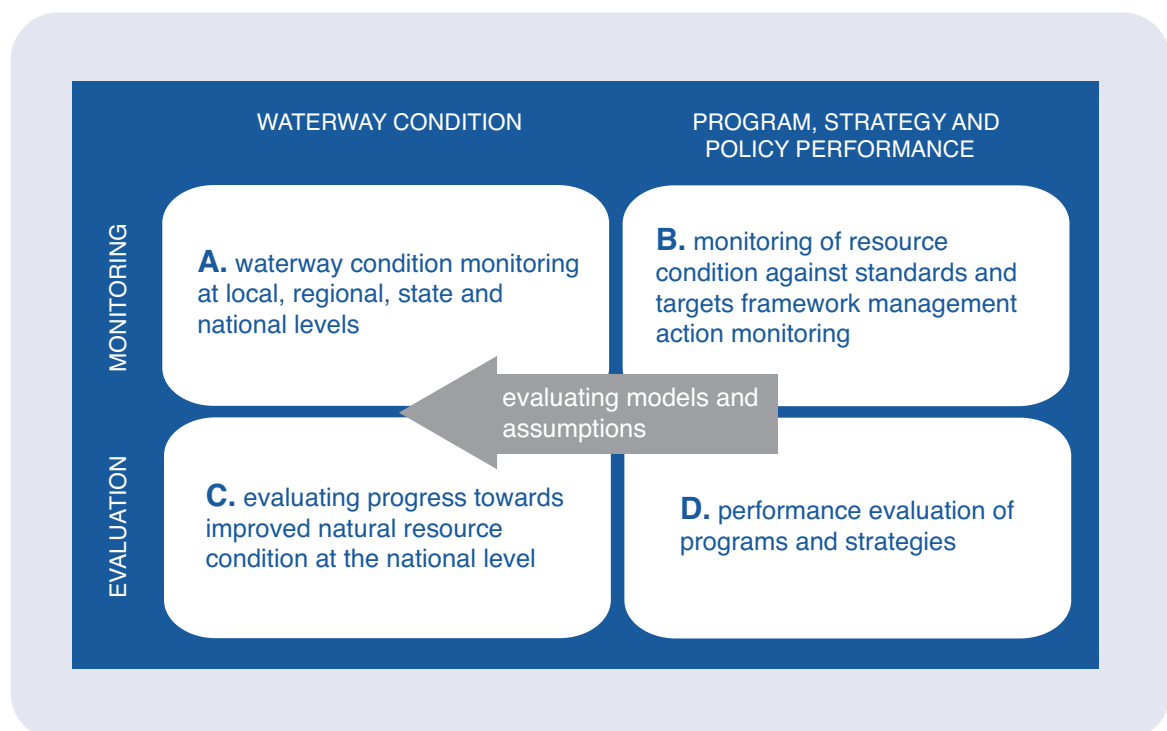
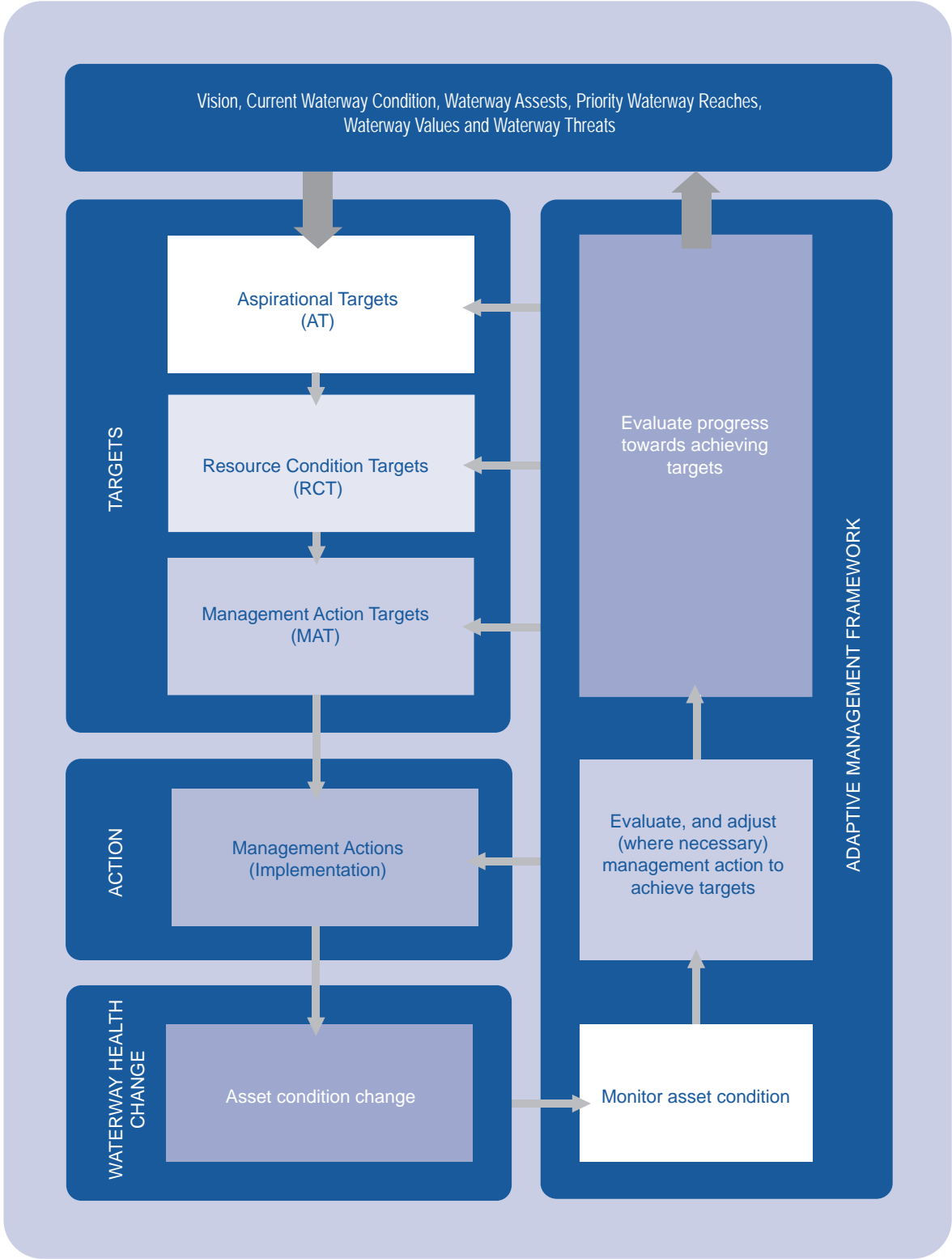


FIGURE 5.2 national NRM monitoring and evaluation framework



The Adaptive Management Framework for the *Wimmera WHS* is provided in Figure 5.3. This simple framework illustrates the linkages between aspirational, resource condition and management action targets and most importantly, the actual condition of the natural resource in question. Implementation of the monitoring and evaluation necessary to apply this framework will require significant resources and coordination. However, this coordinated effort is necessary to ensure not only that management actions are being implemented, but that these actions are contributing to achievement of RCTs and ultimately conservation or improvement in the Wimmera’s waterways.

FIGURE 5.3 adaptive management framework of the Wimmera WHS



9.2 objectives

The objectives of the Adaptive Management Framework for the *Wimmera WHS* are to:

- Monitor waterway health.
- Evaluate the effectiveness of projects, programs and the *Wimmera WHS* in achieving improvements in waterway health.
- Adopt the philosophies of adaptive management and continuous improvement in waterway management.

9.3 adaptive management framework strategic actions – monitoring

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
MON1	Develop, implement and regularly review an overarching monitoring program to monitor the long-term and short-term condition and trend of waterways in the Wimmera.	Wimmera CMA	30,000	RCT23, RCT24	MAT53
MON2	Monitor the saline groundwater intrusion into waterways and its impact on waterway health.	Wimmera CMA	250,000	RCT23, RCT24	MAT53
MON3	Monitor flows at priority sites in waterways across the Wimmera.	Wimmera CMA, DSE, GWMWater	500,000	RCT23,RCT24	MAT53
MON4	Monitor the physical and chemical water quality at priority waterways across the Wimmera.	Wimmera CMA, DSE, GWMWater	500,000	RCT23,RCT24	MAT53
MON5	Monitor the macroinvertebrate communities in waterways across the Wimmera.	Wimmera CMA, DSE, Waterwatch Volunteers	500,000	RCT23,RCT24	MAT53
MON6	Monitor the fish populations and communities in waterways across the Wimmera.	Wimmera CMA, DPI, Fishcare Volunteers	500,000	RCT23,RCT24	MAT53
MON7	Monitor the platypus populations in waterways across the Wimmera.	Wimmera CMA, Australian Platypus Conservancy, Landholders,Volunteers	75,000	RCT23,RCT24	MAT53
MON8	Monitor the bird populations associated with waterways across the Wimmera.	Wimmera CMA, Landholders, Volunteers	250,000	RCT23,RCT24	MAT53
MON9	Monitor the aquatic and riparian vegetation health and extent in waterways across the Wimmera.	Wimmera CMA	250,000	RCT23,RCT24	MAT53
MON10	Monitor the channel-form populations in waterways across the Wimmera.	Wimmera CMA	375,000	RCT23,RCT24	MAT53
MON11	Monitor sediment movement in waterways across the Wimmera.	Wimmera CMA, DPI, Landholders	250,000	RCT16,RCT17, RCT18,RCT20, RCT21	
MON12	Monitor the stability of erosion control structures in waterways across the Wimmera.	Wimmera CMA, DPI, Landholders	50,000	RCT16,RCT17, RCT18,RCT20, RCT21	
MON13	Develop and implement a monitoring program for instream habitat, channel form, bed and bank stabilisation and gully erosion control works.	Wimmera CMA	300,000	RCT16,RCT17, RCT18,RCT20, RCT21	

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
MON14	Ensure that monitoring informs better management and use of environmental water in achieving environmental objectives of priority waterways.	Wimmera CMA		RCT23,RCT24	MAT53
MON15	Continue to support and grow Waterwatch volunteers' contribution to waterway monitoring.	Wimmera CMA , Local Gov't, GWMWater, Waterwatch Volunteers	900,000		MAT77,MAT78, MAT79,MAT80
MON16	Continue to support and grow the bird watcher volunteer network.	Wimmera CMA , Birds Australia	250,000		
MON17	Monitor the implementation of projects implemented under the Wimmera WHS.	Wimmera CMA	250,000		
Total Program Cost			\$ 5,230,000		

* The bold name in the responsibility column indicates the lead authority

9.4 evaluation

Evaluation of the *Wimmera WHS* accounts for more than just the objectives of individual management actions in the Strategy. It also makes provision for monitoring the Strategy's design to ensure it places projects in the best position to achieve maximum impact on waterway health. In looking at Strategy design, the guiding question is whether there exists a logical link between the elements of the Strategy from policy documents right through to outcomes.

The four main parts to evaluating the *Wimmera WHS* and management actions are:

1. Evaluate achievement of objectives of management actions/projects.
2. Evaluate management action contributions to waterway health targets.
3. Assess indirect effects.
4. Evaluate Strategy design.

Evaluating the achievement of objectives of management actions/projects

With any evaluation of an action/project, it is necessary, after identifying objectives, to ask four questions:

1. What are the indicators of achievement of the objectives?
2. Are they measurable?
3. What are the means of verification (source and type) of data?
4. Are there any assumptions which must be true if the objectives are to be met?

Management actions/projects are undertaken to implement the *Wimmera WHS* and contribute to state-wide objectives and policy. The way achievements are recorded and reported can hinder or assist reporting required for the *Wimmera WHS*. For example, recording data at the time of the event is more efficient than trying to locate data at the time of writing the final report. To help with efficient collection of evaluation data at the management action level, each management action:

- Should have an evaluation plan so project leaders can reflect on the success of their project and learn from the failures.
- Must have clear and measurable objectives against which project leaders need to report in their milestone and final reports.

The evaluation component should be about 5% of total budget, depending on the nature of the management action. Any evaluation activity undertaken by project managers within the project must measure the achievement of objectives and contribute to the final report, rather than being discreet and separate activities and looking for information about ongoing management.

Evaluating the contribution of management actions to waterway health targets

Management actions are likely to be in the areas of:

- Onground management actions.
- Resource assessment.
- Capacity building.
- Planning.

Each management action has a number of outputs that are linked through assumptions to achieving waterway health outcomes. The value of these outputs can be measured by asking:

1. What were the results of these activities?
2. What is the value of the results to the catchment, the CMA and the community?

'Value' can be judged in terms of a balance between a positive outcome and the costs (time, funds and personnel). Some criteria to measure value are to ask 'at what cost does the activity?...':

- **For the waterway:**

- Meet the targets as set out in the *Wimmera RCS*, *Wimmera WHS* or other relevant documents?
- Contribute to a discernible improvement in catchment health?
- Target strategic areas and issues?
- Target priorities?

- **For the agencies:**

- Improve agency staff's knowledge and skills?
- Improve the standing of the agency in the community?
- Increase agency's network with relevant stakeholders?
- Contribute to other benefits?

- **For the community:**

- Increase the awareness for individuals and groups of catchment issues?
- Increase their knowledge of catchment issues?
- Involve them in catchment activities?
- Provide them with skills to improve catchment health?
- Contribute to other benefits?

Once the value of the activities to the waterway, agency and the community have been assessed, decisions can be made about which activities are worth repeating, which need more information for a clearer assessment and which need to be discarded or modified.



Assess the indirect effects

Outside targets and objectives, there are unexpected benefits and problems that arise as events occur. These need to be recorded and the best way to do this is to answer an evaluation question when asking about progress of management actions/projects against objectives. Such questions include:

1. What has occurred as a result of the implementation of the *Wimmera WHS* from a broad perspective?
2. What were the results (intended or unintended)?
3. What is the usefulness of the results?
4. What needs to be modified with regard to implementation of the *Wimmera WHS*?

The value of collecting unintended effects is that it provides a more accurate picture of what benefits were achieved with the associated costs. For example, unexpected problems have been caused by the weather or institutional arrangements of some organisations so they could not participate as expected. For example, if the right people were not notified about an event then it runs into difficulties not because anyone is being difficult but because permissions have to be sought from some external source.

With regard to benefits, often it is the case that much more has been achieved than intended because people worked together better than expected or the pooling of all their knowledge and skills accelerated the work. It has also been the case that individuals gained much more knowledge about an issue than they ever expected because they learnt from those around them.

Evaluating the logic of the Wimmera WHS

To evaluate the logic of a program or strategy, there needs to be a clear link and follow-through between any external policy or documents to which the strategy is associated, the objectives of the strategy and its outcomes.

The *Wimmera WHS* is in three main parts:

1. Strategic framework for the *Wimmera WHS* (Part 3).
2. Waterway health programs and their strategic actions (Part 4).
3. Waterway Management Units and Reaches and their associated actions (Part 5).

While evaluation in the *Wimmera WHS* focuses on Part 4, it is clear that this overlaps management actions in Part 5.

Part 4 of the *Wimmera WHS* is a series of waterway health programs with aspirational, resource condition and management action targets. There are also resource condition indicators that should be monitored to assess progress towards achieving targets.

The targets were set on the basis of the best information available at the time. Therefore, assumptions that these management action targets, once met, are the best indicators of waterway health need to be reviewed as new science and knowledge becomes available. As a result, evaluating the logic of the *Wimmera WHS* will need to consider not just the partners, programs and Waterway Management Units and reaches but also the assumptions about waterway health on which the targets are based.

The logic of the *Wimmera WHS* needs to be assessed on the connection of its objectives (and those of its sub-programs) with the methodology used to achieve the outcomes.

The questions that need to be asked for an evaluation of the *Wimmera WHS* are given in Table 5.2.

TABLE 5.2 evaluation questions for the Wimmera WHS

	Questions	Indicator of Success	Value
Logic of the Wimmera WHS	1. Has the Strategy taken into account external policy and documents to which it needs to react?	All external policies and documents identified and accounted for.	Is the integration with these documents valuable or does it hinder the level of innovation?
	2. Are there clear objectives in the Strategy and its sub-programs?	Clear and measurable objectives that have been externally assessed.	Are these objectives of real value to the catchment?
	3. Is the mix of activities in the sub-programs making progress with regard to the Strategy?	Progress against targets.	Is progress worthwhile?
	4. Is the mix of partners the best to carry out implementation?	Partners and CMA cover all responsibilities with regard to implementation of Strategy.	Is this the most valuable mix of partners? Are they the most valuable individuals in terms of being cost effective?
	4a. If not, who can advise me on a better mix?	Finding an appropriate adviser.	Has the advice been valuable?
	5. Is progress sufficient?	Satisfaction of Wimmera CMA and partners with progress.	Is the opinion of these partners valuable?
	6. Is there anything that needs modification?	Good information about what needs modification.	Is this the best information to help modify the Strategy?

Questions		Indicator of Success	Value
Other Aspects of Design	7. When I compare progress in this catchment to that of other catchments, what can I learn and apply from these other catchments?	Something to learn and apply.	What has been the value to the catchment of this learning?
	8. What can I tell others about that has worked better in my catchment?	Something and someone to tell.	Was it valuable to pass on this information?
	9. What have been the unexpected benefits or issues?	Benefits or issues identified.	What has been the value of these benefits? How can issues be overcome?

9.5 adaptive management framework strategic actions – evaluation

Ref.	Strategic Action	Responsibility*	Indicative Cost \$	Targets	
				RCT	MAT
EV1	Develop and implement an evaluation plan for assessing the effectiveness of the Wimmera WHS in achieving waterway health objectives.	Wimmera CMA	5,008,500 [^]	NR	NR
EV2	Develop and implement an evaluation plan for each priority project implemented under the Wimmera WHS.	Wimmera CMA , DSE, DPI, GWMWater, EPA, Local Gov't		NR	NR
Total Program Cost			\$ 5,008,000		

* The bold name in the responsibility column indicates the lead authority

[^] Calculated by taking 5% of the total cost of implementing projects (does not include implementation of the Wimmera-Mallee Pipeline Project)

NR – Not Relevant

program 10 indicative costs of implementing the Wimmera WHS

wimmera waterway health strategy

The indicative cost of implementing priority actions in the strategy is approximately \$11,073,500 per year, with a total of \$55,367,500 identified for priority actions over five years. This investment is focused on management actions in priority and influencing waterways across the 19 Waterway Management Units of the Wimmera region described in Part 4 of the *Wimmera WHS* (Table 5.3). These will be implemented by a range of partners including Wimmera CMA, departments of Primary Industries and Sustainability and Environment, Environment Protection Authority, Local Government, GWMWater and the community.

TABLE 5.3 indicative costs for implementing actions in priority and influencing reaches in the 19 waterway management units (see part 4 of the strategy for details)

waterway management unit		indicative cost (\$)
01	Upper Wimmera River system	5,008,500
02	Mt Cole Creek system	12,073,500
03	Wattle Creek system	5,965,500
04	Concongella Creek system	3,777,500
05	Upper Mt William Creek system	3,508,000
06	Lower Mt William Creek system	2,592,500
07	Grampians system	1,529,000
08	MacKenzie River and Burnt Creek system	3,156,500
09	Norton Creek system	1,677,500
10	Lake Toolondo Creek system	621,000
11	Natimuk Creek system	726,000
12	Heritage River system	2,387,500
13	Terminal Lakes system	2,923,500
14	Yarriambiack Creek system	2,355,500
15	Dunmunkle Creek system	1,498,500
16	Millicent Coast lakes system	1,675,000
17	Millicent Coast west-flowing system	2,237,000
18	Little Desert National Park system	390,000
19	North from the Little Desert National Park	1,675,000
TOTAL		\$55,367,500

The cost of implementing the entire *Wimmera WHS* across the seven waterway health programs is approximately \$21,035,700 per year, totalling approximately \$105,178,500 over five years (Table 5.4). This figure does not include the costs to implement the Wimmera Mallee Pipeline Project.

The indicative costs of implementing the Strategy include funding for on-ground management actions as well as strategic planning, communication, community education and engagement, regional partnerships and monitoring, evaluation and reporting. A broader program than on-ground management actions is necessary for a successful adaptive waterway health improvement program that is informed by good science and supported by the community and land managers.

TABLE 5.4 indicative costs for implementing the strategy

waterway management unit	indicative cost (\$)
1. Floodplain Management	6,515,000
2. Wetland Management	7,410,000
3. Riparian Management	23,490,000
4. Instream Habitat and Channel-Form Management	20,110,000
5. Environmental Water Reserve Management	14,165,000*
6. Water Quality	11,400,000
7. Significant Flora and Fauna	6,900,000
8. Communication, Education and Engagement	4,950,000
9a. Monitoring	5,230,000
9b. Evaluation	5,008,500
TOTAL	\$105,178,500*

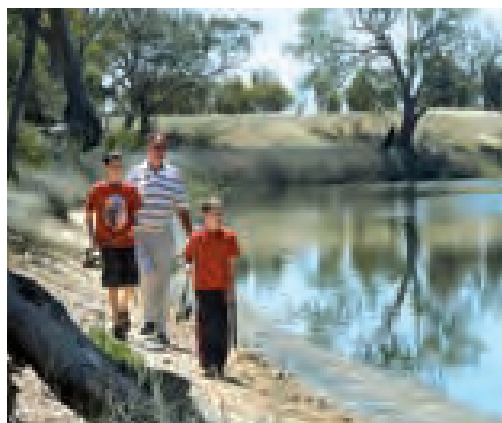
* Total does not include the cost of implementing the Wimmera-Mallee Pipeline Project.

A range of partners including Wimmera CMA, DPI, DSE, Local Government, GWMWater and the community are responsible for implementing these activities. The indicative costs include management actions by key agencies in the region and incorporate landholder contributions.

Wimmera CMA, the statutory waterway manager and caretaker of waterway health, is responsible for implementing the bulk of the waterway health activities. Waterway health-related activities undertaken by other agencies such as GWMWater, DSE, DPI, EPA and Local Government and associated costs have been identified and documented where possible. It is important to recognise that implementation of other action plans and sub-strategies under the *Wimmera RCS* contributes to waterway health outcomes, and are not directly costed or implemented under this Strategy.

It is important to also note that the estimated funding requirements and proposed cost shares are indicative. Wimmera CMA coordinates and implements waterway health-related activities on behalf of Government, in accordance with Government policies. Government's investment in the *Wimmera WHS* is contingent on Government budgets and priorities. The timeline for implementing the strategy and achieving the targets may need to be amended in line with the funding provided.

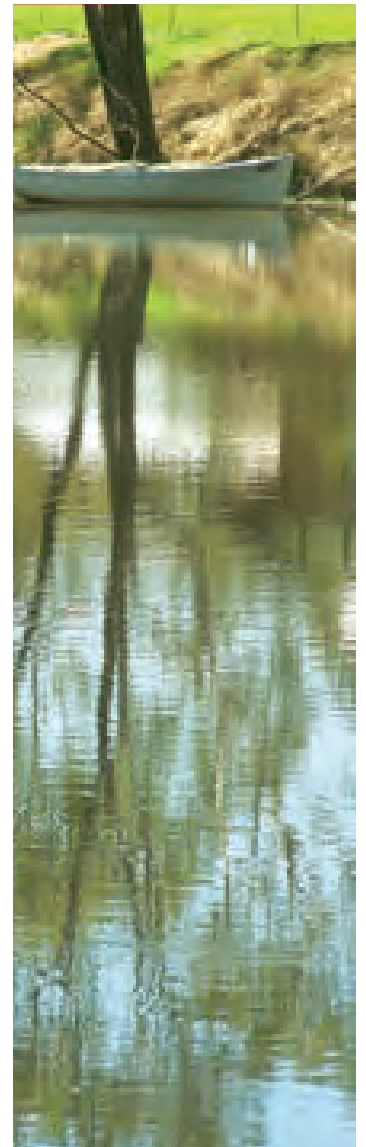
It is also important to note that these costs are indicative and will be refined through the development of more detailed action plans for specific sub-catchments or issues/threats.



part six

wimmera WHS resource book

Introduction	Sub-folder 1
Wimmera Regional Catchment Strategy and Sub-strategies	Sub-folder 2
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Development of the Wimmera WHS – The Process	Sub-folder 4
Waterway Management Units	Sub-folder 5
RiVERS Database	Sub-folder 6
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introduction

wimmera waterway health strategy

introduction

This section of the *Wimmera WHS* contains all the background information and analysis that has been undertaken through the development of the Strategy.

In total there are 22 individual documents and 165 photos contained in this section, and also includes the River Values and Environmental Risk System (RiVERS) database, and the *Wimmera WHS* Prioritisation Tool, both of which are Access databases which are fully operational (with the appropriate software). These documents combine to provide all the background material used to develop the *Wimmera WHS*. This section is only available in CD format as it is considered that the quantity of information contained in it makes it impractical to be provided in hard copy format.

Sub-folder 2 contains a copy of the *Wimmera Regional Catchment Strategy (Wimmera RCS)*. This document is the key document for Wimmera Catchment Management Authority as it sets out the broad strategic direction for the organisation. The *Wimmera WHS* draws on this document for key directions with respect to surface waters and waterway health.

Sub-folder 3 contains a copy of the State of the Catchment. Adopted by the Wimmera CMA in 2002, this document presents a review of the Wimmera region's natural and human resources and provides a report card on the *Wimmera RCS*. The role of the State of the Catchment report is to assess the *Wimmera RCS* against a range of criteria such as transparency, how effectively it has been used and its degree of ownership across the range of stakeholders in the region.

Sub-folder 4 contains documents relevant to the process of preparing the *Wimmera WHS*. This includes the original project brief, and flow chart that demonstrates the steps in preparing the Strategy, and the consultation undertaken as a part of developing the Strategy, and how this consultation informed further development of the Strategy.

Sub-folder 5 contains a paper on how the Waterway Management Units for the *Wimmera WHS* were developed. This was one of the first tasks in the development of the *Wimmera WHS* for the waterways of the Wimmera. Many difficulties can arise when attempting this process, in that once a line is drawn on a map, there are two sides to that line, and any number of arguments may be mounted as to the precise location of that line. Also, there is no one single source of data or information that clearly separates one area from another, and hence many different data sources were consulted in the formation of the Waterway Management Units. This paper sets out the rationale used for determining the Waterway Management Units in the Wimmera CMA region.

Sub-folder 6 contains a fully functional version of RiVERS database, as well as a report on the development and data population of the database. The process for developing and populating the Wimmera RiVERS model was as follows:

- Data from ISC assessments and other Statewide data sets. This information was inputted into the Model by Shelley Heron.
- Population of data from 2002 ISC assessments. This was inputted by Wimmera CMA.
- Workshops to populate the social and economic values fields.
- Review of all fields for all reaches to identify fields that contained no data.
- Review of all existing local knowledge and information to refine the values in RiVERS and input data where no data was available from the Statewide sets.
- Document the data sources for locally inputted data.

There are four main sources of data used to populate the Wimmera RiVERS database:

- 1999 ISC data.
- 2002 ISC field data.
- Community workshops.
- Local knowledge and scientific reports.

Sub-folder 7 contains various documents generated during the consultation exercises undertaken throughout the development of the *Wimmera WHS*. This includes the original Communication and Consultation Strategy developed at the beginning of the process, a report on the first-stage workshops, and a table that contains comments received on the range of Issues Papers (see sub-folder 10) that were released as stage two of the consultation. This section also contains copies of the cognitive maps generated by participants in the first-stage workshop that show the economic and social associations with waterways throughout the region.

Sub-folder 8 contains a discussion paper on Waterway assets for the Wimmera region. The key waterway assets identified in the *Wimmera RCS* are:

- Wetlands and Streams of the Wimmera River Basin.
- Terminal Lakes of the Wimmera River Basin.
- Wetlands and Streams of the Millicent Coast Basin.

Sub-folder 9 contains a discussion paper on Threats to waterway health identified in the Wimmera CMA region. Many of these threats are interrelated and can impact on a number of key aspects of waterway health. This paper expands on these issues. The key threats to waterway health in the Wimmera can be grouped into the following:

- Altered drainage and flow regimes.
- Deterioration of water quality.
- Loss of native biodiversity.
- Changed channel form.
- Deficient floodplain management.

Sub-folder 10 contains a discussion paper on the Values of waterways in the Wimmera. The values of waterways in the Wimmera can be grouped into:

- Cultural values.
- Social values.
- Economic values.
- Environmental values.

Sub-folder 11 contains detailed information on the condition of rivers, creeks and wetlands in the Wimmera CMA region. The documents contained in this folder include:

- 2004 ISC fact sheets.
- 2004 ISC report.
- Map of the Wimmera River Basin 2004 ISC results.
- Map of the Millicent Coast Basin 2004 ISC results.
- Discussion Paper on Waterway Condition in the Wimmera.
- Fact sheets on improvements to the ISC methodology in 2004.
- Summary of the 1999 and 2004 ISC scores for Waterways in the Wimmera.
- Summary report on wetland condition in the Wimmera.
- Technical report on wetland condition in the Wimmera.

Sub-folder 12 contains copies of the Issues Papers that were released as part of the second round of consultation. These Issues Papers were written to do two things, firstly to raise the issues associated with waterway health, and secondly to bring together the current body of knowledge of these issues. There are 16 issues papers in total.

1. Biodiversity.
2. Community Education and Awareness.
3. Cultural Heritage.
4. Economic Values.
5. Environmental Flow.
6. Fish.
7. Floodplain Management.
8. Heritage River and Terminal Lakes.
9. Riparian Land Management.
10. Salinity.
11. Social Values.
12. Threatened Flora and Fauna.
13. Water Allocation and Water Resource Management.
14. Water Quality.
15. Waterway Bed and Bank Maintenance and Rehabilitation.
16. Wetlands Management.

Sub-folder 13 contains the guiding principles that have been adopted as the fundamental basis for management of waterways and waterway health in the Wimmera CMA region.

Sub-folder 14 contains a discussion paper on Management Responsibilities. The health of a waterway is a cumulative outcome of the combined impacts of land and water management within the catchment and the waterway itself. Therefore, the management of waterway health in the Wimmera region needs to be undertaken within the broader integrated catchment management context. As part of the broader program of catchment management, the management and restoration of waterways is undertaken as a partnership between governments and the community. This can only be achieved with clear and agreed roles and responsibilities and ongoing commitment to work together. The general roles, institutional arrangements, partnerships and responsibilities of the major players within this partnership are described in this discussion paper.

Sub-folder 15 contains a discussion paper on cost-sharing Arrangements for waterway health. While the *Wimmera WHS* recommends that resources be directed to the areas of highest priority, based on the guiding principles of waterway health, it is clear that the task to be undertaken to achieve the vision is a major one requiring significant resources and long-term commitment by State and Australian Governments and the local community. It is important that long-term funding reflects the general cost-sharing principles for natural resource management and truly represents, in a fair and equitable way, the impacting groups and the various beneficiaries relating to river health. This discussion paper outlines proposed cost-sharing principles that will be applied in the development and implementation of waterway protection and enhancement programs.

Sub-folder 16 contains the Risk Assessment and Prioritisation methodology and Access database tool developed to interpret the RiVERS database. The basic aim of the risk assessment is to provide some objective measure of the hazard to a particular asset (environmental, social or economic) by a particular threat. Risk is expressed as a function of 'likelihood' and 'consequence'.

Sub-folder 17 contains four documents that have been developed to address the issue of target setting. The first two are reviews of existing targets and target setting methodologies, the third is a copy of the preliminary targets for the *Wimmera WHS*, and the final document outlines the assumptions made to set Resource Condition Targets for on-ground actions. These targets were developed to guide the management of water resources within the catchment. These targets both build on existing projects and management actions as well as highlight areas for future investigation and investment.

Sub-folder 18 contains the Evaluation Plan for the *Wimmera WHS*. The evaluation plan reviews the contribution of the Strategy's programs and actions towards achieving the catchment targets and aims for waterway health and to identify any barriers to achieving this outcome.

Sub-folder 19 contains the Adaptive Management Framework for the *Wimmera WHS*. An Adaptive Management Framework is about learning and applying what has been learnt to improve the management of operational or investment programs and is often referred to as 'learning by doing'.

Sub-folder 20 contains a number of photos taken by various participants in the consultation exercises. Participants were given a camera and asked to take photos of what they consider is important with respect to waterway health. This exercise was designed to involve members of the community in the early stages of the development of the strategy.

part seven references



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part eight glossary



Aggradation	A progressive build-up of the channel floor with sediment over several years.
Anabranh	A secondary channel or weir that leaves the main channel and re-joins it further downstream.
Aspirational Target	Long-term visions or goals to be achieved over 50+ years.
Asset	Something that has an identifiable owner and the owner must be able to derive a benefit from holding or using the asset. A feature in the region that has economic, social or environmental values.
AUSRiVAS	Australian River Assessment System - an indicator of stream condition that is evaluated by comparing the observed aquatic macroinvertebrate taxa at a site with the taxa predicted to occur at the site in the absence of environmental stress.
Average annual (flood) damage	The average damage per year that would occur in a particular area from flooding over a very long period of time. This provides a basis for comparing the economic effectiveness of different flood mitigation projects.
Bank	The relatively steep part of a stream channel cross-section, generally considered as being above the usual water level.
Bar	A relatively flat, temporary, local feature, typically on the inside of a meander bend where sediment is deposited. Vegetation that grows on a bar is usually stripped during large floods.
Barrier	Artificial instream structures, such as dams, weirs, causeways and culverts that restrict the migration and movement of fish or other biota and can interrupt flows and the transport of organic matter and sediment.
Baseflow	Baseflow is a constant flow that covers the bed of the channel, and aims to maintain water quality. Magnitude of baseflow varies depending on the season. Baseflows are the low flows provided during summer either side of the cease-to-flow period. These flows inundate bars between pools, provide some linkages and habitat availability.
Basin	The catchment of a large river or group of rivers. There are 29 basins within Victoria.
Bed stability	Bed stability is when the average elevation of the stream bed does not change much through time. Aggradation and degradation are the two forms of bed instability.
Bonn Convention	The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Program, concerned with the conservation of wildlife and habitats on a global scale.
Bulk Entitlement	The property right to water held by water and other authorities defined in the <i>Water Act</i> 1989. The Bulk Entitlement defines the amount of water that an authority is entitled to take from a waterway or storage and may include the rate at which it may be taken and the reliability of the entitlement.
Burra Charter	International Charter for the Conservation and Restoration of Monuments and Sites (Venice 1964), and the Resolutions of the 5th General Assembly of the International Council on Monuments and Sites (ICOMOS) (Moscow 1978). The Burra Charter was adopted by Australia ICOMOS (the Australian National Committee of ICOMOS) on 19 August 1979 at Burra, South Australia. Revisions were adopted on 23 February 1981, 23 April 1988 and 26 November 1999. The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members.
Catchment	That area of land contributing run-off to a defined stream or stream system; it includes the soil, water, vegetation and developments.
Catchment Management Authority (CMA)	An authority under the <i>Water Act</i> 1989. CMAs are the caretakers of waterway health, responsible for regional and catchment planning and coordination as well as waterway, floodplain and water quality management.

Cease-to-flow	No water flowing in the river or creek; there may be water in pools in the stream, but there is no water between these pools. During these periods rivers and creeks may contract into a series of isolated pools, decreasing the diversity and availability of aquatic habitats. This period also increases stresses and disturbs the system to help eliminate pests.
Channel form	The size and shape of a stream, typically described by longitudinal slope profile, cross sectional dimension and meander pattern.
COAG	The Council of Australian Governments is the peak inter-governmental forum in Australia, comprising the Prime Minister, State Premiers, Territory Chief Ministers and the President of the Australian Local Government Association (ALGA).
Cover	To do with vegetation density; the percentage of vegetation cover is the ratio of the area of vegetation when viewed from above to the ground surface area. Also to do with instream cover. For aquatic biologists, cover can also mean cover for fish and other animals in a stream.
Degradation	Degradation of waterways has a broad meaning including the reduction in quality, and a specific meaning in geomorphology of general lowering of a stream bed, usually over a period of years, by erosional processes. Degradation of land includes a decline in the quality of the soil, vegetation and other natural resources of the land as a result of overgrazing, excessive tillage, over-clearing, mineral extraction, development of towns, disposal of wastes, road construction, infestation by pest plants and animals or any other human activity on the land; degraded has a corresponding meaning.
Desnagging	Removing large trees (usually willows and river red gum) from the bed and banks of streams.
Drowned out	An obstacle to flow (for example a weir) is drowned out if the water surface elevation immediately downstream of the obstacle is approximately equal to the water surface elevation immediately upstream, and there is no sudden change in the water surface between the two points.
Ecologically sustainable development	Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be enhanced.
Effluent stream	A waterway that leaves a watercourse and does not return to it (the opposite of tributary).
Electrical Conductivity (EC)	A measure of salinity. The higher the EC of a stream the greater the salinity.
Environmental water releases	The flow of water released from a water storage or weir to meet environmental water requirements and to maintain appropriate environmental conditions in a waterway.
Environmental Water Reserve	The share of water resources set aside to maintain the environmental values of a water system and other water services which are dependent on the environmental condition of the system.
Ephemeral stream	A stream, which flows intermittently; that is, it is often dry.
Ephemeral waterway	Temporary or intermittent flowing waterway, for instance a creek or wetland which dries up periodically.
Erosion	Modification of the channel boundary by entrainment and removal of sediment.
Exotic vegetation	Introduced species of vegetation from other countries or from other regions of Australia (i.e. not indigenous to the region).
Exotics	Species that are non-indigenous or outside their natural range.
Fish passage	Provision for the movement or migration of fish past barriers.
Fishway	A structure that facilitates fish passage.

Flagship species	A well-known species the community are enthused to protect e.g. Murray cod, platypus.
Floodplain	Relatively flat land beside a river that is inundated when the river overflows its banks during a flood.
Floodway Overlay (FO)	Planning scheme overlay is applied to land identified as part of the active floodway or a high hazard area where high flow velocities are known to occur and where impediment of flood flows is likely to cause significant changes in flood flows, adversely affecting other areas.
Flow regime	The pattern of flow in a river which can be described in terms of the quantity and variability of water flows.
Flow regulation	Changes to the timing and volume of flow brought about by dams, diversions or other interference with a river.
Fresh	Freshes are larger pulses of water for short time periods; in summer they aim to wet the channel and improve water quality, and in winter they aim to initiate breeding in resident fish populations.
Geomorphology	The study of the earth's landforms including their origin and structure. Fluvial geomorphology is the subset that deals with waterways.
Gigalitre (GL)	Gigalitre = 1,000 megalitres or 1,000-million litres
Ground layer	Plants without woody stems less than 1.5 metres high e.g. sedges, reeds, grasses, and saltbush.
Groundwater	All sub-surface water, generally occupying the pores and crevices of rock and soil.
Habitat	Habitat is the place where a particular species lives and grows. It is essentially the environment - at least the physical environment - that surrounds (influences and is utilised by) a species population.
Head cut	A very steep section of stream bed that migrates upstream if not held by a bed control (e.g. a rock bar, or grade control structure). Downstream of a head cut is normally incised and eroding.
Heritage River	Land named under section 5 of the <i>Heritage Rivers Act</i> 1992. A section of the Wimmera River between Polkemmet and Wyperfeld National Park is classified as a Heritage River because of its environmental and social values to the community.
High flows	A big flow that occurs as a result of prolonged rainfall and can sometimes generate a flood. These flows generally occur in winter, when rainfall is higher, and fill the river to the top of the banks. High flows are aimed at channel-forming processes, like eroding away sediment that has become deposited during the low flow season.
Hydrology	The science dealing with surface and groundwaters of the earth; their occurrence, circulation and distribution; their chemical and physical properties; and their reaction with the environment.
Incised stream	A deep narrow stream that has eroded its bed and banks and has a large channel capacity, such that overbank flooding is rare.
Index of Stream Condition (ISC)	The ISC is an integrated measure of waterway health that calculates the state of a stream's hydrology, water quality, aquatic life, vegetation, instream habitat, and bank and bed condition thereby enabling the classification of a waterway's overall health. It is designed to be completed every five years at hundreds of waterways across the state. Each stream that is classified using ISC is divided into reaches of approximately 10-30 km and are each surveyed to provide a snapshot of the health along the vast majority of Victoria's creeks and rivers.
Indigenous	In general, species that originated in, and occur naturally in, a particular region or environment.
Integrated Catchment Management	Management of plants, animals and water in a particular area of land.

Invertebrates	Animals without backbones, including zooplankton, shellfish, worms, shrimps and snails.
Issue	A process that affects an asset's condition or value (they may be threatening or enhancing processes).
Land Subject to Inundation Overlay (LSIO)	Planning scheme overlay applies to land which is subject to inundation, but is not part of the primary floodway.
Large Woody Debris	A tree, branch or root system that has fallen into or is immersed (totally or partially) in a stream.
Longitudinal continuity	An indicator in the streamside zone sub-index. A measure of how continuous streamside vegetation is and the importance of discontinuities in the vegetation.
Low flow	Low flows are small flows that occur in summer. These flows connect pools and provide habitat for plants and aquatic animals such as fish.
Lowland reaches	Lowland reaches are low in gradient, and the flow velocity is, on average, low. Lowland streams often have depositional features. Some lowland streams are tidal. Lowland streams typically meander across broad (greater than 1 km wide) alluvial or coastal floodplains.
Macroinvertebrate	An invertebrate (animal without a backbone) that is visible to the naked eye.
Macrophyte	A water plant that is not an algae. It may be either floating or rooted.
Major streams	Major streams are defined in the ISC as those streams with a catchment area >30,000 ha.
Management Action Target	Short-term targets specific to management actions (1-5 years).
Measuring site	A length (430 m) along a stream for which field data is collected to assess most of the indicators in the physical form and the streamside zone sub-indices. There are three transects within a measuring site.
Megalitre (ML)	One million litres.
Minor streams	Minor streams are defined in the ISC as those streams with a catchment area <5,000 ha.
Modified catchment	A catchment that has been altered by human impact. The most common impacts include altered land use and flow regime, and the introduction of exotic plants and animals.
Morphology	Shape or form.
National Action Plan for Salinity and Water Quality (NAP)	Established by the Australian, State and Territory Governments in November 2000, the objectives of NAP are to enable regional communities and landholders to use coordinated and targeted action to prevent, stabilise and reverse trends in dryland salinity, and to improve water quality.
Natural flows	The flows that would have existed if present rainfall patterns fell on catchments before European settlement.
Natural Heritage Trust (NHT)	Established in 1997 by the Australian Government to fund environmental protection, sustainable agriculture and natural resource management.
Natural Resource Management	The management of natural resources – land, soil, native vegetation, biodiversity and water.
Nutrients	Substances, such as phosphorous and nitrogen, that are necessary for plants (including algae) to grow.
pH	A measure of acidity or alkalinity of water (based on the concentration of hydrogen ions).

Potable	Suitable for drinking.
Program	A collection of project/activities that are directed toward a common goal, addressing a group of like issues.
Protection	Ensuring that there is no further decline in the environmental condition of a river.
Ramsar	The Convention on Wetlands, signed in Ramsar, Iran in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are presently 146 Contracting Parties to the Convention, with 1456 wetland sites, totaling 125.4 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance.
Reach	A length of stream or river, typically 10-30 km long, which is relatively homogenous with regards to its hydrology, physical form, water quality and aquatic life sub-indices and used for management/reporting purposes. In this Strategy, reaches are based on the Index of Stream Condition reaches unless otherwise indicated.
Regeneration	Vegetation that has grown from natural sources of seed, from vegetative growth, or has been artificially planted. In the ISC, the regeneration indicator is based on the amount of woody vegetation <1m high.
Regulated stream	A stream where flows are controlled by releases from a dam.
Regulated systems	Those where the flow of the river is regulated through the operation of large dams or weirs.
Resource Condition Indicator	A measure used to indicate the condition of waterway health.
Resource Condition Target	Pragmatic and achievable medium term goals (10-20 years)
Restoration	Improvement or enhancement of the environmental condition of the river toward 'ecologically healthy'.
Reticulation	The network of pipelines used to take water into areas of consumption. Includes residential districts and individual households.
Riffle	The high point in the bed of the stream between two pools (it is often covered in gravel or coarser material). Water is often shallow and fast flowing.
Riparian land	Riparian land is any land next to or which directly influences a body of water. It includes land immediately alongside small creeks and rivers, gullies and dips that sometimes run with surface water, areas surrounding lakes and wetlands on river floodplains which interact with the river in times of flood. It often has water-dependent vegetation. Riparian land is the interface between the catchment and instream area of a river or stream.
Risk	Risk is the potential harm/danger that may arise from some present process or from some future event.
Salinity	The total amount of water-soluble salts present in the soil or stream.
Shrub layer	Woody plants <5m tall, frequently with many stems arising at or near the base e.g. melaleuca, leptospermum, tree ferns, and blackberry. Includes non-woody vegetation >1.5m high.
SIGNAL	An indicator in the aquatic life sub-index that measures effect of pollution on aquatic biota. SIGNAL is the acronym for Stream Invertebrate Grade Number-Average Level.
Snagging	Refer to desnagging.
Spatial interpolation	To fill a data gap based on data from a reach either upstream or downstream of the actual reach.

Spring fresh	When it rains in spring, flows occur in the river for a short time. These flows are usually much larger than summer freshes because in the Wimmera, the rainfall is much higher in winter and spring (than in summer). These freshes stimulate migration and spawning of native fish. They also mobilise fine organic material that would otherwise smother instream habitats.
Stormwater	Untreated rainfall run-off from urban areas.
Structural intactness	An indicator in the streamside zone sub-index that compares the natural and existing cover of tree layer, shrub layer and ground layer.
Sub-index	A group of indicators that measure a particular aspect of a stream. In the Index of Stream Condition, the five sub-indices are hydrology, physical form, streamside zone, water quality and aquatic life.
Summer	December to May.
Summer fresh	Summer rainfall would naturally result in summer freshes. The size of the flow depends on the amount of rain. Summer freshes are important to re-oxygenate pools, and reduce nutrient levels.
Target	A measurable result expected to be achieved within a given timeframe.
Taxa	A taxonomic category or group, such as a phylum, order, family, genus, or species.
Terminal Lake	Receives inflows from streams or rivers draining its catchment, but has no streams draining from it. It is the end point of a river system.
Threat	An action or process likely to cause harm to an asset i.e. degrade a value.
Total phosphorus	The sum of the concentrations of soluble and in-soluble phosphorus.
Tree layer	Woody plants >5 m tall, usually with a single stem e.g. eucalyptus >5 m tall, acacia >5 m tall, and willow >5 m tall. Note that woody vegetation species <5 m high are classed as shrub layer.
Tributary	A river or creek that flows into a larger river or creek.
Tributary streams	Tributary streams are defined in the Index of Stream Condition as those streams which have a catchment area between 5,000-30,000 ha.
Triple-bottom-line (TBL)	Integrated approach to the achievement of environmental, social and economic outcomes.
Turbidity	The total amount of suspended solids in the water column. Turbidity measures the cloudiness of the water.
Unmodified catchment	A catchment that has not be altered by clearing, forestry or other human activities.
Unregulated system	A system where no major dams or weir structures have been built to supply or extract water.
Urban areas	Urban areas are shown as built up on current street directories. The Index of Stream Condition was not designed for urban reaches.
Value	Something considered to be important or beneficial.
Verge	The area commencing at the top of the bank and extending from the bank to the next major vegetation or land use change.
Water authority	An authority under the Water Act 1989 charged with supplying water to towns and cities, for urban, industrial and commercial use. They administer the diversion of water from waterways and the extraction of groundwater.

Water quality	<p>The quality of water depends on lots of different things, including:</p> <ul style="list-style-type: none"> • How much salt, algae, nutrients (like phosphorus and nitrogen), heavy metals (like lead, and aluminium), and oxygen is present in the water. • How clear or cloudy the water looks. • Whether the water is acidic (like lemons), or alkaline (like household bleach), or somewhere in between. • Whether there are any toxins or pollutants in the water. <p>Water quality is best described over long time periods and is determined by measuring things like salinity, turbidity, hardness, pH, and the amounts of nutrients, algae and toxins in the water.</p>
Waterway	The <i>Water Act</i> 1989 defines a waterway as a river, creek, stream, watercourse and a natural channel where water regularly flows, whether or not the flow is continuous. In this Strategy, a waterway is defined as a natural river, creek, stream, watercourse or wetland.
Waterway Management unit	An area defined at the subcatchment planning level based upon physical feature similarities and stream management issues. A Waterway Management Unit contains a number of reaches.
Wetland	Inland, standing, shallow bodies of water which may be permanent or temporary, fresh or saline.
Width of stream	The distance from one edge of the stream to the other during typical base-flow conditions.
Width of vegetation	Width of vegetation from edge of stream during typical base-flow conditions to adjacent land use.
Winter	July to October.
Winter base flows	A medium flow that occurs in the river during winter. Generally, this flow is big enough to cover the bottom of the river from one side of the bank to the other.
Winter freshes	When it rains in winter, flows occur in the river for a short time. These flows are usually much larger than summer freshes because in the Wimmera, the rainfall is much higher in winter than in the summer.
Woody plants	Vegetation that has a distinct trunk and branch structure, ranging from trees to small shrubs. Generally hard and fibrous.



Waterways for Life.

26 Darlot Street (PO Box 479) Horsham 3400

ph: (03) 5382 1544 fax: (03) 5382 6076

email: wca@wcma.vic.gov.au web: www.wcma.vic.gov.au