

2014 2022



Wimmera Waterway Strategy

a healthy Wimmera catchment where a resilient landscape supports a sustainable and profitable community.

Executive Summary

The value of the Wimmera's waterways to the region cannot be understated. They provide us with the water for our towns, farms and industries. They are a major focus for recreation activities such as fishing, water-sports, camping, walking, or simply watching the abundance of wildlife. A vast range of plant and animal species rely on the rivers, lakes, creeks and wetlands through cycles of wet and dry to survive and thrive.

Historical activities such as land clearing, introducing pest plants and animals and undertaking drainage works have left a legacy of poor waterway condition in parts of the Wimmera. However, great outcomes for the region's waterways have been achieved in recent years, most notably through the completion of the Wimmera Mallee pipeline, leading to substantial water savings for environmental watering. Climate variability has created its own challenges, apart from two flood events in 2010 and 2011, the region has experienced 17 years of below average rainfall since 1996. There has been a significant uptake and desire by landholders to be involved in projects and incentives that improve waterway condition and these programs are always oversubscribed. With over 3,000 wetlands and thousands of kilometres of river and creek frontage there is significant scope for more improved waterway management.

The *Wimmera Waterway Strategy* is intended at a minimum to maintain and where possible improve waterway condition and builds on a number of existing strategies and plans. It provides the wider community with a targeted, long-term action plan outlining what can be done across the region to secure waterway values for this and future generations. The document strategically aligns with the *Wimmera Regional Catchment Strategy 2013-2019* where it provides the action plan for maintaining and improving "Rivers and Streams" and "Wetlands" as natural assets. This strategy also fulfils the Wimmera CMA's obligations under the *Victorian Waterway Management Strategy* (DEPI, 2013) in terms of developing a new waterway strategy for the region and is a legislated requirement under the *Water Act 1989*.

Community input, local knowledge and scientific information were used to identify the values, threats and the most effective management activities that can be undertaken to maintain and improve the condition of priority waterways.

The goals for the *Wimmera Waterway Strategy* are as follows:

- ***Maintaining and improving the values and condition of waterways that have formally recognised significance;***
- ***Improved connectivity and condition along priority wetland systems and riparian corridors;***
- ***Improved water quality in priority areas for; water supply, environmental condition and recreation; and***
- ***Waterways with high social, cultural and economic values are maintained in a state that continues to support those values in line with climatic conditions.***

On-ground management activities are focused on invasive plant and animal control, erosion control, environmental watering and developing wetland and riparian management agreements. Other activities include community engagement events highlighting waterway values and threats as well as investigations into issues such as wetland hydrology, water quality (salinity and nutrients) and carp movement to better inform future management activities.

Through the ongoing commitment of the Wimmera CMA's partners, stakeholders and the broader community, the goals and vision for this region's waterways will be achieved and they in turn will continue to underpin much of the region's prosperity as well as being enjoyed by thousands of people each year.

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Introduction

This strategy provides a rigorous work plan for waterway management activities for the next eight years for Wimmera CMA and its partners. It also provides a reference for interested groups and individuals to see what activities are proposed for their local area.

Part A - Regional Overview and Strategic Context

This section provides an overview of the region's waterways, the legislation and policies that drive the *Wimmera Waterway Strategy*.

Part B - Vision, Goals and Guiding Principles

The process for prioritising waterways and developing a strategic regional work program of management activities to improve and maintain them is underpinned by sound evidence and logical processes. This section outlines the process of translating a long-term vision into activities on the ground as well as highlighting some of the key values and threats associated with the region's waterways.

Part C - Regional Work Program

Site specific activities for priority waterways and grouped into local government areas, following the approach of the *Wimmera Regional Catchment Strategy 2013-2019* (Wimmera CMA, 2013). Also included are actions for Traditional Owner involvement in waterway management and a number of relevant management issues discussed in the *Victorian Waterway Management Strategy* (DEPI, 2013), such as recreational use of waterways, extreme natural events and water quality.

Part A

Regional Overview & Strategic Context



The Wimmera's waterways are a fantastic natural asset that are highly valued by the community. Maintaining and improving these values requires a number of challenges to be addressed through innovative and integrated approaches.

PART A – Regional Overview and Strategic Context

1. Regional Overview

The Wimmera Catchment Management Authority (CMA) region covers sections of the Wimmera River Basin and the Millicent Coast Basin (Figure 1-1). 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 1,000 millimetres (mm) in the Grampians to as low as 300 mm in the northern plains. This diverse environment is located amongst an important and profitable broad-scale agricultural industry.

Wimmera River Basin comprises part of the Murray-Darling Basin and the Wimmera River itself has a catchment of about 2.4 million hectares (ha). Numerous tributaries from the Mount Buangor State Park and Pyrenees Ranges to the southeast join the main Wimmera River upstream of Glenorchy. Major sub-catchments of the Wattle, Concongella and Mt William creeks also provide significant streamflows in wet conditions. The Wimmera River flows west to Horsham where the Burnt Creek joins. Just downstream, the MacKenzie River enters which flows from the northern part of the Grampians National Park as well as Norton Creek which commences near the southern boundary of the Wimmera CMA region.

To the 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 Outlet Creek and on to Lake Albacutya, a Ramsar wetland of international importance and rarely extends to the Wirrengren Plain in the Mallee. The Wimmera River between Polkemmet (10 km northwest of Horsham) and the 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 distributaries, Yarriambiack and Dunmunkle creeks. Yarriambiack Creek flows from Longerenong through Warracknabeal, Brim and Beulah into Lake Coorong near Hopetoun. Dunmunkle Creek, a highly-modified stream, carries water north from Glenorchy through Rupanyup, dissipating in the southern Mallee. Further west, the Millicent Coast Basin has a number of small ephemeral west-flowing streams such as Mosquito Creek that are important due to cross-border influences into South Australia.

These rivers and streams are the lifeblood of the region, supplying water for towns, farms and businesses as well as a wealth of recreational opportunities in all but the driest of climatic periods such as rowing, fishing, water-skiing, camping or simply enjoying a walk along their banks.

There are over 3,000 wetlands in the region, 90% of which are on private land. Most of these occur in the Millicent Coast Basin and are ephemeral. A number of the region's wetlands such as Pink Lake, Natimuk Lake, Oliver's Lake and White Lake are ecologically of national significance. Some like Lake Lonsdale and Lake Wartook are important water storages and recreational areas. Within the Wimmera, wetlands are also economically important for agriculture and tourism. Wetlands like Lake Wallace, Lake Ratzcastle and Lake Charlegark are major drawcards for visitors when they contain water. They reflect the boom and bust of the seasons, bursting to life in wetter times whilst spending much of the time completely dry.

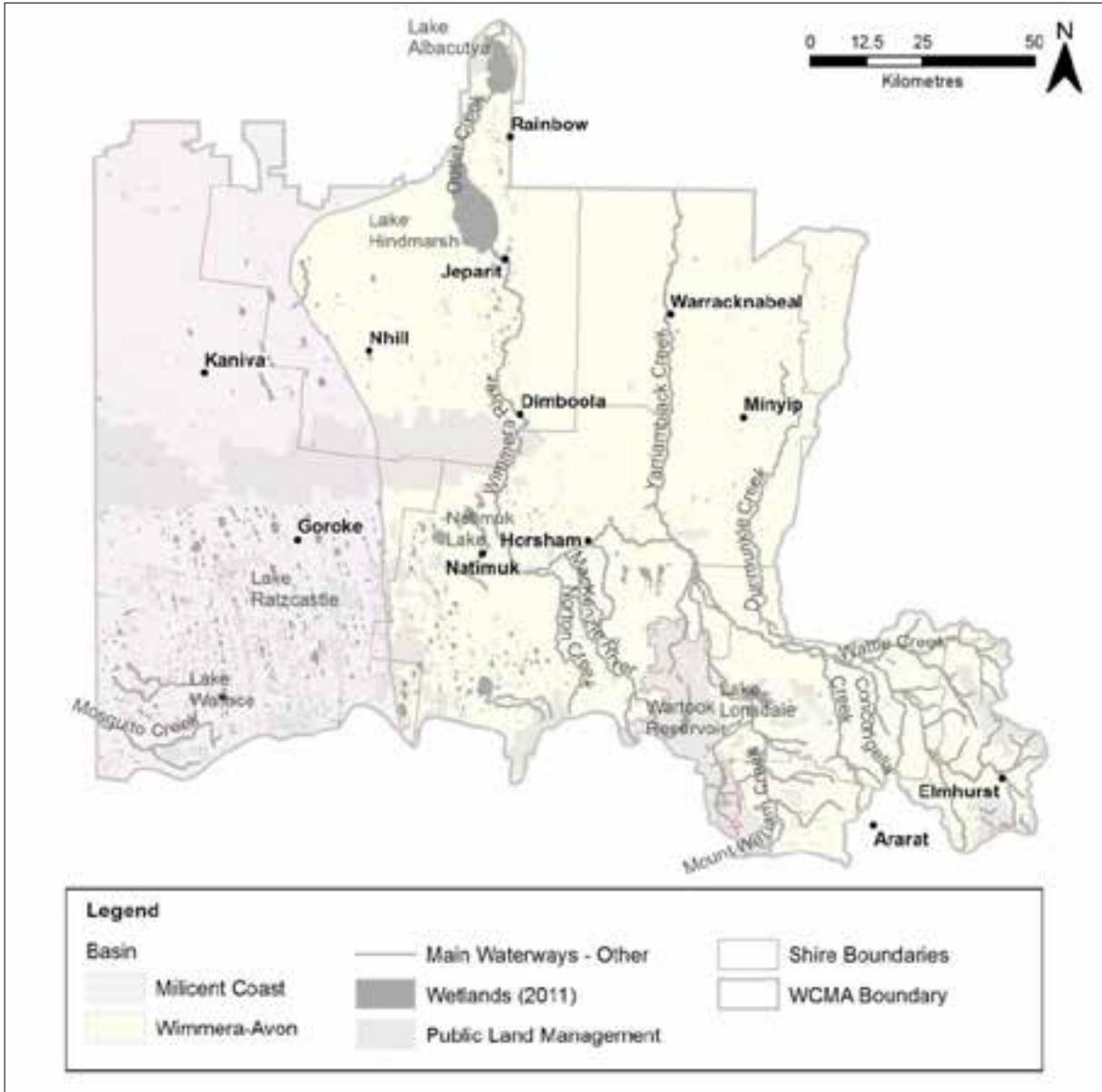


Figure 1-1 Key waterways of the Wimmera CMA region

2. Context

This section sets the strategic context for the *Wimmera Waterway Strategy (WWS)* by outlining its relationship to other regional, state and Commonwealth policies and outlines the current context regarding landholder and government investment in waterway management. Further context is available in Appendix 3 which indicates the roles and responsibilities for those involved in waterway management. Appendix 4 describes outcomes and learnings gained during implementation of the *Wimmera Waterway Health Strategy (2006-2011)* which preceded this strategy.

2.1. Purpose

The *WWS* is the planning document for the management of rivers, creeks and wetlands (including lakes) in the region as required under the *Water Act 1989* and the *Victorian Waterway Management Strategy (VWMS)*. It has been developed in consultation with a wide range of stakeholders and the broader community. This document identifies high value and priority waterways and establishes long-term goals for waterway condition underpinned by an eight-year regional work program listing a number of management activities to attract and direct government and philanthropic investment.

2.2. Legislation and policy

2.2.1. State

The *VWMS* (DEPI, 2013) provides the framework for government, in partnership with the community, to manage rivers, estuaries and wetlands so they can support environmental, social, cultural and economic values now and into the future. The *VWMS* updates the *Victorian River Health Strategy* (DSE, 2002) (*VRHS*) which was a significant milestone for river management in Victoria. It outlined clear principles for making regional decisions on river protection and restoration, identifying regional priorities for management activities and state-wide direction on important management issues affecting river health.

Victoria's water allocation framework provides the basis for the management of Victoria's water resources. Under the *Water Act 1989*, the Victorian Government retains the overall right to the use, flow and control of all surface water and groundwater on behalf of all Victorians. All water taken for consumptive purposes is done so under entitlements set out in the *Water Act 1989*. Victoria's water allocation framework takes a whole-of-system water management approach and considers all water resources (surface water and groundwater) for both consumptive and environmental purposes at all phases of the water cycle. Like surface water, groundwater is allocated for commercial and irrigation purposes under strict licensing arrangements under the *Water Act 1989*.

The *Water Act 1989* also defines the Environmental Water Reserve (EWR) as the amount of water set aside to meet environmental needs. The Victorian Environmental Water Holder (VEWH) was established in 2011, under the *Water Act 1989* as an independent statutory body responsible for making decisions on the most efficient and effective use of Victoria's environmental entitlements.

The key state-wide policy framework for water quality protection in Victoria is the *State Environment Protection Policy (Waters of Victoria) 2003 (SEPP WoV)*. It provides a statutory framework for State and local government agencies, businesses and communities to work together to protect and rehabilitate Victoria's surface water environments. The *SEPP WoV* identifies beneficial uses of water and sets the environmental quality objectives and policy directions required to address higher risk impacts and activities.

The *Flora and Fauna Guarantee Act 1988 (FFG Act)* is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The *FFG Act* lists threatened species and ecological communities and threatening processes.

The *Heritage Rivers Act 1992* identifies and provides protection for Victorian heritage rivers by setting conditions on activities that may impact on their values (such as timber harvesting and water extraction) and requiring a management plan for each heritage river. The Wimmera River, downstream of Polkemmet Bridge is classified as a Heritage River under the *Heritage Rivers Act 1992*. The *WWS* serves as a management plan for the Wimmera Heritage River.

The *Catchment and Land Protection Act 1994 (CaLP Act)* establishes Regional Catchment Strategies (RCSs) as the primary framework for integrated management of land, water and biodiversity in each of the ten catchment regions of Victoria. The Wimmera CMA is responsible for preparing the various iterations of the Wimmera Regional Catchment Strategy and co-ordinating and monitoring its implementation. Regulations made under the *CaLP Act* set out obligations of land managers with respect to invasive plant and animal control.

2.2.2. Regional

The *Wimmera Regional Catchment Strategy (2013-2019) (Wimmera RCS)* (Wimmera CMA, 2013) is the overarching strategy for natural resource management in the Wimmera region, under which sit a range of sub-strategies and action plans. It contains a long-term vision for the region, identifies regionally significant natural assets and sets 20 year condition objectives and six year management

measures. The *Wimmera RCS* involved extensive community consultation to ensure that the document reflects contemporary community values and aspirations. The long-term objectives in the *Wimmera RCS* that relate to waterways will be implemented through the *WWS* (see Appendix 7).

Regional planning processes for waterway management were established in 2002 under the *VRHS* and implemented through the ten regional River Health Strategies (RRHSs). In the case of the Wimmera CMA region, given the importance of wetlands in the region, it was called the *Wimmera Waterway Health Strategy* (Wimmera CMA, 2006) (*Wimmera WHS*) which includes creeks, rivers and wetlands under the definition of ‘waterway’. Community input and participation in these regional planning processes was a critical element to ensure that regional planning reflected the community values of waterways in each region. The strategies identified high value waterways and priority management activities to be undertaken over a six-year period. The *Wimmera WHS* was the cornerstone of the regional planning framework for waterways but has now passed its intended lifespan and the *WWS* will replace the *Wimmera WHS*

Water resource planning in Victoria is addressed through development of regional Sustainable Water Strategies (SWSs) that set out long-term regional plans to secure water for regional growth, while safeguarding the future of its rivers and other natural water sources. They investigate the range of potential changes to water availability under several climate change scenarios. The regional SWSs examine future consumptive demand and environmental needs and set out proposed options to balance and secure water for all users. The SWSs are where the Victorian Government, in partnership with regional communities, decides whether additional water is required for environmental or consumptive needs. In the Wimmera, the *Western Region Sustainable Water Strategy* (DSE, 2011) (*Western Region SWS*) provided a number of actions and policies with respect to water resource management in the region.

2.2.3. National

At the federal level, water reform has been guided by the National Water Initiative (NWI) since 2004. Under this agreement, governments across Australia have committed to actions to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water. The NWI recognises the need to build on the water reforms of the 1994 Council of Australian Government (COAG) agreement to ensure increased productivity and efficiency of Australia’s water use. It includes clear steps to return river and groundwater systems to environmentally sustainable levels of extraction and achieve integrated management of environmental water.

There has also been significant legislative reform in water resource management at the federal level. The *Water Act 2007 (Cth)* established the Murray-Darling Basin Authority (MDBA) and required the MDBA to prepare the *Basin Plan* – a strategic plan for the integrated and sustainable management of water resources in the Murray-Darling Basin. The Act also established the Commonwealth Environmental Water Holder to manage the Commonwealth’s environmental water. The *Water Amendment Act 2008 (Cth)* transferred the functions of the former Murray-Darling Basin Commission to the new Murray-Darling Basin Authority (MDBA). The MDBA is now the single body responsible for overseeing water resource planning in the Murray-Darling Basin. The *Basin Plan 2012*, a strategic plan for the integrated and sustainable management of water resources, was signed into law in November 2012. The *Basin Plan* sets legal limits on the amount of surface water and groundwater that can be taken from Victoria’s share of the Murray-Darling Basin from 1 July 2019 onwards.

The *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (Australian Government, 1999) (*EPBC Act*) is the Australian Government’s central piece of environmental legislation. It provides a legal framework to protect matters of national environmental significance (NES) which include wetlands of international importance (Ramsar sites), nationally threatened species and ecological communities, listed migratory species (those listed under international migratory bird agreements and the Bonn Convention) and heritage places defined in the Act as matters of NES. Waterway related matters of NES in the Wimmera region include Lake Albacutya Ramsar Site,

several nationally threatened and listed migratory species and a nationally threatened ecological community.

The *Native Title Act 1993 (Cth)* provides a framework for the protection and recognition of native title. The *Native Title Act* gives Indigenous Australians who hold native title rights and interests or who have made a native title claim the right to be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land where rights exist.

2.2.4. International

The Australian Government has ratified several international human rights instruments that recognise and protect Indigenous peoples' special connection to land and waters and provide for the right to practice, revitalise, teach and develop culture, customs and spiritual practices and to utilise natural resources (for example, the *United Nations Declaration of Rights of Indigenous Peoples*).

The Convention on Wetlands of International Importance (the Ramsar Convention) provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. The Convention encourages contracting parties such as Australia to nominate sites containing representative, rare or unique wetlands, or that are important for conserving biological diversity, to the List of Wetlands of International Importance, for example Lake Albacutya Ramsar Site.

International treaties have been made with the nations of Japan, China and the Republic of Korea for the protection of migratory birds that travel between these countries and Australia and their habitat. International migratory species are also protected under the *Convention on Migratory Species*. Wetlands in the region provide important habitat for these bird species.

2.2.4.1. Ramsar site management plan

The *WWS* includes a management plan for Lake Albacutya Ramsar Site (Appendix 2). It replaces the *Lake Albacutya Ramsar Site Strategic Management Plan* (DSE, 2003).

The *Environment Protection and Biodiversity Conservation Regulations* (Australian Government, 2000) set out the Australian Ramsar Management Principles. These specify the requirements for management planning for Ramsar sites. The management planning approach for Lake Albacutya Ramsar Site follows these principles while integrating them into the overall framework for waterway management used in Victoria as described in Parts B and C of the *WWS*. As a Contracting Party to the Ramsar Convention, Australia is required to maintain the ecological character of its Ramsar sites at the time they were listed through conservation and wise use (maintaining or improving the condition and the environmental, social and economic values of the wetland). The objective of the management planning arrangements for Lake Albacutya Ramsar Site, which are set out in Appendix 2, are to maintain and, if possible, improve the ecological character of the site.

2.3. Challenges and opportunities regarding waterway management in the Wimmera

2.3.1. Landholder attitudes and knowledge

The Wimmera CMA region is unique in that there is a comprehensive longitudinal record of landholder attitudes towards and knowledge of natural resource management. Surveys were completed in 2002, 2007 and 2011 by a large proportion of landholders across the region. The surveys canvassed views on goals and aspirations for rural properties, level of knowledge on natural resource management issues as well as awareness of the magnitude of environmental values and threats.

Following the completion of the last survey in 2011, a report compiled by researchers from Charles Sturt University (Curtis & Mendham, 2012), synthesised the results by local government area as well

as topographically similar areas to determine what sub-regional trends existed over the past decade. This enables Wimmera CMA and its partners to determine the level of acceptance and take up of practices, success or otherwise of community education on certain issues as well as future plans and key threats that may require resourcing to achieve positive waterway outcomes. Key findings include:

- Landholders are increasingly aware of the value of their property for local biodiversity as well as acknowledging that the public should be able to access wetlands, rivers and streams irrespective of tenure;
- There is a majority view across the region that landholders should be paid for providing environmental services on their land that benefit with wider community;
- There is a strong and increasing understanding of the importance of stock management with respect to revegetation of waterways however there is not as much understanding of the subsequent benefits of the revegetation (i.e. on water quality, bank stability etc.);
- The awareness of the severity of gully erosion is understandably patchy across the region but even so it is at proportionally low levels, especially in light of its impact on waterway health;
- Survey results indicate there is a high degree of uncertainty about the impact of draining or cropping wetlands. A large proportion of landholders say that whilst these activities will create long lasting environmental problems, a significant number have indicated that they are not sure if the negative impacts can be reversed or prevented if there is a careful approach to cropping or draining wetlands; and
- Views on other issues noticeably ebbed and flowed depending on the prevailing climatic conditions at the time of the survey (e.g. water quality and availability issues were more prominent during the 2007 survey during the drought compared to the 2011 survey which saw more prominence placed on prominent issues during floods (e.g. woody debris in streams). There were expected trends landholder attitudes based on their geographic location, for example landholders in the Upper Catchment were less concerned about reduced river flows than those further down the system. Likewise, landholders out of the Wimmera Mallee Pipeline footprint area had limited knowledge about the benefits of the pipeline. Unsurprisingly attitudes around the impacts of flooding were most pronounced in the Upper and Mid-Wimmera catchment.

Therefore it can be concluded that landholders within the region have a strengthening knowledge regarding waterway management issues although it is recommended that there be actions in the WWS to provide additional information to landholders on:

- Water quality and bank stability benefits of waterway fencing and revegetation;
- Impacts of gully erosion on waterway condition; and
- Impacts of cropping and drainage on wetland condition.

2.3.2. Government involvement

Funding

The Wimmera CMA's ongoing pursuit to increase efficiencies and ensure that, as much as possible, funding leads to activities on the ground means the organisation is well-positioned to attract funding for waterway management projects in a competitive funding environment. The inclusion of strategic activities to improve recreational fishing means that there are greater opportunities to attract funding from revenue from recreational fishing licences for waterway management works.

The severe extremes in climate experienced over recent years saw the provision of funding for the Wimmera CMA to manage drought and flood employment programs where local landholders were provided with assistance to conduct works to improve waterway condition such as weed control and waterway fence construction and repair which complemented other ongoing funding programs. The provision of such funding into the future will ultimately depend on what climatic extremes impact on the region over the coming years. Given past history and predicted shifts in climate variability it would be expected to see drought and floods impact on the region to varying degrees over the life of the *WWS*. Therefore, it is crucial that there is sufficient guidance and flexibility within the *WWS* to capitalise on opportunities from future disaster recovery funding.

In the past, Australian Government funding has been critical for improved salinity and wetland condition outcomes in the region. This strategy will provide a logic trail to guide the Wimmera CMA and its partners when building the justification for funding from a variety of sources for waterway management in the region. Ongoing evaluation and periodic reviews of the *WWS* will enable it to be adapted to best take advantage of all funding opportunities for waterway management.

It should be noted that the number and magnitude of management activities proposed in the *WWS* is based on past funding levels with some scope for an increase to take advantage of additional funding opportunities such as those discussed previously. Shortfalls in actual funding over the life of the *WWS* will mean that some of the management activities (and therefore targets) will not be achieved.

Policy

Since the last *VRHS* (DSE, 2002), significant lessons have been learnt due to extremes of climate witnessed in the last decade as well as advances in waterway management such as management of Crown frontage and environmental water. This is reflected in the current *VWMS* (DEPI, 2013). Long-term water resource planning in the region has been undertaken through the *Western Region Sustainable Water Strategy* (DSE, 2011) whilst the *Basin Plan* for the Murray-Darling has provided the impetus for additional water recovery from the purchase of entitlements from the Wimmera Irrigators' Association to benefit the Wimmera River and potentially Lakes Hindmarsh and Albacutya.

This evolution of policy continues and there are other changes in government policy that will impact on waterway management for the region into the future, for example the review of the *Water Act 1989* and future strategic state policy with respect to floodplain management which will be developed within the lifetime of this strategy. It is not anticipated that these changes will materially affect the goals, targets and activities in this strategy however, as mentioned previously, the periodic evaluation and review of the *WWS* will enable any necessary shifts to align with contemporary government policy.

3. Waterways

3.1. Assets

The *Wimmera RCS (2013-2019)* outlined long-term objectives and short-term management measures for five thematic classes of regional natural assets, two these natural assets are ‘Rivers & Streams’ and ‘Wetlands’ – collectively they are termed ‘waterways’.

3.1.1. Rivers and Streams

3.1.1.1. Wimmera River Basin

The Wimmera Basin comprises two major river systems, the Wimmera River system and the Avon-Richardson system (which is within the North Central CMA region). The Wimmera River is the largest endoreic river in Victoria (river that does not eventually flow into the sea), terminating in a series of lakes starting at Lake Hindmarsh near Jeparit.

3.1.1.2. Millicent Coast Basin

Whilst the Millicent Coast Basin is renowned for the large number of wetlands, there are a handful of creeks that flow west across into South Australia. The most notable being Mosquito Creek which contains threatened fish species and is the main source of inflows for the Bool and Hacks Lagoon Ramsar Site near Naracoorte in South Australia.

3.1.2. Wetlands

3.1.2.1. Wimmera River Basin

In the east of the Wimmera there are small spring-fed wetlands at the break of slopes as well as larger wetlands which fill up under very wet conditions such as Green’s Swamp. Some, like Lake Lonsdale and Lake Fyans, have been converted to water supply storages. Moving further west, there are a number of floodplain wetlands that vary in size from large ones such as Darlot and Doon Swamps near Jung and Horsham respectively, to smaller, more discrete ones like Sawpit and Wal Wal Swamps near Murtoa.

The Natimuk–Douglas chain of wetlands is on the western edge of the Wimmera River Basin and is renowned for the sheer number and diversity of wetlands including many wetlands of national significance. There is also an abundance of wetlands scattered around the landscape that fill or remain dry depending on the volume of localised runoff. This wetland chain is a legacy of a paleo-channel from when the Murray-Darling Basin drained through the region on its way to the coast.

Last but not least there are the large lakes, some like Toolondo, Taylor’s and Green have played a role in water supply whilst others like Lake Hindmarsh and Lake Albacutya are regional icons given their sheer size as well as recreation and environmental values.

3.1.2.2. Millicent Coast Basin

The Millicent Coast Basin within the Wimmera CMA region contains about a fifth of Victoria’s wetlands. Water retained within the ancient dune/swale system creates a vast array of wetland areas, from the shallow freshwater marshes that fill and dry on an almost annual basis to the much larger permanent lakes that can fill during exceptionally wet years and hold water for several years before drying out.

These wetlands typically form north-south trending chains that can fill and overflow into others depending on the location and amount of runoff.

3.2. Values

Waterways make up only a small portion of the regional landscape and yet their overall significance for the economy, the ecology and the social and cultural 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 thousands of people, not just those within the region. They supply water to support our rural production including water for irrigation, spraying crops and for livestock to drink. They are also a key input to our manufacturing industries. Waterways provide drainage and water storage services, preventing water-logging and inundation. However, this statement of the community's economic reliance on waterways does not acknowledge their social value. Many Wimmera towns are situated on or near a waterway to provide a reliable source of water. 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 the region.

Communities have been threatened by waterways during floods and anxiously watched them suffer 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 culture and are deeply associated with their 'sense of place' and 'belonging'. This is particularly true for the local Indigenous community.

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 waterway 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, cultural or environmental, are reliant to some extent on waterway condition. Some values, such as maintaining ecological communities, tourism, supply of clean drinking water and recreational fishing all require waterways to be in good condition. The following discussion provides information on the social, economic, cultural and environmental values of Wimmera waterways.

3.2.1. Environmental

The environmental significance of Wimmera waterways can be broken into two key elements, firstly where they have been formally recognised under Acts of parliament or treaties due largely to their environmental significance and secondly recognition of their ecosystem services. The metrics used to ascertain the magnitude of these environmental values for the region's main waterways are listed in Appendix 5 Waterway Values and Threats.

3.2.1.1. Formally Recognised Significance

It is not just the Wimmera community that has a strong appreciation of the values of the region's waterways; some waterways are particularly significant at an international, national and state level. There are also a significant number of threatened species and communities that rely on Wimmera waterways for habitat.

International and National Significance

Ramsar Convention

There is one wetland of international significance, Lake Albacutya, which is one of 11 Ramsar sites in Victoria. As indicated in Section 2.2.4.1, Australia is obligated to maintain the ecological character of Ramsar sites.

Lake Albacutya was listed as a Ramsar site in 1982 due to its high environmental values, including its representativeness of a particular wetland type, providing habitat for the nationally threatened Regent Parrot, supporting a genetically unique population of River Red Gum and supporting large numbers of waterbirds and at least 1% of the population of three waterbird species when inundated. Its values also extend to its cultural significance, being a key part of an Indigenous story of the region as well as a drawcard for recreation with the stories around its yabby population being the stuff seemingly of myth and legend.

Mosquito Creek in the west Wimmera is the main source of water for the Bool and Hacks Lagoon Ramsar Site, located near Naracoorte in South Australia. The diversity of threatened fish that inhabit Mosquito Creek is a key component of the ecological character of this site.

Directory of Nationally Important Wetlands

There are also a number of wetlands in the Wimmera region that are listed in the Directory of Nationally Important Wetlands in Australia. The Directory was first published in 1993 and sets out certain criteria that need to be met before it is considered for listing. The following table includes wetlands in the Wimmera CMA region that are included in the Directory:

Table 3-1 Wetlands of National Significance in the Wimmera CMA region.

- | | | |
|-----------------------|-------------------------------|-------------------------|
| • Heard Lake | • Bitter Swamp | • Natimuk Lake |
| • Mitre Lake | • Friedman's Salt Lake | • Lake Wyn Wyn |
| • White Lake | • Grass Flat (Telfer's) Swamp | • Lake Hindmarsh |
| • Saint Marys Lake | • Hateley's Lake (Swamp) | • Oliver's Swamp (Lake) |
| • Pink Lake (Lochiel) | | |

It should also be noted that sections of the Wimmera River system (downstream Polkemmet Bridge to the Wirrengren Plain) and Natimuk Creek (between Natimuk Lake and Lake Wyn Wyn) are also included in this listing.

Wetland Ecological Communities that are Nationally Threatened

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains is listed under the *EPBC Act* as a critically endangered ecological community due to its significantly reduced abundance and ongoing threats due to modified drainage, vegetation clearing, weed invasion, climate change, inappropriate grazing and lack of connectivity (TSSC, 2012). Only seasonal herbaceous wetlands that meet a condition threshold are included in the listing. There are believed to be a large number of these wetlands in the Wimmera although additional information is required to determine their exact number, location and condition.

State Significance

The lower Wimmera River, from Polkemmet Bridge, north-west of Horsham through to the terminal lakes and Outlet Creek through to the Wirrengren Plain in the Mallee has been classified as a Heritage River under the *Heritage Rivers Act 1992*.

3.2.1.2. Ecosystem services

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, cultural, aesthetic and recreational value;
- Provide aesthetic and recreation services;
- Provide freshwater for domestic supply, irrigation and other purposes;
- Mitigate floods by holding back water on floodplains and in wetlands;
- Support a wide range and significant abundance of native species including threatened species; and
- Remove sediment, nutrients and other pollutants through riparian and wetland buffer vegetation filtering, sedimentation and other mechanisms.

An ecologically healthy waterway will have hydrology, water quality and geomorphic characteristics such that:

- In the wetland 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 or wetland vegetation communities exist sustainably for the majority of its length or circumference;
- Native fauna can move and migrate up and down streams and along chains of wetlands;
- Linkages between river and floodplain and chains of wetlands are able to maintain ecological processes;
- Natural linkages with terminal wetlands and their tributaries are maintained and
- Associated terminal wetlands' systems are productive ecosystems.

Indications are that waterways with high environmental values, for example those that support a large number of threatened species or are in good condition, provide these ecosystem services in abundance. Maps showing the environmental condition of the region's wetlands and rivers and streams are shown in Figure 3-1 and Figure 3-2.



Wimmera River at Antwerp Weir, January 2007 (Photo: D. Fletcher)

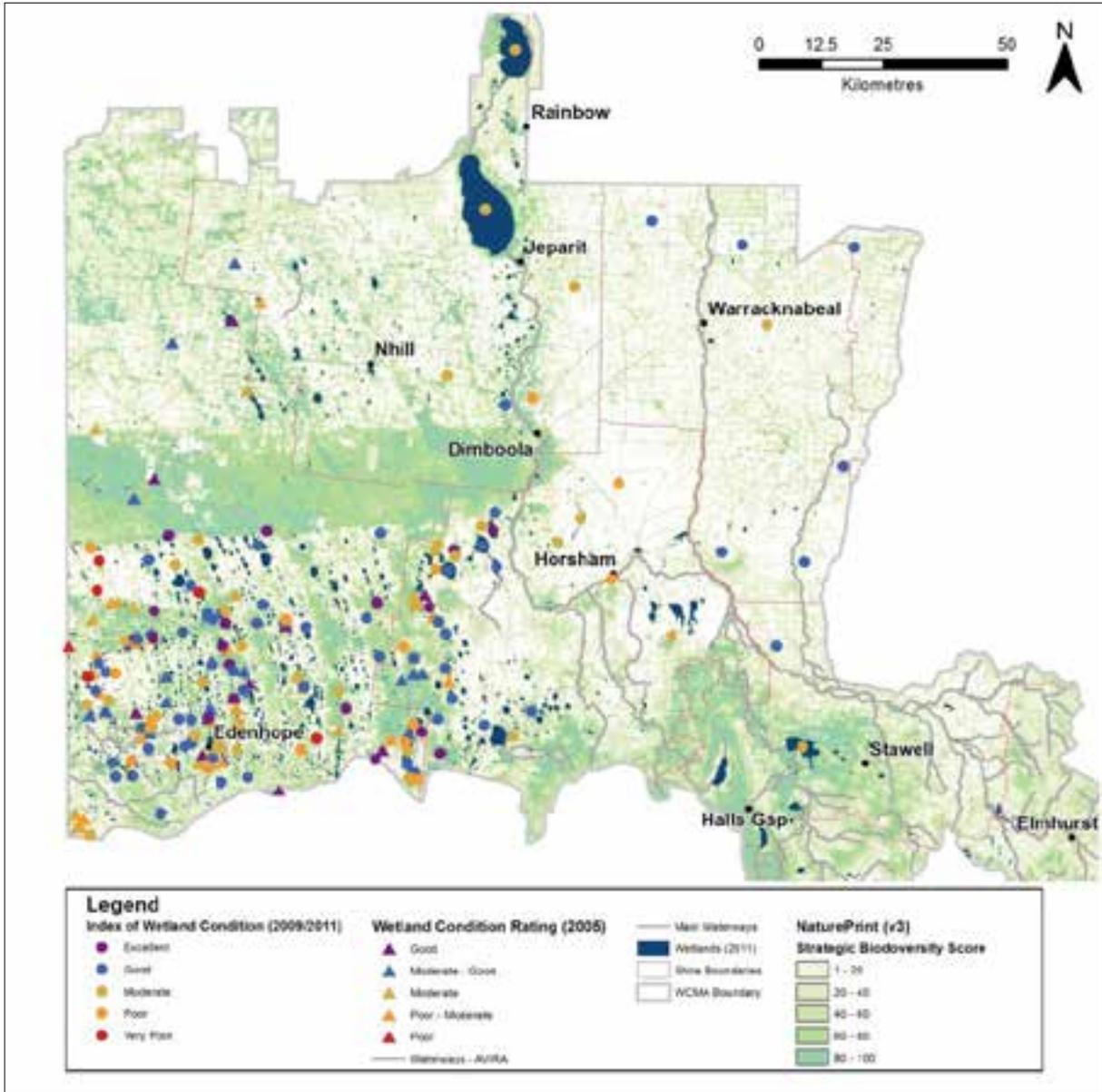


Figure 3-1 Wetland condition data for the Wimmera CMA region



Wimmera River near Dadswell's Bridge, 2007 (Photo: M Hillemacher)

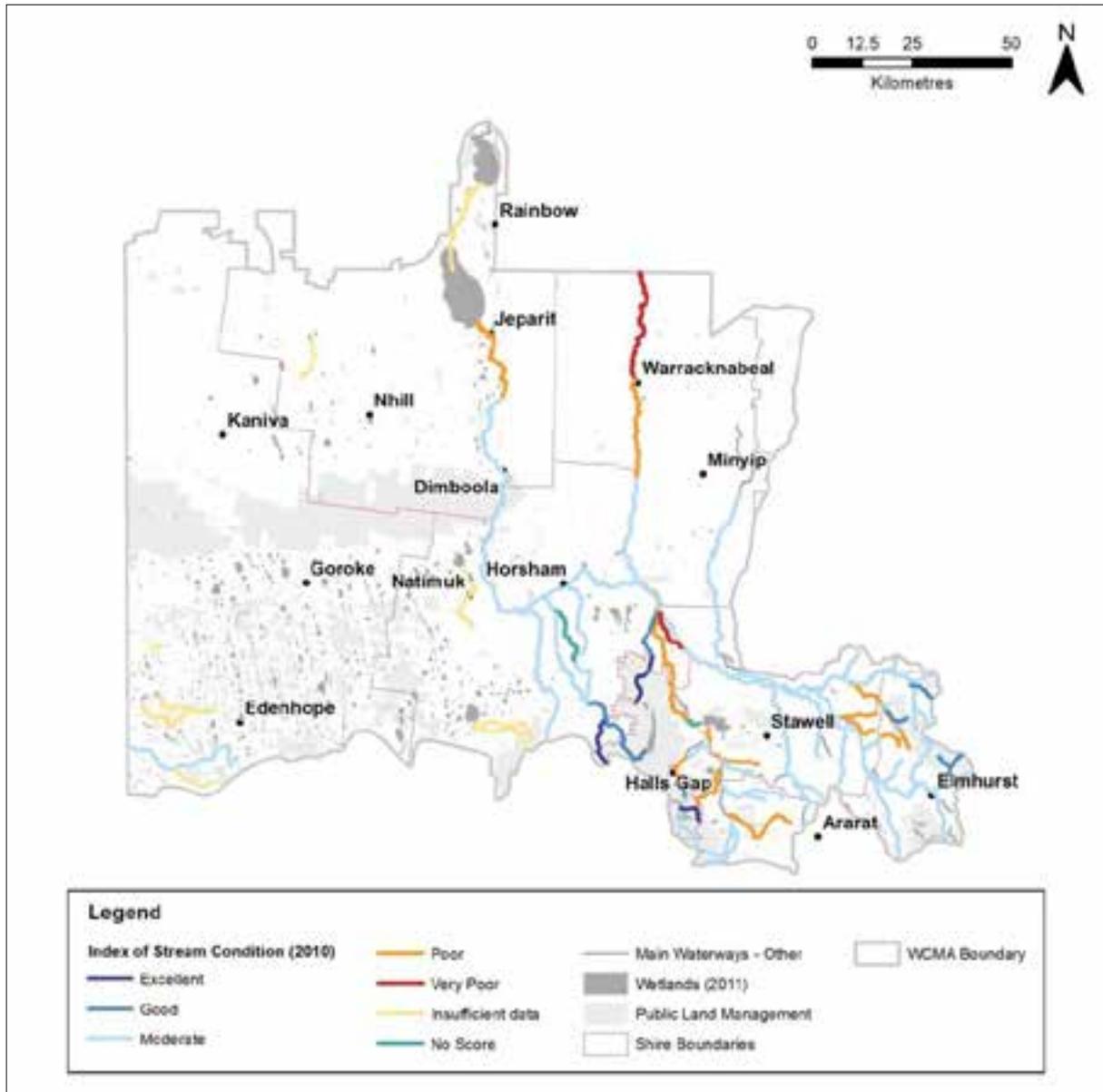


Figure 3-2 River and stream condition data for the Wimmera CMA region

3.2.2. Social

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 vitality of the town is affected by the condition of the waterway. Compared to the rest of Victoria, the impact of the presence or absence of water is most keenly felt in the Wimmera. Dry streams, rivers and wetlands mean the loss of a community hub and a decline in the quality of life whereas when water returns across the region there is a renewed vitality and vigour, as evenings and weekends are spent enjoying all of what the Wimmera’s waterways have to offer.

Social values, as outlined in Appendix 5 Waterway Values and Threats, have been captured via a number of means – local knowledge, previous work and community information provided to the Wimmera CMA.

3.2.2.1. Recreation (Activity)

Information about the locations and types of recreation activities associated with the region’s waterways was obtained from a variety of sources, including during the ‘Make a Splash’ campaign (see Section 4.7).

3.2.2.2. Linkages (People)

There is a high level of motivation for the community to work together on issues relating to a local creek or wetland that they are passionate about, whether it is weeds, recreational facilities or water availability. Without these groups, little would be achieved and regional waterways would not have the high profile they do now. The community has a strong affinity for iconic species like the Freshwater Catfish and platypus and a lot of good work has been done to protect them.

3.2.3. Cultural

3.2.3.1. Aboriginal Cultural Heritage

The values of Wimmera waterways to the indigenous and broader community cannot be oversold. They are the centre of vivid creation stories like how the Wimmera River and Grampians were formed and certain animals got their features. Knowledge passed down through the generations as well as the innumerable examples of the archaeological cultural heritage such as scar trees and shell middens provide additional testimony to the cultural values associated with Wimmera waterways. Therefore it is important that these values are retained for generations to come. Section 6.8 *Traditional Owners and Waterway Management* sets the context and determines actions for Traditional Owner involvement in waterway management in the Wimmera.

Case Study - Yanga Track

Yanga Track is a very popular walking track downstream of the Horsham Weir. It was impacted by bushfire in 2009 and floods in 2010 and 2011. Despite these enormous obstacles, many native plant species have been planted by the Wimmera River Improvement Committee and other groups. To highlight the importance these plants had to indigenous people, the *Yanga Track* booklet was produced which described what these plants were used for (medicine, food, tools) as well as documenting through words and fantastic artwork, the creation story of the Wimmera River and other geographical features.

3.2.3.2. Post-European Heritage

The region's waterways have also been important to people who are not from an indigenous background as they provide historical evidence of activities that have taken place since European settlement. For example, creeks in the upper catchment were targeted by gold miners and waterways were modified to supply water for pastoral settlers and small irrigation communities. Their legacies remain to this day including old weirs and channels on creeks and rivers, sheep dips in wetlands and eroded gullies from the gold dredges that worked headwater streams.

3.2.4. Economic

The economic vitality of the Wimmera can be directly related to the health of its waterways. Water is often a scarce and valuable resource. The Wimmera's economy is worth approximately \$5.7 billion annually (Wimmera CMA, 2013). Agriculture is the dominant land use in the Wimmera, with about one-quarter of the population depending directly on agriculture for their income. In addition to agriculture, the region has manufacturing and retail sectors within the main town centres. Education, health and community services are the other major employers of the region.

Economic values associated with waterways have been determined for the Wimmera's waterways (see Appendix 5 Waterway Values and Threats). Some of these values are obvious, for example the location of water supply catchments and associated infrastructure. However some are less obvious like domestic firewood collection (subject to conditions).

Case Study – Long Time Wet, Long Time Dry

Back in early 2007, the region was in the grip of record drought but on the 2nd February, over 500 people gathered in Horsham Centre Cinema to see the world premiere of “Long Time Wet, Long Time Dry” – a 40 minute long account of the history of wetlands in the Wimmera. The major focus was understandably on the wetlands in the West Wimmera Shire, with anecdotal accounts, amazing historical photos and films and shadow puppetry of wetland creatures performed by school children from Edenhope.

The film received an amazing response, with encore screenings at Edenhope and Rainbow due to popular demand. The feeling amongst those who watched it was immensely positive despite the fact that at the time the wetlands were all dry, and some still are in 2014. Once water returns, everyone knows that they can burst to life again and the values whether they be water-skiing, yabbing, watching broilgas frolic or being deafened by thousands of frogs will return one day.



Long Time Wet, Long Time Dry (Credit. D. Fletcher)

3.2.4.1. Agriculture

The Wimmera region’s agricultural sector is dominated by broadacre cropping of cereals, oilseeds and pulses as well as livestock production, mainly sheep. Intensive animal production is also an important economic contributor to the region and this in turn relies on a reliable source of high quality water. Good quality and reliable water supplied by the Wimmera Mallee Pipeline or captured in catchment stock and domestic dams is vital to sustaining such production whether it is for stock drinking water or for use in chemical sprays.

There is significant irrigation in the Millicent Coast Basin using groundwater, largely supporting crops such as clover seed production, horticulture, cereals and pastures. In the upper Wimmera River system there are a number of vineyards using a variety of water sources (catchment dams, groundwater, recycled water and supplies via the headworks) for production. In the lower Wimmera River there are a small number of irrigators who extract water direct from the river mostly to irrigate pasture.

3.2.4.2. Industry and Domestic

Industry in the Wimmera has traditionally tended not to rely on significant volumes of water given the frequent water shortages experienced over the past 150 years. In more recent years, mineral sand

mining has been an emerging industry in the region which can require large volumes of water for processing.

The Wimmera Mallee Pipeline Project has led to a massive shift in water supplies for much of the region in recent years. The 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.

GWMWater is the responsible corporation for delivering town water supply and waste water services as well as supplies to properties via the Wimmera Mallee Pipeline. Completed in 2010, it was the largest project of its type in the world, replacing 18,000 km of inefficient earthen channels with just over 9,000 km of pressurised pipes. This meant about 9,000 farms and 34 townships in the Wimmera and Mallee could enjoy a much more reliable and better quality water supply going forward and the water that was previously lost to evaporation and seepage would be used to enhance environmental water and provide additional water for economic growth in the region.

The Wimmera Mallee headworks system provide water for most towns in the Wimmera River Basin as well as a number of towns outside of it such as Donald, Hamilton, Charlton and Nhill. Smaller headworks systems provide water supplies to towns like Moyston, Landsborough, Elmhurst and Buangor. All of these systems rely on harvesting high quality water from a number of catchments across the region. Some are in good condition, located on public land like national and state parks whilst others are in catchments where impacts like excessive salinity, turbidity, nutrients and pathogens are evident due to a long history of land clearing and agricultural use.

3.2.4.3. Public infrastructure

A vast amount of public infrastructure such as bridges, fords and weirs either crosses or is located within waterways in the region. These structures represent a significant investment of public and private capital. Just like all public assets they need to be maintained and their risks managed to ensure users continue to be able to benefit from them. These structures may also have an effect on the flow of water, either through altering flow rates or via accelerated erosion or deposition of waterway beds and/or banks. Ongoing management of these infrastructure assets also needs to ensure that their impact on flows is minimal.

3.2.4.4. Tourism

Waterways in the Wimmera CMA region also form the focus for a number of activities and events that bring tourists into the area. The natural assets of the region have been highlighted as an opportunity for economic growth with respect to increasing tourism (DPCD, 2012a).

The Grampians and Little Desert National Parks and Big Desert Wilderness Park are high quality natural areas that attract visitors from throughout Australia and overseas. There are iconic Wimmera waterway scenes recognisable to many Victorians such as the MacKenzie Falls and the Dimboola Rowing Regatta.

Lakes across the region are also high quality tourist attractions; such as hunting, fishing and water sports, as well as enjoyment of scenic values like birdwatching. People come from near and far to enjoy experiences like camping and relaxing by a lake, creek or river and this in turn is a valuable source of revenue for local businesses when they purchase provisions.

3.3. Threats

There are a number of threats that affect the condition and values of the region's waterways. Many of these threats are interrelated and can impact on a number of key aspects of waterway health. For example, altered water regimes leading to declines in water quality and availability affect biodiversity, recreation and economic values. Stream erosion eliminates the deep pool habitats for fish and platypus and threatens agricultural land and public infrastructure. Invasive species like carp reduce biodiversity of fish and aquatic vegetation by out-competing native fish, eating aquatic vegetation as

well as reducing water quality through their ‘mumbling’ over river banks, increasing turbidity. Waterway threats have been determined where possible for a number of the region’s waterways. The list of different threats is in Appendix 3. Information regarding the location and severity of threats was gained from waterway condition monitoring, previous works such as waterway action plans and local knowledge such as community consultation.



Large numbers of waterbirds at Natimuk Lake, March 2014 (Photo: G. Dixon)

Some major threats are of more concern than others, especially if their impacts affect other parts of the catchment such as declining water quality due to streambank instability and livestock access. Other major threats like invasive species such as rabbits and bridal creeper are almost ubiquitous issues and create major impacts through displacing or destroying endemic vegetation species. A great deal of work has been done in the past by landholders and previous government agencies such as the Soil Conservation Authority and the Wimmera Catchment Coordinating Group to address these threats. In more recent years this has been continued by Wimmera CMA, its partners like Project Platypus and Yarrilinks and the community. This means that a lot of good work has been done whether it be fencing and revegetating gullies in the steep hill country, protecting near natural wetlands in the west Wimmera or improving the volume and effectiveness of environmental watering. It should be noted that some threats are unlikely to be of major consequences to waterways in the Wimmera (such as disturbed acid sulfate soils and barriers to fish migration). Some have localised effects but could eventually become a wider issue given the circumstances (e.g. wild pigs, emerging weed species like Chilean Needle Grass).

Catchment management planning has a long history in the Wimmera as people realised the need to shift from looking at specific individual threats to rather focussing on integrated works to protect specific natural assets. This approach continues through the *WWS* which provides a long term plan for all those interested in waterway management to determine what needs to be done and why, from government investors to individuals landholders with waterways on their property.

Part B

Vision, Goals & Guiding Principles



Wimmera CMA's vision is for a healthy Wimmera catchment where a resilient landscape supports a sustainable and profitable community.

PART B – Vision, Goals and Guiding Principles

4. Strategy Approach

To effectively allocate the limited resources available, a regional priority setting process is applied to rivers, streams and wetlands. This process is outlined in Section 4 and 5 and is underpinned by information about the environmental, cultural, social and economic values of waterways that are important to the community (high value waterways) as well as threats to these values. It is a logical process, starting with the development of a vision, principles and long-term goals that filter down to shorter-term targets and the management activities required to meet them. The process is summarised in Figure 4-1.

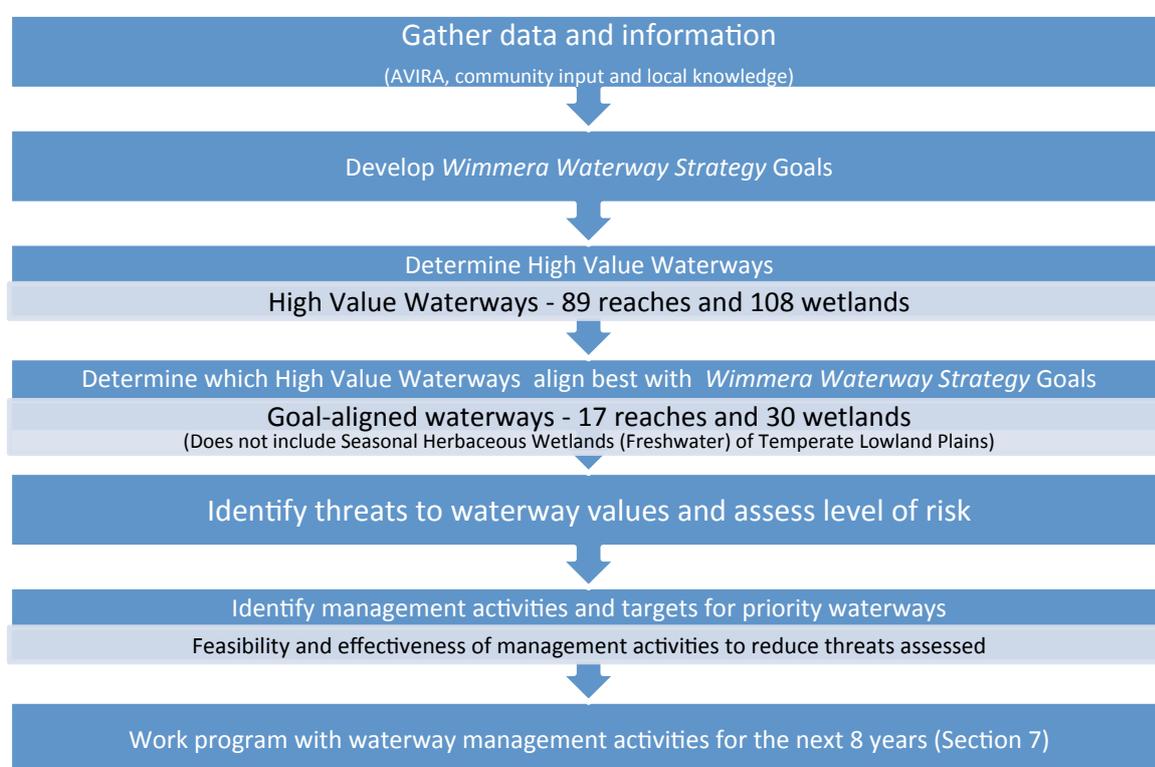


Figure 4-1 Process for identifying priority waterways and management activities over the eight-year planning period

4.1. Vision

The vision of the *Wimmera Waterway Strategy* is identical to that of the *Wimmera Regional Catchment Strategy (2013-2019)*:

A healthy Wimmera catchment where a resilient landscape supports a sustainable and profitable community.

Healthy wetlands, rivers and creeks are a critical part of achieving this broader vision due to the many values (environmental, social, cultural and economic) they support. It also aligns with the state-wide vision in the *Victorian Waterway Management Strategy*:

Victoria's rivers, estuaries and wetlands are healthy and well-managed; supporting environmental, social, cultural and economic values that are able to be enjoyed by all communities.

4.2. Long-term Goals for Wimmera Waterways

To achieve this vision and assist the prioritisation process (Section 5), goals for waterway management for the region were derived in consultation with the community. The logic being, that waterway values that contribute to these goals would be a higher priority for works, to maintain or improve them.

Goals for waterway condition:

- apply to a timeframe generally longer than 20 years;
- have a conceptual or qualitative link to the short-term management outcomes and long-term resource condition outcomes; and
- are region wide and drive priority setting.

The goals for the WWS are as follows:

- *Maintaining and improving the values and condition of waterways that have formally recognised significance;*
- *Improved connectivity and condition along priority wetland systems and riparian corridors;*
- *Improved water quality in priority areas for; water supply, environmental condition and recreation; and*
- *Waterways with high social, cultural and economic values are maintained in a state that continues to support those values in line with climatic conditions.*

4.3. Guiding principles for the Wimmera Waterway Strategy

Guiding principles have been tested with the community through the VWMS. Therefore the strategic management approach for waterways in the Wimmera is guided by these principles:

- **Partnership approach** – waterway management will continue to be a partnership between government, industry and the community;
- **Community involvement** – communities will have the opportunity to be involved in all major phases of waterway management;
- **Integrated catchment management** – integrated management of waterways will occur within a broader framework of integrated catchment management. Management will recognise the importance of waterways as a connection between catchments, groundwater, coasts and the receiving marine environment (where relevant), and the strong influence of land use and catchment condition on waterway condition;
- **Appropriate tools** – the full complement of instruments and approaches will be considered to improve waterway condition including; direct Government investment in on-ground works, grant and incentive programs, management agreements and covenants, market-based instruments, information and extension programs and regulatory controls;
- **Value for money** – Government will direct investment to management activities that provide the most efficient and effective long-term improvements in waterway condition and the greatest community gain (including opportunities for multiple benefits);
- **Regional Waterway Strategies and management plans** – facilitate regional decision-making with community input and use a risk-based approach to identify high value waterways and priority management activities. They will:
 - be quadruple-bottom line; considering environmental, cultural, social and economic values of waterways



- be holistic and integrate on-ground works with the management and delivery of environmental water
- ensure efficient and effective management of the Environmental Water Reserve
- include maintenance as a vital activity to secure both past and future investment in on-ground works
- be flexible in response to seasonal climatic variation and plan for the potential impacts of climate change. This 'seasonally adaptive approach' is born out through determining the most appropriate management activities to undertake based on the prevailing climate (e.g. limited environmental watering and revegetation during drought conditions compared to wetter conditions) (DEPI, 2013);
- **Evidence-based decision-making** - best available knowledge will underpin decision making, policy and waterway management programs; and
- **Adaptive management** - policy and programs are part of a broader framework of adaptive management (supported by effective monitoring, reporting, evaluation and research) to ensure continuous improvement.

Two additional principles that were resoundingly supported during the preliminary consultation phase of the *WWS* include:

- **Secure and maximise benefits from previous waterway works** – the need to maintain and build on the gains achieved by waterway works in the past; and
- **An increasingly informed and engaged community actively participating in waterway management** – a combination of several of the principles articulated in the *VWMS*, communities that can see the benefits well-managed waterways will be crucial in achieving the targets within the *WWS* given the involvement of community members in management activities on both Crown and freehold land.

4.4. Asset-based approach

Approaches to natural resource management have changed over time with increasing experience and learnings from implementing previous programs. This has seen a shift from threat-based planning to asset-based. This prioritises works to maintain what is currently in good or excellent condition and in high value locations rather than rehabilitate areas where many of the values may be already permanently lost. This asset-based approach has a long history of successful implementation in the region such as the historic planning documents like the *Wimmera River Integrated Catchment Management Strategy* (Wimmera Catchment Co-ordinating Group, 1992), the *Wimmera WHS* (Wimmera CMA, 2006) through to more recent plans like the *Wimmera RCS* (Wimmera CMA, 2013) and the *Wimmera Invasive Plant and Animal Management Strategy (WIPAMS)* (Wimmera CMA, 2010). This approach acknowledges that there are insufficient resources to enable management activities to improve all waterways so a prioritisation approach where funding can best be directed to achieve the maximum outcomes is required and is outlined in Section 5.

The *Wimmera RCS* provides the strategic direction and objectives for the region's natural resources – rivers and streams, wetlands, soils, threatened species and native vegetation. Whilst the *WWS* is largely focused on improving rivers, streams and wetlands, their effective management will also lead to benefits for soils, threatened species and native vegetation given their interconnectedness.

4.5. Program logic for waterway management activities

Program logic is an approach to planning which outlines the rationale behind a program through documenting a series of cause and effect relationships between on-ground activities and long-term desired outcomes via a diagram or matrix (Australian Government, 2009). In waterway management, it links in a logical series, the activities (e.g. invasive plant control, riparian fencing, erosion control structures) with the desired long-term outcome. It has become the recognised best-practice approach

for natural resource management planning in Australia and is being used successfully in other fields (e.g. health). The program logic provides the rationale for how the *WWS* will contribute to the vision for Victoria’s waterways, identified in the *VWMS* and the Wimmera CMA vision for natural resource management in the region, identified in the *Wimmera RCS*.

The simplified program logic for the *WWS* is illustrated in Figure 4-2. It describes how each year, specific management activities (outputs) are delivered by CMAs and their partners and community in order to achieve particular management outcomes. Over the eight-year planning period, these outputs and outcomes collectively contribute to either maintaining or improving the environmental condition of waterways. In the long-term, this will ensure that Victoria’s waterways can continue to support environmental, social, cultural and economic values.

The highest level of the program logic (regional goals) is aligned with the vision for Victoria’s waterways and the vision for the region. The long term resource condition outcome level aligns with the management objective for Victoria’s waterways which is “*To maintain or improve the environmental condition of waterways to support key environmental, social, cultural and economic values.*” The management outcome, output and activity levels focus primarily on the levels within the program logic that are measurable over the eight-year implementation period. A more detailed version of this program logic and additional explanatory information is provided in Appendix 3.2 of the *VWMS* (DEPI, 2013).

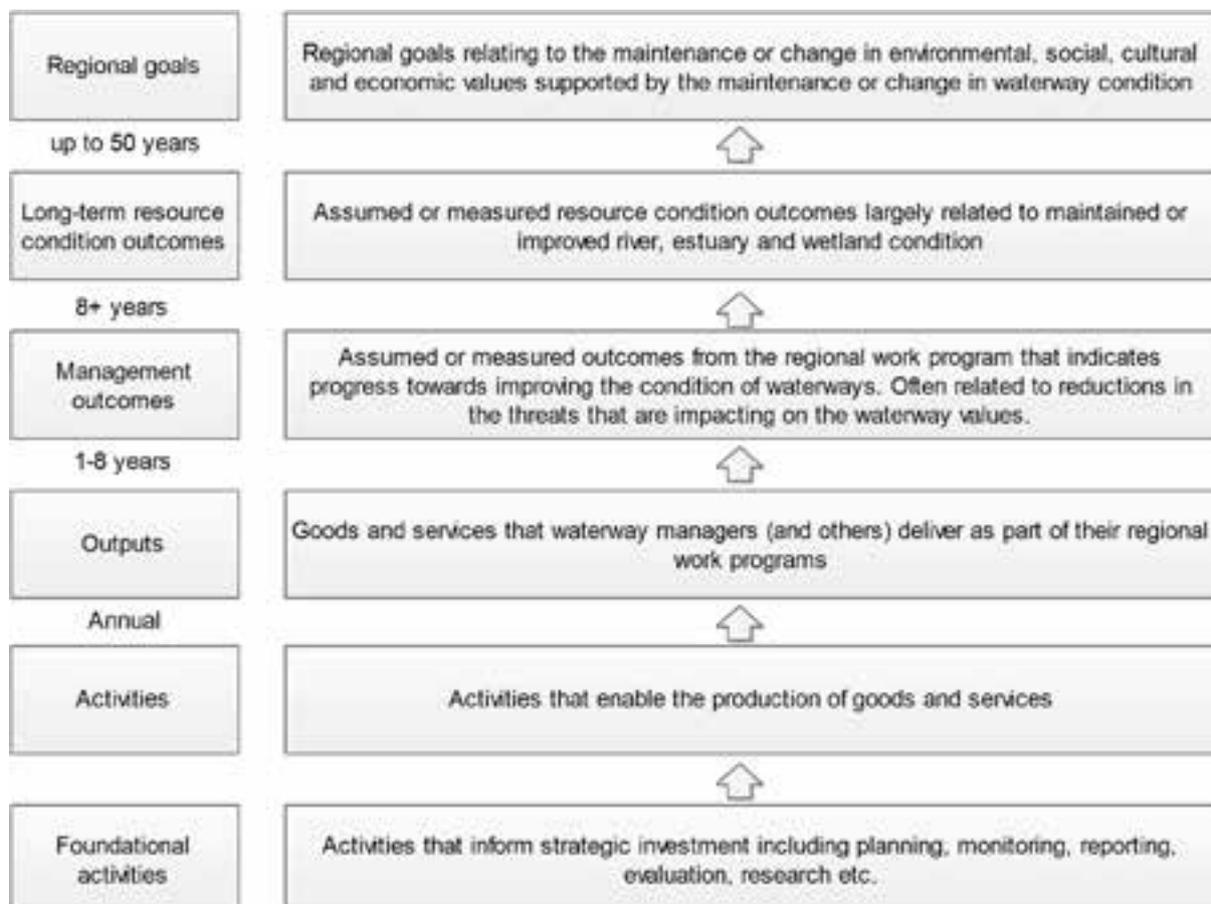


Figure 4-2 Simplified program logic for a regional waterway strategy (DEPI, 2013)

4.6. Target Setting for Wimmera Waterways

As emphasised in the review of the *Wimmera WHS (2006-2011)* (Appendix 4), it is crucial that the *WWS* set meaningful targets for the region’s waterways over a variety of timescales. This enables

effective evaluation and transparent reporting on the effectiveness of the *WWS*'s implementation. It clearly sets out how management activities guided by the *WWS* have contributed to the goals for waterway management both within the region and the state. Targets also have to follow clear program logic – showing the linkages with on-ground activities and improvements or maintenance of waterway condition and specific waterway values. Targets are set at three levels - reflecting the varying timescales and abilities to monitor change;

- Long-term resource condition (8+ years);
- Management outcome (1-8 years); and
- Management outputs (annually).

These targets sit within the following simplified program logic shown in Figure 4-2. The assumptions behind how the activities and outputs contribute to longer term environmental outcomes and link with the other current strategic documents, the *Wimmera RCS (2013-2019)* and *VWMS* are documented in Appendix 7 Target Setting and Linkages with *Wimmera RCS* and *VWMS*. The process for determining the types and quantities of management activities is described in further detail using an example priority reach in Section 5.3.1. More details are included in Appendix 6 Target Setting Assumptions.

4.7. Consultation

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

The Community Consultation and Stakeholder Engagement Plan developed for the *WWS* development had three main objectives;

- The *WWS* is comprehensive and reflects the values, priorities and directions of communities;
- All stakeholders have adequate opportunity to have their views, concerns, ideas and suggestions satisfactorily considered; and
- Stakeholders and the community support the strategy and its implementation.

Consultation took a variety of forms throughout the development of the strategy for example, the *Wimmera CMA* launched the development phase of the *WWS* through the 'Make a Splash' media campaign in the lead up to the 2013 *Wimmera Machinery Field Days* (Figure 4-4). A combination of articles and advertisements in local media asked the community to visit the *Wimmera CMA* stand during the *Field Days* to attach information to a large map of the catchment showing locations where they like to enjoy activities associated with waterways like fishing, swimming, duck hunting and water-skiing. This information was ultimately used to inform the location and magnitude of social values associated with *Wimmera* waterways. Additionally, community members were asked to enter a competition where they could highlight which *Wimmera* waterway was important to them and why (Figure 4-3).



White-faced Heron, September 2009 (Photo: D. Fletcher)



“Green Lake Horsham offers a great family friendly environment. At the end of a busy week we often have a picnic or takeaway at the lake, watching the sun set and listening to all manner of different creatures as the lake really comes alive as dusk turns into night. In this modern world it is great to take some time out and enjoy the simple pleasures that nature has to offer. It showcases everything that is great about living in the Wimmera to locals and passing traffic and is a great meeting place for family or friends whether they are into water sports or simply relaxing.”

Michael Schilling

Figure 4-3 Michael Schilling of Horsham and prize pack for winning the ‘Make a Splash’ competition

Prior to the development of the *Draft WWS*, targeted consultation was held with a number of key stakeholders to gather specific information on waterway values, trends and threats and seek feedback on proposed goals for the strategy. Other stakeholders with a more peripheral or localised interest in waterway management were sent information about the strategy development and asked to contribute. A *Draft WWS* was then prepared and was released for public comment for a four week period. The comments received during that period were used to refine the final *WWS*. Key community and agency groups consulted during development of the *WWS* are listed in Table 4-1.

Table 4-1 – Groups and agencies consulted as part of the *Wimmera Waterway Strategy* Development Process

Wimmera CMA Board	Northern Grampians Shire Council
Wimmera CMA Business and Planning Committee	West Wimmera Shire Council
Wimmera CMA Advisory Committees (Wetlands, Rivers and Streams, Soils, Threatened Species and Native Vegetation)	Ararat Rural City Council
Department of Environment and Primary Industries (DEPI)	Pyrenees Shire Council
Environment Protection Authority (EPA)	Parks Victoria
GWMWater	Barengi Gadjin Land Council
GWMWater water user groups (e.g. Wimmera River Irrigators)	Project Platypus
Horsham Rural City Council	Victorian Environmental Water Holder
Hindmarsh Shire Council	Victorian Farmers Federation
Yarriambiack Shire Council	Forestry South Australia
CFA	South Australian Department of Environment, Water and Natural Resources
Mallee CMA	VRFish
North Central CMA	Wimmera Anglers’ Association
Glenelg Hopkins CMA	Horsham Rowing Club
Buloke Shire	Dimboola Rowing Club
Yarrilinks	Department of Planning and Community Development
Kowree Farm Tree Group	Central Highlands Water
Martang Inc.	Native Fish Australia (Wimmera)
Waterwatch Wimmera	Greening Australia
	Trust for Nature
	Wimmera Development Association
	Dimboola Boat and Ski Club

Wimmera Invasive Plant and Animal Forum
 South East Aboriginal Focus Group (SA)
 Wimmera River Improvement Committee
 Lake Lonsdale Action Group
 Murtoa Anglers' Association
 Murray Darling Basin Authority
 Department of the Environment
 Yarriambiack Creek Advisory Committee
 Local fishing/boating businesses

Conservation Volunteers Australia
 Green Lake Action Group
 Tatiara Council
 Naracoorte Lucindale Council
 Natimuk Lake Action Group
 Australian Department of Agriculture, Fisheries
 and Forestry
 Natimuk Lake Foreshore Committee



Figure 4-4 'Make a Splash' competition promotion flyer

Consultation regarding the implementation of the WWS will be ongoing given many management activities involve working in partnership with the community and other stakeholders. Consultation during the implementation of the WWS will be using Wimmera CMA's engagement framework. This will provide input to the Wimmera CMA Board and staff members on issues relating to waterways in the region and involve a number of community and agency representatives.

5. Approach to Priority Setting

5.1. Aquatic Value Identification and Risk Assessment

Due to the need to prioritise waterways for management activities, a consistent and rigorous process was required to determine their relative values and threats. To achieve this, data about waterway values and threats in the Wimmera was collected and included as scores in the Aquatic Value Identification and Risk Assessment (AVIRA) database. The complete list of values and threats is included in Appendix 5 and the data was obtained from a combination of monitoring and modelled data as well as local knowledge, including from community consultation. Based on the values contained within AVIRA, it can be determined if a waterway is high value or not. An earlier iteration of this process was also previously applied in the *Wimmera WHS*.

5.2. High Value Waterways

The VWMS states that waterways will be considered high value if they have one, or more, of the following characteristics:

- formally recognised significance;
- presence of highly threatened or rare species and communities;
- high naturalness values (for example, aquatic invertebrate communities and riparian vegetation) or special waterway features (for example, drought refuges and important bird habitat); and
- high social, cultural and economic values (for example, recreational fishing, Aboriginal cultural heritage, urban/rural water sources).

Information from a variety of sources, including community consultation indicates that the majority of Wimmera waterways have high values whether they are environmental, cultural, social or economic or a combination (89 rivers and creeks and 108 wetlands - see Appendix 8). This is a positive indication that there are strong motivations from individuals, groups and agencies to maintain and improve the region's waterways. Given the limited resources available there is a need to prioritise a subset of these high value waterways that align best with the goals listed in Section 4.2 and determine the most effective management activities that can be undertaken to maintain and improve them according to the process outlined in Figure 4-1.

All but one of the river reaches (Kojjak Creek in the West Wimmera) and 59% of wetlands assessed in AVIRA were found to be high value under these criteria. A summary table divided by local government area follows (Table 5-1 and Table 5-2) and full details are available in Appendix 8. It should be noted that the AVIRA data was derived for 94 creeks and rivers across the region but there are a number of other (mostly smaller) creeks in the region that were not able to be included. Similarly, for wetlands, only 185 of the 3,928 wetlands have AVIRA data although they represent all of the different wetland types. Also due to limited information available, it is assumed that all waterways are high value for Aboriginal cultural heritage.



West Wimmera wetland, October 2010 (Photo: S Hall)

Table 5-1 High Value Rivers and Streams by local government area in the Wimmera CMA region

Local Govt Area.	Total	Environmental Values					Social Values			Economic Values	
		Formally Recognised Significance	Represent- ativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place#	People	Water	Other Resources
Northern Grampians/Ararat/Pyrenees	60	10		49	44	8	16	11	14	59	
Yarriambiack/Buloke	4	1		3		2	4	2	3		
Horsham	20	5		19	7	8	14	12	12	9	
Hindmarsh	5	4		4	1	1	4	4	4		
West Wimmera	5			4		1					

Table 5-2 High Value Wetlands by local government area in the Wimmera CMA region

Local Govt Area.	Total	Environmental Values					Social Values			Economic Values	
		Formally Recognised Significance*	Represent- ativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place#	People	Water	Other Resources
Northern Grampians/Ararat/Pyrenees	6	2		4			5			4	
Yarriambiack/Buloke	7						2		1		
Horsham	47	6		15	4	10	17	1	8	2	
Hindmarsh	8	3		3		2	6		1		1
West Wimmera	118	5		60	17	5	20		4		

*Does not include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

High value waterways pertain to post-European heritage only, it is assumed that all waterways are of high value with respect to Aboriginal cultural heritage but insufficient information exists to determine their relative value

5.3. Priority Waterways

As flagged in Section 4.4, given the large number of high value waterways and management activities required to improve them compared to the limited resources to undertake them, prioritisation is required. The prioritisation approach was set out in the *VWMS*. The process is based on maintaining improving the environmental, social, cultural and economic values of waterways that are important to the community and underpins the development of the *WWS*.

In order to prioritise in a rigorous and transparent manner the following steps have been taken;

- A set of regional goals for waterway management has been developed (Section 4.2);
- High value waterways were identified (Section 5 and Appendix 8);
- High value waterways that align with regional goals were selected (Section 5.3.1);
- Threats to the values of those waterways were identified and the level of risk was assessed;
- High level management activities were identified and their feasibility and cost effectiveness was determined; and
- Priority management activities to form a regional work program for the eight-year planning period were listed (Section 6) (see Figure 4-1).

The benefits of some works will have more widespread benefits (e.g. erosion control in the upper Wimmera River catchment) whereas others will be more localised (e.g. fencing of a small wetland). This is not to say that the geographic scale of the benefits is the only determining factor, for example protecting a small wetland that is a shallow freshwater marsh will be a higher priority due to the fact that they have high environmental values that are now increasingly rare within the landscape.

5.3.1. Aligning High Value Waterways with Regional Goals

The process on how the goals derived and listed in Section 4.2 were used to refine the list of high value waterways was determined in an internal workshop and is described as follows for each goal:

- **Maintaining and improving the values and condition of waterways that have formally recognised significance.**

Within the Wimmera region this includes:

- River reaches classified as Heritage River under the *Heritage Rivers Act 1992*;
- Ramsar sites;
- Wetlands listed on the National Directory of Important Wetlands;
- Wetlands types listed as threatened under the *EPBC Act**; and
- Waterways within high value parks and reserves as classified by Parks Victoria.

This information is held in various national and state databases, legislation, policy documents and strategies and has been incorporated into the AVIRA database for the region. All waterways listed under any of these categories are understood to fit within this goal (see Table 5-1 and Table 5-2 and Appendix 8)

*Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains is a threatened ecological community listed within the *EPBC Act*. According to the listing description under the *EPBC Act*, these small wetlands are inundated with fresh (not brackish or saline water) for a few months during average and wet years. They are generally treeless. Rather they are dominated by grasses, sedges and rushes but not dominated by cane grass, reeds or spike-sedges. They are under threat because they are easily modified (i.e. drained) to improve opportunities for grazing and/or cropping and therefore many have been lost across the landscape (TSSC, 2012). Given the hydrology, wetlands classified as Freshwater Meadows or Shallow Freshwater Marshes are potentially Seasonal Herbaceous Wetlands but groundtruthing the vegetation present is required.

- **Improved connectivity and condition along important wetland systems and riparian corridors.**

Important riparian corridors were defined to be having a high value for:

- Reaches with a high naturalness (they have relatively intact aquatic or riparian communities), more specifically very good:
 - Riparian vegetation condition;
 - Native fish populations; or
 - Aquatic invertebrate communities.

This information is sourced from 2010 Index of Stream Condition data (riparian vegetation condition) (DEPI, 2013a), EPA databases (macroinvertebrate population condition) and results from MDBA Sustainable Rivers Audits (observed compared to expected native fish populations).

- Or they contain identified important features within the landscape, more specifically:
 - Drought refuges; or
 - Important bird habitats.

This information is sourced from a combination of modelling and local knowledge (drought refuges) and sites listed by Birdlife Australia and Birdlife International as well as local knowledge (important bird habitats).

- Or they support threatened species including at least one of:
 - Significant amphibian population;
 - Significant riparian bird population;
 - Significant waterbird population;
 - Significant fish population (non-migratory); or
 - Significant aquatic invertebrate population.

This information is sourced from DEPI databases relating to sites that have recorded survey information (post-1980) which contains observations of riparian or aquatic threatened species. These species are listed under acts of parliament (e.g. *FFG Act* or *EPBC Act*) or lists such as the International Union for Conservation of Nature Red List and Victorian advisory lists of threatened flora and fauna.

Given many reaches were classified as high value under at least one of these ten categories, it was assumed that reaches that are high value under more categories would be of greater importance than others. Reaches with at least four of the 10 values being classified as 'high value' were understood to align with this goal (see Table 5-1 and Table 5-2 and Appendix 8).

- **Improved water quality in important areas for; water supply, environmental condition and recreation.**

Important areas for water quality for water supply, environmental condition and recreation are assumed to be reaches that contribute flows that are harvested into storages for the Wimmera-Mallee water supply system (a designated water supply catchment) as well as reaches that contain headworks storages and/or are used to transfer water within the headworks system. These reaches have been included in the AVIRA database for the region. Given that water quality objectives for water supply, environmental condition and recreation are similar – it is assumed that using the AVIRA metrics for high value reaches for water supply is a suitable proxy. This also meant that a large number of reaches were classified as aligning with this goal given the fact that many reaches contribute streamflows that are harvested from the Wimmera River and Mt William Creek.

- **Waterways with identified high social, cultural and economic values are maintained in a state that continues to support those values in line with climatic conditions.**

Within the Wimmera region, the economic values of waterways largely relate to their usage for water supply (covered in the previous goal) and recreation. Stream reaches provide a number of

recreational opportunities (picnics and barbeques, walking tracks, camping, hunting, boating, fishing and swimming) and often there are multiple values concentrated in a few reaches that provide a hub for communities within the region as well as tourists. Reaches that are classified as high value for more than two of these values would be classified as a being a priority based on the multiple recreational opportunities they afford. Information regarding high Aboriginal cultural heritage values was not able to be obtained although once priority waterways were identified, they were referred to the Barengi Gadjin Land Council to see if any other waterways should be listed as priority waterways for Aboriginal cultural heritage values. Waterways with post-European heritage values were determined through searches of Victorian and Australian heritage databases.

Thresholds to Determine Waterways for Consideration as Priority Waterways

The majority of waterways in the region that were assessed using the process outlined previously aligned with at least one regional goal. To reduce the number of waterway management activities to a number that is considered achievable over the eight-year life cycle of the WWS, it was necessary to further limit the number of high value waterways. With regards to meeting regional goals, a subset of high value waterways were identified that included:

- reaches that met at least three regional goals; and
- wetlands that met two regional goals.

The lower threshold for wetlands related to the fact that many wetlands have limited economic values, namely water supply. It was also decided that waterways with formal recognition (listed wetlands of national and international significance or wetland types and rivers listed under acts of parliament) would be automatically deemed to be a priority waterway to ensure that legal obligations are met.

Analysis of this subset of high value reaches illustrated that river reaches understood to be of greatest significance for social and economic values were adequately identified during this process however a handful of particularly notable reaches for environmental values were not included (Table 5-3). These reaches are deemed, following literature reviews and community consultation, to be of particular significance and considered for classification as a priority waterway.

Table 5-3 Notable Reaches for Consideration as Priority Reaches due to specific attributes not captured in AVIRA.

Reach name (ISC number)	Reason for priority status
Glenlofty Creek (15-72, 15-73)	Extremely rare intact geomorphology (chain of ponds) that has largely been lost from the region. (Earth Tech, 2003)
MacKenzie River (15-14)	Extremely rare intact geomorphology (discontinuous anabranching) that is unique in Victoria, with Mt Lofty Ranges being the only other location. (Earth Tech, 2004).
Mosquito Creek (39-4)	Main tributary to supply flows to the Ramsar-listed Bool and Hacks Lagoon in South Australia
Golton Creek (15-27)	Excellent ISC condition (DEPI, 2013a)
Boggy Creek (15-17)	Excellent ISC condition (DEPI, 2013a)

Similarly whilst most of the priority wetlands were adequately identified through the AVIRA process, there was not sufficient data available during the WWS development process to definitively identify wetlands that are Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. Furthermore a number of wetlands were classified as ‘excellent’ under the Index of Wetland Condition (IWC) and are therefore included for consideration as priority waterways (See Table 5-4)

Table 5-4 Wetlands classified as ‘Excellent’ under the IWC methodology

Wetland name (IWC number)	Location
Cowes Swamp (39—W13)*	Minimay
Lake Bringalbert (39—W11)*	Bringalbert
Unnamed (39—W31)	Goroke
Unnamed (39—W12)	Tallageira
Unnamed (39—W9)	Bringalbert
Kakadu South (39—W24)*	Patyah
Unnamed (Fish Swamp?) (39—W26)	Awonga
Lake Yampitcha (39—W17)	Edenhope
Unnamed (7223685038)	Brooksby
Unnamed (7224596302)	Gymbowen
Jacka Lake (15-5-W8)*	Tooan
Oliver’s Lake (15-5-W14)*	Duchembegarra
Unnamed (7223723995)*	Kanagulk
Grass Flat (Telfer’s Swamp) (15-5-W12)*	Grass Flat

* Also a priority waterway for other reasons.

5.3.2. Risk Assessment and Identifying Management Activities (Feasibility and Cost Effectiveness)

Once the subset of high value waterways was developed the next phase was to undertake a risk assessment to determine the risks that key threats posed to these values. Appropriate management activities were then determined using conceptual models to mitigate threats to these values. Waterways from the subset of high value waterways that have feasible and cost effective management activities to maintain and enhance their values have been determined to be priority waterways (shown in Figure 5-3 and Figure 5-4) and have management activities specified in Section 6 – Regional Work Program.

To illustrate this process an example is shown for a priority waterway, Reach 9 of the Wimmera River. This reach flows from near Campbell’s Bridge, through Glenorchy to Huddleston’s Weir near Dadswell’s Bridge (see Figure 5-1).

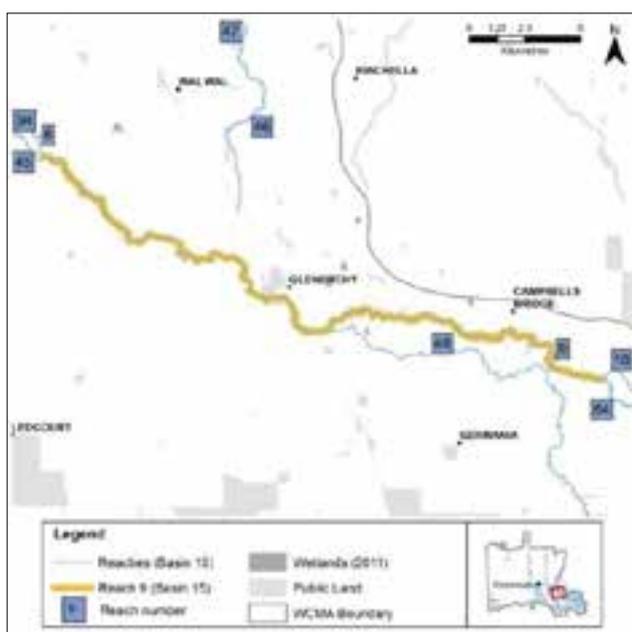


Figure 5-1 Location of Wimmera River Reach 9

Targets over the medium to long term have been established for the Upper Catchment (see Table 6-1 and Table 6-2) which relate to maintenance or improvements in the condition of waterways (especially priority waterways). Undertaking prescribed management activities to mitigate threats to these waterways would then lead to varying degrees of improvement.

Values associated with the reach had been entered in the AVIRA database as either scores from 1-5 or yes/no responses, depending on the metric. Scores above a certain threshold or a 'yes' response in turn meant that there was a high value associated with the waterway. Examples of the values that were rated as 'high' for the Wimmera River Reach 9 are included in Table 5-5.

Table 5-5 – High Values of the Wimmera River Reach 9

Environmental	Social
Significant Birds (Riparian and Waterway)	Picnics and Barbeques
Significant Ecological Vegetation Classes (EVCs).	Walking Tracks
Aquatic Invertebrate Condition	Game Hunting
Economic	Flagship species (platypus)
Urban/Rural Water Source	Cultural
Water Storage (Infrastructure)	Aboriginal Heritage

Threats to waterways were also included in the AVIRA database based on the magnitude of the threat. Threats that were rated as 'high' to the Wimmera River Reach 9 are included in Table 5-6.

Table 5-6 – High Threats to the Wimmera River Reach 9

Threat
Bank Instability
Degraded Riparian Vegetation (Large Trees)
Invasive Fauna (Terrestrial)
Invasive Fauna (Aquatic)
Livestock Access
Loss of Habitat (Large Wood)
Loss of Habitat (Sedimentation)
Reduced Vegetation Width

Within AVIRA, the risk assessment was undertaken on the reach based on the values and threats using information around the association between threats and values as well as the confidence around the association and the likelihood of this threat affecting the value. For example, significant EVCs is a high value for this reach, threats like livestock access and invasive fauna (terrestrial) are the key risks with a high confidence that they impact on this value and the likelihood is certain based on local knowledge of the reach. Because of this, the risk assessment showed that they pose a very high risk to significant EVCs and management activities need to take place to reduce the threat level.

In order to determine the most appropriate management activities to mitigate threats to assets program logic models were developed (GHD, 2012, ARI, 2012). An example is included following (Figure 5-2) which outlines the link between reduced vegetation width (the threat) and recommended activities to address this.

Once the range of management activities were identified, two filters were then applied; one included determining the feasibility of the management activity. For example reducing the loss of habitat (large wood) threat for this reach is unfeasible due to risks around the movement of installed large woody habitat structures during floods. However livestock access (a management activity listed as an option in Figure 5-2) can be effectively managed through working with landholders and establishing riparian management agreements. Another filter used the information from conceptual models regarding the confidence that the activity undertaken will achieve the desired outcome. For example it is well understood that erosion control works will stabilise a stream bed over time but the effectiveness of management activities to mitigate the threat of invasive aquatic fauna (aquatic) are not so well understood. The end results of this example (management activities and quantities) can be seen in Table 6-7 Management Activities for Wimmera River (Reach 9).

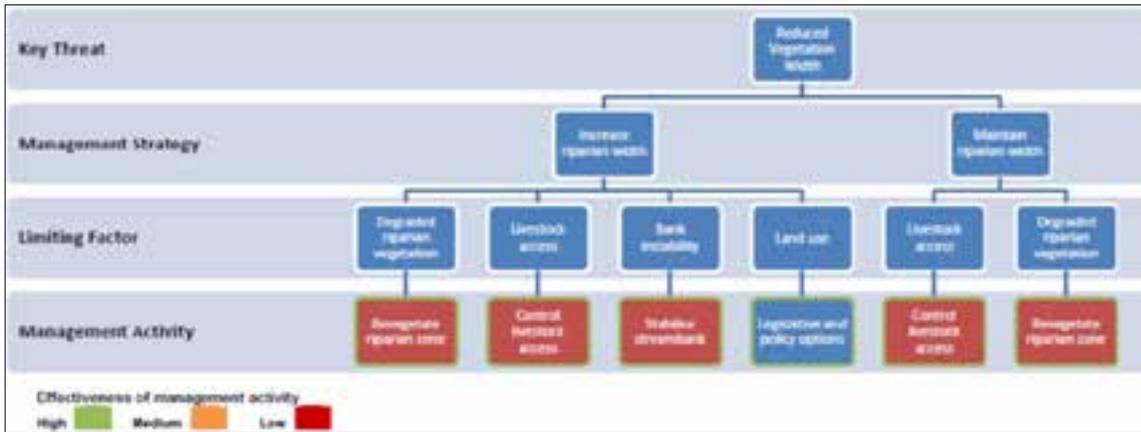


Figure 5-2 Conceptual model for activities to address reduced riparian connectivity (GHD, 2012)

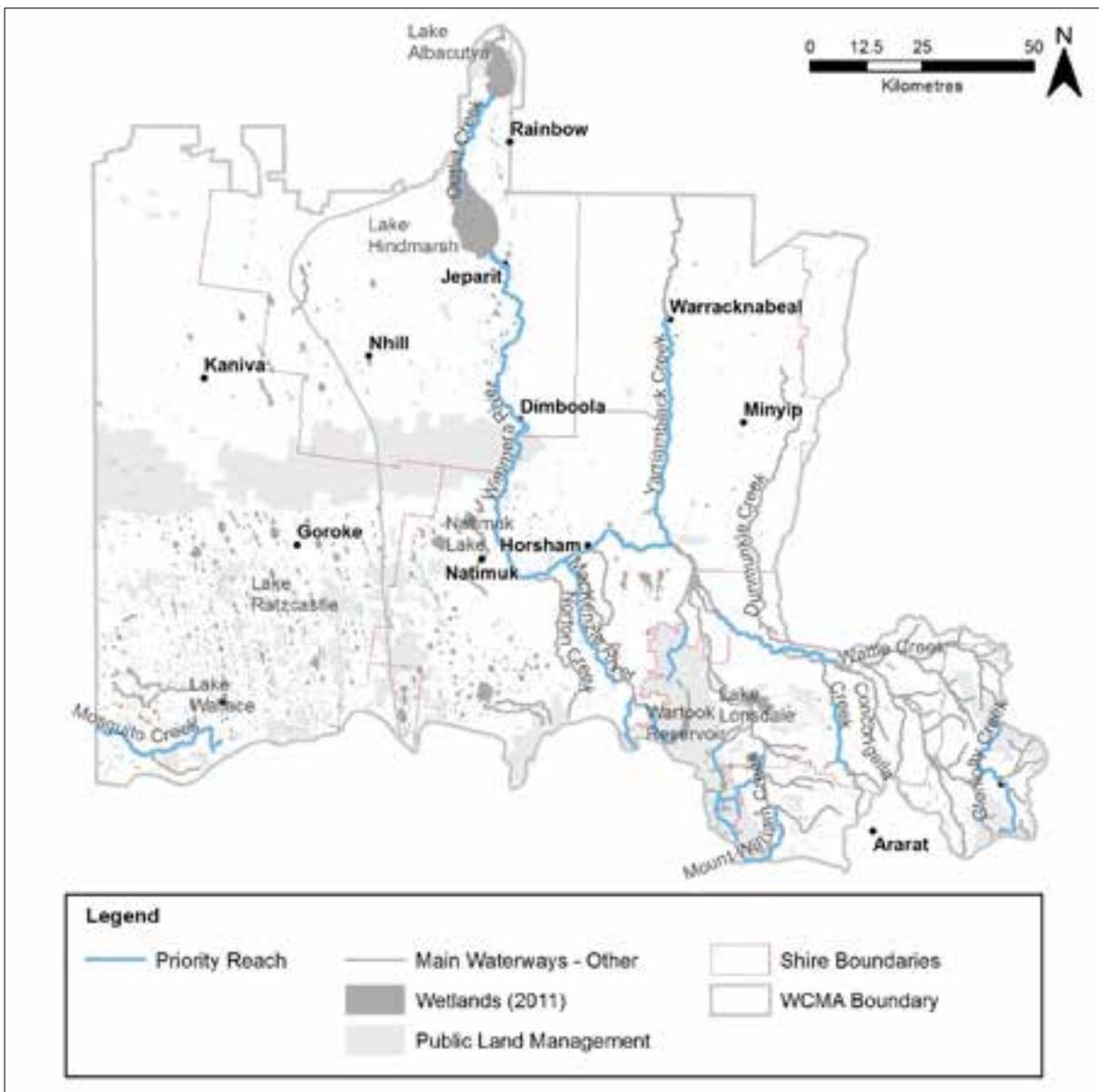


Figure 5-3 Priority reaches in the Wimmera CMA region

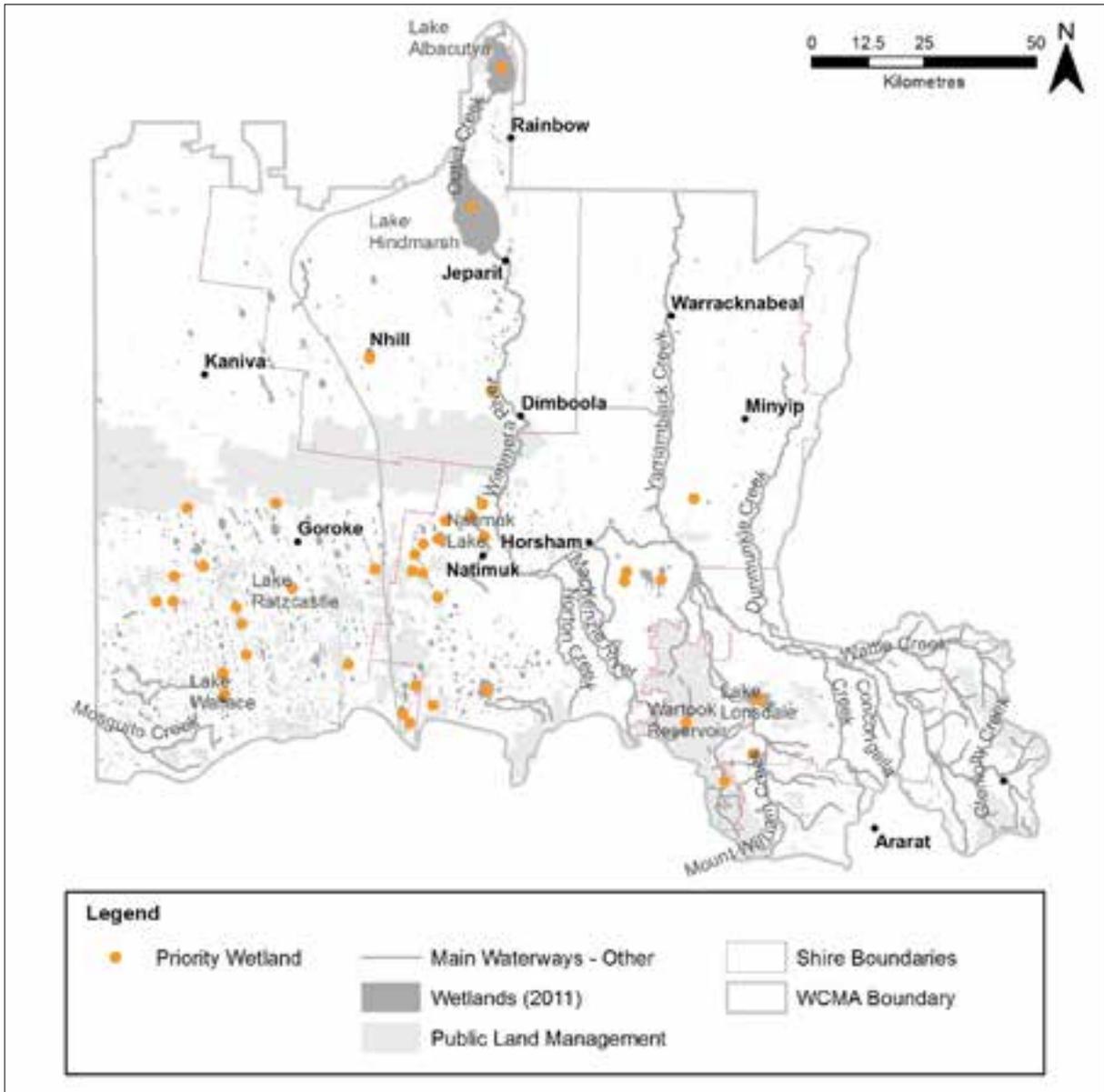


Figure 5-4 Priority wetlands in the Wimmera CMA region

5.4. Management Activities on Non-Priority Waterways

A common theme from consultation during the development of the WWS was the consideration of management activities for non-priority waterways. Feedback included;

- Threats in waterways that are not high value may impact on priority waterways and require management activities to be undertaken to control these threats (e.g. fencing eroding tributary streams leading to sedimentation of pools in a priority river reach). This is consistent with past practice and state policy.
- Many waterways have very high localised importance to parts of the community and may not be a priority for investment within the eight year planning time frame of the WWS. However the WWS should highlight what (if any) activities will be undertaken for these waterways (typically undertaking statutory obligations). In the future Wimmera CMA can provide information to interested community members and groups about the values, threats and potential management activities that can be undertaken to maintain and improve these waterways using AVIRA and other tools developed for the WWS development process.

The VWMS includes criteria around undertaking works outside high value/priority waterways;

- they are a source of threats to priority waterways (for example, downstream);
- they provide important connectivity between other priority waterways;
- there is a serious risk to public infrastructure from waterway processes or an opportunity to reduce risks associated with extreme events (such as floods);
- there is strong community commitment to improving the condition of their local waterway; and
- work is required to meet statutory or regulatory obligations.

(Note: works undertaken on non-priority waterways for the reasons stated above do not make them priority waterways.)

It was also decided to include a process to develop Locally Important Waterway Management Activities – these will be developed on an ‘as needs’ basis should there be sufficient interest from local community groups. They are activities beyond those specified in the WWS with the intent that they are typically resourced from different funding sources to Priority Waterway Management Activities (e.g. local government grants or philanthropic donations).

Waterways that do not fit within either category will not be priorities for management activities within the next eight years however there are other mechanisms (e.g. regulatory and planning controls) to try and ensure that they are managed appropriately and do not deteriorate in their condition.

Figure 5-1 and Section 5.3.1 outline this process.

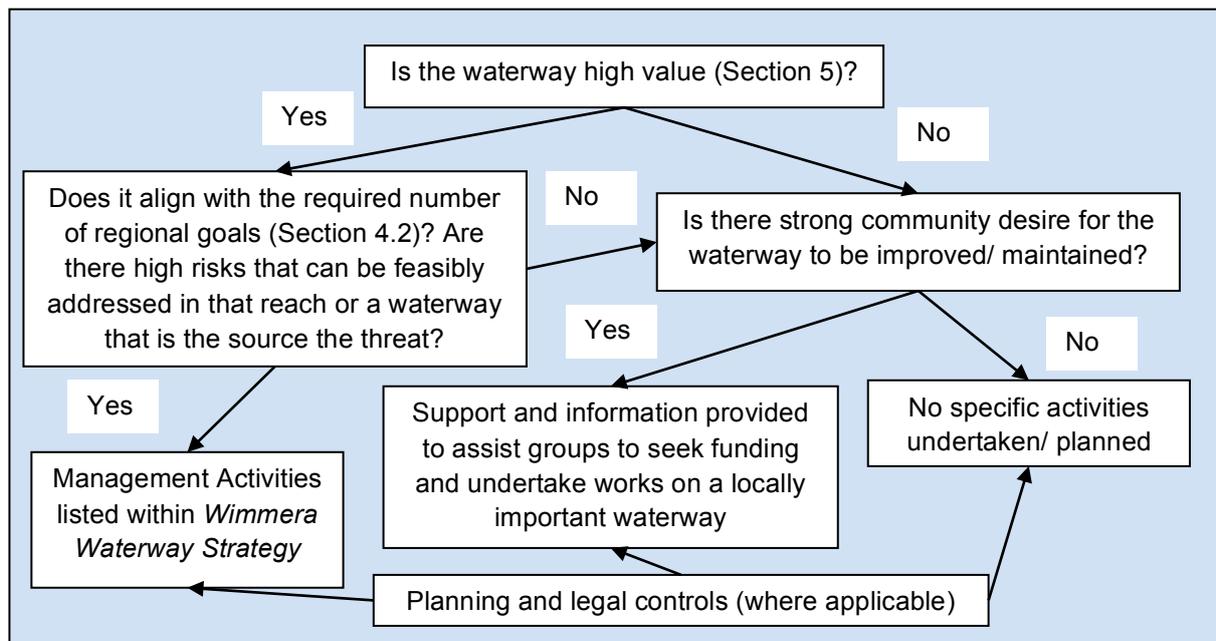


Figure 5-5 Process for determining waterway activities within the timeframe of the WWS.

Case Study - How planning and legal controls protect waterways in the Wimmera

Across the region, licences are required for landholders and agencies to undertake works on designated waterways such as building a low level crossing or upgrading a weir. This is to ensure that the works do not negatively impact on waterway conditions (e.g. through increasing erosion).

In some local government areas there are planning provisions to protect environmentally significant areas. An example of this is the Environmental Significance Overlay within the Hindmarsh Shire where planning applications for works that may impact on the values of wetlands are referred to the Wimmera CMA for advice. Conditions are sometimes placed on applications to ensure that wetland hydrology and other aspects are not impacted.

A summary of recommended management activities (beyond compliance) from the regional priority setting processes is in Table 5-7.

Table 5-7 – Summary of outcomes of the regional waterway priority setting

	Low Risk to Values	High Risk to Values
Regional Priority Waterways	Management activities to maintain waterway condition	Management activities to reduce threats to waterway condition (see Part C)
Local Important Waterways	If funding from other source (e.g. local govt.) available, management activities to maintain waterway condition	If funding from other source (e.g. local govt.) available, activities to reduce threats to waterway condition
Other Waterways	Not a priority within the eight-year planning period	Management activities only if waterway: <ul style="list-style-type: none"> • reduce threat to high value waterways • provide connectivity • are required to meet statutory or regulatory obligations



Geoff ‘Coxy’ Cox and Mike Jenz (DEPI) looking at macroinvertebrates at the Wimmera River at Horseshoe Bend during the filming of an episode of ‘Coxy’s Big Break’. (Photo: G. Fletcher)

Part C

Regional Work Program



Management activities for priority waterways will require a collaborative approach to achieve the best possible outcomes for the region's waterways and community as a whole.

PART C – Regional Work Program

6. Regional Work Program 2014-2022

6.1. Work Program Development

The key role of the *WWS* is to develop a prioritised and costed work program for management activities to maintain and improve the region's waterways. The *Wimmera RCS* is the overarching planning document for integrated catchment management in the region, under which sits the *WWS*. A key feature of the *Wimmera RCS* was the discussion of the region's natural resource management outcomes and challenges located within local government areas; this ensured that members of the community were easily able to identify with elements of the strategy. Each of these areas is distinct within the Wimmera CMA region, having certain individual values and threats but at the same time there are a number of common issues.

6.1.1. Work Program Assumptions

It should be noted that a number of assumptions underpin the development of management activities specified within the Regional Work Program.

Invasive Plants and Animals

Invasive plant and animal management activities are specified in total area across the eight year life of the strategy – this reflects the fact that works are typically undertaken with concentrated works for several reaches or wetlands over several months to drastically reduce the prevalence of invasive plants and animals and then follow-up work may be undertaken in subsequent years on an as needs basis. As most of the targets for invasive plants and animals are derived from the *WIPAMS* (Wimmera CMA, 2010), they have been included in Appendix 9 for ease of reference.

Riparian and Wetland Management Agreements

Assumptions relating to the areas protected compared to the kilometres fenced or number of wetlands protected is based on past results and consideration of the typical size of the type of waterway involved. It should be noted that these agreements contain conditions that the landholder undertake invasive plant and animal control and revegetation where necessary and so contribute to targets for invasive plants and animals as well as improved wetland and riparian vegetation.

Costing Estimates

The costing estimates for management activities are estimated based on the past experience with similar management activities and consultation with partners and reflect as best possible the location and nature of the work. For example costing estimates to undertake invasive plant and animal control works will vary depending on the location and density of the infestation. A number of management activities can be undertaken at a scale much greater than a single reach or wetland and so apply for a number of priority waterways. These broader management activities are marked with an asterisk (*) and have had their costs accounted for in the table for the waterway deemed to be where the activity will have the greatest benefit.





Roosting Ibis on a wetland near Goroke, October 2010. (Photo: S Hall)

6.2. Upper Catchment Work Program

6.2.1. Upper Catchment Description

The Upper Catchment includes portions of the Northern Grampians and Pyrenees Shires as well as Ararat Rural City Council (Figure 6-1). Notable features include northern sections of the Pyrenees and Grampians ranges that are the location of the headwaters of the majority of tributaries to the Wimmera River catchment, including upper reaches of the Wimmera River itself. A number of creeks also start in steep hill country around Navarre and the Black Range between the Grampians and Pyrenees, flowing into Mt William Creek and Wimmera River which head north-west towards the Wimmera plains.



Newly constructed rock chute in a tributary of Nowhere Creek. (Photo: D Fletcher)

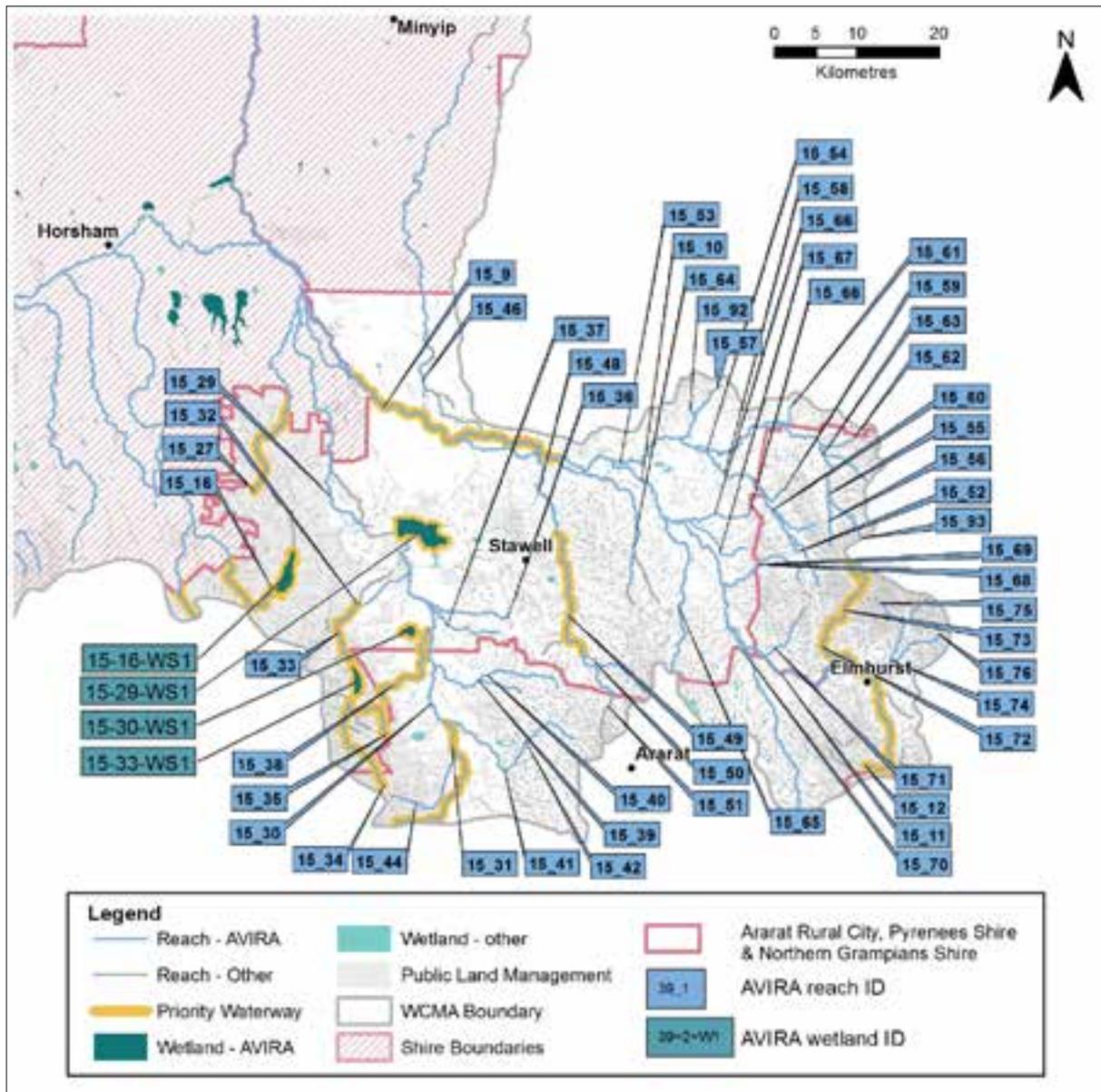


Figure 6-1 Key waterways of the Upper Catchment (parts of Ararat Rural City, Pyrenees Shire and Northern Grampians Shire in the Wimmera CMA region)

The number of wetlands in the Upper Catchment is reasonably small when compared to the rest of the Wimmera catchment (about 220). The most common wetland types are small shallow freshwater marshes and freshwater meadows, largely occurring in and around the Grampians. There are also a number of larger modified wetlands, such as Lake Lonsdale, Lake Wartook, Lake Bellfield and Lake Fyans that were previously swampy areas that have been modified to act as water storages. Their water levels fluctuate depending on inflows and storage management operations.

6.2.1.1. Upper Catchment Waterway Values

The majority of creeks and rivers that are located in national parks and state reserves are in very good environmental condition and contain high value fish and vegetation communities and provide good quality water. Flows from several creeks are harvested via small weirs high in the catchment for towns like Elmhurst, Buangor and Moyston and other creeks flow into larger water storages like Lakes Bellfield and Wartook. These creeks provide an invaluable source of water for the region's towns and farms, supplied from these storages by the Wimmera Mallee Pipeline.

After these creeks come out of the large public land reserves they become used as a source of water for stock and domestic purposes and for irrigating vines or perennial pastures. This, combined with the adjacent agricultural land use means that their environmental values diminish. In the upper reaches, spring-fed pools play an important role preserving populations of platypus and river blackfish in the extremes of drought. Riparian vegetation provides an important thoroughfare for wildlife between large tracts of cleared private land.

Case Study – Glenlofty Creek

Glenlofty Creek, near Elmhurst, is almost unique in the region due to its almost intact geomorphological form – known as a Chain of Ponds system (ID&A, 2002). Prior to European settlement, many tributaries of the Wimmera River would have been similar – deep pools or ponds would fill and overflow downstream during wet conditions. This provided excellent habitat for fish, platypus and other aquatic biota especially during dry conditions.

Currently there is very little erosion along the Glenlofty Creek, in contrast to other tributaries that bear the legacy of drainage and gold mining works and no longer support fish, platypus, water rats etc. There has been an ongoing focus by landholders and the Wimmera CMA to protect the creek's natural values and prevent erosion. Almost all of the creek's length has been maintained or improved through fencing, revegetation and weed control works.



*Glenlofty Creek
August 2010*

Water storages are a hub for recreation and tourism, especially fishing at Lake Lonsdale, Lake Wartook, Lake Bellfield and Lake Fyans. Water-skiing is also very popular when water levels are sufficient at Lake Fyans and Lake Lonsdale. Lake Lonsdale also has immense Aboriginal cultural significance with a large number of artefacts present around its shores. Community feedback indicates that there are a number of other smaller wetlands in this part of the catchment that should be better recognised for their environmental values.

6.2.1.2. Upper Catchment Waterway Threats

There are a number of significant threats present in the Upper Catchment and these threats have major impacts across the region when streamflows from the upper catchment make their way to the lower reaches of the Wimmera River and Yarriambiack Creek.

Fast flowing water erodes unstable creek banks and beds in a number of locations which generates substantial sediment movement. The erosion incises and widens creeks, creating deep, wide gullies

in the hill country and eroded sediment in-fills deep pools in the Wimmera River as well as increasing water turbidity and nutrient levels. The accelerated erosion has been largely created by historic gold dredging, drainage, land clearing and inappropriate farming practices that expose the highly erosive and unstable soils. These practices have meant that some riparian zones are now very narrow and contain a handful of native plant species while some are completely cleared. These historic activities have also led to other negative impacts such as dryland salinity and rising saline groundwater tables that creates very poor water quality when groundwater trickles into creeks during dry conditions.

Problems with water quality are compounded in parts of the catchment by reduced flows to waterways due to the significant number of stock and domestic dams and larger irrigation dams (mainly for viticulture) that capture runoff upstream.

Case Study – Water Quality Trends at Eversley

The Wimmera River at Eversley, between Elmhurst and Crowlands has a long time series of water quality data and the site was one of six across Victoria where water quality trends were analysed in detail as part of the *Victorian Water Quality Trends 1991-2010* report (DEPI, 2013c). It identified concerning trends in water quality from 2005 onwards when record drought and then floods affected the catchment. Salinity measurements were at record levels during the drought. Floods created major problems with unprecedented levels of turbidity, total phosphorous and dissolved oxygen.

Vast quantities of organic matter that built up during the drought as well as bare soil due to a lack of vegetation cover on private land washed into the river. The soil lifted turbidity and total phosphorous levels and the breaking down of the organic matter meant dissolved oxygen levels plummeted. This case study highlights the value of regular flows and importance of healthy riparian zones and ground cover to prevent these severe water quality fluctuations. These results provide a potential snapshot into a future where droughts and extreme rainfall events are more common and so improved riparian zones will be critical to buffer the river against the impacts of such major

Pest plants and animals have been a major focus for works in the Upper Catchment and community feedback during the development of the *Wimmera RCS* and *WWS* highlights that this will need to continue. Many successes have occurred in reducing the abundance and distribution of rabbits, gorse and willows in the Upper Catchment however there are setbacks due to increasing resistance to the Calici virus in rabbits and flooding spreading weeds. A number of other weed species such as sallow wattle, rose briar, poplar and broom will need attention to prevent their future spread. Carp and gambusia are also causing impacts on water quality and native fish populations.

6.2.2. Upper Catchment Reach Targets

Monitoring

Across the Upper Catchment there are a number of long established water quality and flow monitoring sites on the Wimmera River, Concongella Creek, Mt William Creek, Fyans Creek, Mt Cole Creek and Wattle Creek. As well there has been periodic monitoring of indicators such as platypus, fish and macroinvertebrates. Stream condition on most of the key streams has been determined via the state-wide Index of Stream Condition.



Management Activity Planning

Historically a comprehensive suite of management activity plans have been developed including:

- *Wimmera River and Environs Action Program (WREAP)* (Thomas Hay and Associates, 1997) which identified issues like erosion and weeds along the channel of the Wimmera River itself.
- Geomorphic studies of the type and condition of the region's streams in 2002 (ID&A, 2002, Earth Tech, 2003) provided a solid basis for further work into priority streams that posed the greatest erosion threat.
- Waterway action plans were completed for a number of sub-catchments which involved community input and expert opinion leading to the development of a prioritised checklist of management activities to improve stream condition and reduce water quality issues.

Most of the Upper Catchment has had management activity planning undertaken in this manner which provides a good foundation to plan, set targets and implement management activities to improve waterway condition.

Table 6-1 Upper Catchment Long-Term Reach Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish	UC RCT1. Fish populations within the upper catchment will be classified as "good" on average according to the <i>Wimmera Fish Monitoring Project 2008</i> (SKM, 2008a) methodology.	Latest sub-catchment classifications: Upper Mt William "good" (Biosis, 2012) Upper Wimmera "good" (ALS, 2011) Mt Cole "fair" (Ecowise, 2009) Lower Mt William "fair" (SKM, 2010) Concongella "poor" (Ecowise, 2009) Upper MacKenzie "good" (SKM, 2010).
Riparian vegetation condition	UC RCT2. No declines in ISC Streamside Zone scores. UC RCT3. 50% of reaches have an ISC Streamside Zone score of 7 or higher.	According to the ISC 2010 results 39% of reaches have an ISC Streamside Zone score of 7 or higher (DEPI, 2013a).
Macroinvertebrates	UC RCT4. 70% of sites have a Macroinvertebrate Biotic Index (MBI) classification of 'good' or better during average hydrological conditions or better.	66% of sites have MBI classification of 'good' or better (WEC, 2012).
Instream habitat and Channel form	UC RCT5. No declines in ISC Physical Form scores. UC RCT6. 45% of reaches have an ISC Physical Form score of 8 or higher.	According to the ISC 2010 results 41% of reaches have an ISC Physical Form score of 8 or higher.
Water quality	UC RCT7. Long-term improved water quality trends at stream gauges compared to those of the 1991-2005 period according to (DEPI, 2013c) method.	Results available for Wimmera River at Eversley (415207) and Glenorchy Tail Gauge (415201) (DEPI, 2013c).
Platypuses	UC RCT8. Increase population and distribution of platypuses demonstrated by Catch Per Unit Effort (CPUE).	Wimmera River - 0 platypus trapped over 38 trap nights therefore population is believed to be 'very low and sparsely populated' (cesar, 2013). MacKenzie River - CPUE 0.071, 'very low and static' (cesar, 2012).
Hydrology (frequency and persistence of water)	UC RCT9. Stabilisation of streamflow reductions due to water extraction and storage.	According to the ISC 2010 results ISC hydrology scores are moderate (average of 6) (DEPI, 2013a).

Table 6-2 Upper Catchment Reach Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	UC MOT 1. Invasive aquatic fauna population does not spread beyond 2014 range. UC MOT 2. Reducing carp numbers where they are yet to fully establish (Reach 16 MacKenzie River only). UC MOT 3. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> .	Carp have not been found in the Mt William Ck above Lake Lonsdale (Biosis, 2012). Carp comprise 48% of fish biomass (Biosis, 2012a). Rabbit density >25% above target levels (Wimmera CMA, 2010).
Excessive erosion and sedimentation	UC MOT 4. 80% of reaches have less than 20% of stream banks and stream beds eroding. UC MOT 5. 60% of very high priority bed and bank instability actions identified in Waterway Action Plans completed. UC MOT 6. Increased information obtained on bed and bank instability threats through Waterway Action Plans. UC MOT 7. 100% of existing CMA erosion control structures maintained.	78% of reaches have less than 20% of stream banks and 71 % of reaches have stream beds eroding. About 40% of very high priority bed and bank instability actions identified in Waterway Action Plans completed Some waterway action planning required in certain sub-catchments and ongoing review of priorities in completed WAPs. Damage during record floods was relatively minor and has since been repaired.
Inadequate riparian vegetation quality and extent	UC MOT 8. 95% reaches have less than 75% of their length impacted by livestock [#] . UC MOT 9. 75% of reaches have at least moderate riparian connectivity*. UC MOT 10. 30% of reaches have greater than 10m wide riparian vegetation.	89% of reaches have less than 75% of their length impacted by livestock [#] . 70% of reaches have at least moderate riparian connectivity*. 24% of reaches have greater than 10 m wide riparian vegetation.
Modified hydrology	UC MOT 11. Index of Stream Condition 2010 Hydrology scores remain stable or improve.	Average ISC score of 6 (DEPI, 2013a).
Invasive Flora	UC MOT 12. Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>). UC MOT 13. Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>). UC MOT 14. 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone. UC MOT 15. 15% of reaches have no high threat invasive shrub species present. UC MOT 16. 50% of reaches have no high threat invasive tree species present.	Status of <i>WIPAMS</i> targets unknown (Wimmera CMA, 2010). 95% of reaches have less than 11% invasive riparian tree and shrub cover 11% of reaches have no high threat invasive shrub species present. 55% of reaches have no high threat invasive tree/shrub species present.
Degraded water quality	UC MOT 17. 100% of reaches with an ISC Water Quality score will be 5 or higher. UC MOT 18. Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood).	78% of reaches with an ISC Water Quality score of 5 or higher.

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on riparian areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to banks and vegetation are).

* Moderate riparian connectivity is defined as having 0-39% of streambank has overhanging vegetation with 40-59% of vegetated area being gaps OR 40-64% of streambank has overhanging vegetation with 60-79% of vegetated area being gaps OR 65-79% of streambank has overhanging vegetation with 80-100% of vegetated area being gaps according to ISC 2010.



6.2.3. Upper Catchment Priority Reach Management Activities

The priority reaches in the Upper Catchment and their values are shown in Table 6-3.

Table 6-3 Priority Reaches in the Upper Catchment

Reach Name Number	Reasons
Fyans Creek Reach 33	Environment: High value fish community. Key element of Grampians National Park Values. Economic: Important for water supply (Lake Fyans, Lonsdale). Social/Cultural: Valued for sightseeing and camping. Significant Aboriginal cultural and post-European heritage values.
Fyans Creek Reach 34	Environment: High value fish, macroinvertebrate, amphibian and vegetation communities. Key element of Grampians National Park Values. Economic: Important for water supply (Lake Bellfield). Social/Cultural: Valued for sightseeing and camping. Significant Aboriginal cultural and post-European heritage values.
Barneys Creek Reach 35	Environment: High value fish and vegetation communities. Key element of Grampians National Park Values. Economic: Important for water supply (Lake Bellfield). Social/Cultural: Significant Aboriginal cultural and post-European heritage values.
Mt William Creek Reach 31	Environment: High value fish and macroinvertebrate communities. Economic: Important for water supply (Lake Lonsdale). Social/Cultural: Significant Aboriginal cultural and post-European heritage values.
Millers Creek Reach 38	Environment: High value fish and bird communities. Key element of Grampians National Park Values. Economic: Important for water supply (Lake Lonsdale). Social/Cultural: Valued for picnics and barbeques. Significant Aboriginal cultural heritage values.
Concongella Creek Reach 49	Environment: High value fish community. Economic: Important for water supply (irrigation licences, Taylor's Lake). Social/Cultural: Valued for picnics, barbeques, game hunting. Significant Aboriginal cultural and post-European heritage values.
Wimmera River Reach 9	Environment: High value fish, platypus and macroinvertebrate communities. Economic: Important for water supply (Taylor's Lake). Social/Cultural: Valued for picnics, barbeques, game hunting. Significant Aboriginal cultural heritage values.
Wimmera River Reach 12	Environment: High value bird, platypus and macroinvertebrate communities. Economic: Important for water supply (Taylor's Lake). Social/Cultural: Valued for picnics, barbeques, game hunting. Significant Aboriginal cultural heritage values.
Glenlofty Creek Reach 72	Environment: High value macroinvertebrate community, geomorphically rare Economic: Important for water supply (Taylor's Lake). Social/Cultural: Significant Aboriginal cultural heritage values.
Glenlofty Creek Reach 73	Environment: High value bird community, geomorphically rare Economic: Important for water supply (Taylor's Lake). Social/Cultural: Significant Aboriginal cultural heritage values.
MacKenzie River Reach 16	Environment: High value fish, platypus, vegetation and macroinvertebrate communities. Economic: Important for water supply (Taylor's Lake, Horsham). Social/Cultural: Valued for picnics, barbeques, camping, and sightseeing. Significant Aboriginal cultural and post-European heritage values.
Golton Creek Reach 27	Environment: High value vegetation communities. Excellent ISC score. Social/Cultural: Valued for camping, sightseeing, picnics and barbeques. Significant Aboriginal cultural and post-European heritage values.

Table 6-4 Management Activities for Fyans Creek and Barneys Creek (Reaches 15-33, 15-34 and 15-35)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Fyans Creek, Barneys Creek and local tributaries	Identification Nos.	15-33 15-34 15-35
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value fish, macroinvertebrate, amphibian and vegetation communities. Key element of Grampians National Park Values. Economic: Important for water supply (Lakes Bellfield, Fyans, and Lonsdale). Social/Cultural: Valued for sightseeing and camping. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna, Altered water regime, Bank instability, Thermal water pollution				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 1	Invasive aquatic fauna population does not spread beyond 2014 range	UC MA 1. Conduct fish population assessment	2 reports	CMA, DEPI	
		UC MA 2. Coordinate community engagement event	2 events	CMA, DEPI	
UC MOT 11	Index of Stream Condition 2010 Hydrology scores remain stable or improve	UC MA 3. Conduct water transfers considering environmental impacts (Fyans Ck)	NA	GMMWater, CMA	
		UC MA 4. Install flow gauging to determine compliance with passing flow rules on Fyans Ck	1 site	CMA, GMMWater, VEWH	
UC MOT 12, UC MOT 13, UC MOT 14, UC MOT 15	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>), Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present	UC MA 5. Conduct assessment into priority areas for invasive plant management in riparian areas	1 report	CMA, PV, Local govt, Landcare, Landholders	
		UC MA 6. Establish priority groundcover weed control in riparian areas	160 ha	CMA, PV, Local govt., Landcare, Landholders	
		UC MA 7. Establish priority tree/shrub weed control in riparian areas (blackberry)	40 ha	PV, CMA, Landholders, Landcare	
Estimated cost of activities		\$207,500			
Relevant documents: <i>Wimmera Glenelg Bulk Entitlement</i> <i>Regulated Streams of the Wimmera – Waterway Action Plan</i> <i>Grampians National Park Management Effectiveness Report Card</i>					



Table 6-5 Management Activities for Mt William Creek and Millers Creek (Reaches 15-31 and 15-38)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Mt William Creek, Millers Creek and local tributaries	Identification Nos.	15-31 15-38
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value fish, bird and vegetation communities. Key element of Grampians National Park Values. Economic: Important for water supply (Lake Lonsdale). Social/Cultural: Valued for picnics and barbecues. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna, Degraded riparian vegetation, Bank instability, Loss of instream habitat (sedimentation)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 1	Invasive aquatic fauna population does not spread beyond 2014 range	UC MA 1 Conduct fish population assessment	2 reports*	CMA, DEPI	
		UC MA 2 Coordinate community engagement event	2 events*	CMA, DEPI	
UC MOT 3	Achieve waterway relevant invasive fauna targets in the WIPAMS	UC MA 8. Conduct invasive fauna control in riparian areas (rabbits)	120 ha	CMA, PV, Landholders, Landcare	
UC MOT 6	Increased information obtained on bed and bank instability threats through Waterway Action Plans	UC MA 9. Conduct Waterway Action Plan (Millers Creek)	1 report	WCMA, landholders	
UC MOT 8, UC MOT 9, UC MOT 10	95% reaches have less than 75% of their length impacted by livestock [#] , 75% of reaches have at least moderate riparian connectivity*, 30% of reaches have greater than 10m wide riparian vegetation	UC MA 10. Establish riparian management agreements	5 ha	CMA, Project Platypus, landholders	
		UC MA 11. Construct riparian fence	2 km	CMA, Project Platypus, landholders	
UC MOT 12, UC MOT 14, UC MOT 15	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from WIPAMS), Reduce bridal creeper to <10% cover of high value reaches (modified target from WIPAMS), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present	UC MA 5 Conduct assessment into priority areas for invasive plant management in riparian areas (bridal creeper, blackberry)	1 report*	CMA, PV, Local govt., Landcare, Landholders	
		UC MA 12. Establish priority groundcover weed control in riparian areas	16 ha	CMA, PV, Local govt., Landcare, Landholders	
		UC MA 13. Establish priority shrub weed control in riparian areas	16 ha	CMA, PV, Local govt., Landcare, Landholders	
UC MOT 17, UC MOT 18	100% of reaches with an ISC Water Quality score will be 5 or higher, Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood)	Undertake riparian management, erosion control and invasive fauna management activities listed previously	N/A	N/A	
Estimated cost of activities			\$129,600		
Relevant documents: <i>Bulk Entitlement (Willaura, Elmhurst and Buangor Systems)</i> <i>Wimmera Glenelg Bulk Entitlement</i> <i>Regulated Streams of the Wimmera – Waterway Action Plan</i> <i>Grampians National Park Management Effectiveness Report Card</i>					

Table 6-6 Management Activities for Wimmera River and Glenlofty Creek (Reaches 12, 72 and 73)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Wimmera River, Glenlofty Creek and local tributaries	Identification No.	15-12 15-72 15-73
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values		Environment: High value bird, platypus and macroinvertebrate communities. Economic: Important for water supply (Taylors Lake). Social/Cultural: Valued for picnics and barbeques, game hunting. Significant Aboriginal cultural heritage values.			
Threats		Invasive flora and fauna, Degraded riparian vegetation, Bank instability, Loss of instream habitat (sedimentation), Degraded water quality, Altered water regime (increased period of zero flow)			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 3	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	UC MA 14. Establish invasive fauna control in riparian areas (rabbits)	80 ha	CMA, Project Platypus, PV, landholders, Landcare	
UC MOT 4, UC MOT 5	80% of reaches have less than 20% of stream banks and stream beds eroding, 60% of very high priority bed and bank instability actions identified in Waterway Action Plans completed	UC MA 15. Install erosion and sediment control structures	3 structures	CMA, landholders	
UC MOT 7	100% of existing CMA erosion control structures maintained	UC MA 16. Maintenance of erosion control structures	16 structures	CMA, landholders	
UC MOT 8, UC MOT 9, UC MOT 10	95% reaches have less than 75% of their length impacted by livestock [#] , 75% of reaches have at least moderate riparian connectivity*, 30% of reaches have greater than 10m wide riparian vegetation	UC MA 17. Establish riparian management agreements	50 ha	CMA, Project Platypus, landholders	
		UC MA 18. Construct riparian fence	10 km	CMA, Project Platypus, landholders	
		UC MA 19. Coordinate engagement events/ Develop publications to highlight linkages between riparian works and water quality and bank stability	2 events/ publications*	CMA, Project Platypus	
UC MOT 11	Index of Stream Condition 2010 Hydrology scores remain stable or improve	UC MA 20. Establish local management rules for Upper Wimmera River	1 plan*	GWMWater, CMA, DEPI	
UC MOT 12, UC MOT 13, UC MOT 14, UC MOT 15, UC MOT 16	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>), Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present, 50% of reaches have no high threat invasive tree species present	UC MA 21. Conduct assessment into priority areas for invasive plant management in riparian areas (poplar, gorse, bridal creeper, blackberry, willow, rose briar, broom)	1 report*	CMA, Project Platypus, Landholders, Landcare, Local Govt	
		UC MA 22. Establish priority groundcover weed control in riparian areas	32 ha	CMA, Project Platypus, Landholders, Landcare	
		UC MA 23. Establish priority tree/shrub weed control in riparian areas	48 ha	CMA, Project Platypus, Landholders, Landcare	



UC MOT 17, UC MOT 18	100% of reaches with an ISC Water Quality score will be 5 or higher, Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood)	Undertake riparian management, erosion control and invasive fauna management activities listed previously	N/A	N/A
Estimated cost of activities		\$271,200		
Relevant documents: Glenpatrick and Nowhere Creeks Waterway Action Plan Wimmera River Reach 2 Waterway Action Plan Glenlofty Creek Waterway Action Plan Bulk Entitlement (Willaura, Elmhurst and Buangor Systems) Western Region Sustainable Water Strategy				

Table 6-7 Management Activities for Wimmera River (Reach 9)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Wimmera River and local tributaries	Identification No.	15-9
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value fish, platypus and macroinvertebrate communities. Economic: Important for water supply (Taylors Lake). Social/Cultural: Valued for picnics and barbeques, game hunting. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Degraded riparian vegetation, Bank instability, Loss of instream habitat (sedimentation), Degraded water quality, Altered water regime (increased period of zero flow)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 3	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	UC MA 24. Establish invasive fauna control in riparian areas (rabbits)	5,120 ha	CMA , Project Platypus, Landcare, landholders	
UC MOT 4, UC MOT 5	80% of reaches have less than 20% of stream banks and stream beds eroding, 60% of very high priority bed and bank instability actions identified in Waterway Action Plans completed	UC MA 25. Install erosion and sediment control structure	40 structures	CMA , landholders	
UC MOT 7	100% of existing CMA erosion control structures maintained	UC MA 16 Maintenance of erosion control structures	16 structures*	CMA , landholders	
UC MOT 8, UC MOT 9, UC MOT 10	95% reaches have less than 75% of their length impacted by livestock [#] , 75% of reaches have at least moderate riparian connectivity*30% of reaches have greater than 10m wide riparian vegetation	UC MA 26. Establish riparian management agreements	400 ha	CMA , Project Platypus, landholders	
		UC MA 27. Construct riparian fence	80 km	CMA , Project Platypus, landholders	
		UC MA 19 Coordinate engagement events/ Develop publications to highlight linkages between riparian works and water quality and bank stability	2 events/ publications	CMA , Project Platypus	
UC MOT 11	Index of Stream Condition 2010 Hydrology scores remain stable or improve	UC MA 20 Establish local management rules for Upper Wimmera River	1 plan*	GMMWater , CMA, DEPI	
UC MOT 12UC	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches	UC MA 21 Conduct assessment into priority areas for invasive plant management in riparian	1 report*	CMA , Project Platypus, Landholders,	

MOT 13, UC MOT 14, UC MOT 15, UC MOT 16	(modified target from <i>WIPAMS</i>), Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present, 50% of reaches have no high threat invasive tree species present	areas (poplar, gorse, bridal creeper, blackberry, willow, rose briar, broom)		Landcare, Local Govt
		UC MA 28. Establish priority groundcover weed control in riparian areas	1,120 ha	CMA , Project Platypus, Landholders, Landcare, Local Govt
		UC MA 29. Establish priority tree/shrub weed control in riparian areas	800 ha	CMA , Project Platypus, Landholders, Landcare, Local Govt
UC MOT 17, UC MOT 18	100% of reaches with an ISC Water Quality score will be 5 or higher, Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood)	Undertake riparian management, erosion control and invasive fauna management activities listed previously and for upstream priority waterways	N/A	N/A
Estimated cost of activities		\$3,612,000		
Relevant documents: <i>Mt Cole Creek Waterway Action Plan</i> <i>Glendhu Creek Waterway Action Plan</i> <i>Spring and Tuckers Creek Waterway Action Plan</i> <i>Wimmera River Reaches 3,4,5,6.1 Waterway Action Plan</i> <i>Wattle Creek Waterway Action Plan</i> <i>Shays Creek Waterway Action Plan</i> <i>Six Mile Creek Waterway Action Plan</i> <i>Seven Mile Creek Waterway Action Plan</i> <i>Western Region Sustainable Water Strategy</i>				

Table 6-8 Management Activities for MacKenzie River (Reach 15-16)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	MacKenzie River	Identification No.	15-16
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Platypus, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value fish, macroinvertebrate, platypus and vegetation communities. Key element of Grampians National Park Values. Economic: Important for water supply (Taylor's Lake, Horsham). Social/Cultural: Valued for picnics, barbeques and sightseeing. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna, Altered water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 1	Invasive aquatic fauna population does not spread beyond 2014 range	UC MA 1 Conduct fish population assessment	2 reports*	CMA , DEPI	
		UC MA 2 Coordinate community engagement event	2 events*	CMA , DEPI	
UC MOT 11	Index of Stream Condition 2010 Hydrology scores remain stable or improve	UC MA 3 Conduct water transfers considering environmental impacts	NA	GMMWater , CMA	
UC RCT8	Increase population and distribution of platypuses demonstrated by Catch Per Unit Effort (CPUE)	UC MA 30. Investigate and undertake options to ensure the long-term sustainability of the platypus population	TBD	CMA , PV	

UC MOT 12, UC MOT 13, UC MOT 14, UC MOT 15	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>),	UC MA 5 Conduct assessment into priority areas for invasive plant management in riparian areas	1 report*	CMA, PV , Local govt, Landcare
	Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present	UC MA 31. Establish priority groundcover weed control in riparian areas	16 ha	
Estimated cost of activities		\$1,600		
Relevant documents: <i>Wimmera Glenelg Bulk Entitlement</i> <i>MacKenzie River Waterway Action Plan</i> <i>Influences on EWR in the Wimmera Phase 1</i> <i>Grampians National Park Management Effectiveness Report Card</i>				

Table 6-9 Management Activities for Golton Creek (Reach 15-27)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Golton Creek	Identification No.	15-27
Long-term Resource Condition		Targets in Table 6-1 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value vegetation community. Key element of Grampians National Park Values. Social/Cultural: Valued for camping, picnics, barbeques and sightseeing. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 12, UC MOT 13, UC MOT 14, UC MOT 15	Reduce broom, boneseed, blackberry, sallow wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>),	UC MA 5 Conduct assessment into priority areas for invasive plant management in riparian areas	1 report*	CMA, PV , Local govt, Landcare	
	Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present	UC MA 32. Establish priority groundcover weed control in riparian areas	16 ha	PV, CMA , Landholders, Landcare	
Estimated cost of activities		\$3,000			
Relevant documents: <i>Grampians National Park Management Effectiveness Report Card</i>					

Table 6-10 Management Activities for Concongella Creek (Reach 15-49)

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Concongella Creek and tributaries	Identification No.	15-49
Long-term Resource Condition		Targets in Table 6-1 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			

Values	Environment: High value fish community Economic: Important for water supply (Taylors Lake). Social/Cultural: Valued for picnics and barbeques, game hunting. Significant Aboriginal cultural and post-European heritage values.			
Threats	Invasive flora and fauna, Degraded riparian vegetation, Bank instability, Loss of instream habitat (sedimentation), Degraded water quality, Altered flow regime (increased period of zero flow)			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners
UC MOT 3	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	UC MA 33. Establish invasive fauna control in riparian areas (rabbits)	160 ha	CMA , Project Platypus, Landcare, landholders
UC MOT 4, UC MOT 5	80% of reaches have less than 20% of stream banks and stream beds eroding, 60% of very high priority bed and bank instability actions identified in Waterway Action Plans completed	UC MA 34. Install erosion and sediment control structures	4	CMA , landholders
UC MOT 7	100% of existing CMA erosion control structures maintained	UC MA 16 Maintenance of erosion control structures	16 structures*	CMA , landholders
UC MOT 8, UC MOT 9, UC MOT 10, UC MOT 3	95% reaches have less than 75% of their length impacted by livestock [#] , 75% of reaches have at least moderate riparian connectivity*, 30% of reaches have greater than 10m wide riparian vegetation	UC MA 35. Establish riparian management agreements	15 ha	CMA , Project Platypus, landholders
		UC MA 36. Construct riparian fence	6 km	CMA , Project Platypus, landholders
		UC MA 19 Coordinate engagement events/ Develop publications to highlight linkages between riparian works and water quality and bank stability	2 events/ publications*	CMA , Project Platypus
UC MOT 12, UC MOT 13, UC MOT 14, UC MOT 15, UC MOT 16	Reduce broom, boneseed, blackberry, willow, wattle and gorse densities on priority reaches (modified target from <i>WIPAMS</i>), Reduce bridal creeper to <10% cover of high value reaches (modified target from <i>WIPAMS</i>), 100% of reaches have less than 11% invasive tree and shrub cover in riparian zone, 15% of reaches have no high threat invasive shrub species present, 50% of reaches have no high threat invasive tree species present	UC MA 21 Conduct assessment into priority areas for invasive plant management in riparian areas (poplar, gorse, bridal creeper, blackberry, willow, rose briar, broom)	1 report *	CMA , Project Platypus, Landholders, Landcare, Local Govt
		UC MA 37. Establish priority groundcover weed control in riparian areas	16 ha	CMA , Project Platypus, Landholders, Landcare
		UC MA 38. Establish priority tree/shrub weed control in riparian areas	16 ha	CMA , Project Platypus, Landholders, Landcare
UC MOT 17, UC MOT 18	100% of reaches with an ISC Water Quality score will be 5 or higher, Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood)	Undertake riparian management, erosion control and invasive fauna management activities listed previously	N/A	N/A
Estimated cost of activities		\$285,100		
Relevant documents: <i>Concongella Creek Waterway Action Plan</i>				

6.2.4. Upper Catchment Management Activities for All Reaches

Table 6-11 Management Activities for All Reaches

Management Unit	Upper Catchment
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Basin	Wimmera	Waterway	All Reaches	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-1 for Fish, Birds, Riparian Vegetation, Water Quality and Hydrology			
Values	Environment: High value fish, bird, vegetation and macroinvertebrate communities. Economic: Important for water supply Social/Cultural: Valued for picnics and barbeques, game hunting. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna, Degraded riparian vegetation, Bank instability, Loss of instream habitat (sedimentation), Degraded water quality, Altered water regime (increased period of zero flow)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 11	Index of Stream Condition 2010 Hydrology scores remain stable or improve	UC MA 39. Deliver water to regulated reaches (Mt William Creek) in line with Seasonal Watering Plan	1 reach	CMA, GMMWater, VEWH, CEWH	
		UC MA 40. Undertake appropriate water licensing for irrigation/ commercial use	TBD	GMMWater, CMA	
Estimated cost of activities			TBD		
Relevant documents: Water Act (1989) VEWH Seasonal Watering Plan					

6.2.5. Upper Catchment Wetland and Water Storage Targets

Monitoring

In contrast to the rivers and streams in the Upper Catchment, very little wetland monitoring has been undertaken. Information regarding water quality for storages can be inferred from data collected for streams that supply these storages. In terms of other ecological data - the only data available comes from two wetlands assessed for their values to inform environmental watering given they are connected to the Wimmera Mallee Pipeline for supply (Mutton Swamp near Rupanyup and Wal Wal Swamp near Murtoa).

Management Activity Planning

Given the lack of information regarding wetlands in the Upper Catchment there has been no historic management activity planning undertaken specifically for wetlands and water storages. However planning for works undertaken to manage rivers and creeks will lead to improved water quality outcomes for floodplain wetlands and water storages. Management activity planning specifically for wetlands has not been a priority for the Upper Catchment due to the comparatively few wetlands present in relation to the rest of the region and limited understanding about their values and threats. Some strategic planning has been undertaken with the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011) looking at the values and threats to wetlands in the Upper Catchment.

Table 6-12 Upper Catchment Long-Term Wetland and Water Storage Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish	UC RCT10. Maintenance of recreational fishing/yabbing opportunities.	Recreational fishing/yabbing opportunities available and varies depending on the climatic conditions.

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Birds	UC RCT11. Maintenance of significant wetland bird populations. UC RCT12. Maintenance of duck hunting opportunities.	Water storages support threatened bird species when conditions are suitable. Duck hunting undertaken when conditions/regulations allow.
Wetland vegetation condition	UC RCT13. Maintenance of IWC vegetation scores. UC RCT14. Improved understanding of wetland vegetation condition.	Currently IWC vegetation scores are 'good' on average. Two wetlands with IWC data for vegetation (Mutton & Wal Wal Swamp).
Water quality	UC RCT15. Long-term improved water quality trends compared to those of the 1991-2005 period according to (DEPI, 2013c) method. UC RCT16. Maintenance of IWC water properties condition.	Assumed that improved water quality for upstream reaches will lead to improvements in water quality for water storages. Currently IWC water properties scores are 'good' on average.
Hydrology (frequency and persistence of water)	UC RCT17. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.). UC RCT18. Increased water availability in wetlands connected to the Wimmera Mallee Pipeline.	Currently limited data available but anecdotal indicates that rates of hydrological regime modification is low. No water delivered to wetlands connected to the Wimmera Mallee Pipeline.

Table 6-13 Upper Catchment Wetland and Water Storage Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	UC MOT 19. Invasive aquatic fauna population does not spread beyond 2014 range. UC MOT 20. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> .	Some storages remain free of carp (Biosis, 2012). Rabbit density >25% above target levels (Wimmera CMA, 2010).
Changed hydrology and wetland form	UC MOT 21. Rate of wetland loss due to earthworks reduced. UC MOT 22. Increased understanding of wetland hydrology requirements of priority wetlands. UC MOT 23. Wetlands connected to Wimmera Mallee Pipeline receive environmental water to enhance their condition.	Estimated 116 wetlands in 2013 due to reduce to 100 wetlands by 2022 (SKM, 2006). No understanding of priority wetland hydrology. No water supplied to wetlands via pipeline.
Inadequate wetland vegetation quality and extent	UC MOT 24. Improved information about wetland vegetation quality and extent. UC MOT 25. Improved awareness of impacts of cropping and drainage on wetland vegetation. UC MOT 26. Maintenance of AVIRA threat scores for livestock access to wetlands. UC MOT 27. 20% of all wetland types being managed to maintain/improve wetland vegetation.	Only two sites have vegetation information (Wal Wal and Mutton Swamps). Between 33% and 37% of landholders are unsure about the negative impacts of cropping and draining wetlands (Curtis & Mendham, 2012). Currently very low level of threat although data is very limited (1 site). About one third of wetlands have been managed for environmental outcomes.
Invasive Flora	UC MOT 28. All wetlands have less than 11% invasive wetland (tree and shrub) flora.	No data available but target is assumed to be met by extrapolating reach data.
Degraded water quality	UC MOT 29. No decrease in IWC water properties sub-index score.	Only two sites have IWC water properties scores.

6.2.5.1. Upper Catchment Priority Wetland and Water Storage Management Activities

There are a number of water storages in the Upper Catchment and due to their high social, cultural, economic and environmental values are a priority for management and are listed in Table 6-14.

Table 6-14 Priority Wetlands and Water Storages in the Upper Catchment*

Wetland Name Number	Reasons
Lake Fyans 15-30-WS1	Environment: High value bird community and drought refuge. Economic: Important for water supply (water storage) Social/Cultural: Valued for sightseeing, picnics, barbeques, game hunting, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values
Lake Lonsdale 15-29-WS1	Environment: High value bird community Economic: Important for water supply (water storage). Social/Cultural: Valued for picnics, barbeques, game hunting, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.
Lake Wartook 15-16-WS1	Environment: High value bird community and drought refuge Economic: Important for water supply (water storage) Social/Cultural: Valued for sightseeing, picnics, barbeques, boating and fishing.
Lake Bellfield 15-33-WS1	Environment: High value fish and bird communities and drought refuge Economic: Important for water supply (water storage) Social/Cultural: Valued for sightseeing, picnics, barbeques, boating (non-motor) and fishing.

* Does not include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

Wetland Planning for the Upper Catchment

There is a proportionally small number of wetlands (about 220) in the Upper Catchment compared to the other parts of the Wimmera CMA region. Data is only available for a negligible number of wetlands in the area (<0.5%). However this provides some indicative information on the threats and values and has enabled planning to progress to look at priority wetland systems and types which are listed below:

Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

These wetlands are listed as threatened under the *EPBC Act*. There are potentially about 43 of these wetlands scattered around the Upper Catchment. Research has highlighted that these wetlands are most vulnerable to loss from activities such as cropping, overgrazing and drainage (SKM, 2004, 2006). They provide hotspots of wetland biodiversity (vegetation, frogs and birds) in a largely cleared, agricultural landscape. Key threats to these wetlands include drainage, soil disturbance, degraded vegetation, invasive flora and fauna and overgrazing.

Water storages

Lake Fyans, Lake Bellfield, Lake Lonsdale and Lake Wartook are key water storages in the Upper Catchment. Their water levels fluctuate based on inflows, water availability and GWMWater operations to supply entitlement holders from the Wimmera Mallee supply system. Historically these water storages were assessed to have only limited values in terms of habitat for waterbirds (Land Conservation Council, 1978) although their value increases during drought periods due to the lack of other surface water in the landscape. It should be noted that because of historical operations and works that the environmental outcomes achieved by water in these storages are relatively poor when analysed in a regional context especially if that water reduces volumes in natural rivers and wetlands (Ecological Associates, 2004). However further work can be done determining the role water management has on Lake Lonsdale's environmental values. Apart from Lake Lonsdale, water supplied to these storages largely comes from creeks flowing from the Grampians National Park so management activities required to address water quality issues are limited. The reach of Mt William

Creek upstream of Lake Lonsdale will be a priority for riparian works to address current threats posed by stock given its potential to act as a refuge for native fish during years when the lake dries out.

Table 6-15 Management Activities for Upper Catchment Priority Wetlands and Water Storages

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	Lake Fyans Lake Lonsdale Lake Wartook Lake Bellfield	Identification Nos.	15-30-WS1 15-29-WS1 15-16-WS1 15-33-WS1
Long-term Resource Condition		Targets in Table 6-12 for Fish, Wetland Vegetation Condition, Water Quality, Hydrology			
Values	Environment: High value fish and bird communities. Economic: Important for water supply. Social/Cultural: Valued for picnics, barbecues, game hunting, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Degraded water quality, Altered water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 20	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	UC MA 41. Establish invasive fauna control for water reserve areas.	ha TBD*	GMMWater	
UC MOT 19	Invasive aquatic fauna population does not spread beyond 2014 range	UC MA 1, Conduct fish population assessment	2 reports*	CMA, DEPI	
		UC MA 2, Coordinate community awareness event	2 events*	CMA, DEPI	
UC MOT 28	All wetlands have less than 11% invasive wetland (tree and shrub) flora	UC MA 5 Conduct assessment into priority areas for invasive plant management in riparian areas	1 report *	CMA, PV, GMMWater Local govt, Landcare	
		UC MA 42. Undertake priority groundcover weed control in water reserve areas	TBD*	GMMWater	
UC MOT 22	Increased understanding of wetland hydrology requirements of priority wetlands	UC MA 43. Investigate priority wetland hydrology (Lake Lonsdale)	1 report	CMA, GMMWater	
UC MOT 29	No decrease in IWC water properties sub-index score.	UC MA 44. Establish riparian management agreements (upstream Lake Lonsdale)	10 ha	CMA, landholders	
		UC MA 45. Construct riparian fence	2 km	CMA, landholders	
		Undertake riparian management and invasive fauna management activities listed previously and for upstream priority waterways	NA	NA	
Estimated cost of activities		\$65,000			
Relevant documents: <i>Conservation Significance of Wimmera Storages</i> <i>Storage Management Rules for the Wimmera Mallee System Headworks</i>					

Information regarding past works indicates that past wetland protection works have been undertaken at about one third of the priority wetlands (Seasonal Herbaceous Wetlands) which is above the target of 20% established for protection of various wetland types within the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011).

Table 6-16 Management Activities for Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains in the Upper Catchment



Management Unit		Upper Catchment			
Wetland Type		Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains			
Basin	Wimmera	Waterway	Numerous	Identification No.	NA
Long-term Resource Condition		Targets in Table 6-12 for Birds, Wetland Vegetation Condition, Water Quality, Hydrology			
Values	Environment: High value vegetation and bird communities. Social/Cultural: Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Overgrazing, Degraded buffer, Altered wetland form, changed water regime, Degraded soil				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT 21, UC MOT 27	Rate of wetland loss due to earthworks reduced, 20% of all wetland types being managed to maintain/improve wetland vegetation	UC MA 46. Establish wetland management agreements	40 ha (5 wetlands)	CMA, landholders	
UC MOT 21, UC MOT 25, UC MOT 26	Rate of wetland loss due to earthworks reduced, Improved awareness of impacts of cropping and drainage on wetland vegetation, Maintenance of AVIRA threat scores for livestock access to wetlands	UC MA 47. Coordinate community engagement event/ Develop community publication	8 events/ publications*	CMA, DEPI, Field and Game	
UC MOT 29	No decrease in IWC Water properties sub-index score.	Undertake wetland management activities listed above.	N/A	N/A	
Estimated cost of activities			\$45,000		
Relevant documents: Wimmera Wetlands Asset Strategy Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains					

6.2.5.2. Upper Catchment Wetland Activities for All Wetlands

Table 6-17 Management Activities for All Upper Catchment Wetlands

Management Unit		Upper Catchment			
Basin	Wimmera	Waterway	All Wetlands	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-12 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: TBD Social/Cultural: Game hunting. Significant Aboriginal cultural and post-European heritage values.				
Threats	TBD				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
UC MOT	Rate of wetland loss due to earthworks reduced, Improved	UC MA 47. Coordinate community engagement event/	8 events/ publications*	CMA, DEPI, Field and	

21, UC MOT 25, UC MOT 26	awareness of impacts of cropping and drainage on wetland vegetation, Maintenance of AVIRA threat scores for livestock access to wetlands	Develop community publication		Game
UC MOT 23	Wetlands connected to Wimmera Mallee Pipeline receive environmental water to enhance their condition. (Mutton and Wal Wal Swamps).	UC MA 48. Deliver environmental water in line with VEWB Seasonal Watering Plan	2 wetlands	CMA, GMMWater, PV, VEWB
		UC MA 49. Develop Environmental Water Management Plan	1 plan*	CMA, GMMWater, PV, VEWB
		UC MA 50. Undertake wetland vegetation improvements	1 ha	CMA, PV
UC MOT 24	Improved information about wetland vegetation quality and extent	UC MA 51. Conduct vegetation condition assessment at wetlands connected to the Wimmera Mallee Pipeline	2 reports	CMA
Estimated cost of activities		\$22,000		
Relevant documents: <i>Wimmera Glenelg Bulk/Environmental Entitlement</i> <i>Wetland Condition and Benchmarking along the Wimmera-Mallee Pipeline</i> <i>VEWB Seasonal Watering Plan</i>				

6.3. Horsham Rural City Council Work Program

6.3.1. Horsham Rural City Council Description

Horsham Rural City Council is located in the centre of the Wimmera CMA region and it has a very diverse landscape (Figure 6-2). A number of streams flow from the northern edges of the Grampians and Black Range into wetlands and the Wimmera River. The Wimmera River flows through the heart of the Horsham Rural City Council region and Horsham itself before meandering northwards. There are also a significant number of wetlands in the area; some of the largest have been modified to act as water storages like Taylor's Lake, Green Lake and Lake Toolondo. But there are a number of other wetlands of varying sizes and hydrology that are of immense environmental and social value like the Natimuk-Douglas chain of wetlands and Darlot Swamp. These wetlands tend to be concentrated in the western parts of the council area although there are a reasonable number scattered throughout.



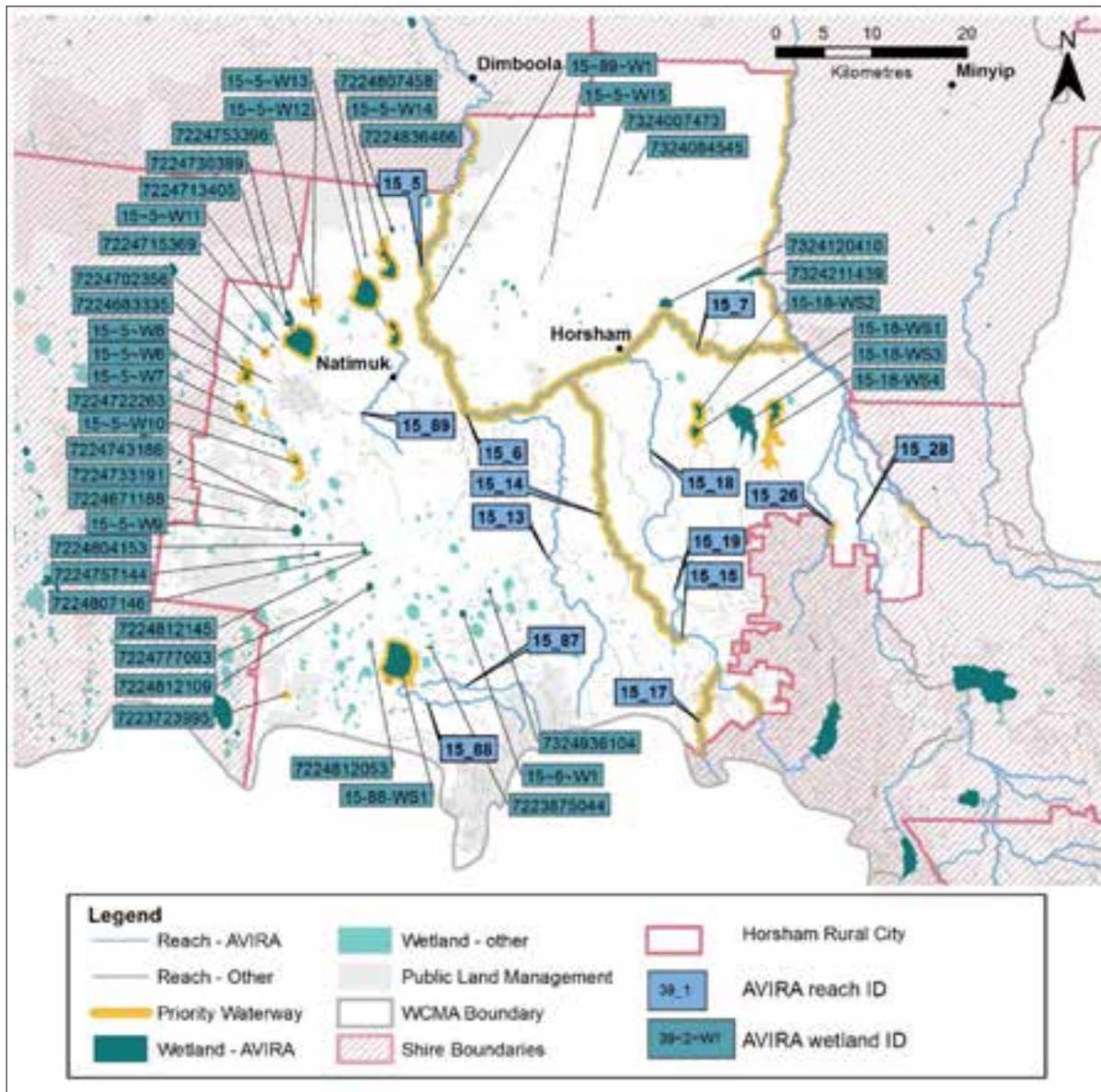


Figure 6-2 Key waterways of Horsham Rural City in the Wimmera CMA region

6.3.1.1. Horsham Rural City Council Waterway Values

The headwaters of a number of creeks begin in the Grampians and Black Range. Some are in excellent environmental condition with outstanding water quality and provide valuable habitat for an abundance of plant, fish and animal species. As these waterways reach the lower plains, they provide important corridors in the landscape, connecting large areas of public land as well as being a source of water for stock and domestic needs. In Horsham, the Wimmera River is the central feature of the town with a number of parks and walking tracks adjacent to it. Rowers, canoeists and anglers also enjoy the recreational opportunities afforded by the Wimmera River. The Wimmera River’s ‘Heritage River’ section starts at Polkemmet, in the north of the Horsham Rural City Council area. There are also a small number of irrigators that pump from the Wimmera River concentrated around Quantong and Polkemmet. Stock and domestic users take advantage of flows in the Wimmera and MacKenzie River as well as Burnt, Bungally and Norton creeks.

The Horsham Rural City Council area contains the Natimuk-Douglas chain of wetlands which are of immense environmental value, with eleven of them listed on the Directory of Important Wetlands in Australia. They provide habitat for a number of rare species especially for migratory waterbirds and

waders. There is evidence of the strong aboriginal cultural values attached to wetlands and creeks in this area with an abundance of scar trees.

Taylor's Lake and Lake Toolondo are water storages that are part of the Wimmera Mallee supply system. Green Lake, Dock Lake and Pine Lake were historically wetlands that were modified to be storages for the Wimmera Mallee headworks system but are no longer required for water supply. Green Lake, Lake Natimuk and St Mary's Lake are very popular for recreation.

6.3.1.2. Horsham Rural City Council Waterway Threats

Threats to waterways in the Horsham Rural City area include the reduced streamflows brought about by high levels of water extraction and diversions in upstream areas. This, combined with poor water quality in a number of waterways has led to the loss or severe reduction of populations of such iconic species as platypuses and river blackfish.

There are also issues with pest plants and animals such as bridal creeper and carp. There are also some locations where erosion and salinity is a pressing issue, a key example being deep pools in the Wimmera River where saline groundwater intrudes into these pools. This leads to very poor water quality and ongoing risks to fish and macroinvertebrates. Intense grazing also threatens the condition of a number of creeks through impacting on water quality and riparian and aquatic vegetation.

Wetlands face ongoing risks from cropping and overgrazing. Shallow freshwater marshes and freshwater meadows are especially vulnerable to these activities with earthworks like drainage and laser levelling being undertaken and impacting on their environmental values.

6.3.1. Horsham Rural City Council River and Stream Targets

Monitoring

Within the Horsham Rural City Council area there are several water quality and flow monitoring sites on the Wimmera River, MacKenzie River and Burnt Creek. There has been periodic monitoring of indicators such as platypuses, fish, vegetation and macroinvertebrates to track the health of these communities, especially their response to drought and flood. The state of riparian vegetation and channel beds and banks on most of the key streams has been determined via the statewide Index of Stream Condition.



Lower Burnt Creek, October 2009 (Photo: G. Fletcher)

Case Study – Horsham Fishing Competition

Held annually along the Horsham Weir Pool during the March Labour Day long weekend, the Horsham Fishing Competition is an annual highlight on the town's calendar. During the record drought through the 2000's the competition was cancelled repeatedly due to low water levels in the weir pool however improved conditions led to the competition returning in 2011. The prizes on offer and the hard work of the organising committee has led to the event regularly attracting over 2000 entrants from near and far, providing a vital boost to the region's economy. The event has also provided great environmental benefits, with the removal of hundreds of carp caught by anglers and the catch and release policy regarding native fish. The event also was used by Native Fish Australia (Wimmera) to source breeding stock Freshwater Catfish for their Freshwater Catfish recovery project given the Wimmera River basin is currently the only area where anglers can legally keep Freshwater Catfish they have caught.



Holding tank of native fish at the Horsham Fishing Competition with information regarding the Freshwater Catfish recovery project.

Management Activity Planning

Historically a comprehensive suite of management activity plans have been developed including:

- *Wimmera River and Environs Action Program (WREAP)* (Thomas Hay and Associates, 1997) in 1997 which identified specific locations with erosion and weeds along the channel of the Wimmera River itself.
- A geomorphic study of the type and condition of the region's streams in 2002 (ID&A, 2002, Earth Tech, 2003) provided a solid basis for further work into priority streams that were the greatest threat in terms of erosion.
- A long history of investigations has occurred in relation to the hypersaline pools that are located in deep sections of the Wimmera River downstream of Quantong (Anderson & Morison, 1989, SKM, 2003, Hocking, 1997);
- Waterway action plans have also been undertaken on the Wimmera River, MacKenzie River and Burnt and Bungally creeks (Earth Tech, 2004, 2005, 2007).
- Assessments were undertaken on regulated streams and Norton Creek regarding potential impacts to environmental flows (Earth Tech, 2006, SKM, 2008).

Therefore there is a solid foundation on which to base management activity planning for rivers and creeks in the Horsham Rural City Council area.

Table 6-18 Horsham Rural City Council Long-Term Reach Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish	HO RCT 1. Fish populations within Horsham Rural City Council Area will be classified as “moderate” on average according to the <i>Wimmera Fish Monitoring Project 2008</i> (SKM, 2008a) methodology.	Lower MacKenzie and Burnt – “good” (Biosis, 2013) Norton – “poor” (SKM, 2010).
Riparian vegetation condition	HO RCT 2. No declines in ISC Streamside Zone scores. HO RCT 3. 80% of reaches have an ISC Streamside Zone score of 7 or higher.	69% of reaches have an ISC Streamside Zone score of 7 or higher (DEPI, 2013a).
Macroinvertebrates	HO RCT 4. 50% of sites have MBI classification of ‘good’ or better during average hydrological conditions or better.	33% of sites have MBI classification of ‘good’ or better (WEC, 2012).
Instream habitat and Channel form	HO RCT 5. No declines in ISC Physical Form scores. HO RCT 6. 75% of reaches have an ISC Physical Form score of 8 or higher.	75% of reaches have an ISC Physical Form score of 8 or higher.
Water quality	HO RCT 7. Long-term improved water quality trends at stream gauges compared to those of the 1991-2005 period.	Results available for Wimmera River at Horsham Gauge (415200) (DEPI, 2013c).
Platypus	HO RCT 8. Increase population and distribution of platypuses demonstrated by Catch Per Unit Effort (CPUE).	CPUE 0.071, population ‘very low and static’ (cesar, 2012).
Hydrology (frequency and persistence of water)	HO RCT 9. Increase streamflows in regulated rivers and streams compared to pre-Wimmera Mallee Pipeline levels under comparable climate conditions. HO RCT 10. Stabilisation of streamflow reductions in unregulated streams due to water extraction and storage.	Wimmera Mallee Pipeline savings have been incorporated into an environmental entitlement managed by VEWH and irrigation entitlement purchased for use by CEWH.



Table 6-19 Horsham Rural City Council Reach Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	HO MOT 1. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> . HO MOT 2. Reducing carp numbers where they are yet to fully establish (Reach 15 MacKenzie River only). HO MOT 3. Increased understanding regarding carp movement and breeding ‘hotspots’ in Wimmera River.	Rabbit density within target levels for MacKenzie River area but unknown for Heritage River area (Wimmera CMA, 2010). Carp comprise 48% of fish abundance in mid-MacKenzie River (Biosis, 2012a). Lack of knowledge regarding carp movement and breeding ‘hotspots’ identified as a knowledge gap (SKM, 2008a).
Excessive erosion and sedimentation	HO MOT 4. 81% of reaches have less than 10% of stream banks and stream beds eroding. HO MOT 5. Increased information obtained on bed and bank instability threats through Waterway Action Plans.	81% of reaches have less than 10% of the stream bank eroding and 87% of reaches have stream beds eroding. Some waterway action planning required in certain sub-catchments (Natimuk Creek, Mt Talbot Creek).
Inadequate riparian	HO MOT 6. 60% of reaches have less than 75% of their length impacted by livestock [#] .	60% of reaches have less than 75% of their length impacted by livestock [#] .

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
vegetation quality and extent	HO MOT 7. 90% of reaches have at least moderate riparian connectivity*. HO MOT 8. 95% of reaches have greater than 10 m wide riparian vegetation.	81% of reaches have at least moderate riparian connectivity*. 94% of reaches have greater than 10 m wide riparian vegetation.
Modified hydrology	HO MOT 9. ISC hydrology sub-index average score improves to 7.	2010 ISC hydrology score average is 5.
Invasive Flora	HO MOT 10. Maintain waterway relevant invasive flora targets in the <i>WIPAMS</i> . HO MOT 11. Increased knowledge around management activities regarding aquatic weeds in weir pools. HO MOT 12. 100% of reaches have <11% invasive riparian (tree and shrub) flora cover. HO MOT 13. 100% of reaches have no high threat invasive tree flora species present.	Bridal creeper below target levels (M. Toomey, Wimmera CMA, <i>pers. comm.</i>) Aquatic weed density increasing but limited information (M. Toomey, Wimmera CMA, <i>pers. comm.</i>). 100% of reaches have <11% invasive riparian (tree and shrub) flora cover. 100% of reaches have no high threat invasive tree flora species present.
Degraded water quality	HO MOT 14. 100% of reaches with ISC Water Quality score of 5 or higher. HO MOT 15. Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood).	80% of reaches with an ISC Water Quality score of 5 or higher.

Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on riparian areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to banks and vegetation are).

* Moderate riparian connectivity is defined as having 0-39% of streambank has overhanging vegetation with 40-59% of vegetated area being gaps OR 40-64% of streambank has overhanging vegetation with 60-79% of vegetated area being gaps OR 65-79% of streambank has overhanging vegetation with 80-100% of vegetated area being gaps according to ISC 2010.

6.3.2. Horsham Rural City Council Priority Reach Management Activities

The priority reaches in the Horsham Rural City Council and their values are shown in Table 6-20.

Table 6-20 Priority Reaches in Horsham Rural City Council

Reach Name Number	Reasons
Wimmera River Reach 5	Environment: High value bird, vegetation communities and drought refuge Social/Cultural: Valued for picnics, barbeques, game hunting, boating. Significant Aboriginal cultural heritage values.
Wimmera River Reach 6	Environment: High value vegetation communities and drought refuge Social/Cultural: Valued for fishing, boating, and game hunting. Significant Aboriginal cultural and post-European heritage values.
Wimmera River Reach 7	Environment: High value bird and vegetation communities and drought refuge Social/Cultural: Valued for picnics, barbeques, fishing, sightseeing, game hunting, boating and swimming. Significant community interest and Aboriginal cultural and post-European heritage values.
MacKenzie River Reach 14	Environment: High value vegetation community and drought refuge Social/Cultural: Valued for game hunting. Significant Aboriginal cultural heritage values.
Boggy Creek Reach 17	Environment: High value vegetation community and excellent ISC score Social/Cultural: Significant Aboriginal cultural and post-European heritage values

Case Study – Plight of the Platypus

The Wimmera's platypus population is facing an uncertain future. Confined to toeholds in the upper Wimmera and MacKenzie rivers, record drought conditions led to most waterways drying up and platypus monitoring efforts struggled to find any platypuses. In 2008, a sole male platypus trapped in the MacKenzie River was aptly-named “Dusty” and he was seen by the community to be emblematic of the plight facing animals and plants across the region suffering due to the drought. Subsequent surveys were able to find that Dusty had a handful of friends, trapping ‘Ted’, ‘Amber’, ‘Beatrix’, ‘Max’ and ‘Kenzee’. However the total MacKenzie River population is expected to be only nudging double figures in a best case scenario. It emphasises the need to provide flows to expand their habitat back into the lower Wimmera River to try and ensure the long-term persistence of this iconic species in the region.



Gathering information on the region's platypus population is a priority given their locally threatened status.

Photos source: Josh Griffiths (cesar)



Table 6-21 Management Activities for MacKenzie River (Reach 15-14)

Management Unit		Horsham Rural City Council			
Basin	Wimmera	Waterway	MacKenzie River	Identification No.	15-14
Long-term Resource Condition		Targets in Table 6-18 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Platypus, Instream habitat and Channel form			
Values	Environment: High value vegetation community, drought refuge. Social/Cultural: Valued for fishing, game hunting. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Livestock access, Altered water regime (reduced high flows)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 1	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HO MA 1. Establish invasive fauna control in riparian areas	240 ha	DEPI, CMA, Landcare	
HO MOT 10	Maintain waterway relevant invasive flora targets in the <i>WIPAMS</i>	HO MA 2. Establish priority groundcover weed control in riparian areas	80 ha	DEPI, CMA, Landholders, Landcare	
HO RCT 8	Increase population and distribution of platypuses demonstrated by Catch Per Unit Effort (CPUE).	HO MA 3. Investigate and undertake options to ensure the long-term sustainability of the platypus population*	TBD	CMA	

HO MOT 9	ISC hydrology sub-index average score improves to 7	HO MA 4. Deliver environmental releases in line with Seasonal Watering Plan	1 reach	CMA , VEWH, GMMWater
		HO MA 5. Develop Environmental Water Management Plan for Wimmera River system	1 report*	CMA , DEPI, VEWH, CEWH, GMMWater
		HO MA 6. Modify outlet from Rocklands Channel into MacKenzie River	1 structure	CMA , GMMWater
		HO MA 7. Maintain site assessing effectiveness environmental water releases (habitat, vegetation, flow, geomorphology)	1 site	CMA
Estimated cost of activities		\$177,000		
Relevant documents: <i>Wimmera Glenelg Bulk/Environmental Entitlement MacKenzie River Waterway Action Plan VEWH Seasonal Watering Plan</i>				

Table 6-22 Management Activities for Wimmera River (Reaches 15-5, 15-6 and 15-7)

Management Unit		Horsham Rural City Council			
Basin	Wimmera	Waterway	Wimmera River	Identification Nos.	15-5 15-6 15-7
Long-term Resource Condition		Targets in Table 6-18 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form			
Values	Environment: High value fish, bird and vegetation communities. Social/Cultural: Valued for picnics and barbeques, fishing, boating, swimming, camping, game hunting. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora, Degraded riparian vegetation, Reduced vegetation width, Altered water regime (increased period of zero flow), Degraded water quality				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 6, HO MOT 7, HO MOT 8	60% of reaches have less than 75% of their length impacted by livestock [#] , 90% of reaches have at least moderate riparian connectivity*, 95% of reaches have greater than 10 m wide riparian vegetation	HO MA 8. Establish riparian management agreements	20 ha	CMA , landholders	
		HO MA 9. Construct riparian fence	4 km	CMA , landholders	
HO MOT 10, HO MOT 12, HO MOT 13	Maintain waterway relevant invasive flora targets in the WIPAMS, 100% of reaches have <11% invasive riparian (tree and shrub) flora cover, 100% of reaches have no high threat invasive tree flora species present	HO MA 10. Establish priority tree/shrub weed control in riparian areas	160 ha	DEPI, PV , CMA, Landholders, Landcare, local govt.	
		HO MA 11. Establish priority groundcover weed control in riparian areas	400 ha	DEPI, PV , CMA, Landholders, Landcare, local govt.	
HO MOT 11	Increased knowledge around management activities regarding aquatic weeds in weir pools	HO MA 12. Investigate aquatic weed management in Horsham Weir Pool	1 report	CMA , local govt.	
HO MOT 9	ISC hydrology sub-index average score improves to 7	HO MA 13. Deliver environmental releases in line with Seasonal Watering Plan	3 reaches	CMA , GMMWater, VEWH, CEWH, local govt.	

		HO MA 14. Prepare Environmental Water Management Plan for Wimmera River system	1 report*	CMA, DEPI, VEWH, CEWH, GMMWater
		HO MA 15. Modify Taylor's Lake Outlet into Wimmera River	1 structure	CMA, GMMWater
		HO MA 16. Modify Mt William Creek/Wimmera Inlet Channel to improve the ability to direct flows into the Wimmera River	1 structure	CMA, GMMWater
		HO MA 17. Install passing flow metering at Huddleston's Weir	1 site	CMA, GMMWater
		HO MA 18. Investigate improving effectiveness of town weir management	1 report*	CMA, local govt., GMMWater.
		HO MA 19. Investigate flow thresholds for Mt William Creek to maximise efficiency of water delivery to Wimmera River	1 report	CMA, VEWH
		HO MA 20. Seek opportunities to maximise environmental water availability (e.g. through improving system efficiency).	Ongoing	CMA, GMMWater, VEWH,CEWH
		HO MA 21. Maintain sites assessing effectiveness of environmental water releases (habitat, vegetation, geomorphology, fish, flow)	6 sites (fish) 4 sites (river red gum) 1 site (others)	CMA
HO MOT 14	100% of reaches with ISC Water Quality score of 5 or higher	HO MA 22. Investigate saline pool management feasibility study (scoping and concept design)	2 reports*	CMA
		HO MA 23. Undertake feasible salinity management activities	TBD	CMA
		Undertake riparian management, erosion control, environmental water management and invasive fauna management activities listed previously and for upstream priority waterways	N/A	N/A
Estimated cost of activities		\$748,000		
Relevant documents: <i>Wimmera Glenelg Bulk/Environmental Entitlement Waterway Action Plan for the Regulated Streams of the Wimmera Heritage River Waterway Action Plan</i> <i>VEWH Seasonal Watering Plan</i>				

Table 6-23 Management Activities for Boggy Creek (Reach 15-17)

Management Unit		Upper Wimmera			
Basin	Wimmera	Waterway	Boggy Creek	Identification No.	15-17
Long-term Resource Condition		Targets in Table 6-18 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form			
Values	Environment: High value vegetation community. Key element of Grampians National Park Values. Economic: Important for water supply (Taylors Lake). Social/Cultural: Significant Aboriginal cultural and post-European heritage values.				

Threats		Invasive flora		
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners
HO MOT 10	Maintain waterway relevant invasive flora targets in the <i>WIPAMS</i>	HO MA 24. Conduct assessment into priority areas for invasive plant management in riparian areas	1 report*	CMA, PV , Local govt, Landcare, Landholders
		HO MA 25. Establish priority groundcover weed control in riparian areas	16 ha	PV, CMA , Landholders, Landcare
Estimated cost of activities		\$3,000		
Relevant documents: <i>Grampians National Park Management Effectiveness Report Card</i>				

6.3.3. Horsham Rural City Council Wetland and Water Storage Targets

Monitoring

There is a comparatively comprehensive data set relating to wetlands in the Horsham Rural City Council area. Wetland monitoring has been undertaken on various wetlands in 2004 with 10 wetlands assessed for their condition using a method developed for the project (WEC, 2005). In 2009 and 2011 another 34 were monitored for the statewide Index of Wetland Condition assessment. Other components that can be used to provide information about the condition of a wetland such as bird and water quality monitoring have been undertaken at various wetlands but have been largely opportunistic and not assessed against benchmarks. There has been no monitoring of water storages apart from water quality by GWMWater. Groundwater-surface water interaction locations for wetlands in the Natimuk-Douglas chain of lakes have also been identified at a coarse level.

Management Activity Planning

The main focus of management activity planning has been Natimuk Lake, managing the foreshore as well as salinity impacts. Strategic planning has been the focus regarding wetlands with documents such as the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011) analysing the values and threats to wetlands in the Horsham Rural City Council area.

Table 6-24 Horsham Rural City Council Long-Term Wetland and Water Storage Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish/Yabbies	HO RCT 11. Continues to provide recreational fishing/yabbing opportunities.	Recreational fishing/yabbing opportunities available when climate is wet.
Birds	HO RCT 12. Increased recognition and understanding of wetland bird values. HO RCT 13. Maintenance of duck hunting opportunities.	Supports bird species listed as threatened. Duck hunting undertaken when conditions allow.
Wetland vegetation condition	HO RCT 14. No declines in IWC vegetation condition. HO RCT 15. Improvement in average IWC scores in the region. HO RCT 16. Increased understanding of wetland vegetation condition. HO RCT 17. Increase wetland connectivity measures.	Currently average of 'moderate' condition according to IWC. 34 wetlands with IWC data for vegetation. No data available for wetland connectivity as yet.
Water quality	HO RCT 18. Improved IWC water properties sub-index score to average of good.	IWC water properties sub-index score average moderate-good.

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
	HO RCT 19. Improved knowledge of water quality issues.	Water quality information only available at 10 wetlands.
Hydrology (frequency and persistence of water)	HO RCT 20. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.)	Wetland loss (hydrological change between 1994 and 2004 was 18% (SKM, 2006).

Table 6-25 Horsham Rural City Council Wetland and Water Storage Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	HO MOT 16. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> for South West Wimmera.	<i>WIPAMS</i> (Wimmera CMA, 2010) does not have a status with respect to invasive fauna but indicates trend is worsening.
Changed hydrology and wetland form	HO MOT 17. Rate of wetland loss due to earthworks reduced. HO MOT 18. Planning scheme provisions protect priority wetland hydrology. HO MOT 19. Increased understanding of threats to wetland hydrology.	Estimated 388 wetlands in 2013 due to reduce to 262 by 2022 wetlands at current trends (SKM, 2006). No planning scheme provisions implemented to protect wetland hydrology. Anecdotal evidence of reduced water for wetlands due to changes in land use, climate and extraction.
Inadequate wetland vegetation quality and extent	HO MOT 20. Increased information about wetland vegetation quality and extent. HO MOT 21. Increased awareness of impacts of cropping on wetland vegetation. HO MOT 22. Priority wetland corridors identified and connection requirements understood. HO MOT 23. 5% reduction in number of wetlands with high threats regarding livestock access [#] . HO MOT 24. 10% of all wetland types being managed to maintain/improve wetland vegetation	33 sites with vegetation condition data available. 61% of landholders surveyed were unsure of the impacts of cropping on wetlands (Curtis & Mendham, 2012). 53% of wetlands currently have high threat from livestock access. All wetland types meet this target except shallow freshwater marshes and freshwater meadows (≈3%).
Invasive Flora	HO MOT 25. Achieve wetland relevant invasive flora targets in the <i>WIPAMS</i> for South West Wimmera HO MOT 26. All wetlands have <11% invasive wetland (tree and shrub) flora HO MOT 27. 70% of IWC wetlands have: less than 25% total weed cover with high threat weeds present; or less than 50% total weed cover with no high threat weeds present.	<i>WIPAMS</i> (Wimmera CMA, 2010) does not have a status with respect to invasive flora but indicates trend is worsening. All wetlands have <11% invasive wetland (tree and shrub) flora. 80% of IWC wetlands have: less than 25% total weed cover with high threat weeds present; or less than 50% total weed cover with no high threat weeds present.
Degraded water quality	HO MOT 28. No decrease in IWC Water properties sub-index score.	IWC Water Properties sub-index scores are good on average.

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on wetland areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to edges and vegetation are).

6.3.3.1. Horsham Rural City Council Priority Wetland Management Activities

There are a number of wetlands in Horsham Rural City Council that due to their high social, economic, cultural and environmental values are priorities for management listed in Table 6-26.

Table 6-26 Priority Wetlands and Water Storages in Horsham Rural City Council.

Wetland Name Code Locality	Tenure	Reasons
Mitre Lake 15-5-W11 Mitre	Crown	Environment: Listed Nationally Important wetland and high value vegetation community Social/Cultural: Significant Aboriginal cultural and post-European heritage values
St Mary's Lake 15-5-W7 Tooran	Crown	Environment: Listed Nationally Important wetland and high value bird population Social/Cultural: Swimming, camping and boating. Significant Aboriginal cultural heritage values
Jacka Lake 15-5-W8 Tooran	Crown	Environment: Excellent IWC condition Social/Cultural: Game hunting. Significant Aboriginal cultural heritage values
Heard Lake 15-5-W10 Tooran	Crown	Environment: Listed Nationally Important wetland and high value vegetation Social/Cultural: Game hunting. Significant Aboriginal cultural heritage values
Oliver's Lake 15-5-W14 Duchembegarra	Crown	Environment: Listed Nationally Important wetland, Excellent IWC condition, high value vegetation and bird population Social/Cultural: Significant Aboriginal cultural heritage values
Lake Wyn Wyn 15-5-W13 Natimuk	Crown	Environment: Listed Nationally Important wetland, high value vegetation and bird population Social/Cultural: Camping and game hunting. Significant Aboriginal cultural heritage values
Lake Natimuk 15-89-W1 Natimuk	Crown	Environment: Listed Nationally Important wetland and high value bird population Social/Cultural: Camping, boating, swimming, fishing and game hunting. Significant Aboriginal cultural heritage values
Friedman's Salt Lake 7224702356 Mitre	Crown	Environment: Listed Nationally Important wetland Social/Cultural: Significant Aboriginal cultural heritage values
Hateley's Lake 7224683335 Mitre	Crown	Environment: Listed Nationally Important wetland Social/Cultural: Game hunting. Significant Aboriginal cultural heritage values
Grass Flat (Telfer's Swamp) 15-5-W12 Grass Flat	Crown/ Freehold	Environment: Listed Nationally Important wetland, Excellent IWC condition, high value vegetation and bird population Social/Cultural: Game hunting. Significant Aboriginal cultural heritage values
Unnamed 7223723995 Kanagulk	Freehold	Environment: Excellent IWC condition and high value vegetation Social/Cultural: Significant Aboriginal cultural heritage values
Taylor's Lake 15-18-WS4 Drung	Crown	Environment: High value bird population and drought refuge. Economic: Important for water supply (water storage) Social/Cultural: Valued for picnics, barbeques, game hunting, boating, swimming and fishing. Significant Aboriginal cultural heritage values
Green Lake 15-18-WS1 Drung	Crown	Environment: High value bird community Social/Cultural: Valued for sightseeing, picnics, barbeques, game hunting, boating, swimming and fishing. Significant Aboriginal cultural heritage values
Dock Lake 15-18-WS2 Drung	Crown	Environment: High value bird population Social/Cultural: Valued for fishing. Significant Aboriginal cultural heritage values
Lake Toolondo 15-88-WS1 Toolondo	Crown	Environment: High value bird population and vegetation Economic: Important for water supply (water storage) Social/Cultural: Valued for picnics, barbeques, game hunting, boating, swimming, game hunting and fishing. Significant

Wetland Name Code Locality	Tenure	Reasons
		Aboriginal cultural heritage values.

Priority wetlands also include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains. Figure 6-7 shows the location of the ten potential Seasonal Herbaceous Wetlands in the Horsham Rural City Council area that have been included in the AVIRA database. This has enabled a determination of values and threats common to these wetland types and they are not a priority for management activities above other Seasonal Herbaceous Wetlands in the Horsham Rural City Council area.

Wetland Planning for Horsham Rural City Council

There are a significant number of wetlands (about 530) in the Horsham Rural City Council area, so there are challenges in planning for their effective management at a number of levels, from individual wetlands to the vast wetland chains that provide vital connections for flora and fauna. Data is only available for a relatively small proportion of wetlands in the region (12%) however this provides some indicative information on the threats and values and has enabled planning to progress to examine priority wetland systems and types which are described below:

Natimuk – Douglas Chain of Wetlands

Wetlands like Natimuk and St Mary’s Lake are iconic wetlands for the region – when they contain water they are a focus for the community with great opportunities for water-skiing, fishing, camping etc. Salt lakes like Oliver’s Lake, Lake Wyn Wyn and Heard Lake support a vast number and diversity of birds and rare flora species. Due to land clearing for agriculture, they tend to have only a small strip of fringing vegetation around them. So as a result the main threats relate to invasive pest plant and animals, narrow buffer zones of fringing vegetation, poor water quality and impacts to their hydrology through land use change and water extraction.



Mitre Lake, January 2011 (Photo: J. Norris)

Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

These wetlands are listed as threatened under the *EPBC Act*. There are potentially around 346 of these wetlands in the Horsham Rural City Council region in the Wimmera CMA area, concentrated in

the south-west and west. Research has highlighted that these wetlands are most vulnerable to loss from activities such as cropping, overgrazing and drainage (SKM, 2004, 2006).

In contrast to the West Wimmera Shire area where these ephemeral wetlands tend to be located in long north-south trending chains, in the Horsham Rural City Council area these wetlands are relatively scattered and isolated. However, they provide hotspots of wetland biodiversity (vegetation, frogs and birds) in a largely cleared, agricultural landscape. Key threats to these wetlands include drainage, soil disturbance, degraded vegetation, invasive flora and fauna and overgrazing.

Water storages

Taylor's Lake and Lake Toolondo are active water storages within the Horsham Rural City Council area; their water levels fluctuate based on inflows, water availability and GWMWater operations to supply entitlement holders from the Wimmera Mallee supply system. Green Lake, Dock Lake and Pine Lake no longer have a consumptive water supply purpose. Depending on water availability and climatic circumstances, Green Lake can receive water to protect water quality in Taylor's Lake and has very high recreational values. Historically Dock Lake had environmental values with a very high use by waterbirds (Land Conservation Council, 1978). Lake Toolondo also has some limited environmental values for bird species as well however it should be noted that because of historical operations and works that the environmental outcomes achieved by water in these storages are relatively poor when analysed in a regional context especially if that water reduces volumes in natural rivers and wetlands (Ecological Associates, 2009). Despite this increased information will enable a determination as to the suitability of their hydrological regime in maintaining these values.

Table 6-27 Management Activities for the Natimuk Douglas Chain of Wetlands

Management Unit		Horsham Rural City Council			
Wetland Type		Natimuk Douglas Chain of Wetlands			
Basin	Wimmera	Waterway	Natimuk Lake St Mary's Lake Mitre Lake Oliver's Lake Hateley's Lake Grass Flat (Telfer's) Swamp Friedman's Salt Lake Heard Lake Lake Wyn Wyn Jacka Lake	Identificati on Nos.	15-89-W1 15-5-W7 15-5-W11 15-5-W14 7224683335 15-5-W12 7224702356 15-5-W10 15-5-W13 15-5-W8
Long-term Resource Condition		Targets in Table 6-24 for Birds, Fish, Wetland Vegetation Condition, Water Quality, Hydrology			
Values	Environment: High value bird communities, excellent IWC condition (Jacka Lake) Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing and camping. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna and degraded buffer				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 16	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HO MA 26. Establish invasive fauna (rabbits, foxes) control for wetlands	400 ha	PV, CMA	

HO MOT 19	Increased understanding of threats to wetland hydrology.	HO MA 27. Investigate influences on and threats to wetland hydrology for key wetlands (e.g. Natimuk Lake, St Mary's Lake)	1 report	CMA
HO MOT 24	10% of all wetland types being managed to maintain/improve wetland vegetation	HO MA 28. Establish native vegetation wetland buffers	20 ha	CMA, PV, Landcare
		HO MA 29. Coordinate engagement events/ Develop publications to reduce impact of intense recreational pressure (e.g. from yabbying) on wetlands	2 events/ publications	CMA, PV, DEPI, local govt.
HO MOT 24, HO MOT 25, HO MOT 26, HO MOT 27	10% of all wetland types being managed to maintain/improve wetland vegetation, Achieve wetland relevant invasive flora targets in the <i>WIPAMS</i> , All wetlands have <11% invasive wetland (tree and shrub) flora, 70% of IWC wetlands have: less than 25% total weed cover with high threat weeds present; or less than 50% total weed cover with no high threat weeds present.	HO MA 30. Conduct assessment into priority areas for invasive plant management in wetland areas (bridal creeper)	1* report*	CMA, PV, Local govt., Landcare, Landholders
		HO MA 31. Establish priority groundcover weed control in wetland areas	800 ha	PV, CMA, Local govt., Landcare, Landholders
Estimated cost of activities			\$280,000	
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i> <i>Natimuk Lake Sub-Catchment Salinity Control Project – Final Action Plan</i>				

Table 6-28 Management Activities for Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains in Horsham Rural City Council

Management Unit		Horsham Rural City Council			
Wetland Type		Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains			
Basin	Wimmera	Waterway	Numerous	Identification No.	See Figure 6-7 plus others
Long-term Resource Condition		Targets in Table 6-24 for Birds, Wetland Vegetation Condition, Water Quality, Hydrology			
Values	Environment: High value vegetation and bird communities. Social/Cultural: Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, overgrazing, degraded buffer, altered wetland form, changed water regime and soil disturbance				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 17, HO MOT 23, HO MOT 24	Rate of wetland loss due to earthworks reduced, 5% reduction in number of wetlands with high threats regarding livestock access [#] , 10% of all wetland types being managed to maintain/improve wetland vegetation	HO MA 32. Establish wetland management agreements	330 ha (33 wetlands)	CMA, landholders	

HO MOT 17, HO MOT 21, HO MOT 23, HO MOT 24	Rate of wetland loss due to earthworks reduced, Increased awareness of impacts of cropping on wetland vegetation, 5% reduction in number of wetlands with high threats regarding livestock access#, 10% of all wetland types being managed to maintain/improve wetland vegetation	HO MA 33. Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	12* events/ publications	CMA, Landcare, DEPI, Field and Game
HO MOT 28	No decrease in IWC Water properties sub-index score.	Undertake wetland management activities listed above.	N/A	N/A
Estimated cost of activities		\$825,000		
Relevant documents: Wimmera Wetlands Asset Strategy Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains				

Table 6-29 Management Activities for Water Storages in Horsham Rural City Council

Management Unit		Horsham Rural City Council			
Wetland Type		Water Storages (Current and Historic)			
Basin	Wimmera	Waterway	Taylor's Lake Green Lake Dock Lake Lake Toolondo	Identification Nos.	15-18-WS4 15-18-WS1 15-18-WS2 15-88-WS1
Long-term Resource Condition		Targets in Table 6-24 for Fish, Wetland Vegetation Condition, Water Quality, Hydrology			
Values		Environment: High value fish and bird communities Economic: Important for water supply Social/Cultural: Valued for picnics, barbeques, game hunting, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.			
Threats		Invasive flora and fauna, degraded water quality and altered hydrology			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 16	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HO MA 34. Establish invasive fauna control for water reserve	ha TBD	GMMWater	
HO MOT 19	Increased understanding of threats to wetland hydrology.	HO MA 35. Undertake FLOWS study for Dock Lake	1 report	CMA, GMMWater, VEWH	
		HO MA 36. Investigate priority wetland hydrology (Lake Toolondo)	1 report	CMA, GMMWater	
HO MOT 25, HO MOT 26, HO MOT 27	Achieve wetland relevant invasive flora targets in the <i>WIPAMS</i> , All wetlands have <11% invasive wetland (tree and shrub) flora, 70% of IWC wetlands have: less than 25% total weed cover with high threat weeds present; or less than 50% total weed cover with no high threat weeds present.	HO MA 37. Conduct priority groundcover weed control in water reserve	ha TBD	GMMWater,	
HO MOT 28	No decrease in IWC Water properties sub-index score.	HO MA 38. Establish riparian management agreements (upstream Green/Dock Lakes)	2 km (10 ha)	CMA, landholders	

		Undertake riparian management and invasive fauna management activities listed previously and for upstream priority waterways	N/A	N/A
Estimated cost of activities		\$114,000		
Relevant documents: <i>Conservation Significance of Wimmera Storages</i> <i>Storage Management Rules for the Wimmera Mallee System Headworks</i>				

Table 6-30 Management Activities for all wetlands in Horsham Rural City Council

Management Unit		Horsham Rural City Council			
Basin	Wimmera	Waterway	All Wetlands	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-24 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value amphibian, vegetation and bird communities. Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing, game hunting and camping. Significant Aboriginal cultural and post-European heritage values				
Threats	Invasive flora and fauna, overgrazing, degraded buffer, altered wetland form, soil disturbance and changed water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HO MOT 17, HO MOT 18	Rate of wetland loss due to earthworks reduced, Planning scheme provisions protect priority wetland hydrology	HO MA 33 Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	8* events/ publications	CMA, DEPI, Field and Game	
		HO MA 39. Support planning scheme amendment for Environmental Significance Overlay affecting wetlands	1 amendment	CMA, local govt.	
		HO MA 40. Provide referral responses for Environmental Significance Overlay affecting wetlands	Referral responses TBD	CMA, local govt.	
HO MOT 22	Priority wetland corridors identified and connection requirements understood.	HO MA 41. Investigate priorities for wetland connectivity	1* report	CMA	
Estimated cost of activities		\$160,000			
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i>					



6.4. Hindmarsh Shire Region Work Program

6.4.1. Hindmarsh Shire Description

Hindmarsh Shire is the location of the iconic waterways of the lower Wimmera River and terminal lakes (Figure 6-3). Lake Hindmarsh is Victoria’s largest freshwater lake and Lake Albacutya is a Ramsar site. They receive water following extremely wet conditions that generate sufficient streamflows from the Wimmera River. The lower Wimmera River flows through Dimboola and Jeparit before entering Lake Hindmarsh.

There are also a number of smaller wetlands and creeks in Hindmarsh Shire like Pink Lake and Nhill, Mt Elgin and Yanac swamps that are important to the local community, often containing abundant birdlife and wildlife when conditions are wet.

6.4.1.1. Hindmarsh Shire Waterway Values

The Aboriginal cultural values in Hindmarsh Shire are very significant. The abundance of scar trees and middens is testimony of the profound indigenous connection to the Wimmera River over the millennia.

The Wimmera River, terminal lakes and Outlet Creek are part of the Wimmera Heritage River under the *Heritage Rivers Act 1992* due to the significant environmental and social values they possess. The terminal lakes are famous for the abundance of life they sustain when they contain water – migratory birds come from thousands of kilometres away to make use of their habitat whilst tourists gather to see this spectacle as well as enjoy the water-skiing, fishing and yabbing opportunities.

The prosperity of the townships of Dimboola and Jeparit mirrors the condition of the river that they are located next to. Flows that fill and freshen the town weir pools enable events like the Dimboola Rowing Regatta and Jeparit Fishing Competition to take place which in turn attracts visitors from far away and also provides vital dollars for local businesses.

6.4.1.2. Hindmarsh Shire Waterway Threats

Given its location at the end of the Wimmera River system, the threats that are present throughout the catchment make their presence felt in the lower Wimmera River and terminal lakes. Water harvesting through stock and domestic and irrigation dams, larger water storages as well as diversion of flows up the Yarriambiack Creek had led to much reduced flows reaching this part of the catchment. Salinity problems are severe due to saline groundwater intrusion, loss of hydrostatic pressure from freshwater flows and insufficient water to dilute and push the salt load through the river into the terminal lakes. This was most evident during the millennium drought conditions when virtually the entire Wimmera River in Hindmarsh Shire was either dry or contained water with salinity levels that approached or exceeded that of seawater.

Similarly the terminal lakes' condition is threatened by the lack of streamflows. Lake Albacutya has not had inflows since the mid-1990's and Lake Hindmarsh was dry for a decade until floodwaters arrived in spring 2010 and summer 2011. Again, threats from pest plants such as boneseed, boxthorn, bridal creeper and olives needs to be managed and rabbits are an ongoing issue, threatening the condition of riparian and wetland vegetation.

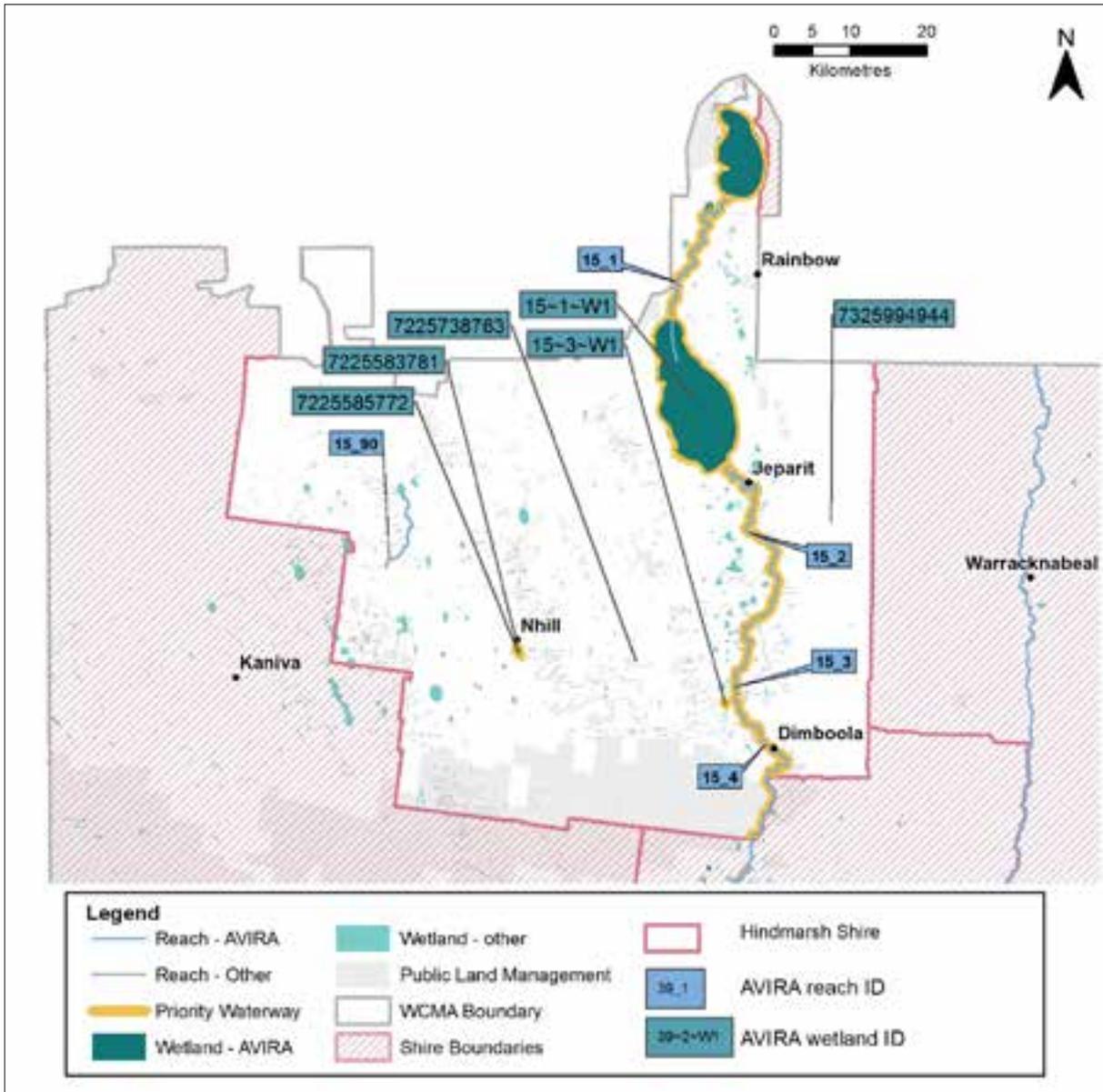


Figure 6-3 Key waterways of the Hindmarsh Shire in the Wimmera CMA region

6.4.1.3. Hindmarsh Shire Reach Targets

Monitoring

The lower Wimmera River has streamflow and water quality monitoring sites at Lochiel and Tarrenyurk. Robust data sets have been attained over the years through regular monitoring of water quality, macroinvertebrates, fish and vegetation, enabling thorough analysis of the impacts of drought and floods on the Wimmera River. The Jeparit Waterwatch group has been undertaking water quality monitoring for almost 20 years, establishing a very comprehensive dataset. Data on riparian vegetation and creek channel condition has been obtained as part of the state-wide Index of Stream Condition assessments for the Wimmera River as well as Outlet and Yanac Creeks.

Case Study – End of the system bears the brunt

The cumulative impacts of the various threats facing the Wimmera River are most keenly felt as the river winds its way to its terminal lakes, Hindmarsh and Albacutya. Water quality is typically very poor, whether due to erosion and salinity issues upstream or from saline groundwater intrusions into the river channel itself. Streamflows are crucial in terms of diluting the salt and nutrients in the water as well as providing sufficient volumes to fill the terminal lakes.

Jeparit Waterwatch has been in existence for well over a decade and the long record of water quality monitoring tells an unfortunate story in terms of the water quality readings measured during the drought, where salinity levels were talked about in terms of multiples of seawater salinity. Such levels were too high for any fish with only a few species of very hardy macroinvertebrates able to persist. However this story has a glimmer of light in terms of the better conditions observed since wetter conditions and increased environmental water releases have been occurring since 2009 although water quality issues will always remain.



Wimmera River at Jeparit Museum, February 2008. The river had turned pink due to the presence of halophytic bacteria.

Management Activity Planning

Historically a comprehensive suite of management activity plans have been developed including:

- *Wimmera River and Environs Action Program (WREAP)* (Thomas Hay and Associates, 1997) which identified locations with weeds and erosion along the channel of the Wimmera River.
- A geomorphic study of the type and condition of the region's streams in 2002 (ID&A, 2002, Earth Tech, 2003) provided a solid basis for further work into priority streams that were a threat in terms of erosion impacts.
- A long history of investigations has occurred in relation to the hypersaline pools that are located in deep sections of the Wimmera River downstream of Quantong (Anderson & Morison, 1989, SKM, 2003, Hocking, 1997);
- Waterway action plans have also been undertaken on the Wimmera River and Outlet Creek (Earth Tech, 2005a) .
- Assessments were undertaken on the Wimmera River regarding potential physical impacts to environmental flows (SKM, 2008).

Therefore there is a reasonable foundation on which to base management activity planning for rivers and creeks in the Hindmarsh Shire.

Table 6-31 Hindmarsh Shire Long-Term Reach Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish	HI RCT 1. Fish populations within the Hindmarsh Shire will be classified as “fair” according to the <i>Wimmera Fish Monitoring Project 2008</i> (SKM, 2010) methodology.	Heritage River “poor” (SKM, 2010).
Riparian vegetation condition	HI RCT 2. No declines in ISC Streamside Zone scores. HI RCT 3. 50% of reaches have an ISC Streamside Zone score of 7 or higher.	40% of reaches have an ISC Streamside Zone score of 7 or higher (DEPI, 2013a).
Macroinvertebrates	HI RCT 4. 50% of sites have MBI classification of ‘moderate’ or better during average hydrological conditions or better.	33% have MBI classification of ‘moderate’ or better (WEC, 2012).
Instream habitat and Channel form	HI RCT 5. No declines in ISC Physical Form scores. HI RCT 6. 80% of reaches have an ISC Physical Form score of 8 or higher.	80% of reaches have an ISC Physical Form score of 8 or higher.
Water quality	HI RCT 7. Long-term improved water quality trends at stream gauges compared to those of the 1991-2005 period.	Long-term data available for Wimmera River at Lochiel (415246) but no analyses completed.
Hydrology (frequency and persistence of water)	HI RCT 8. Increase streamflows in regulated rivers and streams compared to historic (pre-2009) levels under comparable climate conditions.	Wimmera Mallee Pipeline savings have been incorporated into an environmental entitlement and irrigation entitlement purchased for use by CEWH.

Table 6-32 Hindmarsh Shire Reach Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	HI MOT 1. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> . HI MOT 2. Increased understanding regarding carp movement and breeding ‘hotspots’ in Wimmera River.	Rabbit density increased above target levels (Wimmera CMA, 2010). Lack of knowledge regarding carp movement and breeding ‘hotspots’ identified as a knowledge gap (SKM, 2008a).
Excessive erosion and sedimentation	HI MOT 3. 100% of reaches have less than 10% of stream banks and stream beds eroding. HI MOT 4. Accurate information obtained on bed and bank instability threats through Waterway Action Plans.	100% of reaches have less than 10% of stream banks and stream beds eroding. Waterway planning up to date apart from Yanac Creek.
Inadequate riparian vegetation quality and extent	HI MOT 5. 80% reaches have less than 25% of their length affected by livestock [#] . HI MOT 6. 40% of reaches have at least moderate riparian connectivity*. HI MOT 7. 80% of reaches have greater than 10m wide riparian vegetation.	75% of reaches have less than 25% of their length affected by livestock. 40% of reaches have at least moderate riparian connectivity*. 80% of reaches have greater than 10m wide riparian vegetation.
Modified hydrology	HI MOT 8. ISC hydrology scores remain stable or improve.	ISC hydrology score average is 7.
Invasive Flora	HI MOT 9. Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . HI MOT 10. 100% of reaches have <11% invasive riparian (tree and shrub) flora cover.	Bridal creeper and woody weed threat level increasing (Wimmera CMA, 2010), (M. Toomey, WCMA, <i>pers. comm.</i>) 100% of reaches have <11% invasive

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
	HI MOT 11. 100% of reaches have no high threat invasive tree flora species present.	riparian (tree and shrub) flora cover. 80% of reaches have no high threat invasive tree flora species present.
Degraded water quality	HI MOT 12. 100% of reaches with an ISC Water Quality score will be 5 or higher. HI MOT 13. Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood).	66% of reaches with an ISC Water Quality score of 5 or higher. Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood).

Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on riparian areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to banks and vegetation are).

* Moderate riparian connectivity is defined as having 0-39% of streambank has overhanging vegetation with 40-59% of vegetated area being gaps OR 40-64% of streambank has overhanging vegetation with 60-79% of vegetated area being gaps OR 65-79% of streambank has overhanging vegetation with 80-100% of vegetated area being gaps according to ISC 2010.

6.4.1.4. Hindmarsh Shire Priority Reach Management Activities

The priority reaches in the Hindmarsh Shire and their values are listed in Table 6-33.

Table 6-33 Priority Reaches in the Hindmarsh Shire

Reach Name Number	Reasons
Wimmera River Reach 2	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbeques, game hunting, sightseeing, fishing, and boating. Significant community and Aboriginal cultural and post-European heritage values.
Wimmera River Reach 3	Environment: High value vegetation community. Heritage River status. Social/Cultural: Valued for game hunting. Significant Aboriginal cultural and post-European heritage values.
Wimmera River Reach 4	Environment: High value bird and vegetation communities. Drought refuge values. Heritage River status. Social/Cultural: Valued for picnics, barbeques, fishing, camping, sightseeing, game hunting, boating and swimming. Significant community and Aboriginal cultural and post-European heritage values.
Outlet Creek Reach 1	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Game hunting. Significant Aboriginal cultural and post-European heritage values.

Table 6-34 Management Activities for Wimmera River (Reaches 15-2, 15-3 and 15-4)

Management Unit	Hindmarsh Shire				
Basin	Wimmera	Waterway	Wimmera River	Identification Nos.	15-2 15-3 15-4
Long-term Resource Condition	Targets in Table 6-31 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met				
Values	Environment: High value fish, bird and vegetation communities. Wimmera Heritage River. Social/Cultural: Valued for fishing, picnics and barbeques, camping, swimming, boating, sightseeing, game hunting. Significant Aboriginal cultural and post-European heritage values.				

Threats		Invasive flora and fauna, degraded riparian vegetation, degraded water quality and altered water regime (increased period of zero flow)		
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners
HI MOT 1	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HI MA 1. Establish invasive fauna control in riparian areas (rabbits)	9,600 ha	PV, DEPI, CMA, Landcare
HO MOT 3	Increased understanding regarding carp movement and breeding 'hotspots'	HI MA 2. Investigate carp movement and behaviour investigation	2 reports	CMA
		HI MA 3. Implement activities based on carp movement and behaviour investigation	TBD	CMA
HI MOT 3	100% of reaches have less than 10% of stream banks and stream beds eroding	HI MA 4. Establish revegetation works trial with salinity tolerant vegetation.	1 ha	CMA, Landcare, landholders
HI MOT 5, HI MOT 6, HI MOT 7	80% reaches have less than 25% of their length affected by livestock#, 40% of reaches have at least moderate riparian connectivity*, 80% of reaches have greater than 10m wide riparian vegetation	HI MA 5. Established riparian management agreements	6 km (15 ha)	CMA, PV landholders
		HI MA 6. Establish mid-storey vegetation through revegetation works	20 ha	PV, CMA
HI MOT 8	ISC hydrology scores remain stable or improve	HI MA 7. Deliver environmental releases in line with Seasonal Watering Plan	3 reaches	CMA, GMMWater, VEWH, CEWH, local govt.
		HI MA 8. Prepare Environmental Water Management Plan for Wimmera River system	1 report	CMA, DEPI, VEWH, CEWH, GMMWater
		HI MA 9. Investigate improving effectiveness of town weir management	1 report	CMA, local govt, GMMWater.
		HI MA 10. Seek opportunities to maximise environmental water availability (e.g. through improving system efficiency).	Ongoing	CMA, GMMWater, VEWH, CEWH
		HI MA 11. Maintain sites assessing effectiveness of environmental water releases (habitat, vegetation, geomorphology, fish)	6 sites (fish and river red gum) 3 sites (others)	CMA
HI MOT 9	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i>	HI MA 12. Establish priority groundcover weed control in riparian areas	3,000 ha	PV, CMA, Landholders, Landcare
HI MOT 9, HI MOT 10, HI MOT 11	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , 100% of reaches have <11% invasive riparian (tree and shrub) flora cover, 100% of reaches have no high threat invasive tree flora species present	HI MA 13. Establish priority tree/shrub weed control in riparian areas	160 ha	PV, CMA, DEPI, Landholders, Landcare
UC MOT 17, HI MOT 13	100% of reaches with an ISC Water Quality score will be 5 or higher, Extreme water quality events to be within parameters measured at monitoring sites in 2006-2008 (drought) and 2010-2011 (flood)	HI MA 14. Investigate saline pool management feasibility	2 reports	CMA
		HI MA 15. Undertake feasible salinity management activities	TBD	CMA
		HI MA 16. Investigate <i>Phragmites</i> distribution and determine nutrient uptake to benchmark it against previous investigation (2005/06)	2 reports	CMA
		Undertake riparian management, erosion control, environmental water	N/A	N/A

		management and invasive fauna management activities listed previously and for upstream priority waterways		
Estimated cost of activities		\$1,646,000		
Relevant documents: <i>Wimmera Glenelg Bulk/Environmental Entitlement Heritage River Waterway Action Plan VEWH Seasonal Watering Plan</i>				

Table 6-35 Management Activities for Outlet Creek (Reach 15-1)

Management Unit		Hindmarsh Shire			
Basin	Wimmera	Waterway	Outlet Creek	Identification No.	15-1
Long-term Resource Condition		Targets in Table 6-31 for Fish, Riparian Condition, Macroinvertebrates, Water Quality, Instream habitat and Channel form are met			
Values	Environment: High value bird and vegetation communities. Wimmera Heritage River. Social/Cultural: Valued for fishing and game hunting. Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna and degraded riparian vegetation				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HI MOT 1	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HI MA 17. Establish invasive fauna control in riparian areas (rabbits)	1,000 ha	DEPI, PV, CMA, Landcare	
HI MOT 9	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i>	HI MA 18. Establish priority groundcover weed control in riparian areas	240 ha	PV, CMA, DEPI, Landholders, Landcare	
HI MOT 9, HI MOT 10, HI MOT 11	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , 100% of reaches have <11% invasive riparian (tree and shrub) flora cover, 100% of reaches have no high threat invasive tree flora species present	HI MA 19. Establish priority tree/shrub weed control in riparian areas	40 ha	PV, CMA, DEPI, Landholders, Landcare	
Estimated cost of activities		\$88,800			
Relevant documents: <i>Heritage River Waterway Action Plan</i>					

6.4.1.5. Hindmarsh Shire Wetlands Targets

Monitoring

Wetland condition monitoring has been undertaken on wetlands recognized as nationally or internationally important (Lakes Hindmarsh, Albacutya and Pink Lake) as well as Crow Swamp which will be supplied by water from the Wimmera Mallee Pipeline. This provided a useful insight into some of the key values and threats related to these wetlands. Bird monitoring has also been undertaken at Lake Hindmarsh in recent years to documents the shifts in bird species as the lake levels fluctuate. There is also monitoring undertaken on Lake Albacutya's ecological character as part of the national Ramsar Rolling Review (Appendix 2).

Management Activity Planning

Management activity planning has only been undertaken for Lakes Hindmarsh and Albacutya as part of the *Heritage River Waterway Action Plan* (Earth Tech, 2005a). There is also the *Lake Albacutya Ramsar Site Strategic Management Plan* (DSE, 2003) which is being updated as part of the

Wimmera Waterway Strategy (Appendix 2). Lake Albacutya was also included as part of the *Mallee Parks Management Plan* (DCNR, 1996). Strategic planning has been the focus regarding wetlands with documents such as the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011) analysing the values and threats to wetlands in the Hindmarsh Shire area.

Table 6-36 Hindmarsh Shire Long-Term Wetland Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish/Yabbies	HI RCT 9. Continues to provide recreational fishing/yabbying opportunities.	Recreational fishing/yabbying opportunities available in wet conditions.
Birds	HI RCT 10. Increased recognition and understanding of wetland bird values. HI RCT 11. Maintenance of duck hunting opportunities. HI RCT 12. Supports significant bird populations, particularly wetland bird species when the lake contains water	Supports bird species listed as threatened. Duck hunting undertaken when conditions allow. Wimmera CMA bird monitoring shows Lake Hindmarsh supports a large number of wetland birds.
Wetland vegetation condition	HI RCT 13. No declines in IWC vegetation condition. HI RCT 14. Improvement in average IWC vegetation sub-index scores in the region. HI RCT 15. Increased understanding of wetland vegetation condition. HI RCT 16. Increase wetland connectivity measures.	Currently IWC vegetation sub-index scores average 'very poor' to 'poor'. Four wetlands with IWC data for vegetation. No data available for wetland connectivity as yet.
Water quality	HI RCT 17. Improved IWC water properties sub-index scores to average 'moderate'. HI RCT 18. Improved knowledge of water quality issues.	IWC water properties scores average 'poor-moderate'. IWC water properties scores only available at two wetlands.
Hydrology (frequency and persistence of water)	HI RCT 19. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.). HI RCT 20. Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions.	Wetland loss (hydrological change between 1994 and 2004 was 18% (SKM, 2006). Wetland hydrology affected by interception from constructed features. (e.g. channels, roads). Wetland connected to the Wimmera Mallee Pipeline is yet to receive benefits of pipeline supply.

Table 6-37 Hindmarsh Shire Wetland Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	HI MOT 14. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> .	Rabbit density increased above target levels (<i>WIPAMS</i> , 2010).
Changed hydrology and wetland form	HI MOT 15. Rate of wetland loss due to earthworks reduced. HI MOT 16. Planning scheme provisions protect priority wetland hydrology. HI MOT 17. Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions.	Estimated 229 wetlands in 2013 due to reduce to 163 wetlands by 2022 at current trends (SKM, 2006). Planning scheme provisions in place. Increased environmental water availability due to pipeline savings and irrigation entitlement purchase.



Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Inadequate wetland vegetation quality and extent	HI MOT 18. Increased information about wetland vegetation quality and extent. HI MOT 19. Increased awareness of impacts of cropping on wetland vegetation. HI MOT 20. Priority wetland corridors identified and connection requirements understood. HI MOT 21. Increased information regarding the magnitude of livestock access impacts on priority wetlands. HI MOT 22. 5% reduction in number of wetlands with high threats regarding livestock access [#] .	4 sites with vegetation condition data available. About 45% of landholders surveyed were unsure about the negative impacts of cropping and draining wetlands (Curtis & Mendham, 2012). Impacts of grazing on priority wetlands (e.g. Lake Albacutya) is not well understood. 40% of wetlands currently have high threat from livestock access.
Invasive Flora	HI MOT 23. Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . HI MOT 24. All wetlands have <11% invasive wetland (tree and shrub) flora. HI MOT 25. 66% of wetlands have no greater than 50% weed cover with high threat weeds present.	<i>WIPAMS</i> (2010) does not have a status with respect to bridal creeper but indicates trend is worsening. All wetlands have <11% invasive wetland (tree and shrub) flora. 66% of wetlands have no greater than 50% weed cover with high threat weeds present.
Degraded water quality	HI MOT 26. No decrease in IWC Water properties sub-index score	IWC water properties sub-index scores are typically 'poor-moderate'.

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on wetland areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to edges and vegetation are).

6.4.1.6. Hindmarsh Shire Priority Wetland Management Activities

There are a number of wetlands in Hindmarsh Shire that are a priority for management due to their high social, cultural, economic and environmental values and are listed in Table 6-38.

Table 6-38 Priority Wetlands in Hindmarsh Shire

Wetland Name Code	Reasons
Lake Hindmarsh 15-1-W1	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbeques, game hunting, camping, sightseeing, fishing, and boating. Significant community and Aboriginal cultural heritage values.
Lake Albacutya 15-91-W1	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbeques, game hunting, camping, sightseeing, fishing, and boating. Significant community and Aboriginal cultural heritage values.
Pink Lake 15-3-W1	Environment: High value vegetation community. Economic: Extractive industries Social/Cultural: Valued for picnics, barbeques and sightseeing, Significant Aboriginal cultural heritage values.
Nhill Lake/Swamp 7225583781 7225585772	Environment: High value bird community. Social/Cultural: Valued for picnics, barbeques, game hunting, camping, sightseeing, fishing and boating. Significant community and Aboriginal cultural heritage values.

Priority wetlands also include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains. Table 6-39 lists the single potential Seasonal Herbaceous Wetland in the Hindmarsh Shire that has data for consideration in the strategy.

Table 6-39 Potential Seasonal Herbaceous Wetland in Hindmarsh Shire with data for WWS

Wetland Name	Code	Approximate Location	Tenure
Crow Swamp	7325994944	North of King Road, Tarranyurk	Crown

Wetland Planning for the Hindmarsh Shire

There are about 280 wetlands within the Hindmarsh Shire within the Wimmera CMA area. There is perhaps the greatest diversity of wetlands within the Hindmarsh Shire of anywhere in the region, ranging in size from massive Lake Hindmarsh through to small freshwater marshes.

Data is only available at a very small fraction of wetlands in the region (8) however this provides some indicative information on the threats and values and has enabled planning to progress to look at priority wetland systems and types which are listed as following:

Terminal Lakes and large wetlands within small tracts of public land

The terminal lakes are iconic wetlands for the region – when they contain water they are a huge drawcard for the community with great opportunities for water-skiing, fishing, camping etc. Other large wetlands like Nhill Swamp, Yanac Swamp and Mt Elgin Swamp are in very good environmental condition and all are known to support a vast number and diversity of birds when they contain water. Threats to their condition are not helped by the fact that they tend to have only a small strip of fringing native vegetation around them and are surrounded by agricultural land. The main threats relate to invasive flora and fauna (e.g. bridal creeper, boneseed, rabbits), narrow buffer zones of fringing vegetation, poor water quality and impacts to their hydrology through insufficient flows (for Lake Hindmarsh and Albacutya) and upstream historic drainage and channelisation works (for other wetlands).

Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

These wetlands are listed as threatened under the *EPBC Act*. There are potentially about 70 of these wetlands in the Hindmarsh Shire. Research has highlighted that these wetlands are most vulnerable to loss from activities such as cropping, overgrazing and drainage (SKM, 2006). Given their scarcity in the landscape, efforts should be undertaken to ascertain their condition and manage threats.

Table 6-40 Management Activities for Lake Hindmarsh

Management Unit		Hindmarsh Shire			
Basin	Wimmera	Waterway	Lake Hindmarsh	Identification No.	15-1-W1
Long-term Resource Condition		Targets in Table 6-36 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbeques, game hunting, camping, sightseeing, fishing, and boating. Significant community interest and Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Changed water regime, Degraded water quality				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HI MOT 14	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	HI MA 20. Establish invasive fauna control for wetlands (rabbits)	9,600 ha	PV, DEPI, CMA	
HI MOT 17	Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions.	HI MA 21. Environmental watering actions for the lower Wimmera River will assist this.	Ongoing	CMA, GMMWater, VEWH, CEWH, local govt.	
		HI MA 22. Investigate improving use of regulated environmental water to maximise terminal lake outcomes	1 report	CMA, DEPI	

		HI MA 23. Seek opportunities to maximise environmental water availability (e.g. through improving system efficiency).	Ongoing	CMA , GMMWater, VEWH, CEWH
HI MOT 23, HI MOT 24, HI MOT 25	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . All wetlands have <11% invasive wetland (tree and shrub) flora, 66% of wetlands have no greater than 50% weed cover with high threat weeds present	HI MA 24. Establish priority groundcover weed control in wetland areas (bridal creeper)	1,000 ha	PV , DEPI, CMA
		HI MA 25. Establish priority tree/shrub weed control in wetland areas (boneseed)	200 ha	PV , DEPI, CMA
		HI MA 26. Establish native vegetation to prevent colonisation of weed species	20 ha	PV , CMA
HI MOT 26	No decrease in IWC Water properties sub-index score	Undertake environmental water management and invasive fauna management activities listed previously and for upstream priority waterways	N/A	N/A
Estimated cost of activities		\$616,000		
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i> <i>Heritage River Waterway Action Plan</i> <i>Wimmera Glenelg Bulk/Environmental Entitlement</i>				

Table 6-41 Management Activities for Lake Albacutya

Management Unit		Hindmarsh Shire			
Basin	Wimmera	Waterway	Lake Albacutya	Identification No.	15-91-W1
Long-term Resource Condition		Targets in Table 6-36 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbeques, game hunting, camping, sightseeing, fishing, and boating. Significant community interest and Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Changed water regime, Degraded water quality, Degraded buffer				
Management Outcome Targets		Management Activity/Output		Quantity	Lead agency/ Partners
See Appendix 2 Lake Albacutya Ramsar Site Management Plan					

Table 6-42 Management Activities for Pink Lake and Nhill Lake/Swamp

Management Unit		Hindmarsh Shire			
Basin	Wimmera	Waterway	Pink Lake Nhill Lake Nhill Swamp	Identification No.	15-3-W1 7225583781 7225585772
Long-term Resource Condition		Targets in Table 6-36 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value vegetation community. (Pink Lake) Economic: Extractive industries (Pink Lake) Social/Cultural: Valued for picnics, barbeques and sightseeing, Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Degraded buffer				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
HI MOT 23, HI MOT 24, HI MOT 25	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . All wetlands have <11% invasive wetland (tree and shrub) flora, 66% of wetlands have no greater than 50% weed cover with high threat weeds present	HI MA 27. Establish priority weed control in wetland areas (bridal creeper)	32 ha	PV, DEPI, CMA	
Estimated cost of activities			\$5,000		
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i>					

Previous protection works have resulted in the protection of approximately 25% of priority wetlands (Seasonal Herbaceous Wetlands) in the Hindmarsh Shire which is above the target of 20% established for protection of various wetland types within the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011). However there will need to be a renewing of management agreements for wetlands that have expired as well as trying to ensure that threats to the remaining 75% are reduced.

6.4.1.7. Hindmarsh Shire Wetland Management Activities for All Wetlands

Table 6-43 Management Activities for All Hindmarsh Shire Wetlands

Management Unit		Hindmarsh Shire			
Basin	Wimmera Millicent	Waterway	All Wetlands including Seasonal Herbaceous Wetlands	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-36 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value vegetation and bird communities. Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing, game hunting and camping. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Overgrazing, Degraded buffer, Altered wetland form, Soil disturbance, Changed water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	



HI MOT 15, HI MOT 19	Rate of wetland loss due to earthworks reduced, Increased awareness of impacts of cropping on wetland vegetation	HI MA 28. Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	8* events/ publications	CMA , DEPI, Field and Game
HI MOT 16, HI MOT 26	Planning scheme provisions protect priority wetland hydrology, No decrease in IWC Water properties sub-index score	HI MA 29. Issue referral responses for Environmental Significance Overlay affecting wetlands	Referral responses TBD	CMA , Hindmarsh Shire
HI MOT 22, HI MOT 26	5% reduction in number of wetlands with high threats regarding livestock access#, No decrease in IWC Water properties sub-index score	HI MA 30. Establish wetland management agreements for Seasonal Herbaceous Wetlands	56 ha (7 wetlands)	CMA , landholders
HI MOT 17	Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions	HI MA 31. Deliver environmental water in line with seasonal watering plan (Crow Swamp)	1 wetland	CMA , GMMWater, VEWH, PV, landholders
		HI MA 32. Develop Environmental Water Management Plan	1* plan	CMA , GMMWater, PV, VEWH
HI MOT 18	Increased information about wetland vegetation quality and extent	HI MA 33. Monitor vegetation condition at wetlands connected to the Wimmera Mallee Pipeline	2 reports	CMA
HI MOT 25	66% of wetlands have no greater than 50% weed cover with high threat weeds present	HI MA 34. Investigate fire management regime effectiveness on phalaris and other invasive grass species	1* report	PV, CMA
HI MOT 20	Priority wetland corridors identified and connection requirements understood.	HI MA 35. Investigate priorities for wetland connectivity	1* report	CMA
Estimated cost of activities		\$129,600		
Relevant documents: Wimmera Wetlands Asset Strategy Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains VEWH Seasonal Watering Plan				

6.5. Yarriambiack and Buloke Shire Work Program

6.5.1. Yarriambiack and Buloke Shire Description

The Yarriambiack and Buloke Shires encompass a large portion of the northern Wimmera plains (Figure 6-4). The key waterway features are the Yarriambiack and Dunmunkle creeks. These two creeks are distributary streams. This means that they carry water away from the main waterway (north from the Wimmera River in this case) in high flows and floods. Despite the fact that these waterways rarely flow, there is passionate community interest in their condition and management. Weir pools are located on the Yarriambiack Creek at Jung, Warracknabeal and Brim within the Wimmera CMA area.

There are also a number of wetlands in these shires which typically only fill due to localised runoff during exceptionally wet conditions. Lake Marma, a recreational lake in Murtoa and a small number of wetlands are supplied with water from the Wimmera Mallee Pipeline when allocations are sufficient.

6.5.1.1. Yarriambiack and Buloke Shire Waterway Values

The lack of other locations where surface water is present in the area means that several locations on the Yarriambiack and Dunmunkle Creeks have become a focus for community members in and near the townships of Warracknabeal, Brim and Rupanyup. Water-skiing and camping are popular at the

weir pools at Brim and Warracknabeal on the Yarriambiack Creek. Fishing also takes place in these weir pools as well as at Jack Emmett Billabong on the Dunmunkle Creek at Rupanyup and Lake Marma. Given flows into these creeks and wetlands are so infrequent, water provided by stormwater and/or the Wimmera Mallee Pipeline are invaluable in enhancing water levels. There are stock and domestic water diversions from the creeks but these are opportunistic given their infrequent flows.

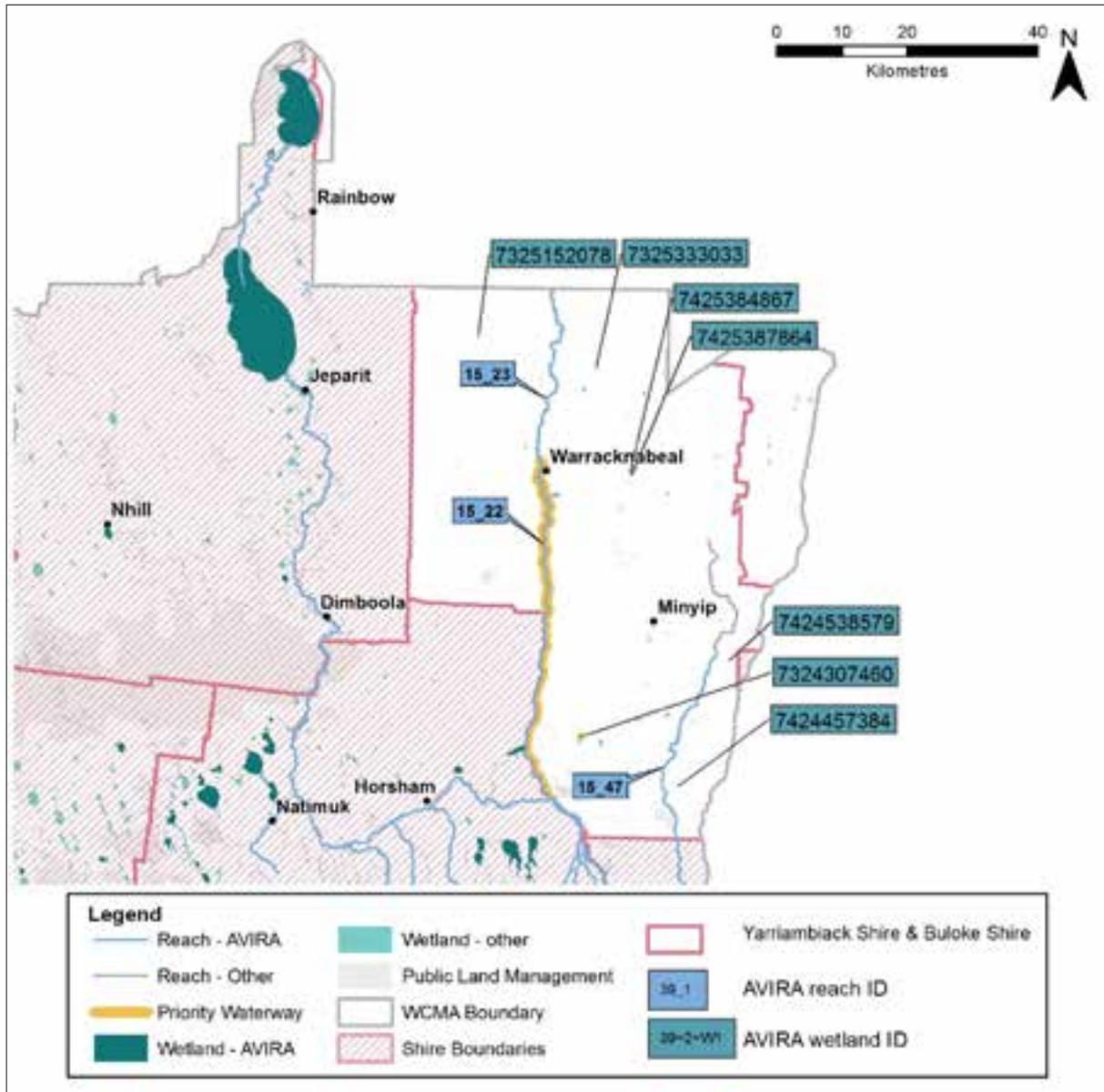


Figure 6-4 Key waterways of the Yarriambiack and Buloke Shires in the Wimmera CMA region

These creeks are also valuable in that in a largely cleared landscape they provide important habitat and connectivity for native plants and animals. Ecological surveys have also revealed that wetlands in the area contain a surprising diversity of native flora and fauna, including a number of threatened species.

6.5.1.2. Yarriambiack and Buloke Shire Waterway Threats

In this largely cleared part of Victoria, there are issues with fragmentation and the spread of weeds into high value parts of the Yarriambiack and Dunmunkle creeks as well as the scattered Black Box wetlands. Modifications to the Dunmunkle and Yarriambiack creeks' channels due to natural processes and their historic use for distributing stock and domestic water supplies as well as isolated cropping activities has meant that in a large number of locations they have lost their structural

diversity, namely the deeper pools. This concern has been echoed by the community who are keen to see a more natural waterway system, especially now the Dunmunkle Creek's role as a water distribution channel has ended.

The flat landscape in the Yarriambiack and Buloke Shires means that drainage is an issue in very wet conditions and this has been highlighted during community consultation. Whilst historical drainage and cropping activities has led to the loss of a lot of shallow, seasonal wetlands in this area, improved understanding of water movement across the landscape could mean that drainage works would improve the hydrology of remaining waterways whose catchments that have been affected by obstructions such as roads and channels.

6.5.1.3. Yarriambiack and Buloke Shire Reach Targets

Monitoring

Due to the episodic nature of flows along the Yarriambiack and Dunmunkle creeks, limited monitoring takes place. Stream condition monitoring is undertaken via the statewide Index of Stream Condition which provides an indication of the state of these creeks' riparian vegetation, bank and bed stability and hydrology. Waterwatch monitoring provides a long history of water quality in the Yarriambiack Creek at Warracknabeal Weir Pool. River Red Gum and Black Box tree condition surveys have also been undertaken.

Case Study - Dunmunkle Creek – changing channel, changing values

One of two distributaries streams in the region, the Dunmunkle Creek was modified decades ago to act as a conduit for water supplies from headworks storages to farms in the northern Wimmera. This meant that extensive levelling and snag removal were undertaken to improve the efficiency of water delivery. As a consequence, the creek has lost many of its natural values although a number of threatened species still remain in isolated patches. Yet despite these impacts, the creek is seen as an important waterway for the local community. Following the construction of the Wimmera Mallee Pipeline there is no need to use it as a water transfer channel anymore. The local community has a keen interest in restoring some of the environmental values that the creek once held.



*Dunmunkle
Creek*

A number of plans and investigations have been developed to improve the management of these creeks including:

- *Yarriambiack Creek Management Plan* (KBR, 2004);
- Waterway action plans were completed for both the Yarriambiack and Dunmunkle creeks (Earth Tech, 2007)
- Several assessments of structures along the Yarriambiack and Dunmunkle Creeks have been undertaken (SMEC, 2001, Wimmera CMA, 2002, Earth Tech, 2006)

Given the current plan for the Yarriambiack Creek is a decade old and there is no management plan for Dunmunkle Creek, new management plans for these creeks are justified, especially in order to deal with threats around invasive flora and fauna and riparian vegetation management.

Case Study – Carapugna Swamp

Located on Crown land near Watchem, Carapugna Swamp is somewhat isolated but well worth a visit given the myriad of wetland species that call it home. Carapugna Swamp was nominated as one of 13 wetlands in the Wimmera CMA region to receive a supply from the Wimmera Mallee Pipeline. A preliminary investigation by ecologists Damien Cook and Karl Just revealed that Carapugna Swamp contained a number of threatened plant species including Western Bitter-cress and Ridged Water-milfoil, listed as ‘vulnerable’ under the *EPBC Act*. An important woodland bird community was noted at the swamp with a number of Brown Treecreepers and nesting Hooded Robins. Surveys at the other wetlands revealed that these wetlands can be small hotbeds of biodiversity across a largely cleared agricultural landscape. Future environmental water deliveries will assist these wetlands in retaining their environmental values whilst community-led revegetation initiatives such as Yarrilinks may provide future opportunities to increase the distribution and abundance of these important plant and animal species.



*Ridged Water milfoil
at Carapugna Swamp*

*Photo: Damien Cook,
Australian Ecosystems*

Table 6-44 Yarriambiack and Buloke Shire Long-Term Reach Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Riparian vegetation condition	Y RCT 1. No declines in ISC Streamside Zone scores. Y RCT 2. 100% of reaches have an ISC Streamside Zone score of 6 or higher.	75% of reaches have an ISC Streamside Zone score of 6 or higher.
Instream habitat and Channel form	Y RCT 3. No declines in ISC Physical Form scores. Y RCT 4. All reaches have an ISC Physical Form score of 7 or higher.	No declines in ISC Physical Form scores. All reaches have an ISC Physical Form score of 7 or higher.
Hydrology	Y RCT 5. Yarriambiack Creek - Increase	Increasing water availability due to

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
(frequency and persistence of water)	streamflows in regulated rivers and streams compared to historic (pre-2009) levels under comparable climate conditions. Y RCT 6. Dunmunkle Creek - Stabilisation of streamflow reductions due to water extraction and storage.	savings from Wimmera Mallee Pipeline as well as CEWH water purchase. Minor impacts due to flow regulation and storage.

Table 6-45 Yarriambiack and Buloke Shire Reach Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	Y MOT 1. Reduce invasive fauna threat.	WIPAMS has no targets for this region.
Excessive erosion and sedimentation	Y MOT 2. 100% of reaches have less than 10% of the reach's banks and beds eroding. Y MOT 3. Accurate information obtained on bed and bank instability threats through Waterway Action Plans.	100% of reaches have less than 10% of the reach's banks and beds eroding. Waterway action planning up to date.
Inadequate riparian vegetation quality and extent	Y MOT 4. 33% of reaches have less than 25% of their length affected by livestock [#] . Y MOT 5. 25% of reaches have at least moderate riparian connectivity*. Y MOT 6. 100% of reaches have greater than 10 m wide riparian vegetation. Y MOT 7. 10% of reaches have low threat for floodplain connectivity.	66% of reaches have less than 25% of their length affected by livestock [#] . 25% of reaches have at least moderate riparian connectivity*. 75% of reaches have greater than 10 m wide riparian vegetation. One reach (Dunmunkle Creek) with reduced floodplain connectivity.
Modified hydrology	Y MOT 8. ISC hydrology scores improve to an average of 6.	2010 ISC hydrology scores is an average of 4.
Invasive Flora	Y MOT 9. Reduce invasive flora threat. Y MOT 10. 100% of reaches have <11% invasive riparian (tree and shrub) flora cover. Y MOT 11. 100% of reaches have no high threat invasive tree flora species present.	WIPAMS has no targets for this region. 100% of reaches have <11% invasive riparian (tree and shrub) flora cover. 100% of reaches have no high threat invasive tree flora species present.

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on riparian areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to banks and vegetation are).

* Moderate riparian connectivity is defined as having 0-39% of streambank has overhanging vegetation with 40-59% of vegetated area being gaps OR 40-64% of streambank has overhanging vegetation with 60-79% of vegetated area being gaps OR 65-79% of streambank has overhanging vegetation with 80-100% of vegetated area being gaps according to ISC 2010.

6.5.1.4. Yarriambiack and Buloke Shire Reach Management Activities

The priority reaches in the Yarriambiack and Buloke Shires and their values are shown in Table 6-46.

Table 6-46 Priority Reaches in the Yarriambiack and Buloke Shires

Reach	Reasons
Yarriambiack Creek Reach 21	Environment: High value bird and vegetation community. Social/Cultural: Valued for fishing and game hunting. Significant Aboriginal cultural and post-European heritage values.
Yarriambiack Creek Reach 22	Environment: High value bird and vegetation community. Social/Cultural: Valued for sightseeing, picnics and barbeques, swimming boating, game hunting, fishing and camping. Significant Aboriginal cultural and post-European heritage values.

Table 6-47 Management Activities for Yarriambiack Creek (Reaches 15-21 and 15-22)

Management Unit		Yarriambiack and Buloke Shires			
Basin	Wimmera	Waterway	Yarriambiack Creek	Identification Nos.	15-21 15-22
Long-term Resource Condition		Targets in Table 6-44 for Riparian Condition, Instream habitat and Channel form are met			
Values		Environment: High value bird and vegetation community. Social/Cultural: Valued for sightseeing, picnics and barbeques, swimming boating, game hunting, fishing and camping. Significant Aboriginal cultural and post-European heritage values.			
Threats		Invasive flora and fauna, Degraded riparian vegetation, (connectivity), Altered water regime			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
Y MOT 1	Reduce invasive fauna threat	Y MA 1. Develop management plan for the creek including targets for invasive fauna and flora	1 report	CMA, YCAC, DEPI, Mallee CMA, Local govt, Yarrilinks, landholders	
		Y MA 2. Conduct invasive fauna control in riparian areas	240 ha	CMA, YCAC, DEPI, Local govt, Landcare, landholders	
Y MOT 4	33% of reaches have less than 25% of their length affected by livestock [#]	Y MA 3. Established riparian management agreements	2 km (8 ha)	CMA, Landcare, landholders	
Y MOT 4, Y MOT 5, Y MOT 6	33% of reaches have less than 25% of their length affected by livestock [#] , 25% of reaches have at least moderate riparian connectivity* 100% of reaches have greater than 10 m wide riparian vegetation	Y MA 1 Develop management plan for the creek including targets for invasive fauna and flora	1* report	CMA, YCAC, DEPI, Local govt, Yarrilinks, landholders	
		Y MA 4. Conduct priority groundcover weed control in riparian areas	240 ha	CMA, YCAC, DEPI, Local govt, Landcare, landholders	
Y MOT 8	ISC hydrology scores improve to an average of 6	Y MA 5. Plan and implement environmental water releases for Wimmera River which will lead to benefits for Yarriambiack Creek	Ongoing	CMA, GMMWater, VEWH, CEWH	
		Y MA 6. Prepare investigation into improving effectiveness of town weir management	1* report	CMA, local govt, GMMWater.	
		Y MA 7. Investigate options to improve arrangements at the Yarriambiack Creek/ Wimmera River offtake.	1 report	CMA, YCAC, local govt, VEWH	
Estimated cost of activities		\$266,800			
Relevant documents: Wimmera Glenelg Bulk/Environmental Entitlement					



**Yarriambiack Creek Management Plan
Waterway Action Plan for the Regulated Streams of the Wimmera**

6.5.1.5. Yarriambiack and Buloke Shire Reach Management Activities for All Reaches

Table 6-48 Management Activities for all Yarriambiack and Buloke Shire Reaches

Management Unit		Yarriambiack and Buloke Shires			
Basin	Wimmera	Waterway	Yarriambiack and Dunmunkle Creeks	Identification Nos.	15-21 15-22 15-47
Long-term Resource Condition		Targets in Table 6-44 for Fish, Riparian Vegetation, Water Quality and Hydrology			
Values	Environment: High value riparian vegetation communities. Social/Cultural: Significant Aboriginal cultural and post-European heritage values.				
Threats	Invasive flora and fauna, Degraded riparian vegetation, Loss of instream habitat (large wood)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
Y MOT 1, Y MOT 9, Y MOT 10, Y MOT 11	Reduce invasive fauna threat, Reduce invasive flora threat, 100% of reaches have <11% invasive riparian (tree and shrub) flora cover, 100% of reaches have no high threat invasive tree flora species present.	Y MA 8. Develop management plan for Dunmunkle Creek	1 report	CMA, YCAC, DEPI, Local govt, Yarrilinks, landholders	
Estimated cost of activities			\$40,000		
Relevant documents: Water Act (1989) Waterway Action Plan for the Regulated Streams of the Wimmera					

6.5.2. Yarriambiack and Buloke Shire Wetland Targets

Monitoring

Minimal wetland monitoring has been undertaken in the Yarriambiack and Buloke Shires. Index of Wetland Condition assessments have been undertaken at a handful of wetlands which are to be supplied by the Wimmera Mallee Pipeline. This provided a useful insight into some of the key values and threats related to these wetlands.

Management Activity Planning

Given the lack of information regarding wetlands in the Yarriambiack and Buloke Shires there has been no management activity planning identified for specific wetlands. Strategic planning has been the focus regarding wetlands with documents such as the *Wimmera CMA Wetland Asset Strategy* (Wimmera CMA, 2011) analysing the values and threats to wetlands in the Yarriambiack and Buloke Shire areas.

Table 6-49 Yarriambiack and Buloke Shire Long-Term Wetland Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish/Yabbies	Y RCT 7. Continues to provide recreational fishing/yabbing opportunities.	Recreational fishing/yabbing opportunities available in wet conditions.
Birds	Y RCT 8. Increased recognition and understanding of wetland bird values. Y RCT 9. Maintenance of duck hunting opportunities.	Supports bird species listed as threatened. Duck hunting undertaken when conditions allow.
Wetland vegetation condition	Y RCT 10. No declines in IWC vegetation condition. Y RCT 11. Improvement in average IWC scores in the region. Y RCT 12. Increased understanding of wetland vegetation condition.	Currently vegetation condition average 'poor to moderate' according to IWC. Three wetlands with IWC data for vegetation.
Water quality	Y RCT 13. Improved knowledge of water quality issues.	No water quality data available.
Hydrology (frequency and persistence of water)	Y RCT 14. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.). Y RCT 15. Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions	Wetland loss (hydrological change between 1994 and 2004 was 18% (SKM, 2006). Wetland hydrology affected by interception from constructed features. (e.g. channels, roads). Most wetlands are yet to receive benefits of Wimmera Mallee Pipeline supply.

Table 6-50 Yarriambiack and Buloke Shire Wetland Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	Y MOT 12. Reduce carp proliferation in Wimmera Mallee Pipeline supplied wetlands.	Carp in Lake Marma.
Changed hydrology and wetland form	Y MOT 13. Rate of wetland loss due to earthworks reduced. Y MOT 14. Wetlands connected to the Wimmera Mallee Pipeline receive environmental water to enhance their condition. Y MOT 15. Reduction of threat due to changed hydrology.	Estimated 56 wetlands in 2013 due to reduce to 34 wetlands by 2022 at current trends (SKM, 2006). Environmental watering of wetlands connected to the Wimmera Mallee Pipeline is just commencing. Channel decommissioning may increase local catchment inflows into wetlands.
Inadequate wetland vegetation quality and extent	Y MOT 16. Increased information about wetland vegetation quality and extent. Y MOT 17. Increased awareness of impacts of cropping on wetland vegetation. Y MOT 18. 5% reduction in number of wetlands with high threats regarding livestock access [#] .	3 sites with vegetation condition data available. 30% of landholders surveyed were unsure of the impacts of cropping on wetlands (Curtis & Mendham, 2012). 29% of wetlands currently have high threat from livestock access.
Invasive Flora	Y MOT 19. Benchmark and reduce invasive weed threat.	Wetland monitoring indicates that weed threat is mainly from agricultural weeds.
Degraded water quality	Y MOT 20. No decrease in IWC Water properties sub-index score.	Water properties are typically 'good'.

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on wetland areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to edges and vegetation are).

6.5.2.1. Yarriambiack and Buloke Shire Priority Wetland Management Activities

There is one wetland in Yarriambiack Shire that due to its high social values, is a priority for management activities.

Table 6-51 Priority Wetlands in Yarriambiack Shire

Wetland Name Code	Reasons
Lake Marma 7324291407	Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.

Priority wetlands also include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains. Table 6-52 lists the potential Seasonal Herbaceous Wetlands in the Yarriambiack and Buloke Shires that have data for consideration in the strategy.

Table 6-52 Potential Seasonal Herbaceous Wetlands in Yarriambiack Shire with data for WWS

Wetland Name	Code	Approximate Location	Tenure
Challambra Swamp	7425384867	South of Borung Highway, Challambra	Freehold/ Crown
Harcoans/ Burrereo	7424538579	North of Minyip – Banyena Road, Burrereo	Crown

Wetland Planning for the Yarriambiack and Buloke Shire

Given the relatively flat topography there are not many wetlands (about 75) within the Yarriambiack and Buloke Shires within the Wimmera CMA area. They tend to be filled episodically during very wet conditions from local runoff and hold water for a few months. Numerous wetlands have been lost as much of this region is productive dryland cropping land and therefore the wetlands have been cropped and often drained.

Small wetlands within small tracts of public land

Dotted around the landscape are a number of small wetlands contained within small bushland reserves. Preliminary indications are that they tend to contain very good environmental values despite their isolated nature and small size. The focus will be on maintaining these values and incorporating them in other natural resource management programs.

Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

These wetlands are listed as threatened under the *EPBC Act*. There are potentially only about a dozen of these wetlands in the Yarriambiack and Buloke Shires but research (SKM, 2006) has highlighted that these wetlands are most vulnerable to loss from activities such as cropping, overgrazing and drainage. Over half have had wetland protection works undertaken on them and there will be a need to secure outcomes from these works in the long-term as well as monitor their condition.

6.5.2.2. Yarriambiack and Buloke Shire Wetland Management Activities for All Wetlands

Given the low threats to the priority wetland (Lake Marma) and relatively small number of wetlands within the region, it was more appropriate to consider management activities for the protection of wetlands as a collective across the region.

Table 6-53 Management Activities for all Yarriambiack and Buloke Shire Wetlands

Management Unit		Yarriambiack and Buloke Shires			
Basin	Wimmera	Waterway	All Wetlands	Identification Nos.	N/A
Long-term Resource Condition		Targets in Table 6-49 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value vegetation and bird communities. Social/Cultural: Valued for picnics, barbecues, boating, swimming, fishing, game hunting and camping. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Overgrazing, Degraded buffer, Altered wetland form, Soil disturbance, Changed water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
Y MOT 12	Reduce carp proliferation in Wimmera Mallee Pipeline supplied wetlands	Y MA 9. Investigate carp trap feasibility	1 report	CMA, DEPI	
Y MOT 15, Y MOT 14	Reduction of threat due to changed hydrology, Wetlands connected to the Wimmera Mallee Pipeline receive environmental water to enhance their condition.	Y MA 10. Deliver environmental water in line with seasonal watering plan (Harcoans, Krong, Challambra, Carapugna, Tarkedia and Sawpit Swamps and Schultz's, Pinedale, Fielding's and Opie's Dams)	10 wetlands	CMA, GWMWater, VEWH, PV, landholders	
		Y MA 11. Develop Environmental Water Management Plan	1 plan*	CMA, GWMWater, PV, VEWH, landholders	
		Y MA 12. Investigate and undertake works to improve wetland outcomes from WMPP water delivery.	1 report Works TBD	CMA, GWMWater, VEWH, PV, landholders	
Y MOT 13, Y MOT 15, Y MOT 17	Rate of wetland loss due to earthworks reduced, Reduction of threat due to changed hydrology, Increased awareness of impacts of cropping on wetland vegetation	Y MA 13. Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	8* events/ publications	CMA, DEPI, Field and Game	
Y MOT 19, Y RCT 13, Y MOT 16	Benchmark and reduce invasive weed threat, Improved knowledge of water quality issues, Increased information about wetland vegetation quality and extent	Y MA 14. Undertake vegetation monitoring of wetlands connected to Wimmera Mallee Pipeline	2 reports	CMA	
		Y MA 15. Undertake vegetation improvement works	5 ha	CMA, PV	
HI MOT 22, Y MOT 20	5% reduction in number of wetlands with high threats regarding livestock access, No decrease in IWC Water properties sub-index score.	Y MA 16. Wetland management agreements developed for Seasonal Herbaceous Wetlands	50 ha (5 wetlands)	CMA, Landcare, landholders	
Estimated cost of activities			\$280,000		
Relevant documents: Wimmera Wetlands Asset Strategy Wetland Condition Monitoring and Benchmarking Along the Wimmera Mallee Pipeline Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains VEWH Seasonal Watering Plan					

6.6. West Wimmera Shire Work Program

6.6.1. West Wimmera Shire Description

The West Wimmera Shire has an abundance and diversity of wetlands, the scale of which is not present anywhere else in Victoria (Figure 6-5). Ancient dune and swale systems created by sea level transgression and regression have left a legacy of long chains of wetlands in the south of the West Wimmera Shire. In wet years, wetlands will progressively fill and spill into other ones along the chain as well as receiving inflows from local catchments. Depending on prevailing climatic conditions they can remain wet or dry out completely for years at a time. Elsewhere, there are a number of localised smaller wetlands including some of the more seasonal freshwater marshes, freshwater meadows and Gilgai areas (crabholes). Towns like Apsley and Edenhope have wetlands as a key feature associated with the town. There are also a handful of small, west-flowing streams like Mosquito, Morambro, Naracoorte, and Kojak Creeks that provide flows into South Australia during wet conditions.

Waterways are not so prevalent in the north of the West Wimmera although there are a number of wetland chains north of the Little Desert such as those adjacent to the Lawloit Ridge. There are a number of small creeks that fill and connect these wetlands whilst some larger creeks like Tatiara and Nalang Creek flow west into South Australia but only infrequently during very wet years.

Case Study – Groundwater and Groundwater Dependent Ecosystems (GDEs)

Anecdotal evidence combined with detailed investigations (e.g. *West Wimmera Hydrogeological Study* (SKM, 2009)) has highlighted the threat posed by declining groundwater levels on GDEs. Numerous wetlands and Mosquito Creek relied on groundwater in part to sustain many environmental values. Ongoing declines in groundwater water levels due to decreasing groundwater recharge and increased extraction will threaten these values. Therefore improved management of groundwater in terms of both state policy (e.g. *Western Region Sustainable Water Strategy* (DSE, 2011)) and local implementation (e.g. *West Wimmera Groundwater Management Strategy* (GMMWater , 2011)) is underway to try and prevent this. More detailed information is available on the DEPI and GMMWater websites.



Groundwater is intrinsically related to the hydrology of a number of wetlands such as Lake Kemi Kemi, near Edenhope

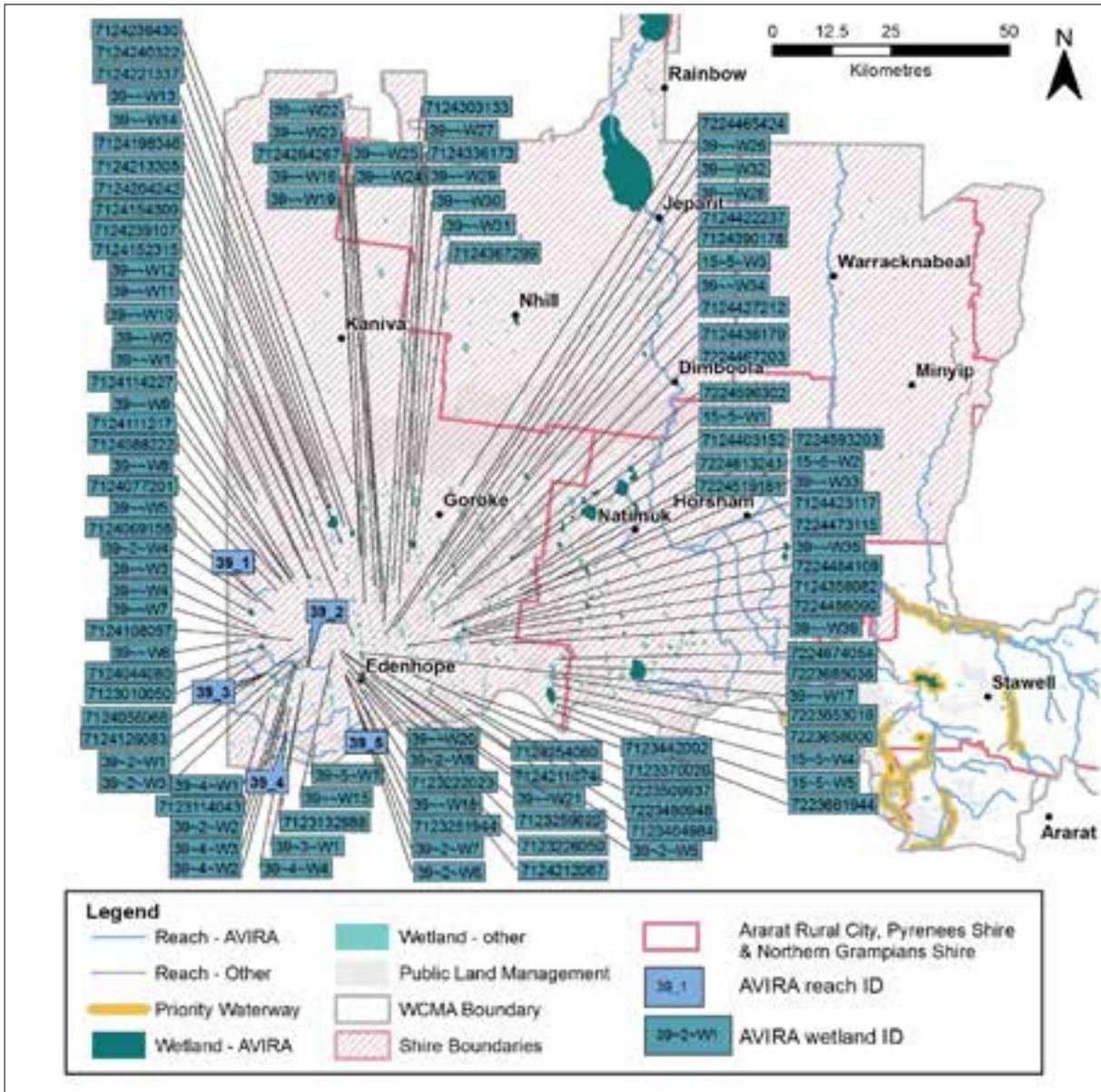


Figure 6-5 Key waterways of the West Wimmera Shire in the Wimmera CMA region

6.6.1.1. West Wimmera Shire Waterway Values

The substantial number of wetlands in the West Wimmera is a very high value in itself. The long chains of wetlands provide a very good level of connectivity for frogs, birds and vegetation. Some of the larger wetlands like Lakes Wallace, Charleglark and Ratzcastle are a great recreational focus for the region when they are full of water. Many waterbirds, including threatened bird species like Brolgas and Freckled Ducks, rely on these wetlands for habitat and breeding locations. Some wetlands north of the Little Desert like Lake Lawloit and Serviceton North Railway Dam are high valued by the local community.

Mosquito Creek and its tributaries are of high value given they provide the majority of inflows into the Bool and Hacks Lagoon Ramsar Site in South Australia. Also threatened species including Yarra Pygmy Perch, Southern Bell Frogs and Dwarf Galaxias are found in Mosquito Creek.

6.6.1.2. West Wimmera Shire Waterway Threats

Monitoring data has shown that wetland habitat is being lost over time through factors such as drainage and cropping (Figure 6-6). As well as impacting on environmental values, through soil

disturbance and loss of wetland vegetation, cropping in wetlands also poses risks to landholder profitability. Crops can be lost or the yield reduced through inundation with the result that input costs may exceed the value of the yield. These impacts lead to a massive loss of wetland-dependent environmental values. Over-grazing also reduces the environmental value of wetlands through reducing the quality of water and vegetation. Poor management of land surrounding wetlands also leads to water quality and invasive plant impacts.

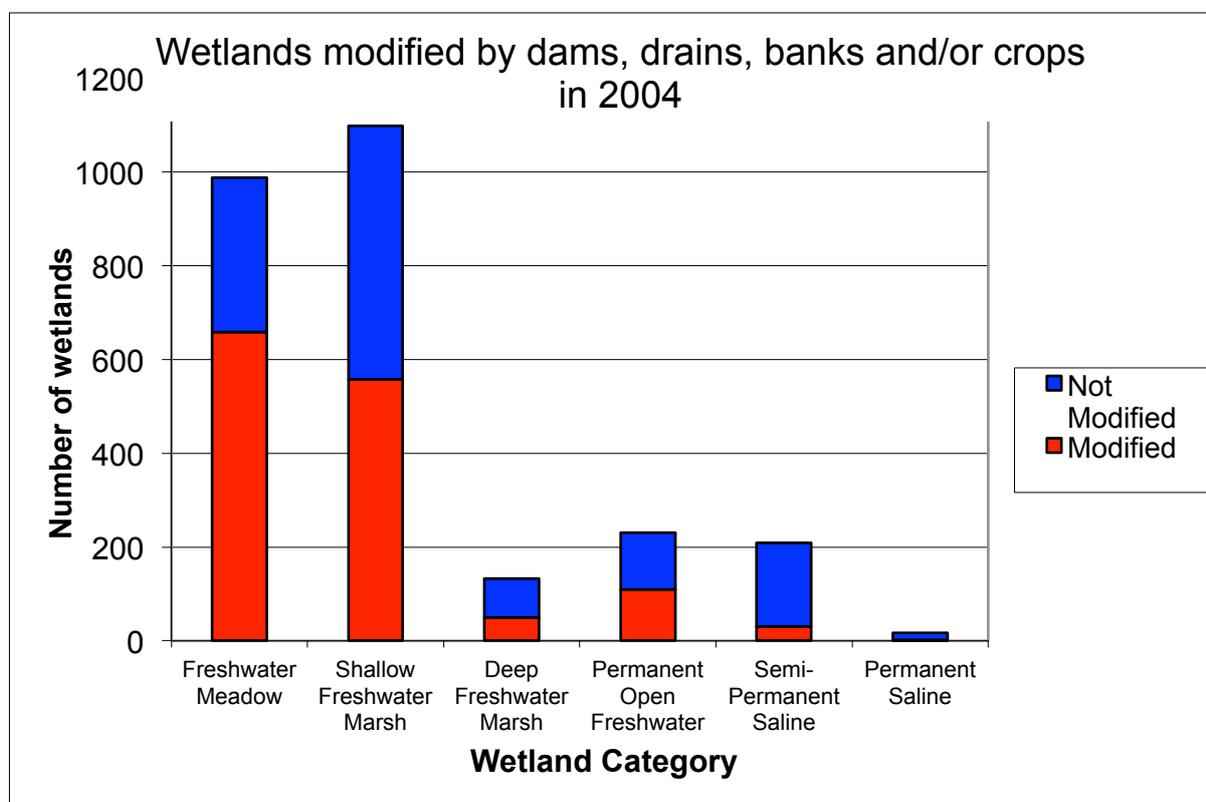


Figure 6-6 Proportion of wetlands modified by various activities in the Wimmera CMA region in 2004 (Wimmera CMA, 2011)

Clearing of vegetation is also a threat to waterways in the region. The West Wimmera is fortunate in having abundant good quality native vegetation. Activities like cropping and pivot irrigation lead to reduction of native vegetation although typically not in or adjacent to waterways. Declining groundwater levels and water quality also pose a threat to wetlands that have environmental values (e.g. vegetation, wading birds) that rely on sufficiently high groundwater levels. Surface water flows for waterways and groundwater levels have also been affected by various changes in land use, most noticeably when grazing land is converted into timber plantations.

6.6.1.3. West Wimmera Shire Reach Targets

Monitoring

With only a handful of streams in the West Wimmera Shire that only flow periodically during wet conditions, there is limited monitoring information available. Only five reaches are included in the Index of Stream Condition assessment, confined to the south-west of the region. Apart from that, there is a reasonable level of information on Mosquito Creek for fish, water quality and flow, largely collected for the South East NRM Board in South Australia, given its importance for Bool and Hacks Lagoon.

Management Activity Planning

Comprehensive strategic planning has been undertaken for the Mosquito Creek Catchment for the South East NRM Board (Sheldon, 2007) but specific management activity planning has not yet been undertaken in that catchment. Little information exists regarding other streams.

Case Study – Fire and water

Wayne Caldwell’s property ‘Langlea’ at Scrubby Lake has experienced the extremes of the Wimmera’s climate. In 2011, birdlife including brolgas, ducks, parrots and cockatoos abounded once good rains led to water filling Dix Swamp on Wayne’s property. A couple of years later a bushfire sparked by lightning burnt 400 ha including Dix Swamp. Fortunately, other wetlands on his property that are part of the Wimmera CMA’s Wetland Tender project were spared.

Bushfires are of course very much a hazard that planning authorities need to plan for as best they can. From a wetland maintenance and improvement perspective, it is about ensuring that there are a sufficiently sizeable number of diverse wetland types managed to build resilience with opportunities for flora and fauna that may have been lost from a wetland to recolonise. There are also regional Strategic Bushfire Management Plans that need to be factored into planning for revegetation works. This will be undertaken with the development of the Wimmera CMA’s *Carbon Ready Plan*.



Bushfire impacts in 2013 left (Photo: Wayne Caldwell), and Wayne at the location in 2012 right (Photo: D. Fletcher)

Table 6-54 West Wimmera Shire Long-Term Reach Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish	WW RCT 1. Native fish populations will maintain diversity and contribute to the ecological character for Bool and Hacks Lagoons’ Ramsar-listed wetland status.	Bool and Hacks Lagoon retains its Ramsar listing in part due to the presence of a diverse native fish community.
Riparian vegetation condition	WW RCT 2. No declines in ISC Streamside Zone scores. WW RCT 3. 50% of reaches have an ISC Streamside Zone score of 6 or higher.	40 % of reaches have an ISC 2010 streamside zone score of 6 or higher.
Instream habitat and Channel form	WW RCT 4. No declines in ISC Physical Form scores. WW RCT 5. 100% of reaches have an ISC	100% of reaches have an ISC 2010 Physical Form score of 7 or higher.

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
	Physical Form score of 7 or higher.	
Water quality	WW RCT 6. Long-term improved water quality trends.	Water quality very poor (ISC 2010 score of 3) based at one site on Mosquito Creek.
Hydrology (frequency and persistence of water)	WW RCT 7. Stabilisation of streamflow reductions in unregulated streams where it does not impact on wetland hydrology.	No ISC 2010 scores for hydrology. Cease to flow periods extended due to land use change (DSE, 2011). Limited impacts from other sources of water extraction (dams, pumping).

Table 6-55 West Wimmera Shire Reach Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	WW MOT 1. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> .	<i>WIPAMS</i> (Wimmera CMA, 2010) indicates uncertainty around rabbit numbers being within target levels.
Excessive erosion and sedimentation	WW MOT 2. 100% of reaches have less than 10% of stream banks and stream beds eroding.	Bed and bank instability largely not an issue.
Inadequate riparian vegetation quality and extent	WW MOT 3. All reaches have <25% of their length impacted by livestock [#] . WW MOT 4. 85% of reaches at least moderate riparian connectivity*. WW MOT 5. 60% of reaches have greater than 10 m wide riparian vegetation.	All reaches with data have <25% of their length impacted by livestock [#] 80% of reaches have at least moderate riparian connectivity * 60% of reaches have greater than 10 m wide riparian vegetation.
Modified hydrology	WW MOT 6. ISC hydrology sub-index scores remain stable or improve.	No ISC hydrology sub-index scores available for 2010 ISC, although hydrology scores were 10 in 2004 ISC.
Invasive Flora	WW MOT 7. Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . WW MOT 8. All reaches have <11% invasive riparian (tree and shrub) flora. WW MOT 9. 100% of reaches have no high threat invasive flora species present.	<i>WIPAMS</i> (Wimmera CMA, 2010) indicates status unknown. 100% of reaches have <11% invasive riparian (tree and shrub) flora cover. 100% of reaches have no high threat invasive tree flora species present.
Degraded water quality	WW MOT 10. 100% of reaches with an ISC Water Quality sub-index score will be 5 or higher.	One reach with ISC Water Quality sub-index score of 3 (ISC 2010).

[#] Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on riparian areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to banks and vegetation are).

* Moderate riparian connectivity is defined as having 0-39% of streambank has overhanging vegetation with 40-59% of vegetated area being gaps OR 40-64% of streambank has overhanging vegetation with 60-79% of vegetated area being gaps OR 65-79% of streambank has overhanging vegetation with 80-100% of vegetated area being gaps according to ISC 2010.

6.6.1.4. West Wimmera Priority Reach Management Activities

The priority reach in the West Wimmera Shire is Mosquito Creek (Reach 4) and its values are listed in

Table 6-56.

Table 6-56 Priority Reach in the West Wimmera Shire

Reach Name Number	Reasons
Mosquito Creek Reach 4	Environment: High value fish and bird communities. Unique attributes – fish communities within this reach are important for Bool and Hacks Lagoons' Ramsar status Social/Cultural: Significant Aboriginal cultural heritage values.

Table 6-57 Management Activities for Mosquito Creek (Reach 4)

Management Unit		West Wimmera Shire			
Basin	Millicent	Waterway	Mosquito Creek	Identification No.	39-4
Long-term Resource Condition		Targets in Table 6-54 for Fish, Riparian Condition, Water Quality, Instream habitat and Channel form are met			
Values		Environment: High value fish and bird communities. Unique attributes – fish communities within this reach are important for Bool and Hacks Lagoons' Ramsar status Social/Cultural: Significant Aboriginal cultural heritage values.			
Threats		Invasive flora and fauna, Degraded riparian vegetation, Degraded water quality, Changed water regime			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
WW MOT 1	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	WW MA 1. Establish invasive fauna control in riparian areas	40 ha	DEPI, CMA, Landcare, landholders	
WW MOT 3, WW MOT 4, WW MOT 5	All reaches have <25% of their length impacted by livestock [#] , 85% of reaches at least moderate riparian connectivity*, 60% of reaches have greater than 10 m wide riparian vegetation	WW MA 2. Establish riparian management agreements	2 km (8 ha)	CMA, Landcare, landholders	
WW MOT 6	ISC hydrology sub-index scores remain stable or improve	WW MA 3. Implement moratorium on new surface water entitlements for commercial/irrigation use.	N/A	GMMWater	
		WW MA 4. Consider including Mosquito Creek catchment as an intensive management area for land used change as flagged in the <i>Western Region SWS</i> (DSE, 2011).	N/A	DEPI, GMMWater, CMA	
WW MOT 7, WW MOT 8, WW MOT 9	Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , All reaches have <11% invasive riparian (tree and shrub) flora, 100% of reaches have no high threat invasive flora species present	WW MA 5. Establish priority groundcover weed control in riparian areas	80 ha	DEPI, CMA, Landholders, Landcare	
WW MOT 10	100% of reaches with an ISC Water Quality sub-index score will be 5 or higher	Undertake riparian and invasive fauna management activities listed previously	N/A	N/A	
Estimated cost of activities			\$37,600		
Relevant documents: <i>Western Region Sustainable Water Strategy</i> <i>Determination of Environmental Water Requirements for Mosquito Creek Catchment and Bool and Hacks Lagoon</i>					



6.6.1.5. West Wimmera Reach Management Activities for All Reaches

Table 6-58 Management Activities for All West Wimmera Shire Reaches

Management Unit		West Wimmera Shire			
Basin	Wimmera	Waterway	All Reaches	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-54 for Fish, Birds, Riparian Vegetation, Water Quality and Hydrology			
Values	Environment: High value riparian vegetation communities. Social/Cultural: Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Degraded riparian vegetation, Loss of instream habitat (large wood)				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
WW MOT 6	ISC hydrology sub-index scores remain stable or improve	WW MA 6. Implement cap on new surface water allocations for commercial/irrigation use.	N/A	GMMWater	
WW MOT 1, WW MOT 2, WW MOT 3, WW MOT 4, WW MOT 5, WW MOT 6, WW MOT 7, WW MOT 8, WW MOT 9, WW MOT 10	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> , 100% of reaches have less than 10% of stream banks and stream beds eroding All reaches have <25% of their length impacted by livestock [#] , 85% of reaches at least moderate riparian connectivity*, 60% of reaches have greater than 10 m wide riparian vegetation, ISC hydrology sub-index scores remain stable or improve, Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , All reaches have <11% invasive riparian (tree and shrub) flora, 100% of reaches have no high threat invasive flora species present 100% of reaches with an ISC Water Quality sub-index score will be 5 or higher	WW MA 7. Continue waterway management aligned to the scope, purpose and principles of the <i>Memorandum of Understanding – Connecting the Catchments</i> (South East NRM Board, 2009)	N/A	Natural Resources South East, CMA, GMMWater	
Estimated cost of activities			N/A		
Relevant documents: <i>Water Act (1989)</i> <i>Western Region Sustainable Water Strategy</i>					

6.6.1.6. West Wimmera Shire Wetland Targets

Monitoring

Wetlands in the West Wimmera have one of the best data sets regarding their condition in Victoria. Aerial photography and LiDAR (aerial terrain mapping) have been able to map the thousands of wetlands in the West Wimmera Shire and combined with hydrogeological data have enabled them to be classified based on their hydrology and salinity (fresh/ brackish/saline). Periodic collection of this data has tracked the gradual decline in the overall number of wetlands due to impacts like drainage. In contrast to data about their physical characteristics and hydrology, proportionally few (<1%) have been assessed for their ecological values. Given the abundance of wetlands and the diversity of their

condition due to historic land management practices, gaining accurate data on their ecological condition and trends will be an ongoing challenge. This is particularly the case for the threatened Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains.

Management Activity Planning

Strategic planning in terms of the *WWHS* (Wimmera CMA, 2006) and *Wimmera Wetlands Asset Strategy* (Wimmera CMA, 2011) have brought together much of the information with respect to wetland values and threats in the region as well as prioritising areas for management activities. This in turn has informed a number of on-ground wetland maintenance and improvement projects in recent years such as Wetland Tender. Studies have also examined wetland hydrology and geomorphology as well as social and economic drivers for wetland rehabilitation to inform the most suitable tools for wetland rehabilitation.

Table 6-59 West Wimmera Shire Long-Term Wetland Resource Condition Targets

Level	Long-term resource condition (8+ years)	
Linked to	Goals and Values	
Value	Target	2014 Status
Fish/Yabbies	WW RCT 8. Continues to provide recreational fishing/yabbying opportunities.	Recreational fishing/yabbying opportunities available when conditions are wet.
Birds	WW RCT 9. Increased recognition and understanding of wetland bird values. WW RCT 10. Maintenance of duck hunting opportunities.	Supports bird species listed as threatened. Duck hunting undertaken when conditions/regulations allow.
Wetland vegetation condition	WW RCT 11. No declines in IWC vegetation condition. WW RCT 12. Improvement in average IWC scores in the region to moderate. WW RCT 13. Increased understanding of wetland vegetation condition. WW RCT 14. Increase wetland connectivity measures.	Currently average of 'moderate' condition according to IWC. 118 wetlands with IWC data for vegetation. No data available for wetland connectivity as yet.
Water quality	WW RCT 15. Maintain water quality to average of 'good' to 'excellent' according to IWC water properties sub-index. WW RCT 16. Improved knowledge of water quality issues.	Water quality average is 'good' to 'excellent' according to IWC water properties. Water quality information only available at 56 wetlands.
Hydrology (frequency and persistence of water)	WW RCT 17. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.).	Wetland loss (hydrological change between 1994 and 2004 was 18% (SKM, 2006).

Table 6-60 West Wimmera Shire Wetland Management Outcome Targets

Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
Invasive Fauna	WW MOT 11. Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> .	<i>WIPAMS</i> (2010) indicates uncertainty about rabbit numbers being within target levels.
Changed hydrology and wetland form	WW MOT 12. Rate of wetland loss due to earthworks reduced. WW MOT 13. Planning scheme provisions protect priority wetland hydrology and form. WW MOT 14. Priority threats to wetland	Estimated 1391 wetlands in 2013 due to reduce to 887 wetlands by 2022 at current trends (SKM, 2006). No planning scheme provisions implemented to protect wetlands.



Level	Management outcome (1-8 years)	
Linked to	Threats	
Threat	Target	2014 Status
	hydrology understood.	Poor information regarding hydrological threats to wetlands.
Inadequate wetland vegetation quality and extent	WW MOT 15. Increased information about wetland vegetation quality and extent. WW MOT 16. Increased awareness of impacts of cropping on wetland vegetation. WW MOT 17. Priority wetland corridors identified and connection requirements understood. WW MOT 18. 60% of wetlands with high threats regarding livestock access. WW MOT 19. 10% of each wetland type being managed to maintain/enhance wetland vegetation.	118 sites with vegetation condition data available. 37% of landholders surveyed were unsure about the negative impacts of cropping and draining wetlands (Curtis & Mendham, 2012). No information regarding connectivity requirements. 65% of wetlands currently have high threat from livestock access. 194 wetlands protected within long-term agreements.
Invasive Flora	WW MOT 20. Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> . WW MOT 21. All AVIRA wetlands have <11% invasive wetland (tree and shrub) flora. WW MOT 22. 70% of wetlands have: less than 25% total weed cover with high threat weeds present; or less than 50% total weed cover with no high threat weeds present.	Invasive Flora target status unknown but trend data indicates increasing weediness. All wetlands have <11% invasive wetland (tree and shrub) flora. 75% of wetlands have: less than 25% total weed cover with high threat weeds present; or 50% total weed cover with no high threat weeds present.
Degraded water quality	WW MOT 23. No decrease in IWC water properties sub-index score.	IWC water properties scores average of 'good' to 'excellent'.

Impacted by livestock is a qualitative evaluation of the threat posed by the estimated extent and magnitude of livestock impacts on wetland areas (e.g. managed, light grazing for short periods is not classified as a threat whereas major impacts like pugging, extensive tracks and manure as well as damage to edges and vegetation are).

6.6.1.7. West Wimmera Priority Wetland Management Activities

There are a number of wetlands in Hindmarsh Shire that due to their high social, economic, cultural and environmental values are a priority for management activities.

Table 6-61 Priority Wetlands in West Wimmera Shire

Wetland Name Number Locality	Tenure	Reasons
Cowes Swamp (?) 39—W13 Minimay	Crown	Environment: High value bird community and wetland EVCs. Formally recognised (National Park). Excellent IWC score Social/Cultural: Valued for picnics and barbeques. Significant Aboriginal cultural heritage values.
Lake Charlegrark 7124213305 Boorookpi	Crown	Environment: SBirds Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.
Lake Bringalbert 39—W11 Bringalbert	Crown	Environment: Excellent IWC condition Social/Cultural: Valued for picnics, barbeques, boating and camping. Significant Aboriginal cultural heritage values.
Lake Wallace 7123259020 Edenhope	Crown	Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.
Lake Ratzcastle 39—W32 Kangawall	Crown	Social/Cultural: Valued for picnics, barbeques, game hunting, boating and camping. Significant Aboriginal cultural heritage values.

Wetland Name Number Locality	Tenure	Reasons
White Lake 15-5-W4 Douglas	Crown	Environment: Listed Nationally Important wetland, Significant birds Social/Cultural: Game hunting. Significant Aboriginal cultural heritage values.
Bitter Swamp 15-5-W4 Douglas	Crown	Environment: Listed Nationally Important wetland, Significant birds, wetland vegetation Social/Cultural: Game hunting Significant Aboriginal cultural heritage values.
Polpara Lake 39—W36 Charam	Crown	Environment: Significant birds, wetland vegetation Social/Cultural: Significant Aboriginal cultural heritage values.
Lake Carpolac 39—W32 Ozenkadnook	Crown	Environment: Significant amphibians, fish birds, wetland vegetation Social/Cultural: Significant Aboriginal cultural heritage values.
McClossen Swamp 39—W17 Edenhope	Crown	Environment: Significant birds, wetland vegetation Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed 39—W31 North west of Brooks Swamp , Goroke	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed 39—W12 East of Apsley Natimuk Road, Tallageira	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed 39—W9 West of Lake Bringalbert, Bringalbert	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Kakadu South 39—W24 North west of West Hut Swamp, Patyah	Freehold	Environment: Excellent IWC Condition Potentially a formally recognised Seasonal Herbaceous Wetland (Freshwater) of Temperate Lowland Plains Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed (Fish Swamp?) 39—W26 West of Lake Yallakar, Awonga	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Lake Yampitcha 39—W17 Edenhope	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed 7223685038 South of Lake Copper Colour, Brooksby	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.
Unnamed 7224596302 West of Toaan Reference area, Gymbowen	Crown	Environment: Excellent IWC condition Social/Cultural: Significant Aboriginal cultural heritage values.

Priority wetlands also include Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains. Figure 6-7 shows the location of the 41 potential Seasonal Herbaceous Wetlands in the West Wimmera Shire that have information for inclusion in the AVIRA database. This has enabled a determination of values and threats common to these wetland types and they are not a priority for management activities above other Seasonal Herbaceous Wetlands in the West Wimmera Shire.

Wetland Planning for the West Wimmera Shire

Given the vast number of wetlands in West Wimmera Shire, there are challenges in planning for their effective management at a number of levels from individual wetlands to the vast wetland chains that provide vital connections for flora and fauna, especially during very wet years when these wetlands typically sequentially fill and spill. Detailed data is only available for a very small fraction of wetlands in the region (<1%), however this provides some indicative information on the threats and values and has enabled planning to progress to look at priority wetland systems and types which are listed as following:

Priority small wetlands within large tracts of public land

Index of Wetland Condition and other data sources on threatened species have highlighted the high value of small wetlands contained within large areas of public land such as the Little Desert National Park, Morea State Forest and Tallageira Nature Conservation Reserve. Given their small size in relation to the public land they are situated their threat level is generally quite low and typically involves invasive flora and fauna. Management activities to manage these wetlands are outlined in Table 6-62.

Large wetlands within small tracts of public land

Lakes like Charlegrark, Wallace, Bringalbert and Ratzcastle are iconic wetlands for the region – when they contain water they are extremely popular with great opportunities for water-skiing, fishing, camping etc. Some like Lake Bringalbert and White Lake are in excellent environmental condition and all are known to support a vast number and diversity of birds when they contain water. Their condition is affected due to the fact that they only have a small buffer of wetland vegetation around them and are surrounded by agricultural land. The main threats relate to invasive flora and fauna, small wetland vegetation buffers, poor water quality and impacts to their hydrology through drainage and channelisation. Management activities to manage these wetlands are outlined in Table 6-63.

Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains

These wetlands are listed as threatened under the *EPBC Act*. There are potentially around 1,500 of these wetlands in the West Wimmera Shire in the Wimmera CMA region (about 70% of all wetlands in the West Wimmera Shire) but research has highlighted that these wetlands are most vulnerable to loss from activities such as cropping, overgrazing and drainage (SKM, 2006). Yet they provide important linkages between the larger, more permanent wetlands on both private and public land which tend to be better preserved due to a combination of land tenure and reduced viability for agricultural production.

Wetland condition data indicates that the better condition wetlands tend to be focussed in a chain along the Lawloit Ridge north of the Little Desert and running south from Minimay-Morea to Mundarra – Kadnook. These wetland chains provide connectivity between large areas of public land, typically have higher environmental values within a landscape context (using GIS-based data, namely Natureprint – see Figure 3-1) and should be the focus of works to maintain good condition Seasonal Herbaceous Wetlands in this area. It also aligns with and would complement previous work undertaken by other groups such as the Kowree Biolink between the Glenelg River and Little Desert created by the Kowree Farm Tree Group. Key threats include drainage, soil, degraded vegetation, invasive flora and fauna and overgrazing. Management activities to manage these wetlands are outlined in Table 6-64.

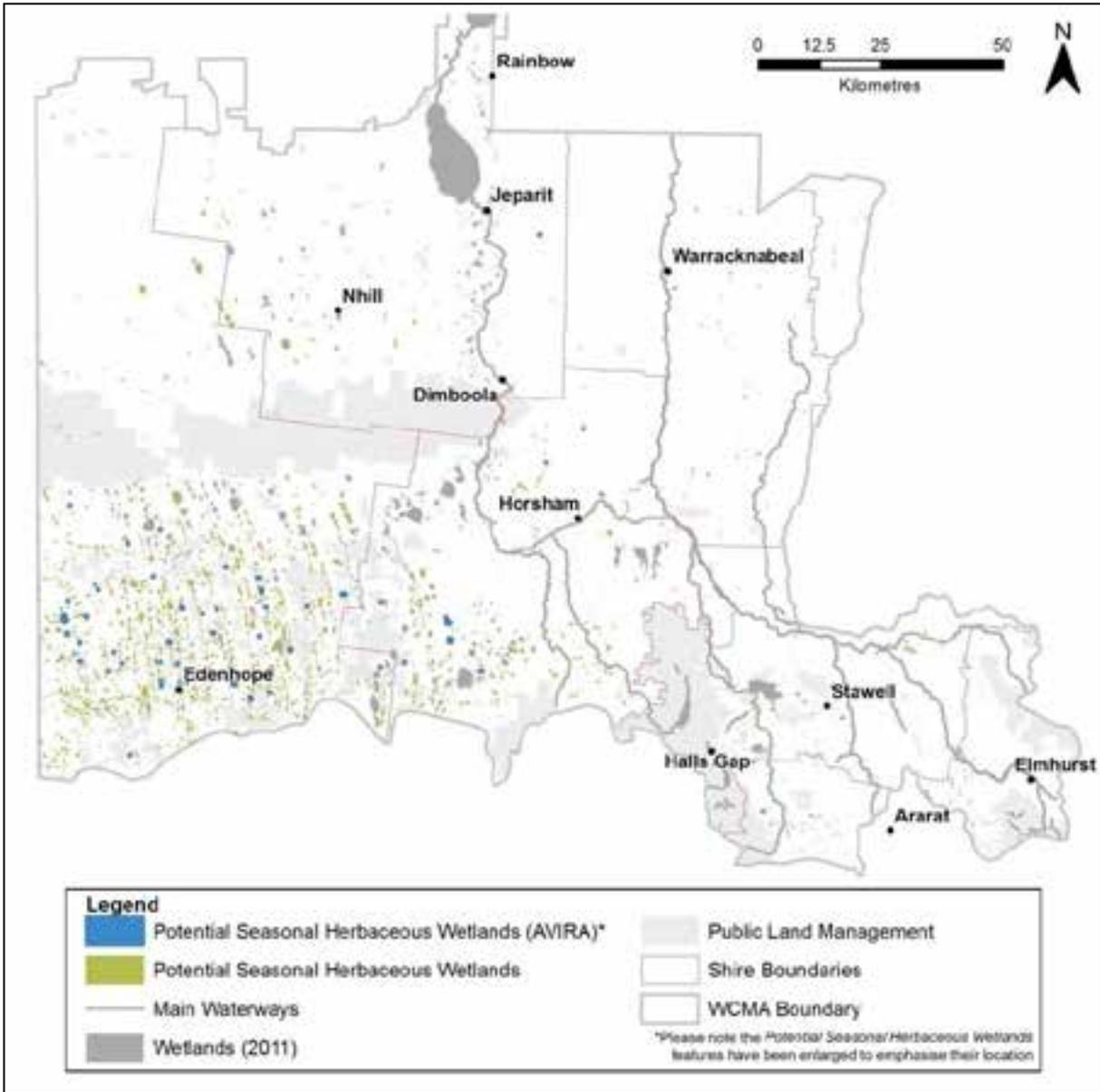


Figure 6-7 Potential seasonal herbaceous wetlands in the Wimmera CMA region including locations where AVIRA data is available.

Table 6-62 Management Activities for priority small wetlands within large tracts of public land

Management Unit	West Wimmera				
Wetland Type	Priority small wetlands within large tracts of public land				
Basin	Millicent	Waterway	Cowes Swamp Polpara Lake Unnamed Wetlands	Identification Nos.	39—W13 39—W36 39—W31 39—W9 39—W12 39—W26
Long-term Resource Condition	Targets in Table 6-59 for Birds, Wetland Vegetation Condition, Water Quality, Hydrology				

Values	Environment: High value vegetation and bird communities. Social/Cultural: Valued for picnics and barbeques (Coves Swamp). Significant Aboriginal cultural heritage values.			
Threats	Invasive flora and fauna			
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners
WW MOT 11	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> , Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	WW MA 8. Establish invasive fauna control for wetlands	160 ha	PV, CMA
WW MOT 19, WW MOT 20, WW MOT 21	10% of each wetland type being managed to maintain/enhance wetland vegetation, Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , All AVIRA wetlands have <11% invasive wetland (tree and shrub) flora	WW MA 9. Conduct assessment into priority areas for invasive plant management in wetland areas (bridal creeper)	1 report	CMA, PV, Local govt, Landcare, Landholders
		WW MA 10. Establish priority groundcover weed control in wetland areas	160 ha	PV
Estimated cost of activities		\$88,000		
Relevant documents: <i>Little Desert National Park Management Effectiveness Report Card</i> <i>Wimmera Wetlands Asset Strategy</i>				

Table 6-63 Management Activities for priority large wetlands within small tracts of public land

Management Unit	West Wimmera				
Wetland Type	Priority large wetlands within small tracts of public land				
Basin	Millicent, Wimmera	Waterway	Lake Charlegrark Lake Bringalbert Lake Wallace Lake Ratzcastle	Identification No.	7124213305 39—W11 7123259020 39—W32
Long-term Resource Condition	Targets in Table 6-59 for Birds, Fish, Wetland Vegetation Condition, Water Quality, Hydrology				
Values	Environment: High value bird communities. Excellent IWC condition (Lake Bringalbert) Social/Cultural: Valued for picnics, barbeques, boating, swimming, fishing and camping. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, degraded buffer				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
WW MOT 11	Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i> , Achieve waterway relevant invasive fauna targets in the <i>WIPAMS</i>	WW MA 11. Establish invasive fauna control for wetlands	1,600 ha	PV, CMA	
WW MOT 19, WW MOT 20, WW MOT 21	10% of each wetland type being managed to maintain/enhance wetland vegetation, Achieve waterway relevant invasive flora targets in the <i>WIPAMS</i> , All AVIRA wetlands have <11% invasive wetland (tree and shrub) flora	WW MA 9. Conduct assessment into priority areas for invasive plant management in wetland areas (bridal creeper)	1 report*	CMA, PV, Local govt, Landcare, Landholders	
		WW MA 12. Establish priority groundcover weed control in wetland areas	1600 ha	PV, CMA, DEPI, local govt.	
		WW MA 13. Investigate fire management regime effectiveness on phalaris and	1 report	PV, CMA	

		other invasive grass species		
WW MOT 19	10% of each wetland type being managed to maintain/enhance wetland vegetation	WW MA 14. Coordinate engagement events/ Develop publications to reduce impact of intense recreational pressure (e.g. from yabbing) on wetlands	2 events/ publications	CMA, PV, DEPI, local govt
WW MOT 14	Priority threats to wetland hydrology understood	WW MA 15. Investigate influences on and threats to priority wetland hydrology	1 report*	CMA, PV, local govt.
Estimated cost of activities		\$400,000		
Relevant documents: Wimmera Wetlands Asset Strategy				

Table 6-64 Management Activities for Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains in West Wimmera Shire.

Management Unit		West Wimmera			
Wetland Type		Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains			
Basin	Millicent, Wimmera	Waterway	Numerous	Identification No.	See Figure 6-7 plus others
Long-term Resource Condition		Targets in Table 6-59 for Birds, Wetland Vegetation Condition, Water Quality, Hydrology			
Values	Environment: High value vegetation and bird communities. Social/Cultural: Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, overgrazing, degraded buffer				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
WW MOT 12, WW MOT 18, WW MOT 19, WW MOT 20, WW MOT 21	Rate of wetland loss due to earthworks reduced, 60% of wetlands with high threats regarding livestock access, 10% of each wetland type being managed to maintain/enhance wetland vegetation, Achieve waterway relevant invasive flora targets in the WIPAMS, All AVIRA wetlands have <11% invasive wetland (tree and shrub) flora	WW MA 16. Establish wetland management agreements WW MA 17. Investigate mechanisms and options for securing wetland outcomes in perpetuity	1,800 ha (233 wetlands) 1 report	CMA, landholders CMA, landholders	
WW MOT 12, WW MOT 16, WW MOT 18, WW MOT 19	Rate of wetland loss due to earthworks reduced, Increased awareness of impacts of cropping on wetland vegetation, 60% of wetlands with high threats regarding livestock access, 10% of each wetland type being managed to maintain/enhance wetland vegetation	WW MA 18. Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	8* events/ publications	CMA, DEPI, Field and Game	
WW MOT 15, WW MOT 18, WW MOT 19	Increased information about wetland vegetation quality and extent, 60% of wetlands with high threats regarding livestock access, 10% of each wetland type being managed to maintain/enhance wetland	WW MA 19. Undertake trial of mapping and identification of Seasonal Herbaceous Wetlands	1 report	CMA	

	vegetation			
WW MOT 23	No decrease in IWC water properties sub-index score	Undertake wetland protection management activities listed above	N/A	N/A
Estimated cost of activities		\$4,070,000		
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i> <i>Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains</i>				

6.6.1.8. West Wimmera Shire Wetland Management Activities for All Wetlands

Table 6-65 Management Activities for All West Wimmera Shire Wetlands

Management Unit		West Wimmera			
Basin	Wimmera	Waterway	All Wetlands	Identification Nos.	NA
Long-term Resource Condition		Targets in Table 6-59 for Fish, Birds, Wetland Vegetation, Water Quality and Hydrology			
Values	Environment: High value amphibian, vegetation and bird communities. Social/Cultural: Valued for picnics, barbecues, boating, swimming, fishing, game hunting and camping. Significant Aboriginal cultural heritage values.				
Threats	Invasive flora and fauna, Overgrazing, Degraded buffer, Altered wetland form, Soil disturbance, Changed water regime				
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/ Partners	
WW MOT 12, WW MOT 16, WW MOT 18, WW MOT 19	Rate of wetland loss due to earthworks reduced, Increased awareness of impacts of cropping on wetland vegetation, 60% of wetlands with high threats regarding livestock access, 10% of each wetland type being managed to maintain/enhance wetland vegetation	WW MA 18 Coordinate engagement events (e.g. courses)/ Develop publications to increase awareness around cropping/ drainage impacts on wetlands	8* events/ publications	CMA, DEPI, Field and Game	
WW MOT 12, WW MOT 13	Rate of wetland loss due to earthworks reduced, Planning scheme provisions protect priority wetland hydrology and form	WW MA 20. Support planning scheme amendment for Environmental Significance Overlay affecting wetlands	1 amendment	CMA, local govt	
		WW MA 21. Issue referral responses for Environmental Significance Overlay affecting wetlands	Referral responses TBD	CMA, local govt.	
WW MOT 17	Priority wetland corridors identified and connection requirements understood.	WW MA 22. Investigate priorities for wetland connectivity	1 report	CMA	
Estimated cost of activities		\$280,000			
Relevant documents: <i>Wimmera Wetlands Asset Strategy</i>					

6.7. Catchment-Wide Management Issues

The effective management of waterways is complex, challenging and ever-evolving. Variability in climate, land use and the interactions with surface and groundwater continuously shape the characteristics of our waterways. Competing demands for water resources and the uses of the

waterways themselves require well-measured, flexible and sustainable actions. New and emerging threats, risks and opportunities will continue to influence the overall management of our waterways.

The *Victorian Waterway Management Strategy (VWMS)* (DEPI, 2013) covers a number of management issues in detail from a state perspective, providing policies and actions to improve current arrangements. The *WWS* covers a number of the key management issues from a local perspective as well as proposing actions to be implemented during the life of the *WWS* that align with policies and actions outlined in the *VWMS*.

6.7.1. Recreational Use of Waterways

The recreational values associated with Wimmera waterways are plentiful. Across the catchment there are many and varied opportunities to enjoy what the region's waterways have to offer such as water-skiing at Lake Fyans, fishing in the Wimmera River or camping at Lake Charlegrark to name but a few. This was reflected strongly in the initial community consultation process for the *WWS* especially during the 'Make a Splash' campaign. Recreational activities, if not managed appropriately, may reduce other values associated with the region's waterways. The following section outlines management issues associated with the recreational use of waterways.

6.7.1.1. Recreational Fishing

Background

Many of the region's waterways are popular fishing spots. Native species, namely Golden Perch, Silver Perch, Freshwater Catfish and Murray Cod have historically been stocked in the Wimmera River and water storages to improve angling as they are not endemic to the region. Of these species, only Freshwater Catfish are self-sustaining in the Wimmera with the remainder having been managed as a 'put-and-take' fishery. Exotic angling species including Rainbow Trout, Brown Trout, Chinook Salmon, Redfin, Goldfish, Tench and Carp have also been historically introduced in Wimmera waterways. Redfin, Goldfish, Tench and Carp have become self-sustaining in the region. Captures of Australian Bass have been reported, having been illegally translocated into the Wimmera River although the size and status of the population is unknown. River Blackfish is the only angling species native to the region but due to pressures such as reduced water quality and the introduction of other species, has become restricted in both range and population size. Yabbying is also extremely popular in wetlands. DEPI is the responsible government department for the ongoing management and regulation of recreational fishing.

Issues

Exotic species can pose a threat to native fish, competing with native fish for resources and habitat and especially preying on small-bodied fish species like gudgeons, pygmy perch, smelt and galaxias. Redfin is also known to be a vector of the Epizootic Haematopoietic Necrosis (EHN) virus which impacts on other fish species.

The boom-bust cycle of wet and dry conditions means that in wetlands and water storages there can be periods of intense pressure with large numbers of people taking advantage of excellent fishing or yabbying conditions in a short time period. Sometimes this leads to damage to tracks, vegetation and facilities as well as occasional problems with littering and unattended campfires.

Stocking fish in lakes in such a variable climate also creates risks around fish death events given that years of low rainfall and high evaporation rates can mean that they will have little to no water within a couple of years. During community consultation it was highlighted that there is also uncertainty about how water resource management operations and environmental water releases would affect recreational fishing opportunities.

Wimmera Recreational Fisheries Management Priorities (Appendix 1) was developed by DEPI Fisheries in consultation with regional angling and native fish advocacy representatives, and



Wimmera CMA staff and advisory committee members. It outlines priorities for actions and investment to improve recreational fishing and environmental outcomes in the region of the next eight years. An additional action relating to angling and waterway management is listed below.

Action 1

Encourage responsible fishing behaviour with respect to minimising environmental impacts on wetlands.

Who: Wimmera CMA, DEPI, Parks Victoria, VRFish

6.7.1.2. Recreational Duck Hunting

Background

Duck hunting is a popular activity in the Wimmera region. Duck hunters come from far and wide to shoot ducks on wetlands across the region which in turn provides economic benefits to the local economy through purchasing equipment and supplies. DEPI is the responsible government department for the regulation of duck hunting and an independent Game Management Authority was established to improve the management of and education about hunting. Wimmera CMA has worked with local landholders and the Field and Game Australia in recent years to promote good wetland management on freehold land as the best way of increasing opportunities for duck hunting whilst achieving broader environmental outcomes.

Issues

The VWMS provides state-wide direction regarding duck hunting and waterways. Regulatory processes exist to ensure duck hunting is undertaken in a safe and sustainable manner.

Action 2

Continue to support good wetland management on freehold land to improve duck hunting opportunities.

Who: Wimmera CMA, Field and Game, landholders, DEPI

6.7.1.3. Recreational use of Lakes and Reservoirs

Background

Lakes and reservoirs across the region are hotspots of activity when they contain water. Fishing and water-skiing are the main activities although people will come to camp and just enjoy the scenery, paddle a canoe or look at the abundance of birds using the lake as habitat. Many people are familiar with the episodic nature of Wimmera lakes, filling during floods and drying during droughts and know that water levels can fluctuate significantly from year to year. A future of greater climate extremes will impact on the frequency and duration of recreational opportunities for these lakes.

Issues

Controversy around the recreational use of certain lakes and reservoirs has endured as long as there has been an ability to artificially reduce or increase water levels. Water storages are managed primarily for the security of supply for water entitlement holders, with the aim of minimising the duration and severity of water restrictions for towns, farms and businesses. Decreasing efficiency of storage operation to improve recreational opportunities for one part of the region can threaten social, economic, cultural and environmental outcomes for the much of the broader region. Water kept or moved somewhere will affect different parts of the community at different times.

GWMWater, in their role as water storage manager has some discretion over release points and water transfers which may be able to temporarily allow a longer duration of recreational water use provided it has a negligible impact on efficiency of system operations but this will only ever be opportunistic. A key issue will be determining the appropriate management of storages that have environmental values associated with their ongoing wetting and drying for consideration in context of broader storage operations.

Action 3

Undertake study on appropriate hydrological regimes for Lake Lonsdale and Lake Toolondo to maintain environmental values where possible.

Who: Wimmera CMA, GWMWater

Other recreational lakes rely solely on localised catchment inflows but there has been concern about catchment activities potentially reducing inflows such as stock and domestic dams, drainage works, cropping practices and land use change as well as climatic variability. Investigations into the changing hydrology for wetlands with high recreational and environmental values will be able to determine the magnitude and consequences of changes in hydrology which would have broader applications for the hydrology of many wetlands in the region.

Action 4

Undertake investigation into hydrological impacts and consequences for key recreational lakes with high environmental values.

Who: Wimmera CMA

6.7.2. Environmental Water Management

Background

Environmental water management has a long history in the Wimmera. Experimental environmental flows were released for the Wimmera River in the late 1980's. Water savings from the Northern Mallee Pipeline were used to provide environmental water to the Wimmera River from 1993 onwards when there was sufficient volumes in headworks storages. Since then there has been significant increases in both the size of water entitlements available for environmental watering and the knowledge and science used to inform decision-making. There have also been major changes in the policies and processes that relate to environmental water management. Within the Wimmera, the savings from the Wimmera Mallee and Northern Mallee Pipeline Projects will enable crucial water to be provided to the regulated waterways of the region for years to come. The purchase by the Commonwealth of the entitlements formerly held by irrigators will also provide substantial benefits for the Wimmera River and in turn the broader community who use the river. The combination of these environmental water recovery efforts will also lead to improvements in the level and duration of inundation on the Wimmera River's terminal lakes, although very wet conditions will always be required to fill them.

The VWMS outlines the issues around environmental water management, principles underpinning environmental water decision making and the roles and responsibilities of the various agencies involved in environmental water management.

Environmental water management can be grouped into two specific components;



- Unregulated water - flows in creeks and rivers upstream of headworks water storages or water that is unable to be harvested and stored in headworks storages due to operational rules (e.g. passing flows) or infrastructure limitations (e.g. spills).
- Regulated water – allocations of water to the Victorian Environmental Water Holder that can be deliberately released from storages into creeks, rivers or wetlands to meet objectives specified in seasonal environmental watering proposals.

Some waterways in the region are groundwater-dependent ecosystems (GDEs). In these waterways, groundwater contributes to driving the natural hydrological regime and water properties which, in turn, maintain waterway values. Changes to groundwater levels or quality threaten those values. Some wetlands in the Natimuk Douglas Chain of Lakes rely on saline groundwater in part to fill and a number of bird and plant species rely on these saline wetlands for habitat. In other places, trees and shrubs tap into groundwater to survive during dry spells and droughts.

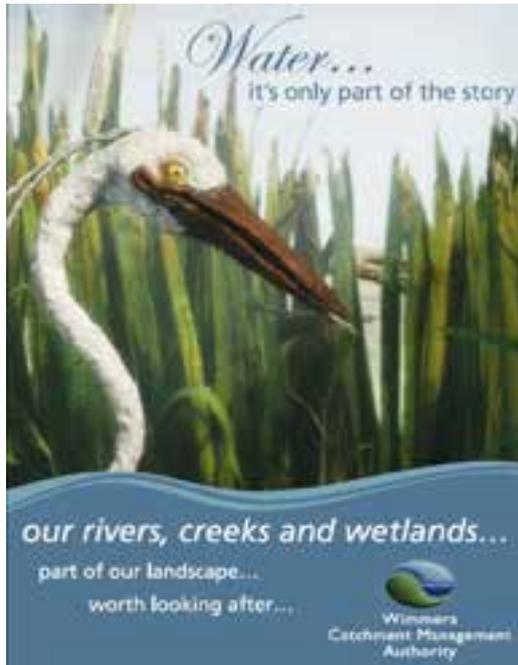
Issues

Given the relatively rapid progress of environmental water management and water resource management and policy there is a need to focus on community engagement and education about the objectives and processes behind water allocation and usage, especially environmental water releases. This is not unique to the region and effort will be required at federal, state and local level to improve communication between government departments, agencies and the community.

There are also a number of opportunities to improve the efficiency and effectiveness of environmental water delivery. This can be achieved through improving infrastructure at delivery points or enhancing the operation of current infrastructure (e.g. weirs) as well as ongoing monitoring to determine if the desired environmental outcomes are being achieved. This is partially achieved through the implementation of the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP), a comprehensive program looking at the outcomes for fish and vegetation and geomorphology achieved by flows at eight regulated rivers across Victoria which includes the Wimmera and MacKenzie Rivers. However there is a requirement for other monitoring to determine what impact flows are having on other waterways within the region and on other parameters (e.g. platypuses, water quality, and macroinvertebrates). Finally there is an ongoing need to ensure that environmental water is actually reaching target locations at desired rates and durations. This has been achieved through a network of telemetered stream gauges at key points in the catchment, although there are always opportunities to expand this network.

Case Study – Waterway values during the drought

During the depths of the record drought conditions that prevailed from 1997 through to 2009, the Wimmera CMA commissioned renowned Natimuk animator Dave Jones to produce a series of ads. They used sound bites of local residents talking about the values of the region's waterways in wet and dry conditions and matched them to animated fish, birds, mussels and trees in an engaging manner and provided a valuable reminder that no matter the circumstances, the region's waterways were something to be valued.



Part of the media campaign highlighting the values of the region's waterways.

Action 5

Undertake actions (e.g. SMS updates, website features) to improve communication to the broader community around water resource management with respect to environmental water releases.

Who: Wimmera CMA, GWMWater, VEWH, DEPI, CEWH

Action 6

Develop processes for including community feedback and information regarding environmental water into annual water planning processes.

Who: Wimmera CMA

Action 7

Facilitate the upgrading of infrastructure to improve the efficiency and effectiveness of environmental water releases.

Who: Wimmera CMA, GWMWater



Action 8

Identify and implement options for improving the use of current infrastructure to get better environmental water release outcomes.

Who: Wimmera CMA, GWMWater, local govt.

Action 9

Undertake monitoring (e.g. VEFMAP) to determine the effectiveness of environmental water releases in achieving outcomes targeted.

Who: Wimmera CMA, DEPI

6.7.3. Riparian and Wetland Buffer Management

Background

Many of the values held and ecosystems services provided by waterways are protected by the vegetation that grows along rivers and streams and around wetlands. These services include:

- Filtering of overland flows into waterways to trap sediment, pathogens and nutrients which in turn improves water quality for towns, farms, recreation and the environment;
- Stabilising the edges of waterways to reduce erosion rates;
- Providing connectivity and habitat for native fauna;
- Shading the water which regulates temperatures for aquatic fauna and reduces algal blooms; and
- Storing carbon.

Wimmera CMA working in partnership with other organisations (e.g. Project Platypus) and landholders has led to significant works being undertaken in recent years to improve riparian and wetland vegetation to achieve those functions.

Issues

The management of frontage of waterways can be quite complex at times, given the different management arrangements associated with the tenure of the land. Major waterways and the land abutting them is often Crown land managed by DEPI, Parks Victoria or local government. In many cases the riparian or wetland buffer land is next to farmland and is therefore used by the adjoining landholder under a licence which establishes conditions for its management. Sometimes land next to waterways in and around townships is administered by committees of management acting on behalf of government. There are also quite a few examples where waterways are completely within freehold land. Ownership and management of land adjoining creeks, rivers and wetlands can be confusing for agencies and the communities and this presents an ongoing challenge. This is especially the case with changing ownership of freehold land adjoining licensed Crown land given the licence is not automatically transferred upon sale of the adjoining freehold land. Processes are being continually improved to ensure landholders still have legal access to water for stock when there are changes to their Crown frontage licences aimed at improving the environmental outcomes for riparian land.

Case Study - Securing Priority Riparian Areas (SPRA)

Starting in 2010, the SPRA project was a three year project was undertaken to secure government investment in Crown frontages by improving their management and administration. The project focussed on building co-operation between CMAs and DEPI to develop processes and standards for the management of Crown frontages.

Data on landholder practices from *The Social Drivers of Natural Resource Management in the Wimmera* report (Curtis & Mendham, 2012) shows that the role of fencing to manage stock access is increasingly well-understood to manage revegetation works for waterways. However there is a high degree of uncertainty of the subsequent benefits of these management activities for bank stability and water quality. Therefore a stronger link between the activity and the outcome needs to be made to demonstrate the values of these works and encourage ongoing uptake.

Action 10

Wimmera CMA to continue to support improved management of Crown frontages in priority areas through working with DEPI Regional Services and licences to ensure the implementation of minimum standards for managing licensed frontages (once these are introduced).

Who: Wimmera CMA, DEPI

Action 11

Wimmera CMA will undertake monitoring at locations where riparian and wetland management agreements have been developed to ensure that minimum standards are being adhered to with respect to invasive plant and animal management and grazing.

Who: Wimmera CMA

Action 12

Wimmera CMA will work with DEPI and GWMWater to assist landholders who have Crown frontage licence conditions changed for improved environmental outcomes legally access water for stock.

Who: Wimmera CMA, DEPI, GWMWater

Action 13

Wimmera CMA will work with DEPI and other agencies to develop and communicate information about the outcomes achieved by riparian and wetland buffer management with respect to water quality and bank stability.

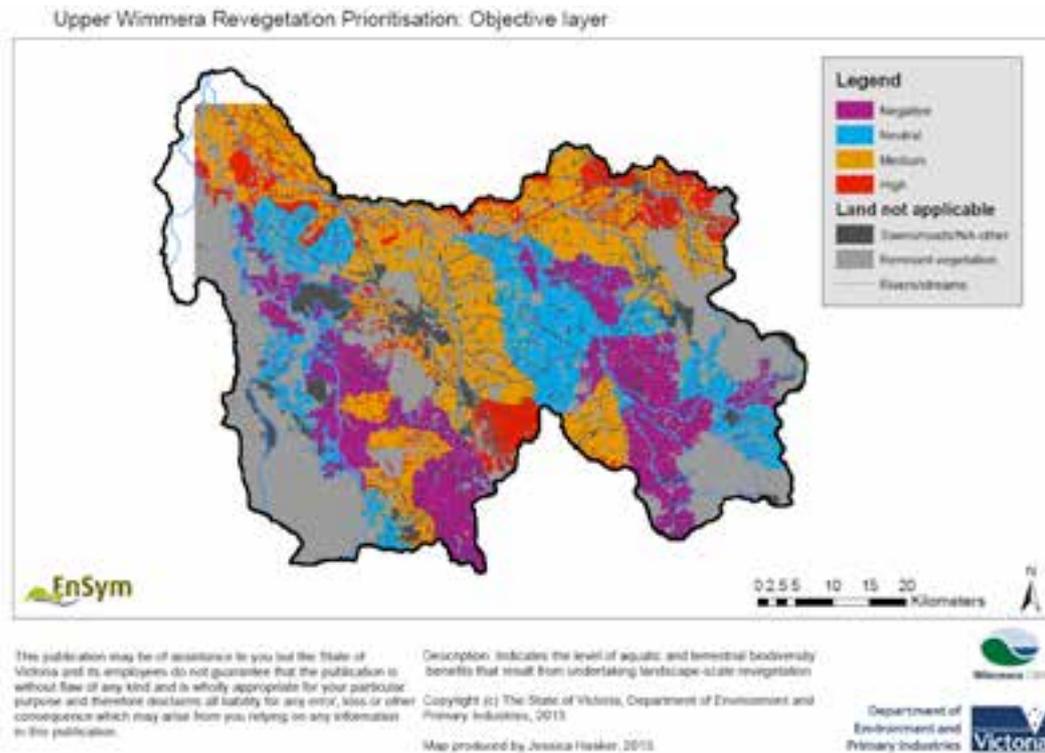
Who: Wimmera CMA, DEPI



Case Study - Upper Wimmera Large Scale Revegetation Prioritisation Tool

A project completed by DEPI ecomarkets in 2013 involved the development of an innovative tool to assist in the prioritisation of areas for large-scale revegetation based on maximising the positive benefits. Positive contributions around improvements to biodiversity, water quality (including salinity and turbidity) were offset by reductions that these works would have on streamflows given the impact revegetation has on reducing runoff and groundwater reaching creeks and wetlands.

The tool uses the EnSym modelling platform and a Bayesian Belief Network to provide indications of the magnitude of the benefit based on these criteria with the potential for it to be expanded at a later date to include factors such as fire management, agricultural productivity and carbon sequestration.



There have also been concerns raised locally about vegetated wetland and riparian areas presenting an increased bushfire risk. The *Riparian Land and Bushfire Risk Resource Document* (CFA, 2014) discusses the details of waterway land management and bushfires in depth. Key points are that research indicates that under most conditions land adjoining waterways poses less of a risk to assets from bushfires than most other vegetation types due to the fact that they tend to contain more moisture and tend to be further away from built assets. That said, there is a need to work with land managers to ensure that they are using tools such as controlled grazing and weed control to limit the build-up of weedy vegetation whilst preserving environmental values. Furthermore there is a need to ensure that revegetation planning considers regional Strategic Bushfire Management Plans and vice versa. This work will be largely undertaken during the development of the *Wimmera Carbon Ready Plan* by Wimmera CMA.

Fencing off riparian areas in floodplains is also challenging; it is a matter of balancing desired riparian outcomes with agricultural production, especially as floodplain areas tend to be very productive. Whilst every effort (such as fence type and location) will be made to minimise the risk to these works, they may be damaged by extreme floods, in this case the principles around replacing riparian fences as established in the VWMS will apply.

Action 14

Riparian and wetland management agreements will enable actions to be undertaken to reduce weedy vegetation load (e.g. crash grazing) whilst maintaining environmental values.

Who: Wimmera CMA, DEPI, landholders

Action 15

Planning for revegetation works in riparian and wetland areas is to consider bushfire management (e.g. access points to water for firefighting, proximity to built assets and strategic firebreaks).

Who: Wimmera CMA, Landcare, CFA, DEPI, local govt.

6.7.4. Water Quality

Background

Good water quality is vital to support social, environmental and economic outcomes for the region. Towns and farms need clean water for drinking, washing and activities like spraying crops. Poor water quality can lead to algal blooms and fish deaths in waterways which impacts on recreational opportunities such as water-skiing and angling. Fish, vegetation and macroinvertebrate species are sensitive to poor water quality which can lead to reduced abundance and diversity of aquatic life.

There has been a long and robust data set of water quality data collected in the region over the years through ongoing regional water quality monitoring programs, specific event-based water quality monitoring and data from Waterwatch monitors. This has been able to document the shifts in water quality over time and the impacts of drought and flood.

Issues

The issues around water quality across the Wimmera region are prominent; salinity is a major problem with saline groundwater intruding into many freshwater creeks and rivers. Whilst saline groundwater intrusions are not a recent issue, their impact has increased due to increasing sources (including eroded gullies intersecting with groundwater and land clearing leading to rising water tables) and lower streamflows. Saline water also intrudes into wetlands, for example, along the Natimuk Douglas Chain of Lakes where naturally saline wetlands support a high diversity of bird species and threatened vegetation communities. Other water quality issues relate to excessive nutrients entering waterways and causing problems through issues such as algal blooms and excessive reed growth (Agricultural Victoria Services, 2006). This is compounded by high turbidity levels which occur when eroded sediments muddy up the water and releases nutrients into the river. There are also risks to human and animal health posed by pathogens from animal faecal matter entering creeks and rivers that can be captured by storages for subsequent use as potable water (Water Futures, 2011).

Many of the management activities undertaken by Wimmera CMA, landholders and Landcare groups lead to improved water quality. Riparian and wetland revegetation works filter out nutrients and silt before they enter waterways. Improved vegetation combined with other engineering works reduces stream instability which in turn reduces sediment and nutrient inputs into waterways.



Case Study – Phragmites Investigation

Although it is understood to be native to the region (Earth Tech, 2003a), there has been ongoing concerns about the proliferation of *Phragmites* (common reed) growth in the Wimmera River. In response to this in 2004-05, Wimmera CMA commissioned a team of investigators from Deakin and Monash Universities as well as the (then) Department of Primary Industries to undertake an extremely comprehensive study mapping the distribution of *Phragmites* in the lower Wimmera River and the role it played in capturing nutrients and buffering against reduced water quality.

The *Phragmites* distribution mapping completed by project established a benchmark which can be compared with in future years. Amongst the key findings of the study was that depending on the location along the Wimmera River, *Phragmites* growth was constrained by the lack of nitrogen or phosphorus. It also highlighted the extent of nutrients captured by the stands of *Phragmites* which in turn would significantly reduce the likelihood of algal blooms impacting on the lower Wimmera River (Agricultural Victoria Services, 2006).

In the longer term, management activities such as riparian revegetation and stormwater wetlands will reduce nutrient inputs into the Wimmera River, thereby limiting the growth of *Phragmites* stands in the Wimmera River. Greater streamflows from environmental water releases will also limit the suitable habitat for *Phragmites* as it does not grow in locations where water flows at higher velocities.

In other cases more innovative solutions may be required, for example deep pools in the lower Wimmera River intersect the saline regional groundwater and so the pools stratify with a lower hypersaline section with fresher water above. The hypersaline pools limit the available habitat for fish and macroinvertebrates as well as posing risks to downstream reaches should a slug of hypersaline water be washed out of the deep pools but is not subsequently diluted by higher streamflows.

There is also a need to continue the invaluable work undertaken by Waterwatch volunteers in regularly collecting water quality information across the region. This data is useful for understanding trends over a number of timescales. Waterwatch volunteers also have a passion and knowledge around waterway issues that disseminates throughout the community.

Action 16

Investigate and if possible implement options for managing hypersaline pools in the lower Wimmera River.

Who: Wimmera CMA, VEWH

Action 17

Review Phragmites distribution and nutrient dynamics in the lower Wimmera River.

Who: Wimmera CMA

Action 18

Continue to collect water quality data at key locations as well as supporting Waterwatch volunteers to collect additional water quality data.

Who: Wimmera CMA

6.7.5. The River Channel

Background

The river channel is the crucial element that supports almost all the other elements of a healthy river (vegetation, water quality, aquatic life). Stable river channels provide a diversity of habitat such as deep pools for fish and bugs to live in during dry spells, they also have limited erosion which means that turbidity, nutrient and salt levels are much lower. A healthy river channel also contains in-stream vegetation and snags which in turn provides the habitat for many species to live as well as providing features such as the deep holes scoured out around snags by fast flowing water that many large fish call home.

Issues

Management of the river channel presents challenges during times of flooding, rivers and creeks will always move their channel over time due to sediment erosion and deposition. This process can be drastically accelerated during very high flow events with a channel avulsion leading to a major alteration of the course of a river or creek. This in turn leads to issues around land tenure when the boundary is defined by the channel of the waterway as well as leading to threats to private and public infrastructure such as bridges and crossings.

Threats from channel movement need to be considered by asset owners in a collective sense with all other risks (e.g. bushfire) with risk mitigation strategies developed and implemented. Wimmera CMA can provide information and advice to asset owners around threats posed by waterways.

Activities such as building low level crossings or bridges also present risks in terms of waterway processes should they not be constructed to a sufficient standard and based on an appropriate design. Wimmera CMA is the statutory body that issues licences for works on waterways to mitigate risks to waterways from erosion and other negative impacts associated with the works.

In the past, pieces of large woody habitat (snags) were removed from rivers and creeks with the belief that it would improve the passage of floodwaters. Research indicates that this only has a negligible benefit at a local scale and has a detrimental impact at a catchment scale (Anderson, 2005).

Removing all of the snags and in-stream vegetation means that water rushes out of headwater creeks and all the peak volumes converge on the larger creeks and rivers at the same time creating much higher peak volumes than if there was a slower, more staggered timing of peak volumes from the headwater creeks. Floodwaters hitting large woody habitat disperses its energy thereby slowing the flood rate and reducing erosion and risks to infrastructure.

Large woody habitat is critical in supporting angling fish species as well as reducing erosion rates. However large woody habitat poses a safety risk for recreational water users in places like weir pools and so approval can be gained from the CMA to move it. This is also the case if it poses a risk for erosion or flooding and is typically undertaken by the affected landholder much like they would remove vegetation that has fallen on a fence. Similarly Wimmera CMA works with landholders and land managers (e.g. councils) and where appropriate gives approval for removal of in-stream vegetation such as *Phragmites* and cumbungi to improve access in key locations.

Action 19

When Wimmera CMA is made aware of risks to public assets (e.g. through waterway action planning or information from the community) the information will be communicated to the asset owner/manager.

Who: Wimmera CMA

Action 20



Wimmera CMA will work with groups and the community to highlight the benefits that large woody habitat provides with respect to fish populations and erosion protection.

Who: Wimmera CMA, DEPI, VRFish

Action 21

Wimmera CMA will issue works on waterways licences in accordance with provisions in the Water Act 1989.

Who: Wimmera CMA

6.7.6. Wetland Management

Background

Wetland values are not purely environmental; there are considerable recreational values attached to them but also economic values such as yabby production and periodic grazing. The region's wetlands are a massive tourist drawcard when they contain water however much can be done to manage wetlands when they are wet or dry. Wimmera CMA has focussed on working with other organisations and landholders to maintain and improve wetland values. This has involved tools like; fixed incentives or market-based instruments to enable private landholders to undertake wetland improvement works, planning scheme provisions in the Hindmarsh Shire, incorporating wetland management into farm planning courses as well as community engagement events and extension materials. The VWMS provides a number of policies that aim to build a strong basis for wetland management through improving knowledge about wetland condition and funding management activities to assist landholders with wetland management.

Issues

Community feedback has indicated that there is still substantial scope to promote the Wimmera's wetlands to people outside the region as very worthwhile destinations to visit. Information gathered as part of the WWS development process has also highlighted the risks around wetland management relating to modification due to earthworks (drains and dams) impacting on the hydrology of wetlands. Other impacts such as cropping and overgrazing can lead to the loss of many environmental values of wetlands. Invasive plants and animals have been identified as a major risk through the WWS and related plans such as the *Wimmera Invasive Plant and Animal Management Strategy 2010-2015 (WIPAMS)* (Wimmera CMA, 2010). The drought highlighted issues around roles and responsibilities as well as potential actions associated with wetlands and lakes drying out which the *Guide to Agency Management of Drying Lakes in Victoria* (DSE, 2010) set out to address.

Wimmera CMA sees itself in a leadership position with respect to wetland management within Victoria through being the first CMA to incorporate strategic planning for wetlands as well as rivers and creeks within the *Wimmera Waterway Health Strategy* (Wimmera CMA, 2006). Wimmera CMA also developed and implemented a number of initiatives with key partners such as wetland environmental significance overlays with the Hindmarsh Shire and planning to protect wetlands through the FarmPlan21 program delivered by DEPI. The focus is to continue the momentum in this leadership role through using information from the community and researchers to continuously improve wetland management. Furthermore as multi-year management agreements between landholders and Wimmera CMA expire, the challenge will be to provide an adequate mechanism to secure environmental outcomes into perpetuity. Similarly for wetlands which intersect both Crown and freehold land, there may be options to secure ongoing wetland management through various legal instruments.

Action 22

Seek opportunities to promote the significant environmental values of Wimmera wetlands.

Who: Wimmera CMA, local government

Action 23

Implement relevant responses to manage drying lakes as per Guide to Agency Management of Drying Lakes in Victoria (DSE, 2010).

Who: Wimmera CMA, land managers, other agencies

Action 24

Work with Wimmera CMA Wetlands Advisory Committee and partners to continue to develop innovative and effective wetland protection actions.

Who: Wimmera CMA

Action 25

Investigate and implement most appropriate mechanisms for securing wetland outcomes in perpetuity.

Who: Wimmera CMA, landholders, Parks Victoria, Trust for Nature, Landcare

6.7.7. Waterways in Townships

Background

The value of waterways in and adjacent to urban areas is seen to be exceptionally high amongst the Wimmera community. Weir pools on the Wimmera River and Yarriambiack Creek provide a focal point for towns, similarly with wetlands including Nhill Lake, Lake Marma and Lake Wallace. Community members have invested significant time and effort improving and maintaining the facilities and amenity of these waterways which benefits residents and visitors. Stawell has modified waterways (such as stone-lined creeks) to improve drainage which has impacted on their environmental value however constructed wetlands also built to improve stormwater management (e.g. Cato Lake) have been highlighted as having high social values.

Issues

Waterways in urban areas are particularly at risk of threats from poor water quality due to stormwater inputs and pollution events. Fish death events have occurred in the past due to pollutants entering waterways. A key focus should be improved planning and infrastructure (such as artificial wetlands) to minimise the risk of pollution from industrial areas entering waterways. It should also be noted that stormwater (when of sufficient quality) is a valuable source of freshwater to these waterways especially in times of drought.

Action 26



Promote and support improved planning and infrastructure to deal with threats from stormwater flooding and pollution.

Who: Wimmera CMA, local government, Office of Living Victoria, EPA.

6.7.8. Extreme Events of Flood and Bushfire

Background

The Wimmera has a very long history of bushfires and floods impacting on communities and waterways. Major bushfires affected much of the region in 1851 and 1939 and in more recent years fires such as the Mt Lubra bushfire in 2006 and Northern Grampians and Albacutya bushfires in 2014 affected a large number of waterways and increased their vulnerability to impacts from floods such as the record January 2011 flood.

Floods have also impacted heavily on the region in 1909, 1956, 1981 and 1983 with more recent floods in 2010 and 2011 providing a stark reminder of the problems caused by flooding such as destroyed bridges and fences as well as inundated crops.

Issues

Floods can lead to major environmental issues such as causing avulsions and accelerated erosion as well as having large quantities of organic material wash into rivers and creeks which can cause blackwater events. Erosion control and revegetation works can be damaged or destroyed. Weeds are also spread by floodwaters and can rapidly take over areas that have been scoured by floodwaters. The consequences of large floods for private and public infrastructure can be devastating with bridges, pipelines and fences washed away. Livestock and crop losses can also be significant. Conversely floods generate positive outcomes for waterways, filling wetlands, watering floodplain vegetation, scouring sediment from riverbeds and triggering a burst of life as plants, invertebrates and animals take advantage of the floodwaters.

Bushfires lead to major losses of wetland, riparian and instream vegetation as well as aquatic fauna. The ash created by bushfires can be washed into creeks and wetlands, smothering habitat and creating water quality issues. After bushfires, weed species and reeds are the first to re-establish and in the long term, streamflows decrease as regenerating vegetation intercepts more rainfall and runoff.

The VWMS provides a number of policies to enable improved waterway management in the face of extreme events. Previous sections discussing management of the river channel (6.7.5) and riparian and wetland buffer management (6.7.3) list actions that can mitigate risks associated with floods and fires. The revised *Victorian Floodplain Management Strategy* will establish policies and actions to minimise the impacts of flooding on towns and rural areas. Following the floods in 2010 and 2011, funding was provided to undertake works such as weed control and fencing repair and reconstruction of priority assets affected by flooding. Wimmera CMA sees this flood recovery work as critical to securing waterway health outcomes into the long term.

Action 27

Wimmera CMA to implement relevant state flood policies and actions.

Who: Wimmera CMA, DEPI

Action 28

Wimmera CMA to coordinate works to improve waterway condition as part of flood and bushfire recovery when funding is available.

Who: Wimmera CMA

6.7.9. Invasive Species Management in Waterways

Background

Carp and Mosquito Fish (*Gambusia*) are two of the major invasive fauna species affecting the region's waterways. The impacts of other exotic species such as Tench and Goldfish are less well understood. Redfin, trout and salmon have also been introduced into the region and have major impacts on native fauna through predation and competition but are highly valued for their recreational angling value.

Issues around invasive species in riparian and wetland buffer zones are discussed in Section 6.7.3; this section involves invasive species within wetlands, rivers and creeks. Whilst the Wimmera does not have the problems with willows and aquatic weeds such as *Azolla* experienced elsewhere in Victoria, there are a number of emerging and potential invasive plant species that will potentially lead to major impacts on waterway values.

Issues

Carp cause significant issues through their feeding actions stirring up sediment, increasing turbidity and nutrient levels. They consume aquatic vegetation and compete for resources with native species. The biomass of carp in the Wimmera River is substantial, with fish survey results often showing that carp comprise over 90% of the biomass of fish in the lower Wimmera River (SKM, 2010). Water quality declines that lead to fish death events can lead to tonnes of carp dying *en masse*, creating amenity, health and water quality issues. Carp have unfortunately spread throughout much of the Wimmera River system but some areas such as the upper Mt William Creek, upper Fyans Creek and MacKenzie River above the MacKenzie Falls remain carp-free. There is a need to monitor priority locations to determine if carp have spread into these areas and undertake activities to try and eradicate them. Following the January 2011 floods, carp moved into a section of the MacKenzie River upstream of Distribution Heads Weir in large numbers for the first time. Wimmera CMA has and will continue to undertake actions to remove carp from this waterway to try and prevent them establishing in this priority reach. There is also work that can be done to increase community awareness around issues with the dispersal of these species to try and prevent other species becoming established region. Looking longer term, Wimmera CMA will continue to monitor the progress of other control mechanisms such as the carp herpes virus and daughterless carp with the intent that the region, due to the fact it is an enclosed catchment, presents an ideal proving ground for these mechanisms.

The focus for dealing with invasive flora species is on prevention and there are a number of actions and policies relating to this in the VWMS and WIPAMS. Invasive flora species management for waterways in terms of control will be undertaken where possible when undertaking works for the riparian or wetland buffer area.

Action 29

Undertake fish monitoring in priority reaches to determine the distribution of carp.

Who: Wimmera CMA



Action 30

Undertake awareness activities to highlight risks around illegal translocations of carp and other fish species.

Who: Wimmera CMA, DEPI

6.8. Traditional Owners and Waterway Management

Background

Land is fundamental to the cultural heritage and wellbeing of Aboriginal people. It is the core of all spirituality and this relationship and the spirit of 'country' (BGLC, 2014). As such Aboriginal people have an inherently strong link to waterways as they provide great spiritual significance as well as an important resource. The VWMS recognises these values.

Water holds a significant place in Aboriginal culture. Water is intimately linked to the health of Country and life and Traditional Owner groups each have responsibility and obligations under their lore and custom to protect, conserve and maintain the environment and the ecosystems in their natural state to ensure the sustainability of the whole environment (DSE, 2011).

The VWMS (DEPI, 2013) sets out a number of policies in relation to Traditional Owner involvement in waterway management including:

- The Department of Environment and Primary Industries and its regional service providers will include and engage with Victoria's Traditional Owners and Aboriginal people in its programs and related activities, consistent with policy direction set under the DEPI *Meerreeeng Wanga Aboriginal Inclusion Plan* (DEPI, 2014). This direction will align with the principles outlined in the *Victorian Aboriginal Affairs Framework 2013-2018* (DPCD, 2012).
- Waterway managers (CMAs) and other relevant state agencies will undertake activities in a way that recognises and respects Aboriginal cultural heritage places and complies with national and State legislation.
- Traditional Owner groups that have recognized native title rights or formal agreements with the State will be involved in the development of the regional Waterway Strategies. Where these groups have the capacity and desire to be engaged at a higher level, opportunities for collaboration will be provided.
 - For decisions on areas where there is a formal native title agreement, Registered Aboriginal Party or other formal agreement; only the relevant formally recognised Traditional Owner Group will be engaged. Outside of these areas decisions on engaging Traditional Owner Groups will be made in consultation with the Victorian Office of Aboriginal Affairs. Decisions must reflect the existence of Traditional Owner Land Management Boards, Traditional Owner Corporations and Registered Aboriginal Parties.
 - Aboriginal values associated with waterways will be identified in the regional Waterway Strategies.
 - Waterway managers will seek to work with Traditional Owners to incorporate their traditional knowledge and values into the regional Waterway Strategies (where this is culturally appropriate, desired by Traditional Owners and consent is provided).
- Government will facilitate Traditional Owner access to waterways and riparian areas on Crown Land and use of natural resources in their Country through formal agreements.
 - Waterway managers will work with Traditional Owners where issues affect access to waterways and riparian areas and consider actions to remove impediments.

The WWS, amongst other State initiatives, will assist in delivering these policies.

Local Values

Across Australia, many significant cultural artefacts and significant sites are located close to waterways, demonstrating the relationship between them and the people.

Many Aboriginal cultural sites in the western region are on or near waterways, and streams and water bodies are still important sources of food and medicine. Waterways are important meeting places for families and communities to come together for cultural, social and recreational activities, and to teach culture to young people. Access to healthy waterways is vitally important for these activities (DSE, 2011). This relationship, between people and water is demonstrated by the creation stories about the formation and importance of the Wimmera River and other waterways in our region. In the Wimmera, Traditional Owners use waterways for:

- Fishing and hunting;
- Gathering food and medicine;
- Meeting places;
- Making canoes; and
- Gathering resources to make tools.

There remains a strong link between Traditional Owners and their waterways. This was reinforced by a successful Native Title claim.

Consultation processes with Traditional Owners during the development of the *Western Region Sustainable Water Strategy* (DSE, 2011) identified a number of key points that were important to Indigenous people including:

- the importance of health of Country; and
- ensuring that Traditional Owners are active participants in managing water.

Native Title

In December 2005, the Federal Court recognised the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagalk peoples' non-exclusive native title rights over a part of their original claim area.

The native title rights are the right to hunt, fish, gather and camp for personal, domestic and non-commercial purposes, under their traditional laws and customs. These rights are also subject to the laws of the State of Victoria and the Commonwealth of Australia. Many of these rights are linked to waterways, in particular the Wimmera River.

State Government Agencies such as DEPI, Parks Victoria and Wimmera CMA work with Traditional Owners, through the Barengi Gadjin Land Council (BGLC), to ensure that government activities do not impact on the Native title rights. More recently this has been done through the Winyula Council. It also provides an opportunity for discussion about possible collaborations and opportunities to work on Country

Cultural Heritage

Land and water is the core of all Traditional Owner spirituality and this relationship and the spirit of 'country' is what needs to be protected during Cultural Heritage Management activities. Aboriginal cultural heritage includes:

- artefacts, objects and skeletal remains;
- sites, landscapes or areas of significance; and
- cultural knowledge, lore, language, stories, song, dance and identity.

As a Registered Aboriginal Party BGLC, is the primary source of advice and knowledge for the Victorian Government on matters relating to Aboriginal places located in or Aboriginal objects originating from the area for which the party is registered. Barengi Gadjin Land Council participates in the preparation of Cultural Heritage Management plans and evaluates plans written by other cultural



heritage advisors. They also consider and advise State and Local Governments on applications for Cultural Heritage Permits, negotiate and enter into Cultural Heritage Agreements and advise and negotiate the repatriation of Aboriginal cultural heritage.

Some other functions are to:

- Receive cultural heritage audit reports
- Apply for and monitor the status of protection declarations
- Victorian Civil and Administrative Tribunal (VCAT) hearings relating to disputes
- Decide on applications for access to the Victorian Cultural Heritage (VCH) Register
- Negotiate on matters that overlap boundaries.

Local Traditional Owner Aspirations

Other planning that has been carried out previously in our region, including through the development of the *Western Region Sustainable Water Strategy*, the *Victorian Waterway Management Strategy* (DSE, 2011) and planning in other regions, has highlighted some of the following aspirations of Traditional owners and Aboriginal people that may be relevant to our local traditional owners. These include:

Values

- Protecting cultural heritage and maintaining 'connection to Country';
- Respect for Country, culture and environment; and
- Access to waterways.

Goals

- To be involved in water and catchment management to protect cultural heritage;
- Meaningful engagement in decision making processes;
- Develop capacity to contribute expertise and knowledge to decision-making processes and water management rather than just being consulted;
- Opportunities to participate in education programs and traineeships to build capacity. (See *Western Region Sustainable Water Strategy*); and
- Continue to develop business opportunities in the area of waterway management.

Priorities for Traditional Owner involvement in waterway management

- Wimmera government authorities continue to engage with BGLC in relation to water management through an appropriate forum in accordance with the interim co-operative management arrangements;
- BGLC continue to be represented on the Wimmera CMA Board's advisory committees.
- Wimmera CMA, in collaboration with Traditional Owners work towards developing traineeships to build participation capacity and for ongoing employment in water management (See *Western Region Sustainable Water Strategy*);
- Annually Wimmera CMA, in consult with BGLC, investigate opportunities for participation by Indigenous people in relation to its waterway investment program;
- Wimmera CMA will review its guidelines for protecting Cultural Heritage in relation to its waterways program in consultation with BGLC. Other government organisations will also be encouraged to do so;
- Investigate the linkages between environmental water and cultural values with the view to provide cultural benefits with environmental flows where possible, for example the Ranch Billabong near Dimboola and Datchak Creek near the Ebenezer Mission; and
- Government authorities work with BGLC to improve access to waterways in the Wimmera region where there are recognised impediments.

7. Delivering the Strategy

7.1. Roles and Responsibilities

Achieving the goals, targets and management activities of the *WWS* involves a close partnership between landholders, community groups, agencies and the Wimmera CMA. The details of respective roles and responsibilities are listed in *Appendix 3 Roles and Responsibilities for Waterway Management*. The Wimmera CMA's Wetlands and Rivers and Streams Advisory Committees will have a key role in tracking the progress of the *WWS* on an annual basis.

7.2. Tools and Approaches

Conceptual models developed to assist the development of the *WWS* (GHD, 2012, ARI, 2012) have set out a range of management activities that will mitigate threats to waterway values. The *WWS* development process has led to the refining of the management activities to what has been determined to be the most effective under current circumstances. The method of delivery of the management activity (for example delivering improved wetland management via incentives or market-based instruments) will be determined on an ongoing basis, with advice from the Wimmera CMA's Wetlands and Rivers and Streams Advisory Committees to ensure their effectiveness.

7.3. Resourcing

The implementation of the *WWS* will be largely contingent on adequate funding being available for Wimmera CMA and its partners. As has been past practice, opportunities will be sought to attract funding from different sources. An example of this is the inclusion of angling priorities that align with the *WWS* (Appendix 1). This will assist to obtain funding from the revenue derived from recreational fishing licences to achieve specific waterway management activities that benefit recreational angling.

8. Monitoring, Evaluation and Reporting

The management of rivers and wetlands in the region is conducted within an adaptive management framework. At the core of adaptive management is the ability to learn from previous experience and update management approaches to reflect the knowledge gained during implementation. Such measures (i.e. reviewing previous strategic plans for the region) have been invaluable in refining the *WWS*. Monitoring, evaluation and reporting are critical to inform adaptive management.

A monitoring, evaluation, reporting and improvement (MERI) plan has been developed to support the planning, implementation and review of the *WWS*. The MERI plan:

- Presents the program logic underpinning the *WWS*;
- Clarifies the assumptions associated with the program logic and identifies strategies to manage potential risks;
- Identifies the key questions for evaluation and establishes processes to monitor progress;
- Clarifies the communication and reporting needs and identifies the processes required to support these needs; and
- Enables lessons learned from monitoring and evaluation to be gathered and inform improvement.

This MERI plan will be reviewed, at minimum, on an annual basis to ensure it remains current and relevant to informing adaptive management processes.

8.1. Monitoring

Monitoring activities are targeted to inform evaluation and reporting of the implementation of the *WWS* given its purpose in fulfilling the objectives of the *Wimmera RCS*, and of the foundational influences and externalities that impact on *WWS* implementation.



Foundational influences include factors such as climatic variability, drought, flood, bushfire and potential impacts of climate change – monitoring data has shown that they have the major bearing on waterway outcomes over the short-medium term and for some (i.e. bushfires) the impacts are more localised. However longer-term trends can be demonstrated by enduring monitoring programs across a broad geographic area.

Externalities include factors such as changes in land use, population, government support, economic support, community expectations, and landholder attitudes. These factors vary in the speed and magnitude of impacts (e.g. funding changes occur more rapidly than changes in population). However monitoring is able to determine the changes brought about by these externalities, both positive (e.g. an increase in government support for waterway improvement works) and negative (e.g. reduced flow into waterways due to land use change).

Monitoring activities are undertaken by Wimmera CMA to facilitate its catchment condition reporting obligations as stated under the *CaLP Act 1994* as well as determining the severity of threats (e.g. poor water quality) or the effectiveness of activities (e.g. environmental water releases). The monitoring of various indicators depends on what outcome it relates to and the funding available. For example water quality is monitored monthly at a number of locations in the Wimmera River catchment to enable an understanding of long and short-term waterway condition changes whereas fish monitoring had been undertaken in a rolling fashion across sub-catchments for the same purpose but dependent on water availability. Monitoring indicators such as platypuses, macroinvertebrates, birds and waterway vegetation has all occurred in recent years as part of co-ordinated large-scale monitoring programs or in a more *ad hoc* fashion as specific questions arose that needed investigation.

In terms of an on-going monitoring program to assist Wimmera CMA deliver on its statutory requirements for catchment condition reporting and determine the effectiveness of waterway management activities, recommendations are specified in Table 8-1.

Table 8-1 Indicative priority monitoring components, timing and costings

Purpose	Parameter	2014 Cost (Frequency) Estimate
Catchment Condition	Waterwatch support	\$50,000 (annual)
	Fish	\$60,000 (annual)
	Macroinvertebrates	\$50,000 (biennial)
	Water Quality	\$50,000 (annual)
	Platypus	\$15,000 (annual)
	Birds	\$15,000 (annual)
	Waterway Works	Works Monitoring
Environmental Water	VEFMAP Fish	\$50,000 (annual)
	VEFMAP Water Quality	\$30,000 (annual)
	VEFMAP Vegetation	\$50,000 (biennial)
	VEFMAP Geomorphology	\$50,000 (five yearly)
	Flow telemetry	\$15,000 (annual)

The development of *WWS* has highlighted the many monitoring gaps that exist – particularly with respect to wetlands and therefore resources are proposed to be used to reduce those monitoring gaps (also see Section 8.4). Furthermore there is a significant amount of information gathered by other groups and agencies related to waterway condition that can be useful in the ongoing monitoring of waterways. For example platypus monitoring has been conducted by Project Platypus and much of the stream gauge network is funded by a range of partners such as local councils, Bureau of Meteorology and GWMWater. Little would be known of the values of Mosquito Creek were it not for the South Australian government agencies undertaking monitoring to track changes in condition in the creek to determine the implications for the Ramsar-listed Bool and Hacks Lagoon.

Monitoring of resource condition change is also undertaken periodically at a state-wide level through the Victorian Waterway Management Program through such means as the Index of Wetland Condition and Index of Stream Condition.

Just as critical as bio-physical catchment indicators, surveying the outlook and attitudes of landholders in the region are important to gauge to enable the effective targeting of mechanisms for waterway improvement works on freehold land. This work also assists in determining the extent of threats such as salinity and invasive plants and animals in terms of geographic area and awareness of their severity and required mitigation measures (see Section 2.3.1).

8.2. Evaluation

The strategy and planning phase of the adaptive management cycle (Figure 8-1) includes the development of pre-determined key evaluation questions by which to assess the *WWS*. Evaluation questions provide the basis for assessing the extent to which the outcomes have been achieved at each level of the program logic for the *WWS*. They also address assumptions in the program logic and their evaluation provides direction and improved knowledge for subsequent planning cycles.

The evaluation questions developed for *the WWS* address the following five categories:

- **Impact** - changes to resource condition, management activities or institutions;
- **Appropriateness** - addressing the needs of beneficiaries and against best practice;
- **Effectiveness** - Achievement of desired management outputs and resource condition objectives;
- **Efficiency** - Value or return from investment; and
- **Legacy** - After the activity/program ends.

The process, timing and outputs of evaluation of the *WWS* is discussed in Sections 8.3 to 8.6

8.3. Reporting

Reporting is an important tool to ensure accountability for the investment of government funds into waterway management activities. Over the long-term, consistent and effective reporting provides evidence to evaluate the effectiveness of the *WWS*. Three types of reporting will support this evaluation and accountability process:

- Annual management reporting;
- Resource condition reporting; and
- Reporting on *WWS* targets.

Annual management reporting focuses on financial reporting and on outputs achieved in the region for the financial year. Financial audits are required to ensure that reported expenditure is accurate and accountable. This provides assurance that investment in delivering outputs has been strategic, cost effective and consistent.

Resource condition reporting is led through the Victorian Waterway Management Program. This involves the collection, analysis and reporting of information on the condition of Victoria's waterways every eight years, subject to available funding (DEPI, 2013). This reporting, combined with regional knowledge, provides the collective data to assess the condition of waterways over the long term and the effectiveness of the implementation of the *WWS*.

Reporting on *WWS* targets will occur at different intervals depending on the target level. Reporting on outputs will occur annually in the annual investment reports and in the Wimmera CMA Annual Report. Public reporting against *WWS* management outcome targets will occur at minimum following the mid-term internal and final independent review of the *WWS* scheduled for 2018 and 2022 respectively. The Wimmera CMA will also support reporting of management outcome targets for the *VWMS* in 2016 and 2020.



The MERI Plan for the *WWS* identifies further detail of the key stakeholders at organisational, community, regional, state and Commonwealth levels that should be kept informed on the progress of the *WWS* or would benefit from its information. It also identifies what they need to know and how it will be communicated. This information will support the *WWS* engagement and implementation plan.

8.4. Knowledge Gaps and Research

The process of developing the program logic, assumptions and evaluation questions demonstrates the areas where critical knowledge gaps exist. The MERI Plan for the *WWS* identifies the key knowledge gaps identified through this process, and also identifies the strategies for addressing them. These strategies may involve collating existing information or proposing areas for further research programs. To align with the Victorian Waterway Management Program the *WWS* supports research that:

- provides essential knowledge to address critical short-term and/or strategic long-term knowledge gaps. The resulting research findings will be incorporated into policy and management; and
- targets knowledge gaps or low confidence in the relationships between outputs, management outcomes and long-term resource condition outcomes (if significant for waterway management and investment)

Research will be directed to investigating those relationships where there is little scientific evidence, or the confidence in the evidence is low. This targeted approach to research also provides an increased focus on prediction and testing of these predictions, rather than more general, descriptive research. It is also vital that research is targeted to better understanding the effectiveness of management activities that the Victorian Government currently invests heavily in (for example, riparian revegetation).

Historically, Wimmera CMA has been successfully involved in partnerships with agencies and research institutions to fill knowledge gaps and will continue to do so into the future. A number of areas for investigation (e.g. fire management, wetland hydrology and securing wetland management outcomes in perpetuity) have been identified in the Regional Work Program (Section 6).

8.5. Adaptive Management

Monitoring, evaluation and reporting are integrated into the adaptive management cycle presented in Figure 8-1. The cycle includes:

- **Strategy and Planning** – state policy framework and targets, planning for waterway management through regional waterway strategies with priorities and regional targets;
- **Implementation and Monitoring**- Government and other investment in regional priorities, implementation of priority management activities, intervention monitoring and long-term resource condition assessment; and
- **Evaluation and reporting**- management reporting, resource condition reporting, program evaluation and improvement.

Community participation and research and innovation occur across all parts of the program. This manifests itself via the Wimmera CMA Rivers and Streams and Wetlands Advisory committees as they play an important role in the adaptive management cycle. Members have been appointed by the Wimmera CMA Board to inform them on strategic decision-making using the following approach:

- **Analysis** – review strategic documents, including investment plans, policies and government objective;
- **Design** – using evidence and incorporating the committee’s collective knowledge and expertise, provide recommended responses to issues;
- **Delivery** – inspect and review impact of the designed response; and
- **Review** – assess the yearly progress on meeting the objectives of the *RCS* and *WWS*.



Figure 8-1 The eight-year adaptive management cycle of the Victorian Waterway Management Program and Wimmera Waterway Strategy

8.6. Strategy Review

Internal reviews will assess interim progress towards implementing management activities outlined in the *WWS* on an annual basis in line with the review of investment proposals and annual reporting. More detailed reviews will be undertaken at the midpoint and at the end of the *WWS*' lifespan (interim and final reviews). The intent of the internal annual and interim reviews will be assess progress and to consider any new information on values and threats and consideration of foundational influences and externalities. The interim review may lead to the Wimmera CMA choosing to change or update the management activities to be undertaken during the final years of implementation in response to new knowledge and truly facilitate an adaptive management approach.

The final independent review at the end of the *WWS* will focus on capturing and evaluating all of the knowledge gained during implementation of the strategy and progress against all of the targets. This will ensure that there is a clear record of lessons learned and an evidence base for updating or changing regional programs and management approaches in the future.

9. Acronyms and Glossary

9.1. Acronyms

ABC	Actions for Biodiversity Conservation
AVIRA	Aquatic Values and Risk Assessment
BGLC	Barengi Gadjin Land Council
CaLP	Catchment and Land Protection
CAMBA	China-Australia Migratory Bird Agreement
CEWH	Commonwealth Environmental Water Holder
COAG	Council of Australian Governments
CMA	Catchment Management Authority
CPUE	Catch Per Unit Effort
DEPI	Department of Environment and Primary Industries
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
ECD	Ecological Character Description
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EVC	Ecological Vegetation Class
EWR	Environmental Water Reserve
FFG	Flora and Fauna Guarantee
ha	Hectares
Hi	Hindmarsh Shire
Ho	Horsham Rural City Council
ISC	Index of Stream Condition
IWC	Index of Wetland Condition
JAMBA	Japan-Australia Migratory Bird Agreement
km	Kilometres
LAC	Limit of Acceptable Change
LCC	Land Conservation Council
LiDAR	Light Detection and Ranging
MAT	Management Action Target
MBI	Macroinvertebrate Biotic Index
MDBA	Murray-Darling Basin Authority
MERI	Monitoring Evaluation Reporting Improvement
MOT	Management Outcome Target
NES	National Environmental Significance
NRM	Natural resource management
NWI	National Water Initiative
PV	Parks Victoria
RCS	Regional Catchment Strategy
RCT	Resource Condition Target
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SEPP (WoV)	State Environment Protection Policy (Waters of Victoria)
UC	Upper Catchment
VCAT	Victorian Civil and Administrative Tribunal
VCH	Victorian Cultural Heritage
VEWH	Victorian Environmental Water Holder
VRHS	Victorian River Health Strategy
VWMS	Victorian Waterway Management Strategy
Wimmera WHS	Wimmera Waterway Health Strategy
Wimmera CMA	Wimmera Catchment Management Authority
Wimmera RCS	Wimmera Regional Catchment Strategy
WIPAMS	Wimmera Invasive Plant and Animal Strategy
WoNS	Weed of National Significance
WW	West Wimmera Shire
WWS	Wimmera Waterway Strategy

9.2. Glossary

Bank	The relatively steep part of a stream channel cross-section, generally considered as being above the usual water level.
Basin	The catchment of a large river or group of rivers. There are 29 basins within Victoria.
Broodstock	Fish selected to breed with in an aquaculture setting.
Bulk entitlement	The property right to water held by water and other entities defined in the <i>Water Act (1989)</i> . 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.
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 (1989)</i> . CMAs are the caretakers of waterway health, responsible for regional and catchment planning and coordination as well as waterway, floodplain and water quality management.
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).
Crown Land	Land that is possessed and managed by government or its delegates
Distributary	A waterway that leaves a watercourse and does not return to it (the opposite of tributary).
Endoreic	Does not flow to the sea.
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.
Ephemeral stream	A stream, which flows intermittently; that is, it is often dry.
Ephemeral wetland	A wetland which dries up periodically.
Erosion	Modification of the channel boundary by entrainment and removal of sediment.
Exotic	Species that are non-indigenous or outside their natural range.
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.
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.
Frontage	Land adjacent to the river/stream channel or wetland edge.
Geomorphology	The study of the earth's landforms including their origin and structure. Fluvial geomorphology is the subset that deals with waterways.
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.
Halophytic	Organism that grows in very saline conditions
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.
Heritage River	Land named under section 5 of the <i>Heritage Rivers Act 1992</i> . 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 threat weeds	Weed species identified as a priority for management through various planning processes (e.g. <i>WIPAMS</i>) due to their impacts on natural values.
Hydrology	The science dealing with surface and groundwaters of the earth; their occurrence, circulation and distribution. In an applied sense – the timing and volumes of water in waterways.
Index of Stream Condition (ISC)	The Index of Stream Condition 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 occurs naturally in, a particular region or environment.
Issue	A process that affects an asset's condition or value (they may be threatening or enhancing processes).
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.
Long-term resource condition target	Long-term targets specific to management actions (8+ years).
Macroinvertebrate	An invertebrate (animal without a backbone) that is visible to the naked eye.
Management outcome target	Short-term targets specific to management activities (1-8 years).
Management unit	An area defined at the subcatchment planning level based upon. A management unit contains a number of reaches and wetlands.
Megalitre (ML)	One million litres
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.
Natural flows	The flows that would have existed if present rainfall patterns fell on catchments before European settlement.
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. Excessive nutrients cause water quality impacts like algal blooms.
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.
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. Specific wetlands have been specifically listed for protection such as Lake Albacutya and Bool and Hacks Lagoon.
Reach	A length of stream or river, typically 10-30km 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.
Regulated stream	A stream where flows are controlled by releases from a dam or weir.
Reticulation	The network of pipelines used to take water into areas of consumption. Includes residential districts and individual households.

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.
Stormwater	Untreated rainfall run-off from urban areas.
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.
Target	A measurable result expected to be achieved within a given timeframe.
Terminal Lake	Receives inflows from streams or rivers draining its catchment. 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. High levels lead to increased algal blooms and reed growth.
Tree layer	Woody plants >5m tall, usually with a single stem e.g. eucalyptus >5m tall, acacia >5m tall, and willow >5m tall. Note that woody vegetation species <5m high are classed as shrub layer.
Tributary	A river or creek that flows into a larger river or creek.
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.
Value	Something considered to be important or beneficial.
Water corporation	A corporation under the <i>Water Act 1989</i> 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	The quality of water depends on lots of different things, including: 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. 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.
Water storage	Lake/dam that is operated to capture and supply water.
Waterway	The <i>Water Act 1989</i> 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 document, a waterway is defined as a natural river, creek, stream, watercourse or wetland.
Wetland	Inland, standing, shallow bodies of water which may be permanent or temporary, fresh or saline.

10. References

- Agricultural Victoria Services. (2006). *The Role of the Common Reed Phragmites Australis on Nutrient Cycling in Aquatic Systems*. Melbourne: Agriculture Victoria Services.
- ALS. (2011). *Mt Cole Creek and Upper Wimmera Waterway Management Units Fish Survey Results 2011*. Melbourne: ALS Water Sciences Group.
- Anderson, B. (2005). Will replanting vegetation along riverbanks make floods worse? *Riversymposium* (pp. 1-9). Brisbane: Riversymposium.
- Anderson, J., & Morison, A. (1989). *Environmental Flow studies for the Wimmera River, Victoria - Part C Water quality and experimental releases, Technical Report Series No. 75*. Melbourne: Arthur Rylah Institute for Environmental Research.
- ARI. (2012). *Wetland Conceptual Models: Associations between Wetland Values, Threats and Management Interventions- Version One - Technical Report Series No. 237*. Melbourne: ARI.
- Australian Government. (1993). *Native Title Act*. Canberra: Australian Government.
- Australian Government. (1999). *Environment Protection and Biodiversity Conservation Act*. Canberra: Australian Government.
- Australian Government. (2000). *Environment and Biodiversity Conservation Regulations*. Canberra: Australian Government.
- Australian Government. (2007). *Water Act*. Canberra: Australian Government.
- Australian Government. (2008). *Water Amendment Act*. Canberra: Australian Government .
- Australian Government. (2009). *Developing and using Program Logic in Natural Resource Management - User Guide*. Canberra: Australian Government.
- Australian Government. (2012). *Basin Plan*. Canberra: Australian Government.
- BGLC. (2014). *Cultural Heritage Site Monitoring*. Retrieved March 19, 2014, from Barengi Gadgin Land Council: <http://www.bglc.com.au/cultural-heritage-site-monitoring>
- Biosis. (2012). *Fish Community Assessment of the Upper Mount William Creek Catchment*. Melbourne: Biosis Research.
- Biosis. (2012a). *Carp Population Assessment of the mid MacKenzie River*. Melbourne: Biosis Research.
- Biosis. (2013). *Fish Community Assessment of the Burnt Creek and Lower MacKenzie River catchment*. Melbourne: Biosis.
- cesar. (2012). *Distribution and Relative Abundance of Platypuses in the MacKenzie River: survey results 2011/12*. Melbourne : cesar.
- cesar. (2013). *Platypus Distribution and Abundance in the Upper Wimmera Region*. Melbourne: cesar.
- CFA. (2014). *Riparian Land and Bushfire Risk Resource Document*. Melbourne: obliqua for CFA and DEPI.
- Cibilic, A., & White, L. (2010). *Ecological Character Description for Lake Albacutya, a Wetland of International Importance - a report prepared for the Department of Sustainability, Environment, Water, Population and Communities*. Ballina: WetlandCare Australia.
- Curtis, A., & Mendham, E. (2012). *The Social Drivers of Natural Resource Management in the Wimmera Region*. Albury: Charles Sturt University.
- DCNR. (1996). *Mallee Parks Management Plan*. Melbourne : Department of Conservation and Natural Resources.
- DEPI. (2013). *Victorian Waterway Management Strategy*. Melbourne: DEPI.
- DEPI. (2013a). *Index of Stream Condition - The Third Benchmark Of Victorian River Condition*. Melbourne: DEPI.
- DEPI. (2013b). *DEPI Output Data Standard*. Melbourne: DEPI.
- DEPI. (2013c). *Victorian Water Quality Trends 1991-2010*. Melbourne: Department of Environment and Primary Industries.
- DEPI. (2014). *Meereeng Wanga Aboriginal Inclusion Plan 2014-2019*. Melbourne: Department of Environment and Primary Industries.
- DNRE. (1997). *Victoria's Biodiversity Strategy*. Melbourne: Department of Natural Resources and Environment.
- DNRE. (1998). *Victoria Flood Management Strategy*. Melbourne : Department of Natural Resources and Environment.
- DPCD. (2012). *Victorian Aboriginal Affairs Framework 2013-2018*. Melbourne: Department of Planning and Community Development.
- DPCD. (2012a). *Wimmera Southern Mallee Draft Background Report*. Melbourne: Department of Planning and Community Development.

- DSE. (2002). *Victorian River Health Strategy*. Melbourne: DSE.
- DSE. (2003). *Lake Albacutya Ramsar Site Strategic Management Plan*. Melbourne : Department of Sustainability and Environment.
- DSE. (2010). *Guide to Agency Management of Drying Lakes in Victoria*. Melbourne: Department of Sustainability and Environment.
- DSE. (2011). *Western Region Sustainable Water Strategy*. Melbourne: DSE.
- DSE. (2012). *Monitoring, Evaluation and Reporting Framework* . Melbourne: Department of Sustainability and Environment.
- Earth Tech. (2003). *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment*. Melbourne: Earth Tech.
- Earth Tech. (2003). *Geomorphic Categorisation and Stream Condition Assessment of the Wimmera River Catchment*. Melbourne: Earth Tech.
- Earth Tech. (2003a). *The History of Reed Species in the Wimmera*. Melbourne: Earth Tech.
- Earth Tech. (2004). *MacKenzie River Waterway Action Plan*. Melbourne: Earth Tech.
- Earth Tech. (2005). *Burnt Creek Waterway Action Plan*. Melbourne : Earth Tech.
- Earth Tech. (2005a). *Heritage River Waterway Action Plan*. Melbourne: Earth Tech.
- Earth Tech. (2006). *Assessing Influences on Environmental Water Releases in the Wimmera*. Melbourne: Earth Tech.
- Earth Tech. (2007). *Regulated Streams of the Wimmera Waterway Action Plan*. Canberra: Earth Tech.
- Ecological Associates. (2004). *The Environmental Water Needs of the Wimmera Terminal Lakes BF001-A*. Adelaide: Ecological Associates .
- Ecological Associates. (2009). *Conservation Significance of the Wimmera Storages BP007-1-C*. Adelaide: Ecological Associates .
- Ecowise . (2009). *Wimmera Fish Monitoring Project 2009*. Melbourne: Ecowise Environmental.
- GHD. (2012, October). *River and Estuary Conceptual Models to Support Development of Regional Waterway Strategies*. Melbourne: GHD.
- GWMWater . (2011). *West Wimmera Groundwater Management Strategy*. Melbourne : GWMWater.
- Hocking et al. (2012). *Salinity Treatment Effectiveness: 2012 environmental data assessment*. Melbourne: Hocking et al. .
- Hocking, M. (1997). *Groundwater trends and discharge along the Lower Wimmera River, Technical Report No. 42*. Melbourne: Centre for Land Protection and Research.
- ID&A. (2002). *Wimmera River Geomorphic Investigation Sediment Sources, Trasnpport and Fate*. Melbourne: Ian Drummond and Associates.
- Jacobs. (2014) *Optimising Environmental Entitlement Use for the Wimmera River and Terminal Lakes*. Melbourne, Jacobs.
- KBR. (2004). *Yarriambiack Creek Management Plan*. Melbourne: Kellogg, Brown & Root.
- Land Conservation Council. (1978). *Report on South Western Area, District 2*. Melbourne: LCC.
- Riverness. (2011). *Aquatic Value Identification and Risk Assessment Summary of Metrics and Measures of Values and Threats*. Torquay: Riverness.
- Riverness. (2013). *Regional Waterway Strategy Monitring, Evaluation, Reporting and Improvement Planning*. Torquay: Riverness.
- Sandell, P. (1996). *The Outlook for Outlet Creek and the Terminal Lakes - Proceedings of a Community Forum*. Melbourne: National Parks Servive.
- Sheldon, R. (2007). *Knowledge Review and Gap Analysis, Connecting the Catchment: the Integrated management of Mosquito Creek*. Mt Gambier: Department of Environment and Heritage.
- SKM. (2003). *Wimmera River groundwater interception scheme feasibility study*. Melbourne: SKM.
- SKM. (2004). *Social and Economic Drivers of Wetland Rehabilitation*. Melbourne: SKM.
- SKM. (2006). *Wetland Extent and Drainage Line Mapping Project*. Melbourne: SKM.
- SKM. (2008). *Influences on Environmental Water Releases in the Wimmera River* . Melbourne : Sinclair Kinght Merz.
- SKM. (2008a). *Wimmera Fish Monitoring Project 2008*. Melbourne: Sinclair Knight Merz.
- SKM. (2009). *West Wimmera Hydrogeological Study*. Melbourne: Sinclair Knight Merz.
- SKM. (2010). *Wimmera Fish Monitoring Project 2010*. Melbourne: Sinclair Knight Merz.
- SMEC. (2001). *Assessment of the Impact of Priority Structures on Natural Flow Regimes and Flooding in the Yarriambiack Creek*. Melbourne: Snowy Mountains Engineering Corporation.
- South East NRM Board. (2009). *Memorandum of Understanding - Connecting the Catchments*. Mt Gambier: South East NRM Board.
- Thomas Hay and Associates. (1997). *Wimmera River and Environs Action Progam - Action Plan*. Ballarat: Thomas Hay and Associates.

- TSSC. (2012). *Commonwealth Listing Advice on Seasonal Herbaceous Wetlands (Freshwater) of Temperate Lowland Plains*. Canberra: Threatened Species Scientific Committee.
- Victorian Government. (1988). *Flora and Fauna Guarantee Act*. Melbourne: Victorian Government.
- Victorian Government. (1989). *Water Act*. Melbourne: Victorian Government.
- Victorian Government. (1992). *Heritage Rivers Act*. Melbourne: Victorian Government.
- Victorian Government. (1994). *Catchment and Land Protection Act*. Melbourne: Victorian Government.
- Victorian Government. (2003). *State Environment Protection Policy (Waters of Victoria) S 107*. Melbourne: Victorian Government.
- Water Futures. (2011). *Public health issues associated with stock accessing waterways upstream of drinking water off-takes*. Killara: Water Futures .
- WEC. (2012). *Wimmera Macroinvertebrate Monitoring 2011-12*. Melbourne: Water's Edge Consulting.
- Wimmera Catchment Co-ordinating Group. (1992). *Wimmera River Integrated Catchment Management Strategy*. Horsham: Wimmera Catchment Co-ordinating Group.
- Wimmera CMA. (2002). *Structures on Yarriambiack Creek*. Horsham: Wimmera CMA.
- Wimmera CMA. (2006). *Wimmera Waterway Health Strategy 2006-2011*. Horsham : Wimmera CMA.
- Wimmera CMA. (2010). *Wimmera Invasive Plant and Animal Management Strategy*. Horsham: Wimmera CMA.
- Wimmera CMA. (2011). *Wimmera Wetlands Asset Strategy*. Horsham: Wimmera CMA.
- Wimmera CMA. (2013). *Wimmera Regional Catchment Strategy 2013-2019*. Horsham: Wimmera CMA.



Lake Ratzcastle, February 2007

Appendices

Appendix 1 Wimmera Recreational Fisheries Management Priorities



Wimmera Recreational Fisheries Management Priorities

Acknowledgements

Workshop attendees: Rob Loats and Chris Spence (VRFish), Tim Curmi and Bruce McInnes (Native Fish Australia), Ken Flack (Wimmera Anglers Association and WCMA Rivers and Streams Committee), Kelvin Robinson (Horsham Angling Club), Barry Williams (Murtoa Angling Club), Jim McGuire (WCMA Rivers and Streams Committee), Gary Aitken (Wimmera River Improvement Committee and WCMA Rivers and Streams Committee), Greg Fletcher and Tony Baker (Wimmera Catchment Management Authority), Renae Ayres (Arthur Rylah Institute, Fish Habitat Network), Murray Burns, Anthony Forster and Taylor Hunt (Fisheries Victoria).

Workshop invitees: Australian Trout Foundation, Futurefish Foundation, Stawell and District Angling Club, David Brennan (WCMA CEO) and Geoff Miller (DEPI).

Background

Recreational fishing makes an important social and economic contribution to Victorian regional communities. In particular, the Wimmera Catchment Management Authority (WCMA) region provides popular native and trout recreational fishing opportunities.

The Department of Environment and Primary Industries (Fisheries Victoria) is focused on managing fisheries in a balanced way to ensure ecological sustainability and social and economic outcomes. Fisheries Victoria is also responsible for implementing state government initiatives to improve recreational fishing opportunities by supporting fish habitat recovery works, improving angler access and facilities, fish stocking, protecting fisheries resources and education and compliance activities.

Recreational fishing is highly dependent on the health of the environment including the availability of suitable habitat, water quality and water regimes to sustain productive fisheries. Recreational fishers acknowledged this critical dependency in surveys (2009 and 2012) that revealed “repairing where fish live” was the most important recreational fishing investment priority. To improve habitat outcomes on the ground, there is mutual benefit in Fisheries Victoria and recreational fishers working with the WCMA to identify and collaborate on habitat related projects that lead to better fishing outcomes.

Key recreational fisheries in the Wimmera Catchment

Waters within the Wimmera CMA region support a number of popular recreational fisheries, especially during wet conditions when rivers, storages and wetlands are full. Key recreational species can include golden perch, redfin and yabbies. During drier conditions there are still recreational fishing opportunities in certain water storages and the Wimmera River. There are also a number of popular waters such as small lakes in townships that are annually stocked to enhance recreational fishing opportunities within the Wimmera CMA region.

A complete assessment of the Wimmera regions recreational fishing waters can be found in a Guide to Inland Angling Waters of Victoria at: www.dpi.vic.gov.au/fisheries/recreational-fishing/inland-angling-guide



Strategic Priorities

Fisheries Victoria invests in the following strategic priorities for the management of inland fishing in Victoria:

- **Protect key fisheries assets**
- **Advocate for fish habitat recovery works**
- Manage fish stocking
- Encourage compliance with regulations
- Improve angler access
- Develop recreational fishing opportunities

The first two of these strategic priorities (bold) fall within the scope of the Regional Waterway Strategy.

Fishery management priorities

On 20 November 2013, Fisheries Victoria and the WCMA convened a workshop with key recreational fishing representatives to identify key fisheries management priorities for the region. The ideas and proposals from this forum were reviewed by Fisheries Victoria against project feasibility criteria and are captured as fishery management priorities (Table 1). The outcomes of this workshop builds on past fishery management planning processes, in particular the 2009 Wimmera Fishery Management Plan.

Table 1. Wimmera Fishery Management Priorities

No.	Fishery management priorities
1	Investigate opportunities to improve fish habitat through reconnecting an anabranch in the Wimmera river upstream of the Horsham weir.
2	Support a survey of instream woody habitat (IWH) in the Wimmera river and potential for cost effective staged reintroduction of secure IWH in required locations.
3	Investigate opportunities to enhance fish stocking outcomes by providing refuge habitat at stocking locations and expanding the range of stocking locations (upper Wimmera).
4	Share information between CMA, GWMWater and angling representatives on water flows, water quality, fish population assemblages and indications on fish species caught by anglers for improved fish stocking outcomes.
5	Determine the socio-economic value of high value priority waters as recreational fisheries in the Wimmera region as identified by anglers, agencies and RFL survey.
6	Work with recreational fishers, land holders and CMA to improve recreational access in the Wimmera region by providing opportunities to manage excessive weed and reed growth.
7	Identify hotspots for aggregation of carp and support community efforts for removal and responsible disposal in the Wimmera region.
8	Identify the key environmental factors likely to influence freshwater catfish populations in the Wimmera River
9	Investigate blackfish populations in the Wimmera River and identify strategies to improve their abundance

Appendix 2 Lake Albacutya Ramsar Site Management Plan

The management plan for the Lake Albacutya Ramsar Site has been developed in accordance with the Australian Ramsar Management Principles, applying them within the broader waterway management planning framework used in Victoria (Section 2.2.4.1). Given the length and detail required to undertake management planning for Lake Albacutya within the context of the WWS, it has been included as a separate appendix rather than being located within the body of the text. Actions specified within this plan relate to the wetland and surrounding wetland vegetation rather than the entire Lake Albacutya Park.

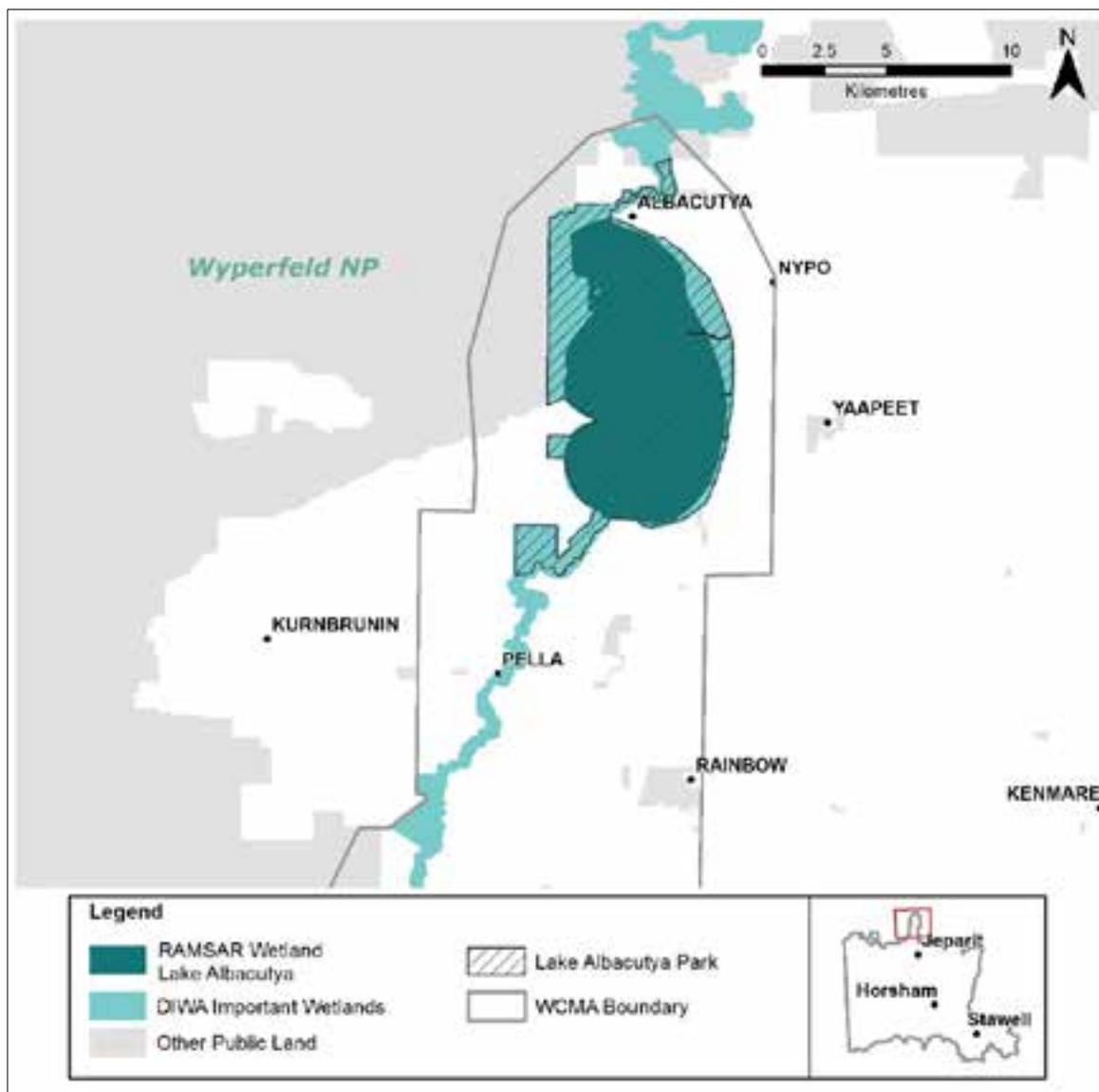


Figure 1 Lake Albacutya Ramsar site

Ramsar Site Description

Lake Albacutya Ramsar Site (Figure 1) was listed as a Ramsar site in 1982. It is a large (5,732 hectare) sub-terminal lake of the internally draining, north-flowing Wimmera River located in semi-arid northwest Victoria. It is fed when Lake Hindmarsh, which is located upstream, fills and overflows into Outlet Creek. It is located within the Wimmera-Avon Basin which is part of the Murray-

Darling Drainage Division. Lake Albacutya is a large, relatively shallow freshwater lake dominated by open water when inundated. It fills episodically, typically after years of being completely dry and consists of just one of the wetland types in the Ramsar Convention wetland classification system, namely a *seasonal intermittent freshwater lake over eight hectares*. It is located on Crown land reserved under *Victorian National Parks Act (1975)* and managed by Parks Victoria. Land abutting the site includes Wyperfeld National Park on the northern and western sides and mostly freehold agricultural land on the southern and eastern sides. The key features are listed in Table 1.

Table 1 Key Characteristics of Lake Albacutya Ramsar Site

Wetland	Area (Ha)	Ramsar wetland type	Land tenure	Land Manager
Lake Albacutya	5,732	Sub-terminal intermittent freshwater lake	Lake Albacutya Park	Parks Victoria

The Ramsar site is dominated by the lakebed of Lake Albacutya (3,769 hectares) which supports aquatic vegetation when wet and lakebed hermland in dry phases. The lake is fringed by a Eucalypt woodland of River Red Gum with some Black Box occupying 1,271 hectares. The site also includes non-wetland habitat comprised of small areas of mallee, non-eucalypt woodland, grassland and shrubland.

Ecological Character

An ecological character description (ECD) has been prepared for Lake Albacutya Ramsar Site (Cibilic & White, 2010). To be listed as a Ramsar site, a wetland, or wetland system, must meet at least one of the nine Ramsar Convention criteria for listing. The Ramsar criteria met at the time of Ramsar listing are provided in Table 2. The ECD identifies:

- the Ramsar Convention criteria for which the sites are listed;
- ecosystem services/benefits and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Ramsar site;
- limits of acceptable change for these values, components and processes;
- threats to the ecological character of each site; and
- the requirements to monitor ecological character and to detect if any LACs are likely to or have been exceeded.

Table 2 Ramsar Site Criteria Applicable for Lake Albacutya (Cibilic & White, 2010).

Criterion 1	A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region
Criterion 2	A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
Criterion 4	A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
Criterion 5	A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
Criterion 6	A wetland should be considered internationally important if it regularly supports one percent of the individuals in a population of one species or subspecies of waterbird.

The ECD provides a key source of information for applying the risk assessment and prioritisation process described in Section 6.1 of the *WWS*. It includes a detailed description of the ecosystem services/benefits, components and processes which are considered critical to the ecological character of the site. Ecological character is a term defined by the Ramsar Convention as “the combination of the ecosystem components, processes and benefits/services that characterise the wetlands at a

given point in time". A change in ecological character is the "human induced adverse alteration of any ecosystem component, process and/or ecosystem benefit/service." Whilst it is inevitable that change takes place to wetlands over time, changes have to be within the limits of acceptable change (LACs). Table 3, sourced from the ECD, summarises the critical components, processes and services and sets out the LACs for each of them. The LAC has been defined as; *the variation that is considered acceptable in a particular component or process of the ecological character of the wetland, without indicating change in ecological character that may lead to a reduction or loss of the criteria for which the site was Ramsar listed.*

The ECD also identifies other essential elements which, while not considered critical, are also important in contributing to the ecological character of the site. These include; climate, landform, water quality, groundwater hydrology, flora, aquatic and terrestrial fauna, food web and nutrient cycling. These elements contribute to the maintenance of all values associated with the site whether they be environmental, social, cultural or economic (Table 4 Description of the Values of Lake Albacutya Ramsar Site).



Lake Albacutya Boat Ramp (Top: 1950's Rainbow Historical Society, Bottom: 2009, D. Fletcher)

Table 3 Critical ecosystem services/benefits, components and processes as well as limits of acceptable change of Lake Albacutya Ramsar Site (Cibilic & White 2010).

Component/Process/ Benefit/Service	Summary description	Limit of Acceptable Change
<p>Component/Process Morphology/Geomorphology</p>	<ul style="list-style-type: none"> Sub-terminal lake of up to 5732 ha, full capacity 290 GL, flood capacity 320 GL, up to an average of 6 m deep. Underlying clays of the lakebed enable the lake to hold water for long periods of time. One of only 3 major sub-terminal lakes in the Murray-Darling Basin Drainage Division which fill from northern flowing rivers. 	<ul style="list-style-type: none"> The lake bed is comprised of a suitable substrate enabling it to hold water for extended periods to depths of over 6 m when full, while allowing some seepage to recharge the groundwater aquifer. Attribute retained without significant change as a result of human interference. The single natural inlet creek allows unimpeded flows from Lake Hindmarsh. Attribute retained without significant change as a result of human interference. The sill of the single natural discharge creek allows water to accumulate in the lake to a depth of over 6 m. Attribute retained without significant change as a result of human interference. The lake margins have an elevation significantly higher than the discharge creek bed. Attribute retained without significant change as a result of human interference.
<p>Component/Process Surface water/Hydrology</p>	<ul style="list-style-type: none"> Receives flows from the Wimmera River during sustained periods of high upper catchment rainfall. Extended dry periods occur between inflow events. When full, retains water for several years emptying slowly by evaporation and seepage. No comprehensive historical data is available on hydrology at the lake but limited records, anecdotal evidence and modelling suggest a decrease in the frequency and extent of flooding of Lake Albacutya to the time of listing. There is a long history of high levels of regulation of the Wimmera River for rural and urban water supply to which the altered hydrology of Lake Albacutya has been attributed. Models analysed prior to installation of the Wimmera-Mallee Pipeline predicted the average overflow frequency to be once in 49 years, reduced from natural conditions (once in 4 years) due to river regulation. These results showed that the lake was expected to be shallow or empty about 80% of the time compared with only about 20% of the time naturally. Hydrology-driven ecology includes waterbird arrival and breeding, Eucalypt woodland recruitment and survival and aquatic ecosystem development. 	<ul style="list-style-type: none"> The average return period for shallow floods of at least nine months duration will be no more than eight years. The average return period for lake-full overflow events of 24 months duration will be no more than 20 years.

Component/Process/ Benefit/Service	Summary description	Limit of Acceptable Change
Component/Process Flora - Eucalypt woodland/Recruitment, Regeneration	<ul style="list-style-type: none"> Extensive Eucalypt woodland fringes the lake, dominated by River Red Gum (<i>Eucalyptus camaldulensis</i>). Provides habitat, particularly nesting hollows, for waterbirds and nationally vulnerable Regent Parrot (<i>Polytelis anthopeplus</i>). Lake Albacutya River Red Gum population is genetically unique having very high drought and salinity tolerance. The Eucalypt woodland at Lake Albacutya is suffering some degree of dieback probably due to the altered hydrological regime. 	<ul style="list-style-type: none"> At least 75% of the extent of the eucalypt woodland community is maintained, based on a benchmark as soon as possible after 1982. At least one successful recruitment event occurs every 20 years on average.
Component/Process Fauna – Waterbirds, Threatened species/Migration, Reproduction	<ul style="list-style-type: none"> High waterbird abundance of many waterbird species during wet phases. Capable of supporting more than 20 000 waterbirds in total and ≥1 % of populations of at least 3 waterbird species. Breeding recorded for 12 waterbird species. Key population area for nationally vulnerable Regent Parrot with at least 50 individuals (at least 2% of the national population) and several breeding events recorded at the site. 	<ul style="list-style-type: none"> Supports 20,000 or more waterbirds on one in three occasions when the lake holds water for a period of at least nine months. A local Regent Parrot population is maintained at Lake Albacutya. Supports 1 % of the individuals in a population of one species or subspecies of waterbird on one in three occasions when the lake holds water for a period of at least nine months.
Benefit/service Near-natural wetland- representativeness	<ul style="list-style-type: none"> Lake Albacutya is a representative example of a near-natural intermittent sub-terminal lake within the Murray Darling Drainage Division. As a gazetted Park under the <i>Victorian National Parks Act 1975</i>, its key land-based values are protected. 	<ul style="list-style-type: none"> Lake Albacutya is maintained in a near-natural state.
Benefit/service Waterbird habitat	<ul style="list-style-type: none"> Lake Albacutya is capable of supporting more than 20 000 waterbirds particularly ducks, Banded Stilt and Eurasian Coot when full. Capable of supporting more than 5% of the south-eastern Australian population of Freckled Duck, more than 4.5 % of the Banded Stilt population and 1% of the Australasian shoveler population. 	<ul style="list-style-type: none"> Lake Albacutya waterbird habitat is maintained in a near-natural state.
Benefit/service Supports threatened species	<ul style="list-style-type: none"> Supports breeding populations of nationally vulnerable Regent Parrot. At least 2 % of the national population has been recorded at the site. 	<ul style="list-style-type: none"> At least 2% of the national Regent Parrot population is recorded at Lake Albacutya in one year in ten, at a minimum.

The 2011 Ramsar rolling review of the status of the Ramsar site showed that the LAC for the critical ecosystem component and process of surface water hydrology that was specified by Cibilic & White, 2010 has been exceeded. The LAC in the ECD were based on the frequency of 24 month and 9 month flooding events necessary to maintain the ecological character of the site. However it should be noted that *The Environmental Water Needs of the Wimmera Terminal Lakes* (Ecological Associates, 2004) which the ECD uses as a basis for the LAC, prescribes the frequency of 24 month and 6 month (rather than 9 month) flooding events. The review stated that since the lake has not undergone a lake full event since the early 1980's and shallow inundation since 1996 that the LAC has been exceeded given these events were many years ago. However the LAC refers to average rather than maximum return periods for lake filling and shallow inundation events. Hydrologic modelling shows that the environmental water provided by the Wimmera Mallee Pipeline savings and purchase of the Wimmera irrigation entitlement for use by the CEWH would have more than doubled the frequency of lake-full events over the historical flow record and so there remains no conclusive evidence that LAC has been exceeded.

Water regulation and diversion from the Wimmera River upstream of the lake for agricultural and domestic purposes was at its maximum at the time the site was listed in 1982. Long term drought impacted the region from 1995-2010 (attributed at least in part to changes in climate) which has severely limited volumes of water reaching the lower Wimmera River despite the recovery of additional water for the environment. Floodwaters in 2010 and 2011 failed to reach the lake, which has not received inflow for almost two decades.

Values of Lake Albacutya Ramsar Site

The value of Lake Albacutya to the Wimmera Mallee community and beyond is extremely significant. When the lake contains water it attracts visiting waterbirds and tourists from near and far. Its values are outlined in Table 4 and summarised in the following sections.

Environmental Values

The Lake Albacutya Ramsar Site is environmentally significant largely in relation to its important bird habitat and threatened bird species that have been observed at the lake. Species listed under Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) utilise the lake when water is present. In addition to this, the lake has several significant Ecological Vegetation Communities (EVCs). Cibilic & White (2010) lists the bird species and EVCs of significance. There is also a genetically distinct river red gum sub-species that is naturally found only at Lake Albacutya and is noted for its extreme tolerance of salinity and drought.

The key environmental values of the site relate to the critical components, processes, services and benefits (Table 3) and the justifications for the site meeting the Ramsar Convention criteria for which it was listed (Table 2).

Social, Cultural and Economic Values

When it contains water, Lake Albacutya is a huge drawcard for tourism in the Wimmera. Popular activities such as yabbing, camping, motor and non-motor boating, swimming, sightseeing, walking tracks, picnicking and barbequing and duck hunting attract between 20,000 and 40,000 visitors a year (Sandell, 1996). There are also profound Aboriginal cultural values attached to the lake. Lake Albacutya features in local Aboriginal legend as Nalbagadja, the place where Purra the kangaroo fed on bitter quandongs while fleeing from Wembulin the spider. Albacutya is derived from the word Nalbagadja and means 'place of bitter quandongs'.

Though there is no significant economic value of the lake directly, its indirect economic stimulation of local communities through tourism has been crucial to the region (Cibilic & White, 2010). Tourism supports the area economically through fuel, food, camping and fishing supplies, accommodation and

tours. A survey conducted by the former Department of Sustainability and Environment in 2003 of residents in nearby towns of Jeparit, Rainbow and Dimboola revealed that the sub-terminal lakes (i.e. Lake Hindmarsh and Lake Albacutya) are seen as being linked to the social and economic wellbeing of the towns (Cibilic & White, 2010).

The ECD also identifies a number of supplementary benefits and services which relate to the social and economic values of the site including;

- fish, crustacea and waterbird food resources associated with recreational fishing and licensed duck hunting;
- licensed sheep grazing;
- genetic material from the unique genetic provenance of River Red Gum at Lake Albacutya which is acknowledged as the best performing genotype of the species, now used for forestry purposes worldwide;
- tourism and recreational activities, especially when the lake is full;
- aboriginal cultural values and native title rights for the Wotjobaluk people; and
- scientific and educational opportunities.

Table 4 Description of the Values of Lake Albacutya Ramsar Site

High Values		
Type	Attribute	Details
Formally Recognised Significance Environmental	Ramsar Site	<p>Lake Albacutya is a sub-terminal intermittently filling lake which has significant environment value for the abundance of waterbirds including migratory shorebirds. Species observed at Albacutya above 1% of total population include:</p> <ul style="list-style-type: none"> • Banded Stilt • Freckled Duck • Blue Winged Shoveler <p>In addition to this, 20,000 Grey Teal were documented in 1993. When Albacutya holds water it is a popular recreational duck hunting lake.</p>
	Nationally Important Wetland	<p>Lake Albacutya was listed in the Directory of Important Wetlands in Australia for meeting the following criteria:</p> <ul style="list-style-type: none"> • It contains a highly diverse range of both Mallee and Riverine vegetation communities, including many threatened and significant species. These vegetation communities also act as a wildlife corridor between Lakes Hindmarsh and Albacutya and the Wirrengren Plain. • 60 waterbird species have been recorded at Lake Albacutya. This has included: <ul style="list-style-type: none"> ○ 3.5% of the national population of Freckled Duck ○ 10,000 Banded Stilts ○ Blue Billed Duck ○ Australasian Shoveler ○ Painted Snipe ○ Regent Parrot and ○ White Bellied Sea Eagle • Social and Cultural values – when it contains water Lake Albacutya draws thousands of people to it for camping, fishing, swimming, bird watching, boating and duck hunting. The area contains many middens and scarred trees which indicate the strong link that indigenous people have had with the lake for many years. There is also a native title over Lake Albacutya which is held by the traditional owners of the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk People. (http://www.environment.gov.au/cgi-bin/wetlands/report.pl)
	Heritage	The Wimmera River, which supplies Lake Albacutya with its water,

High Values		
Type	Attribute	Details
	Rivers	<p>is listed as a Heritage River site as it has high conservation values, cultural heritage and recreation values. These include:</p> <ul style="list-style-type: none"> • preserving cultural heritage; • providing opportunities for recreation, education and landscape appreciation; • improving water quality; • managing flow regimes; • preventing dieback in the riparian vegetation; and • conserving flora and fauna.
	Victorian Parks and Reserves	<p>Lake Albacutya Park was reserved in 1980 under schedule 3 ('Other Parks') of the <i>Victorian National Parks Act (1975)</i>. It is significant for its environmental values as well as its high social and economic value for recreation when containing water.</p>
	Important Bird Habitat	<p>60 waterbird species have been recorded at this wetland, including a number of vagrant species.</p> <p>The waterway is known to support significant numbers of waterbirds with more than 20,000 birds recorded on occasion. Internationally significant numbers (i.e. >1% of the relevant population) have been recorded for the following species (maximum count provided):</p> <ul style="list-style-type: none"> • Eurasian Coot (<i>Fulica atra</i>) – 20,000 • Black Swan (<i>Cygnus atratus</i>) – 10,000 • Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) – 4,500 • Red-necked Stint (<i>Calidris ruficollis</i>) – 3,200 • Banded Stilt (<i>Cladorhynchus leucocephalus</i>) – 3,100 • Curlew Sandpiper (<i>Calidris ferruginea</i>) – 2,100 • Freckled Duck (<i>Stictonetta naevosa</i>) – 730 • Great Crested Grebe (<i>Podiceps cristatus</i>) – 254 <p>In addition, Lake Albacutya supports waterbirds during critical life stages with 12 species recorded breeding and a number of waterfowl using the site during moult of primary flight feathers (Cibilic & White, 2010).</p>
	Significant Birds	<p>Thirteen species of migratory shorebirds listed under international agreements (JAMBA, CAMBA and ROKAMBA) have been recorded within Lake Albacutya. However, only six species are regularly observed:</p> <ul style="list-style-type: none"> • Caspian Tern (<i>Hydroprogne caspia</i>) • Curlew Sandpiper (<i>Calidris ferruginea</i>) • Eastern Great Egret (<i>Ardea modesta</i>) • Glossy Ibis (<i>Plegadis falcinellus</i>) • Red-necked Stint (<i>Calidris ruficollis</i>) • Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) <p>Lake Albacutya also supports the following bird species listed under the Advisory List of Threatened Vertebrate Fauna in Victoria as Endangered (EN) or Vulnerable (VU) in Victoria :</p> <ul style="list-style-type: none"> • Australasian Shoveler (<i>Anas rhynchos</i>) (VU). Habitat: all kinds of wetlands, preferring large undisturbed heavily vegetated freshwater swamps. It is also found on open waters and occasionally along the coast. http://www.birdlife.org.au/bird-profile/australasian-shoveler • Blue-billed Duck (<i>Oxyura australis</i>) (EN). Habitat: fresh to saline, deep permanent open wetlands and deep, densely vegetated lakes. http://bird.net.au/bird/index.php?title=Blue-billed_Duck • Freckled Duck (<i>Stictonetta naevosa</i>) (EN). Habitat: prefers large, well-vegetated swamps, but moves to open water after

High Values		
Type	Attribute	Details
		<p>breeding or in dry periods.</p> <p>http://bird.net.au/bird/index.php?title=Freckled_Duck</p> <ul style="list-style-type: none"> • Hardhead (<i>Aythya australis</i>) (VU). Habitat: freshwater swamps and wetlands and occasionally in sheltered estuaries. They prefer deep, fresh open water and densely vegetated wetlands for breeding. <p>http://www.birdlife.org.au/bird-profile/hardhead</p> <ul style="list-style-type: none"> • Musk Duck (<i>Biziura lobata</i>) (VU). Habitat: permanent swamps with dense vegetation.
	Significant EVCs	<p>Wetland EVCs threatened in the Murray Mallee bioregion</p> <ul style="list-style-type: none"> • Intermittent Swampy Woodland– Conservation Status: Vulnerable • Lake Bed Herbland– Conservation Status: Depleted • Riverine Chenopod Woodland – Conservation Status: Depleted <p>Terrestrial EVCs</p> <ul style="list-style-type: none"> • Semi-arid Woodland -Conservation Status: Vulnerable • Parilla Mallee - Conservation Status: Endangered • Low Rises Woodland - Conservation Status: Endangered • Plains Woodland - Conservation Status: Endangered • Woorinen Mallee - Conservation Status: Vulnerable • Plains Savannah - Conservation Status: Endangered <p>http://mapshare2.dse.vic.gov.au/MapShare2EXT/imf.jsp?site=bim</p>
	Noteworthy species	A genetically distinct salt tolerant sub-species of River Red Gum was discovered at Lake Albacutya.
Social	Game Hunting	Lake Albacutya is a game reserve and used for duck hunting.
	Aboriginal Cultural Heritage	<p>There are 17 registered heritage sites within the Lake Albacutya Ramsar site, including:</p> <ul style="list-style-type: none"> • Artefact scatters; • Burial sites; and • Scarred trees. <p>Lake Albacutya plays an important role in creation stories for the local traditional owners.</p>
	Motor Boating	Lake Albacutya has an upgraded boat ramp (2012) on the Western Beach which supports large motor boats
	Non-Motor Boating	Lake Albacutya is renowned for its non-motor boating opportunities including yachting.
	Picnics and Barbeques	Lake Albacutya has formal picnicing and barbequing facilities on the Western Beach as well as informal facilities around the lake in other areas
	Recreational Fishing	When full, the lake provides good recreational fishing but is most famous for its yabbying opportunities
	Sightseeing	When full, Lake Albacutya brings in between 20,000 and 40,000 visitors per year (Sandell, 1996)
	Tracks	There are numerous walking tracks and 4WD tracks around the lake
	Camping	The lake provides many options for camping and several areas have toilets, tables and water available which are most popular when the lake contains water.
Economic	Tourism	When full, Lake Albacutya provides a significant boost to local communities such as Rainbow and Jeparit with up to 40,000 visitors a year visiting the area contributing money through food, accommodation, camping, hunting and fishing equipment.

As with other high priority waterways considered in the *WWS*, the AVIRA tool was used to undertake a risk analysis to determine the most effective management activities that can be undertaken to maintain or improve Lake Albacutya's values. AVIRA contains a subset of the environmental, social and economic values (Appendix 5) that are supported by the Ramsar site (Table 4). These were identified using information in the ECD as well as data from other sources. In maintaining these values, it can be reasonably assumed that the other values not included in the AVIRA risk assessment are being maintained or improved. The AVIRA values are described in Table 5. The most significant of these are:

- important bird habitat;
- significant birds;
- game hunting;
- tracks;
- recreational fishing;
- swimming; and
- picnics and barbeques.

Table 5 AVIRA Values of Lake Albacutya Ramsar Site

Waterway		Environmental Values					
Wetland Number	Name	Formally Recognised Significance	Representativeness	Rare or Threatened Species/Communities	Naturalness	Landscape Features	
18835 (7226880425)	Lake Albacutya	✓	✓	✓	✓		
		Social Values			Economic Values		
		Activity	Place	People	Water	Power Generation	Other Resources
		✓	✓	✓			

Threats to Lake Albacutya Ramsar Site

Lake Albacutya faces a diverse number of threats. First and foremost reduced water availability due to water regulation and extraction which is exacerbated by reduced rainfall due to climate change. When the site was listed in 1982 the hydrological regime of the lake had been significantly altered from its natural condition due to long term regulation of the Wimmera River which commenced in the 1850s and increased significantly from the 1920's to the 1960's. The lake has not contained water for extensive periods since the 1980's. It is almost two decades since there were any inflows from Outlet Creek.

Other significant threats are the decline of the health of the fringing Eucalypt woodland and invasive plants and animals. Lake Albacutya was also severely affected by a bushfire that burnt most of the lake area in early 2014. Detailed descriptions of threats facing the lake are listed in Table 6. However it should be noted that given Lake Albacutya's position, near the end of the Wimmera River system, it is vulnerable to catchment-scale threats (e.g. poor water quality, invasive plant and animal species) and therefore actions to address these threats elsewhere in the catchment will benefit the values of Lake Albacutya.

Case Study – Water Recovery and Lake Albacutya

Following the floods of 2010 and 2011, there was a degree of optimism that water would soon reach and potentially fill Lake Albacutya, something that has not taken place for approximately 20 and 30 years respectively. Unfortunately this was not the case and Lake Albacutya remains dry. However much has been done to increase the likelihood of water returning to Lake Albacutya. Based on hydrological modelling and using historical inflow data, an annual average of 45.6 GL will be returned to the Wimmera River due to water savings from the construction of the Wimmera Mallee Pipeline and another annual average of 24.5 GL from the purchase of the irrigation entitlement for environmental watering.

The benefits of this for Lake Albacutya are likely to be significant – based on historic inflows. It reduces the average recurrence interval of the lake full events recommended in Ecological Associates (2004) report with 6 month lake full events reduced from every 59 years to every 20 years and 24 month lake full events from once every century to once every 50 years. Whilst changes to climate will continue to be the greatest threat to the lake's hydrology, the threat posed by water extraction has been significantly reduced.



Lake Albacutya, May 2009 (Photo: D. Fletcher)

Table 6 Description of the Threats to Lake Albacutya Ramsar Site

Threats that are bolded and italicised are taken from the *Ecological Character Description for Lake Albacutya* (Cibilic & White, 2010).

Threats	Details	Potential Impacts	Significance of threat	Likelihood of impacts	Timing of Impacts
Natural System Modifications					
River Regulation/Channelled Water Regime	Under the river regulation regime which was in place at the time of listing, the average overflow frequency of Lake Albacutya is predicted to be once in 39 years, reduced from natural conditions (once in 4 years). However this has been increased to once in 12 years following the recovery of significant volumes of water for the environment.	Reduced frequency and duration of flooding. Interference with migration, reproduction, regeneration and recruitment processes. Reduced habitat availability and quality for waterbirds. Declining Eucalypt woodland health.	High	High	Short Term
Climate Change and Severe Weather					
Climate Change – reduced rainfall	Reduced rainfall, which occurred throughout the Wimmera River catchment from 1995 to 2010 has been one of the core issues for Lake Albacutya. Climate modelling suggests that in the future there is likely to be even less of the wet winter/springs required to get water into Hindmarsh and Albacutya. However, one key element of uncertainty is around extreme wet events during summer periods (such as the one experienced in 2011).	Reduced frequency and duration of flooding. Interference with migration, reproduction, regeneration and recruitment processes. Reduced habitat availability and quality for waterbirds. Declining Eucalypt woodland health.	High	Medium	Short to Long Term
Ecosystem/community stresses					
Decline in Eucalypt Woodland Health/ Degraded Wetland Buffer	The River Red Gum populations at Lake Albacutya have experienced widespread dieback over the past decade or so. Lake Albacutya's River Red Gum sub-species is however noted for its salt and drought tolerance which has aided in minimising the negative effects of prolonged dry periods experienced of recent times.	Reduces habitat for waterbirds and Regent Parrot	Medium	High to Medium	Short to Medium Term
Human Intrusion and Disturbance/Biological Resource Use					
Recreation	Some species of waterbirds and the nationally vulnerable Regent Parrot are sensitive to disturbance during roosting periods. This disturbance comes in the form of walkers, swimmers, anglers, duck hunters and other recreational activities	Recreational hunting and human activity may disturb waterbirds and Regent Parrot breeding	Low	Unknown	Dependent upon hydrology
Invasive and Overabundant Native Species					
Pests (carp, birds, bees, rabbits, foxes, cats, dogs)	Carp are the main invasive aquatic pest species and only become an issue when the lake has filled and held water for a number of years. Rabbits are the most noxious invasive species in the Park and the Wimmera CMA, along with Parks Victoria and DEPI have conducted extensive control and eradication projects in recent years (Wimmera CMA, 2010). Introduced predators (dogs, cats and foxes) and bees are also causing issues in the park through predation and nest competition	Carp reduce habitat quality for fish, aquatic flora and fauna and waterbirds. Bees compete with waterbirds and Regent Parrot for tree hollows. Rabbits inhibit Eucalypt woodland recruitment. Foxes, cats and dogs may prey on waterbirds and Regent Parrot	High to Medium	High to Medium	Short to Medium Term

Threats	Details	Potential Impacts	Significance of threat	Likelihood of impacts	Timing of Impacts
Weeds	The Lake Albacutya Ramsar Site has several Weeds of National Significance (WoNS) present, namely Boneseed and Bridal Creeper. Extensive works have been done to control these species with projects continuing, these works are guided by recommendations under the WIPAMS.	Degradation of Eucalypt woodland. Reduced habitat quality for waterbirds and Regent Parrot. Competition with native vegetation for ground cover.	High to Medium	High to Medium	Short Term
Overabundant kangaroos and native birds	Overabundant kangaroos are impacting on regeneration of vegetation. Overabundant native bird species compete with species such as Regent Parrots for nests.	Overgrazing by kangaroos leads to reduced vegetation condition. Overabundant native bird populations affect Regent Parrot recruitment.	Medium	High to Medium	Short to Medium Term
Agriculture					
Agricultural Cropping	Historically the lakebed has been cropped though this has not occurred since Lake Albacutya was Ramsar listed. Cropping of the lakebed ceased in the early 1980's. There are no plans to reintroduce it.	The effect of cropping on the lake ecology is unknown, however it could have included: <ul style="list-style-type: none"> Disturbance and erosion of lakebed soil and reduction in soil organic matter; Reduction in diversity of terrestrial flora and fauna Reduction in post-flood nutrient pulse; Depletion of lakebed seed and egg bank; and Initial reduction in aquatic primary productivity and faunal density. There is no information on how long these impacts persisted after cropping ceased.	Moderate	Low	Long term
Agricultural Grazing	Agricultural grazing on the lake bed of Lake Albacutya has occurred for over 160 years as the area was classed as freehold prior to 1980. Formal grazing licenses were established in 1983 and covered a total area of 2,117.6 ha. Currently around 40% of the wetland is being grazed	There is a potential that agricultural grazing by sheep on the wetland can effect recruitment of native species and can also aid in the spreading of weeds.	Unknown	High	Long Term

Note: short term = 0-25 years, medium term = 25-50 years, long term = >50 years.

Risk Assessment

The threats described in Table 6 were aligned where possible to threats used in AVIRA (Appendix 5) and a risk assessment was undertaken against the significant values supported by the Ramsar site (Table 7). The natural hydrological regime of the Ramsar site has been progressively altered since the 1850's. This posed a very high or high risk to five of the seven significant AVIRA values, while degraded water quality, invasive fauna (terrestrial) and degraded wetland buffer also posed a high risk to some significant values.

Through undertaking this risk assessment of threats impacting on values at Lake Albacutya, priority management activities can be determined that are designed to protect the lake's values. Resultant on-ground management activities that are feasible and aim to mitigate the highest threats follow the conceptual models for addressing wetland threats in ARI (2012) are included in Table 8.

Management Objectives, Targets and Outcomes

The objective of the management planning arrangements for Lake Albacutya Ramsar Site is to maintain and, if possible, improve the ecological character of the site. Therefore, to maintain the ecological character of the Lake Albacutya Ramsar site, it is crucial that the critical components, processes and benefits/services remain within the relevant LACs and that the lake continues to support the values which justifies it meeting the criteria for Ramsar site listing in 1982.

The changed water regime of Lake Albacutya represents the key threat to the ecological character of the Ramsar site and the values relating to the Ramsar criteria for which it is listed. It poses a threat to the health of the fringing Eucalypt woodland as well as the waterbird and the Regent Parrot populations. The significant changes that were in place at the time of listing have since been exacerbated by drought and are predicted to continue with reduced rainfall due to climate change. At the same time, water savings and the purchase of irrigation entitlements have the potential to partially offset these adverse impacts.

To maintain ecological character, it will be necessary to ensure that the hydrological regime is within the LAC however this will be challenging, especially if reductions in rainfall persist. The completion of the pipeline projects and the purchase of the irrigation entitlement for use for environmental flows there are now substantial volumes available to provide flows to the lower Wimmera River which in turn will benefit the terminal lakes in extremely wet years. Based on the historical flow record, there could be occasions where high flows during a sequence of very wet years have led to substantial volumes entering Lake Hindmarsh and Lake Albacutya and there are substantial environmental water allocations (at least 70,000 ML) which can make a difference in terms of 'topping up' the lakes to achieve lake-full events. In light of this a plan is proposed to investigate ways to improve the use of regulated environmental water in the Wimmera River system to maximise Lake Albacutya's hydrological regime. However modelling results to date suggest that due to the long (20 year) wet-dry periods for Lake Albacutya, the current 121 year hydrological record is too short to make definitive conclusions around the lake's hydrological regime (both current and desired) (Jacobs, 2014). Therefore there is some uncertainty around the potential for Lake Albacutya's hydrological regime to remain with the LAC.

The management activities in Table 8 address the long-term resource condition targets (RCTs) set out in Table 7-40 of the WWS and the management outcome targets (MOTs) set out in Table 7-41 of the WWS. Other management activities in Section 6.7 Catchment-Wide Management Issues, in particular Section 6.7.1. Recreational Use of Waterways will also benefit Lake Albacutya.

Table 7 Risk assessment for Lake Albacutya Ramsar Site

High Value Type	Attribute	Altered Wetland Form	Changed Water Regime	Degraded Water Quality	Invasive Fauna (Terrestrial)	Invasive Flora (Wetland)	Reduced Wetland Area	Soil Disturbance	Degraded Wetland Buffer	Livestock Access to Buffer
	Significant Birds	Low Risk (No Priority Action)	Very High Risk (Reduce Threat)	High Risk (Reduce Threat)	High Risk (Reduce Threat)	Very Low Risk (Reduce Threat)	Moderate Risk (Protect)	Low Risk (Reduce Threat)	High Risk (Reduce Threat)	Moderate Risk (Reduce Threat)
	Game Hunting	No Risk (No Priority Action)	High Risk (Reduce Threat)	Low Risk (Reduce Threat)	Moderate Risk (Reduce Threat)	Moderate Risk (Reduce Threat)	Moderate Risk (Protect)	No Risk (No Priority Action)	Moderate Risk (Reduce Threat)	Low Risk (Reduce Threat)
	Tracks	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)
Social	Recreational Fishing	Very Low Priority Action)	Very high Risk (Reduce Threat)	Moderate Risk (Reduce Threat Level)	Low Risk (Reduce Threat)	Moderate Risk (Reduce Threat)	Very Low Risk (Reduce Threat Level)	No Risk (No Priority Action)	Low Risk (Reduce Threat)	Low Risk (Reduce Threat)
	Swimming	No Risk (No Priority Action)	Very High (Reduce Threat)	Very Low (Reduce Threat)	No Risk (Reduce Threat)	No Risk (Reduce Threat)	Very Low (Reduce Threat)	No Risk (No Priority Action)	Low Risk (Reduce Threat)	No Risk
	Picnics and Barbeques	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)	No Risk (No Priority Action)

Table 8 Long-term Resource Condition and Management Actions for Lake Albacutya

Management Unit		Hindmarsh					
Basin	Wimmera	Waterway	Lake Albacutya	Identification No.	18835 / 15-91-W1		
Long-term Resource Condition	Social	Duck Hunting	HI RCT 11. Continuing to provide recreational duck hunting opportunities	Contribution to ecological character:	Process		
		Fishing/Yabbying	HI RCT 9. Continues to provide recreational fishing/yabbying opportunities			Component	
	Environmental	Hydrology (frequency and persistence of water)	HI RCT 19. Reduction of threat from modification of hydrological regimes due to earthworks (drains, embankments etc.) HI RCT 20. Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions		Morphology, Surface Water	Geomorphology, Hydrology – Surface Water	
		Water Quality	HI RCT 17. Improved IWC water properties sub-index scores to average 'moderate'. HI RCT 18. Improved knowledge of water quality issues		NA	NA	
		Birds	HI RCT 12. Supports significant bird populations, particularly wetland bird species when the lake contains water HI RCT 10. Increased recognition and understanding of wetland bird values		Fauna: Water birds, Threatened bird species	Migration/Reproduction	
	Economic	Wetland Vegetation Condition	HI RCT 13. No declines in IWC vegetation condition HI RCT 14. Improvement in average IWC vegetation sub-index scores in the region. HI RCT 15. Increased understanding of wetland vegetation condition. HI RCT 16. Increase wetland connectivity measures		Flora: Eucalypt woodland	Recruitment/Regeneration	
		Tourism	Tourism to Lake Albacutya remains similar to previous times the lake contained water				
	Values	<p>Environment: High value bird and vegetation communities. Heritage River status. Social/Cultural: Valued for picnics, barbecues, game hunting, camping, sightseeing, fishing and boating. Significant community and Aboriginal cultural heritage values. Economic: Tourism</p>					
	Threats	<p>Invasive flora and fauna, Changed water regime, Degraded water quality, Degraded buffer</p>					

Management Unit		Hindmarsh		
Basin	Wimmera	Waterway	Lake Albacutya	Identification No.
		18835 / 15-91-W1		
Management Outcome Targets		Management Activity/Output	Quantity	Lead agency/Partners
HI MOT 14	Achieve waterway relevant invasive fauna targets in the W/PAMS (Wimmera CMA, 2010)	Conduct invasive fauna control for wetlands (Rabbits)	7000 Ha	PV, DEPI CMA
HI MOT 17	Increased persistence of water in wetlands compared to historic (pre-2009) levels under comparable climate conditions	Environmental watering actions for the lower Wimmera River will assist this	Ongoing	CMA, GWMWater, VEWH, CEWH, Local Govt.
		Plan improving use of regulated environmental water to maximise terminal lake outcomes	1 report	CMA, DEPI
		Seek opportunities to maximise environmental water availability (e.g. through improving system efficiency).	Ongoing	CMA, GWMWater, VEWH, CEWH
HI MOT 23, HI MOT 24, HI MOT 25	Achieve waterway relevant invasive flora targets in the W/PAMS. All wetlands have <1% invasive wetland (tree and shrub) flora, 66% of wetlands have no greater than 50% weed cover with high threat weeds present	Conduct priority groundcover weed control in wetland areas (Bridal Creeper, African Love Grass)	600 ha	PV, DEPI, CMA
		Conduct priority tree/shrub weed control in wetland areas (Boneseed and Boxthorn)	120 ha	PV, DEPI, CMA
HI MOT 18, HI MOT 14	Increased information about wetland vegetation quality and extent, Achieve waterway relevant invasive fauna targets in the W/PAMS	Undertake monitoring actions described in Table 9	NA	PV, DEPI, CMA
NA	Information on the status of Lake Albacutya's critical components, processes and benefits/services in relation to the relevant LACs	Develop a program to monitoring the ecological character of the Ramsar site based on monitoring actions described in Table 9.	NA	PV, DEPI, CMA
		Report on the status of ecological character as Part of the national Ramsar site rolling review	NA	DEPI, PV, CMA
Estimated cost of activities		\$532,000		
Relevant documents:				
Wimmera Wetlands Asset Strategy Heritage River Waterway Action Plan Wimmera Invasive Plant and Animal Management Strategy		Western Region Sustainable Water Strategy Ecological Character Description – Lake Albacutya Basin Plan		

Monitoring, Evaluation and Reporting for Lake Albacutya Ramsar Site

Whilst monitoring, evaluation and reporting processes for Wimmera waterways is outlined in Section 8 of the *WWS*, there are specific additional requirements for Lake Albacutya given Australia reports on the ecological character of its Ramsar sites through a national Ramsar site rolling review. The findings are included in Australia's national report to the triennial Conventions of Contracting Parties to the Ramsar Convention. The broad aims of the Ramsar Rolling Review program are to:

- review and report the on status of the ecological character of Australia's Ramsar sites (including positive or adverse change);
- assist managing sites in order to maintain their ecological character, improving links between ecological character, site management plans and monitoring programs for critical components, processes and services and associated threats;
- provide input to a database of baseline and threat data;
- record updates as knowledge gaps are addressed and refinement of LACs;
- highlight issues and facilitate assessment of a potential change of character focussing on proactive management before the situation requires notification; and
- identify broad trends or common threats across site and jurisdiction boundaries.

Under the Ramsar rolling review, reporting for Lake Albacutya Ramsar Site will focus on the LACs (Table 3) but may also include critical components, processes or services where knowledge gaps exist or key threats as identified in the ECD.

Specific reporting actions include:

- Collation of monitoring results for the Lake Albacutya Ramsar Site and, every three years (2015/16 and 2018/19) to:
 - report on the status of ecological character as part of the national Ramsar site rolling review;
 - assess if the Ramsar site continues to meet the criteria for which it was listed.
- Report any adverse changes in ecological character to the Ramsar Secretariat in accordance with Action 12.4 of the *VWMS*.

In order to inform the development of the various reporting requirements listed previously as well as enable adaptive management of Lake Albacutya, a program to monitor the ecological character of the Ramsar site addressing key knowledge gaps needs to be developed. Priorities for monitoring have been outlined in Cibilic & White (2010) and are summarised in Table 9. Responsibilities for monitoring lie with DEPI and Parks Victoria, supported by Wimmera CMA.

Table 9 Monitoring Priorities for Lake Albacutya from (Cibilic & White, 2010)

Component/ process	Monitoring objective	Indicator	Frequency	Priority
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Component/ process	Monitoring objective	Indicator	Frequency	Priority
Hydrology	<ul style="list-style-type: none"> Keep a comprehensive record of inflows - flow commencement, depth, volume, extent (area), date, season, duration. Can be used to improve hydrology models and to quantify any changes in hydrology over time and inform release of environmental water allocations. Monitor environmental water releases. Assessment against Limits of Acceptable Change 	Water Level	Annually when holding water	Moderate
Waterbirds	<ul style="list-style-type: none"> Rigorously monitor waterbirds to detect any change in numbers, especially in relation to Ramsar criteria. Also monitor impacts of recreation and hunting on waterbird numbers and breeding. Assessment against Limits of Acceptable Change 	Abundance and species present. Observations of breeding	Annually when holding water	Moderate
Flora – Eucalypt woodland including River Red Gum	<ul style="list-style-type: none"> Detect and quantify any changes/trends in the health of the Eucalypt woodland including River Red Gum community (which may assist in determining the exact cause of dieback). Keep records of recruitment events and monitor recruitment and seedling survival. Assessment against Limits of Acceptable Change 	Health of existing woodland species including River Red Gum Recruitment of woodland species	Annually when holding water	Moderate
Species – Regent Parrot	<ul style="list-style-type: none"> Monitor the Regent Parrot population in terms of numbers, breeding, and movement/migration. Assessment against Limits of Acceptable Change 	Regent Parrot Evidence of breeding	Annual	High
Pest Animals (Rabbits)	<ul style="list-style-type: none"> Monitor rabbit densities as a threat indicator 	Abundance	Annual	High

Appendix 3 Roles and Responsibilities for Waterway Management

Wimmera CMA, along with nine other CMAs, was established in 1997 by the Victorian Government, under the *Catchment and Land Protection Act 1994* with the aim of creating a whole of catchment approach to natural resource management in the state.

The primary goal of the Victorian CMAs is to ensure the protection and restoration of land and water resources, the sustainable development of natural resources-based industries and the conservation of our natural and cultural heritage. Under Part 10 of the *Water Act 1989*, CMAs are designated with specific responsibility for the management of waterways as well as aspects of drainage and floodplains.

The range of functions that CMAs undertake relating to waterways includes:

- developing a regional Waterway Strategy and associated action plans;
- developing and implementing work programs;
- authorising works on waterways, acting as a referral body for planning applications, licences to take and use water and construct dams, for water use and other waterway health issues
- identifying regional priorities for environmental watering and facilitating water delivery;

- providing input into water allocation processes;
- developing and co-ordinating regional floodplain management plans;
- managing regional drainage along with local governments and water corporations, as appropriate;
- responding to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms; and
- undertaking community participation and awareness programs.

Advisory Committees comprised of community members and agency representatives play a crucial role in assisting the Wimmera CMA plan and implement actions to protect the region’s natural assets. Two committees (Rivers and Streams; Wetlands) will provide feedback to ensure that waterway management activities continue to be effective and able to be delivered in a partnership.

In undertaking these functions, Wimmera CMA works in partnership with a large number of organisations and departments as well as significant numbers of landholders and other community members (Table 1).

Table 1 Partners and their roles and responsibilities in waterway management

Level	Partners	Roles and responsibilities/links with waterways
State Government Agencies and statutory bodies	Department of Environment and Primary Industries (DEPI)	<p>The Department of Environment and Primary Industries (DEPI) is the lead agency for waterway management. It is responsible for the development of waterway policy, co-ordination of regional delivery and prioritisation of Government investment in waterways. DEPI is also responsible for other aspects of natural resource management that are of relevance to waterways, including:</p> <ul style="list-style-type: none"> ▪ sustainable management of Victoria’s water resources ▪ overseeing the catchment planning framework to promote integrated catchment management throughout Victoria ▪ management of biodiversity ▪ management of public land, including Crown frontages. It is responsible for their administration, including their licensing for riparian management and for grazing and ensuring compliance with licence conditions. It also has a direct onground responsibility for unlicensed Crown frontages and is responsible for some aspects of waterways on public land. ▪ bushfire management on public land ▪ delivery of sustainability and environment services at the regional level, including some services that relate to waterway management. ▪ manage fisheries and recreational fishing in waterways to optimise economic and social value while ensuring the sustainability of resources ▪ invest in and delivers farming programs on private land where waterways occur ▪ oversee the management of biosecurity, including aquatic invasive species
	Environment Protection Authority Victoria (EPA)	<p>EPA Victoria is an independent body responsible for the protection and improvement of Victoria’s environment by establishing environmental standards, regulating and working with organisations to meet these standards. Their roles and responsibilities include;</p> <ul style="list-style-type: none"> ▪ identifying the beneficial uses of water environments and the level of environmental quality needed to protect them through the <i>State Environmental Protection Policy (Waters of Victoria)</i> ▪ setting statutory standards for acceptable water quality and indicators of water quality ▪ investigating water quality incidents classified as ‘pollution’ ▪ using mandatory and regulatory mechanisms, such as licensing and other discretionary tools to assist in the achievement of water quality objectives

Level	Partners	Roles and responsibilities/links with waterways
		<ul style="list-style-type: none"> acting in partnership with DEPI and regional bodies to monitor water quality and waterway health, and enables problem solving approaches and independent audits of impacts on the environment and the protection of beneficial uses
	Parks Victoria (PV)	Parks Victoria manages parks and conservation reserves in which many waterways are located, including national, State, wilderness, metropolitan and regional parks, marine national parks and sanctuaries and conservation and natural features reserves. They create, manage and maintain visitor sites and manage a range of assets, including visitor facilities and access points, piers and jetties, sporting facilities and navigation aids, many of which are associated with waterways.
	Victorian Environmental Water Holder (VEWH)	The Victorian Environmental Water Holder is appointed under the <i>Water Act (1989)</i> to manage Victoria's environmental water entitlements. The Victorian Environmental Water Holder works with the waterway managers, Commonwealth Environmental Water Holder, Murray–Darling Basin Authority. Storage operators and land managers to ensure environmental water entitlements are used to achieve the best environmental outcomes.
National/other state authorities	Murray–Darling Basin Authority (MDBA)	The Murray–Darling Basin Authority was established under the federal <i>Water Act (2007)</i> as an independent, expertise based statutory agency. The primary roles of the Authority as outlined in the <i>Water Act (2007)</i> include: <ul style="list-style-type: none"> preparing and reviewing the Basin Plan measuring, monitoring and recording the quality and quantity of the Basin's Water resources supporting, encouraging and conducting research and investigations about the Basin's Water Resources developing equitable and sustainable use of Basin water resources disseminating information about the Basin's water resources engaging and educating the Australian community about the Basin's water resources.
	Commonwealth Environmental Water Holder (CEWH)	The Commonwealth Environmental Water Holder manages an entitlement in the Wimmera CMA region to assist in its role to protect or restore the environmental assets of the Murray-Darling Basin. Water will be managed in accordance with the environmental watering plan that will be part of the Murray-Darling Basin Plan.
	Department of Environment	The Department of Environment designs and implements the Australian Government's policies and programs to protect and conserve the environment, water and heritage and promote climate action. It is also is Australia's administrative authority for the Ramsar convention.
	South East NRM Board (South Australia)	The SE NRM Board is a group of community, state and local Government members who make decisions about regional investment in NRM, derived from the NRM Levy in conjunction with state and regional NRM plans. The implementation and on ground works of decisions made by the SE NRM Board are carried out by staff (project and administrative) from Natural Resources South East
Water Corporations	GWMWater and Central Highlands Water	Water corporations in Victoria are established under the <i>Water Act (1989)</i> and provide a range of water services to customers within their service areas. Central Highlands Water provides urban water supplies to Navarre and Landsborough. <p>GWMWater provide a combination of irrigation services, domestic and stock services, bulk water supply services and urban water and wastewater services in most of the Wimmera CMA Region. Their link with the <i>WWS</i> includes;</p> <ul style="list-style-type: none"> broader catchment health and improved water quality links

Level	Partners	Roles and responsibilities/links with waterways
		<p>to water supply.</p> <ul style="list-style-type: none"> management of water storages and other parcels of land vested in the water corporation water reform, operational role in environmental water management. responsible for Blue Green Algae regional coordination
Local Government	Ararat Rural City, Buloke Shire, Hindmarsh Shire, Horsham Rural City, Northern Grampians Shire, Pyrenees Shire, West Wimmera Shire and Yarriambiack Shire	<p>Councils are involved in the management of waterways in Victoria through their role as responsible planning authorities, managers of stormwater drainage and onsite domestic wastewater systems, users of integrated water systems, land managers, emergency management bodies, and supporters of community groups. Specifically with regard to waterways, local government have the following roles and responsibilities:</p> <ul style="list-style-type: none"> incorporate waterway and catchment management objectives, priorities and actions into strategic and statutory planning processes; undertake elements of floodplain management in accordance with the renewed Victorian Floodplain Management Strategy; develop and implement urban stormwater plans; manage on-site domestic wastewater systems; manage sections of waterways where formal agreements are in place; and manage rural drainage and infrastructure (e.g. town weirs) where appropriate.
Traditional Owners	Barengi Gadjin Land Council Aboriginal Council, Martang Pty Ltd.	<p>Traditional Owners with recognised native title rights or formal agreements with the State are important in land and water management. Joint management co-operative management agreements can involve establishment of majority Traditional Owner boards or councils that prepare management plans and/or provide advice about the management of specific areas.</p>
Community	Landholders	<p>Landholders are vital to successful implementation of this strategy, as most works are on privately owned land or affect areas that require private co-operation, and their land management practices have a vital role in catchment health. Under the <i>Catchment and Land Protection Act (1994)</i> landholders are required to;</p> <ul style="list-style-type: none"> protect water resources avoid causing or contributing to land degradation which causes or may cause damage to land of another owner conserve soil eradicate regionally prohibited weeds and prevent the growth and spread of regionally controlled weeds prevent the spread of, and as far as possible eradicate, established pest animals.
	Individuals	<p>Community members have an important role in protecting waterway health by avoiding and reporting pollution, reducing resource consumption and contributing to environmental management processes.</p>
	Community Groups	<p>Community groups (such as Landcare, Waterwatch, 'Friends of groups) participate in regional planning, priority setting and the implementation of regional works programs, participate in monitoring waterways condition and undertake projects in priority areas.</p>
	Industry	<p>Industry can assist in the protection and improvement of waterways by managing its activities in accordance with the principles of ecologically sustainable development and minimising impact on the environment by the implementation of best practices, in accordance with 'duty of care' responsibilities and good corporate citizenship.</p>

Appendix 4 Review of Wimmera Waterway Health Strategy 2006-2011

Background to the review of the Wimmera Waterway Health Strategy (2006-2011)

A key step in developing this document was a review of the *Wimmera Waterway Health Strategy (2006-2011)* (*Wimmera WHS*) which built on previous strategic and technical planning undertaken in the region for rivers, creeks and wetlands and combined it in a series of prioritised actions based on maintaining or improving the social, economic and environmental values attached to each waterway. Actions were specified for 19 waterway health management units. Details on specific actions undertaken for these waterway health management units over the life of the *Wimmera WHS* are included in relevant sections and the review has also focused on the different elements of waterway management the *Wimmera WHS* specified actions for.

History of Strategic Waterway Planning in the Region

The Wimmera region has had a long and successful history of catchment-based planning to improve initially the region's rivers and streams and later the many wetlands across the landscape. Work completed by the Land Conservation Council (LCC) in the 1970's highlighted the many natural values associated with the Wimmera's waterways whilst discussing some of the processes threatening them. This was built on in the 1980's with recommendations from the LCC to protect the environmental values on Crown land parcels across the Wimmera, particularly Crown stream frontage and State and National Parks. This progressed further in the 1990's with the publication of the *Wimmera River Integrated Catchment Management Strategy* (Wimmera Catchment Co-ordinating Group, 1992) which provided an initial integrated plan for Crown and freehold land management to improve the condition of the Wimmera River catchment. Subsequent Wimmera Regional Catchment Strategies in 1997 and 2002 built on and expanded this work to encompass areas in Millicent Coast Basin and provided a solid framework for future strategic plans such as the *Wimmera WHS*.

The *Wimmera WHS* was another vital step forward in terms of integrated management of waterways across the region. For the first time in Victoria, a strategic regional plan was developed that incorporated rivers, creeks and wetlands and provided a robust and transparent process for undertaking effective works during a period during which the region experienced extremes of drought and flood.

A critical step in developing the *WWS* is the review and evaluation of the *Wimmera WHS* and the identification of areas for improvement. Evaluation of the previous *Wimmera WHS* included comparison of outputs generated over the life of the *Wimmera WHS* compared to targets within the *Wimmera WHS*. Also to assist the review, the *Wimmera WHS* contained an evaluation report and DEPI has provided a guidance note on the reviewing previous waterway health strategies undertaken by CMAs. This document synthesises the results of the review considering information from these sources across the various subprograms that combine to provide a holistic waterway management program. These subprograms are:

- Floodplain Management;
- Wetland Management;
- Riparian Land Management;
- In-stream and Channel Form Management;
- Environmental Water Reserve Management;
- Water Quality;
- Significant Flora and Fauna;
- Communication and Engagement; and
- Adaptive Management Framework.

Floodplain Management

The objectives were to:

- Manage floodplains to minimise flood risk and damage to people and property;

- Enhance the ecological values of floodplain environs of the Wimmera; and
- Improve our knowledge of Wimmera floodplains and their flood characteristics.

These objectives were intended to be achieved through undertaking work in three areas – undertaking flood studies for priority areas, transferring improved flood information into municipal planning schemes and flood information databases and enhancing knowledge of floodplain ecology in the Wimmera. Whilst floodplain management is crucial to effective waterway management, evolving government policy in response to the record floods in 2011 means that floodplain strategic planning is not to be considered within the *WWS*. As state-wide policy is developed for floodplain management it will be progressively applied at a local level.

Positive Outcomes – flooding risks in many priority areas are well understood

Flood investigations were completed for Glenorchy, Warracknabeal and Jeparit that were specified as targets within the strategy. Additionally, large-scale modelling was undertaken in the floodplain between Glenorchy, Horsham and Warracknabeal as well as a flood study for Hall's Gap. This work proved invaluable in assisting emergency management of the floods of 2010 and 2011 as well as reducing risks of future floods through providing information for local governments to consider in implementing best practice floodplain management through preventing inappropriate development on floodplains. Such information also assists councils in the development of Municipal Emergency Management Plans which prescribes actions for reducing risks and damage during floods.

Learnings from the Past – need to know more about floodplain environment

Given the *Wimmera WHS* was in effect for mostly drought years, investigating floodplain ecology was understandably not a priority for Wimmera CMA or its investors. There were also issues in transferring the results of flood investigations into municipal planning schemes. This could in part be attributed to a lack of resourcing for councils to undertake this work, the deemed low priority when drought conditions prevailed and ongoing challenges to highlight their value to council staff and councillors of floodplain planning provisions to reduce risks to life and property from future floods.

Challenges for the Future – dealing with shifts in policy and improvements in knowledge

The floods of 2010 and 2011 reminded everyone of the importance of effective floodplain management and emphasised the value of the work Wimmera CMA had been undertaking. Subsequent to these floods, a number of government reviews were undertaken looking at flood warnings, flood infrastructure and rural drainage. Recommendations from these reviews as well as local learnings from the floods will be important to include in future strategic documents for floodplain management in the region. There is also the need to ensure that progress is made on managing the environmental values of Wimmera floodplains. Lastly, there needs to be an understanding and appreciation amongst all key agencies of best practice floodplain management to ensure that improved flood knowledge from flood investigations are incorporated into emergency management plans and municipal planning schemes in a timely fashion.

Wetland Management

The objectives were to:

- Protect the high value wetlands of the Millicent Coast Basin; and
- Manage wetlands and wetland systems of the Millicent Coast Basin to achieve a balance between economic, social and environmental values.

Positive Outcomes – lots of great work has been achieved and wetlands protected

There were enormous gains in terms of wetland protection over the life of the *Wimmera WHS*. Over 1240 Ha of land in over 70 wetlands and their surrounds was protected in long-term management agreements using market based instruments where landholders received funds to undertake works to maintain and/or improve wetlands on their property (Figure 1 and Figure 2). Almost all of the wetland types were freshwater meadows and freshwater marshes – wetland types that have been declining most rapidly in number and quality.

A major focus for wetland management has been the number and quality of community engagement and education activities. One avenue has been through the provision of Property Management Planning courses, providing advice to landholders on how to appropriately manage wetlands within the context of profitable and sustainable farming. Community events such as World Wetlands Day celebrations were highlights in the region, with packed out venues at events where the community appreciated the enormous value of wetlands even in the depths of record drought where they were virtually all completely dry. More recent events linking healthy wetlands with values such as duck hunting and yabbing have also resonated with the community. Sourcing funding from the Federal Government to complement State government funding has been pivotal to undertaking the works on such a large scale.

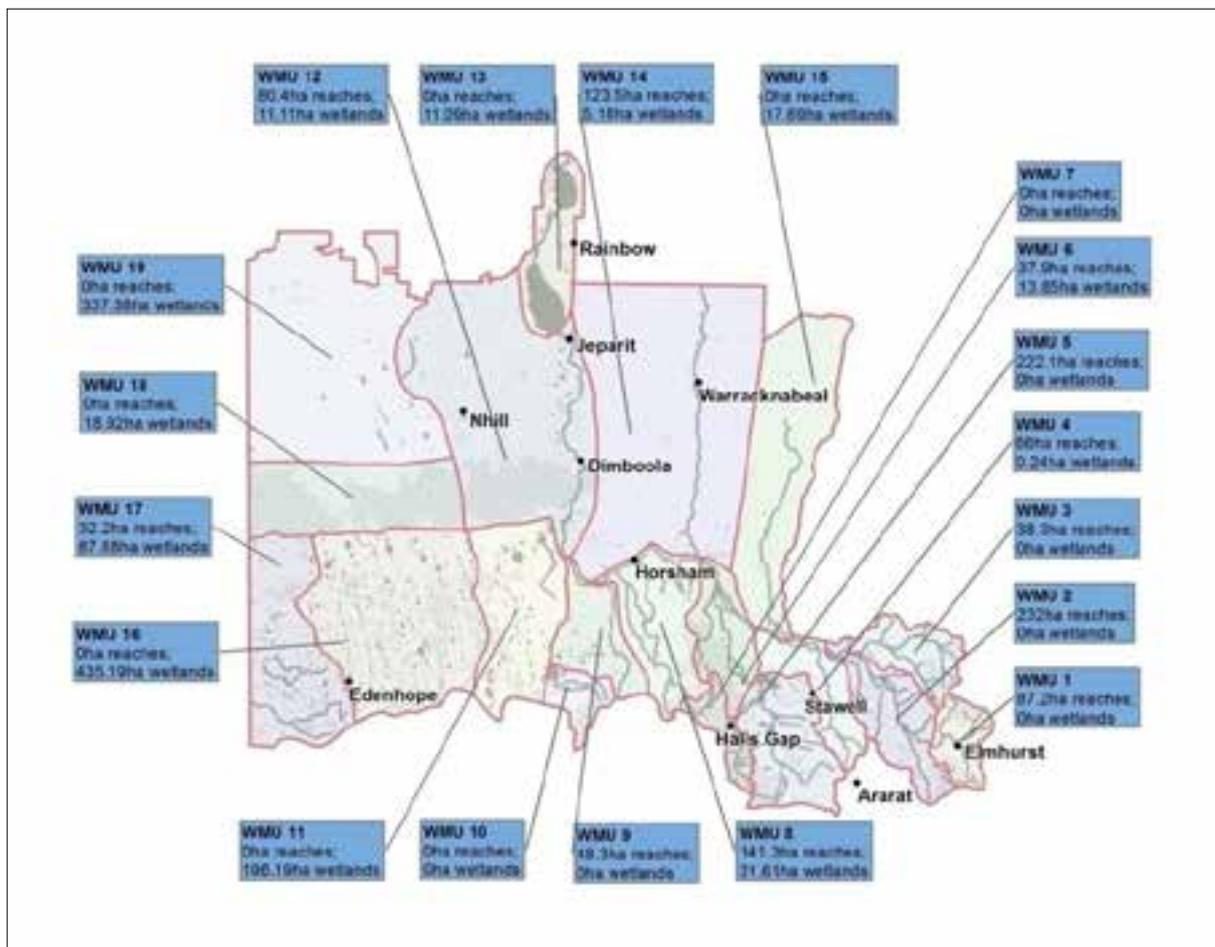


Figure 1 Waterway fencing undertaken during the life of the *Wimmera Waterway Health Strategy*

Learnings from the Past – effectively monitoring wetland condition and change is difficult and there have been improvements in planning

A large number of objectives related to wetland monitoring and targets had assumptions that related to changes in condition against the Index of Wetland Condition (IWC). The IWC only commenced in

2009 and there have been issues extrapolating condition scores for the proportionally small (< 5%) number of wetlands that have been assessed. The objectives largely related to wetlands within the Millicent Coast Basin which meant that large numbers of wetlands elsewhere in the region were at risk of being overlooked for management activities. The *Wimmera Wetlands Asset Strategy* (Wimmera CMA, 2011) incorporated many of the more recent learnings and in turn provides a more comprehensive and updated planning document for wetland management into the region and had largely superseded the wetland management objectives and targets within the *Wimmera WHS*.

Challenges for the Future – the need to reduce the loss of wetlands and secure gains of the past.

Variable climate impacting on wetland hydrology and in turn management will be the main challenge for wetland management going forward. Risks to wetlands exist at either climate extreme whether it is extremely wet (i.e. wetland drainage) or dry (i.e. cropping). Therefore there is a need to ensure that the full suite of tools (e.g. community education, incentives, and planning provisions) are effectively used to protect wetlands. Lastly, given many wetlands are currently protected under multi-year management agreements, the next challenge will be to ensure that these gains are consolidated beyond the life of the current agreement.

Riparian Land Management

The objectives were to:

- Establish a regional network of protected and maintained riparian zones with high environmental values through fencing, revegetation along with grazing and pest plant and animal management; and
- Protect and enhance riparian land and vegetation according to current best practice.

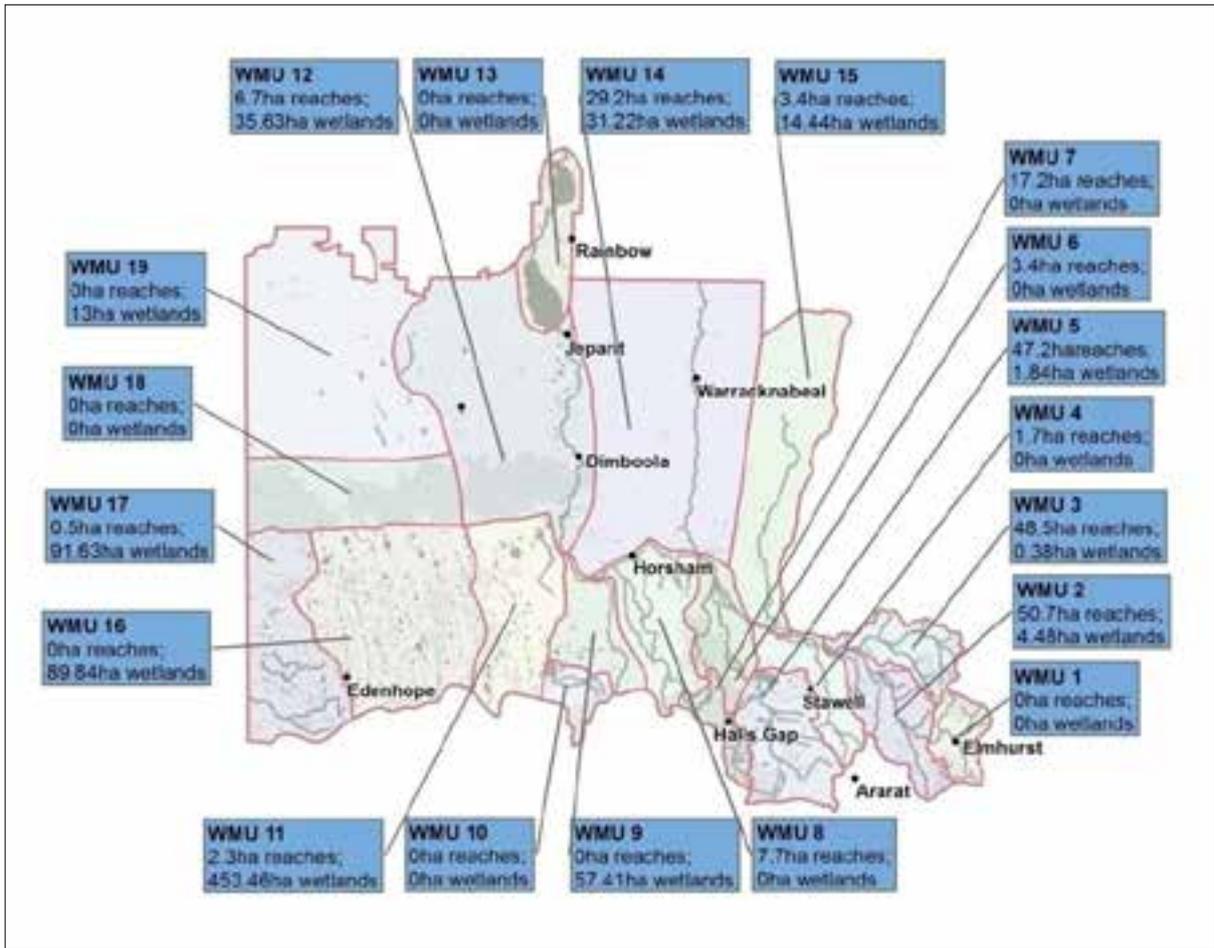


Figure 2 Waterway revegetation works undertaken during the life of the *Wimmera Waterway Health Strategy*

Positive Outcomes – significant gains have been made

A significant proportion of investment is undertaken in riparian protection works hence the fact that over the life of the *Wimmera WHS*, over 110 km of fences and 10 off-stream watering points were constructed, protecting almost 1,100 Ha of riparian land (Figure 1). Almost 7,300 Ha of riparian land had rabbit control activities undertaken and 8,800 Ha had weed control which emphasises the magnitude of the issue in the region (Figure 3 and Figure 4). These statistics include waterway outcomes funded by other programs (e.g. Landcare) which contributed to the targets within the *Wimmera WHS*. The additional resources provided in terms of drought and flood employment programs enabled a much greater volume of work to be undertaken which complemented other CMA programs. The history of works in priority sub-catchments means that some are reaching a stage where the majority of priority targeted works have been undertaken. Furthermore land managers (e.g. Parks Victoria and DEPI) and private landowners have undertaken significant works improving riparian land using their own resources.

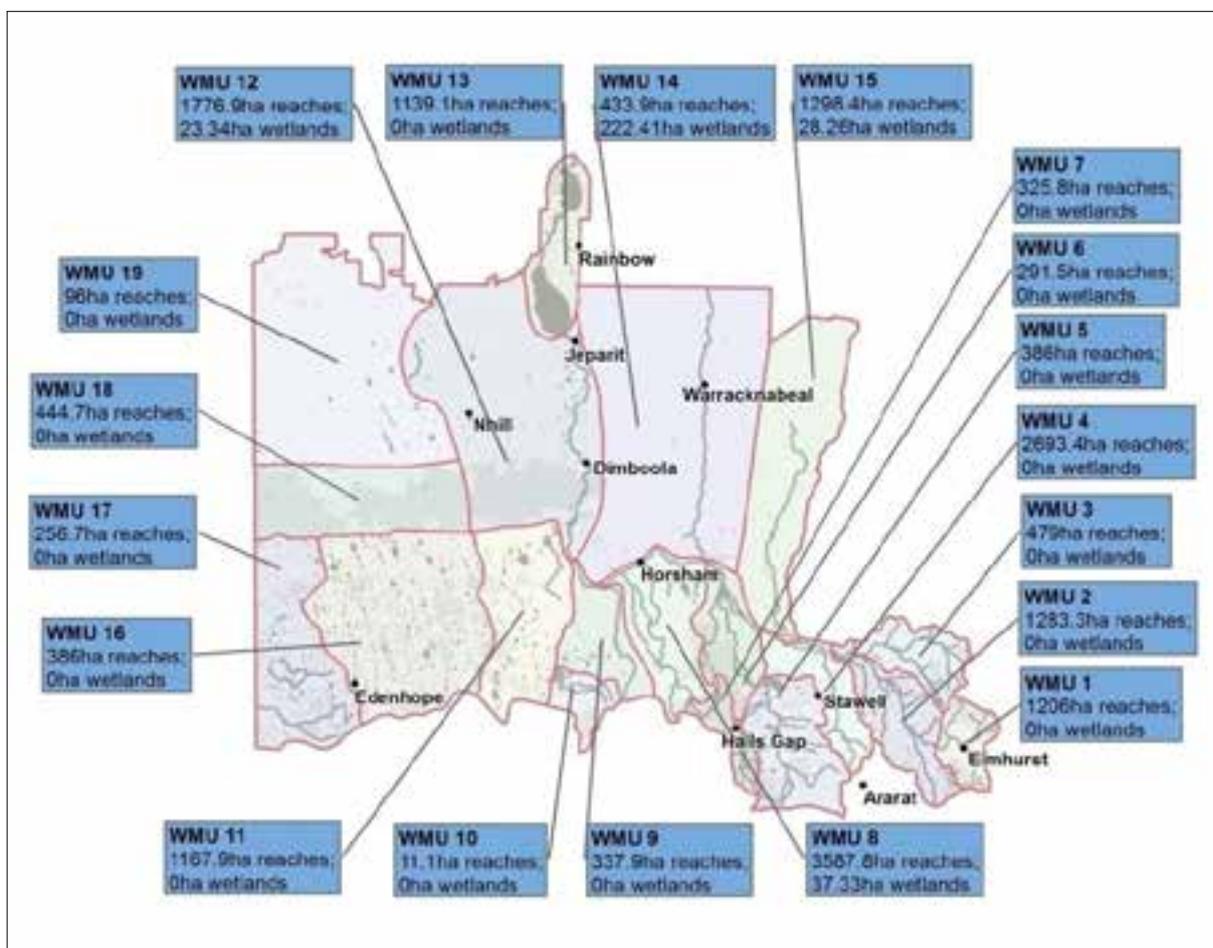


Figure 3 Waterway weed control undertaken during the life of the *Wimmera Waterway Health Strategy*

Learnings from the Past – better integration of Crown riparian frontage management is required

There is an ongoing need to maximise the environmental value of riparian land management works, for example ensuring that riparian vegetation improvement works are of sufficient width and quality to attain the desired benefits in terms of improved water quality, bank stability and riparian condition. This also needs to be better reflected in the development of strategic targets. Furthermore, given the vast tracts of riparian land are licensed Crown land frontages, it is critical to ensure that this land is

being managed in a way that enables the productive use of the land to not diminish its environmental condition. Issues around fencing riparian land and flooding were highlighted in floods during 2010 and 2011 with a number damaged or destroyed by floods.

Challenges for the Future – ongoing and emerging weed and pest animal threats

Riparian land management is facing a number of considerable challenges in terms of dealing with the ongoing problems posed by invasive plants and animals, especially new and emerging weeds and increasing rabbit resistance to Calici virus. Riparian fencing in flood-prone land will continue to be an issue given the fact that there needs to be a balance between achieving riparian outcomes whilst not greatly diminishing the productive capacity of rural land (i.e. when riparian outcomes are desired the agricultural productivity of floodplains means that riparian fencing works will never be immune to flood risks).

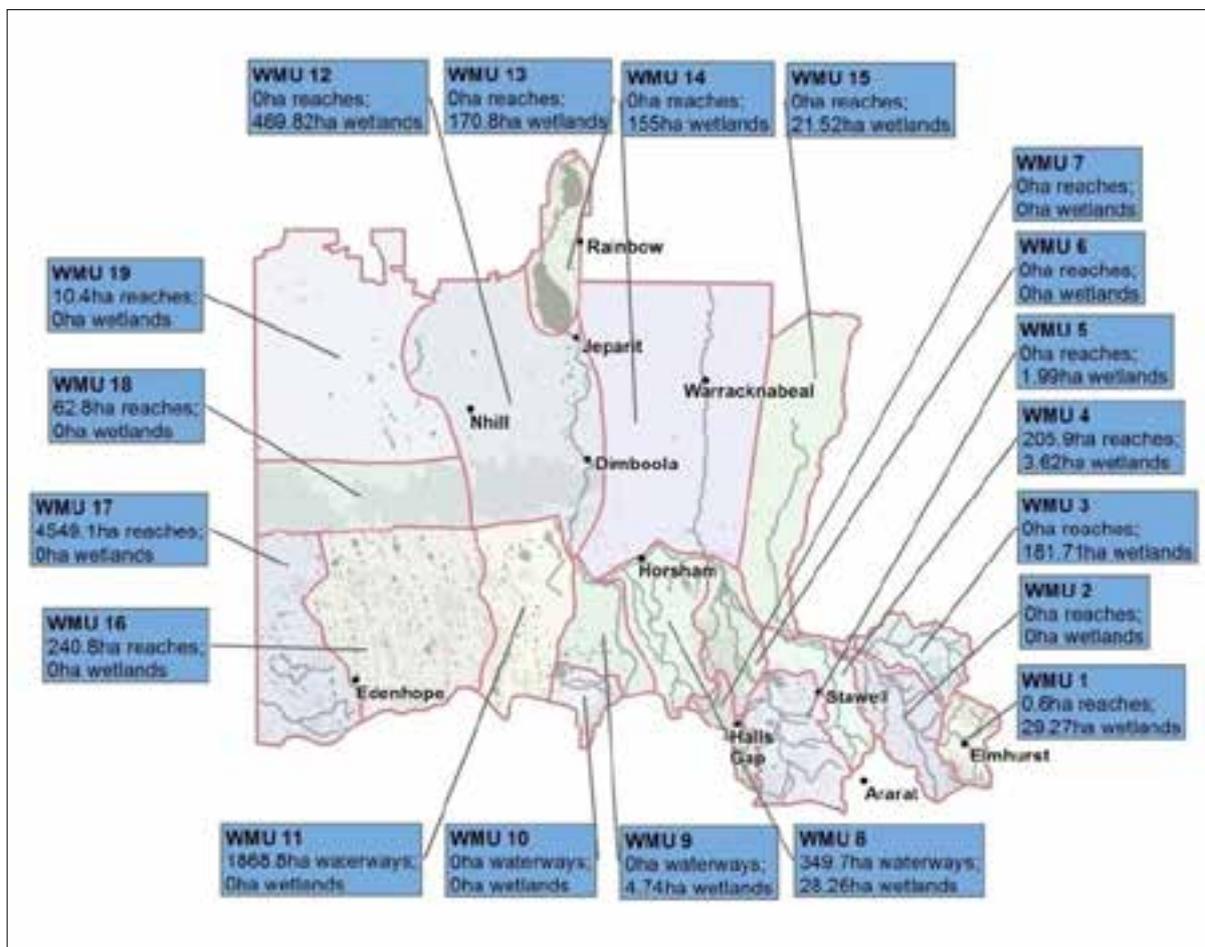


Figure 4 Waterway rabbit control undertaken during the life of the Wimmera Waterway Health Strategy

In-stream Habitat and Channel-form Management

The objectives were to:

- Undertake on-ground management actions targeting bed and bank erosion, sedimentation and gully erosion; and
- Restore diversity, habitats, connectivity and movement of in-stream material, through stabilisation and the restoration of channels, banks, substrate and riparian vegetation.

Positive Outcomes – significant volumes of sediment is being captured

Whilst there will be works required in this area for decades to come, given the magnitude of the issue, some very positive outcomes have been achieved. Almost 100 rock structures have been completed across 31 sites treated for gully erosion, stabilising 36 km of stream banks and almost 15 km of streambeds. These works have withstood unprecedented flood events with only minor damage in several locations whilst also capturing many tons of sediment that would otherwise travel down the Wimmera River, smothering deep river pools and decreasing water quality. There is widespread interest from landholders in erosion control works being undertaken on their properties.

Learnings from the Past – highlighting the value of large wood in creeks and rivers

Experience provided by the recent flood events highlights that the Wimmera CMA's approach has been extremely sound and that the practices and techniques have proven more effective than other methods such as gully plug dams. The flooding in 2010 and 2011 however has also resurrected some misconceptions about the role of large woody debris in flooding. There needs to be ongoing education about this topic to highlight its value both in terms of aquatic habitat and a means of reducing regional flood peaks.

Challenges for the Future – erosion control structure demands outstrips supply

It will be an ongoing challenge to ensure that there is adequate funding to undertake these works into the future as rigorously designed and constructed erosion control structures are costly and several are coming to the end of their useful life having captured many tons of sediment. Less costly works (e.g. grass chutes) may be an option in some cases to increase the number of sites where erosion control works are undertaken. There is also the need to fund ongoing maintenance that is being addressed through more responsive and flexible funding arrangements. Appropriate large woody debris management will also be critical, minimising risks around localised flooding and damage to infrastructure without creating unwanted precedents around expectations for removal of vegetation that does not pose a significant flood risk.

Environmental Water Reserve (EWR) Management

The objectives were to:

- Manage the 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 *Western Region Sustainable Water Strategy*;
- 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 pressure on waterways through water harvesting; and
- Realise savings from the Wimmera Mallee Pipeline to achieve minimum environmental water needs.

Positive Outcomes – more environmental water and more information to inform its use

The completion of the Wimmera Mallee Pipeline, coinciding with wetter conditions in 2010 and 2011 meant that environmental water availability increased to record levels. This in turn has led to substantial improvements in the condition of regulated waterways. The reaches that environmental water has been released into are identified in Figure 5. A considerable benefit has been the increased recreational opportunities and commensurate economic benefits to the community as people come from near and far to enjoy the return of water to the region. Considerable quantities of data have been derived from monitoring environmental water releases in the region and this, combined with expertise

from ecologists, hydrologists and hydraulic modellers is providing a sound basis for decision making on flow volumes and durations.

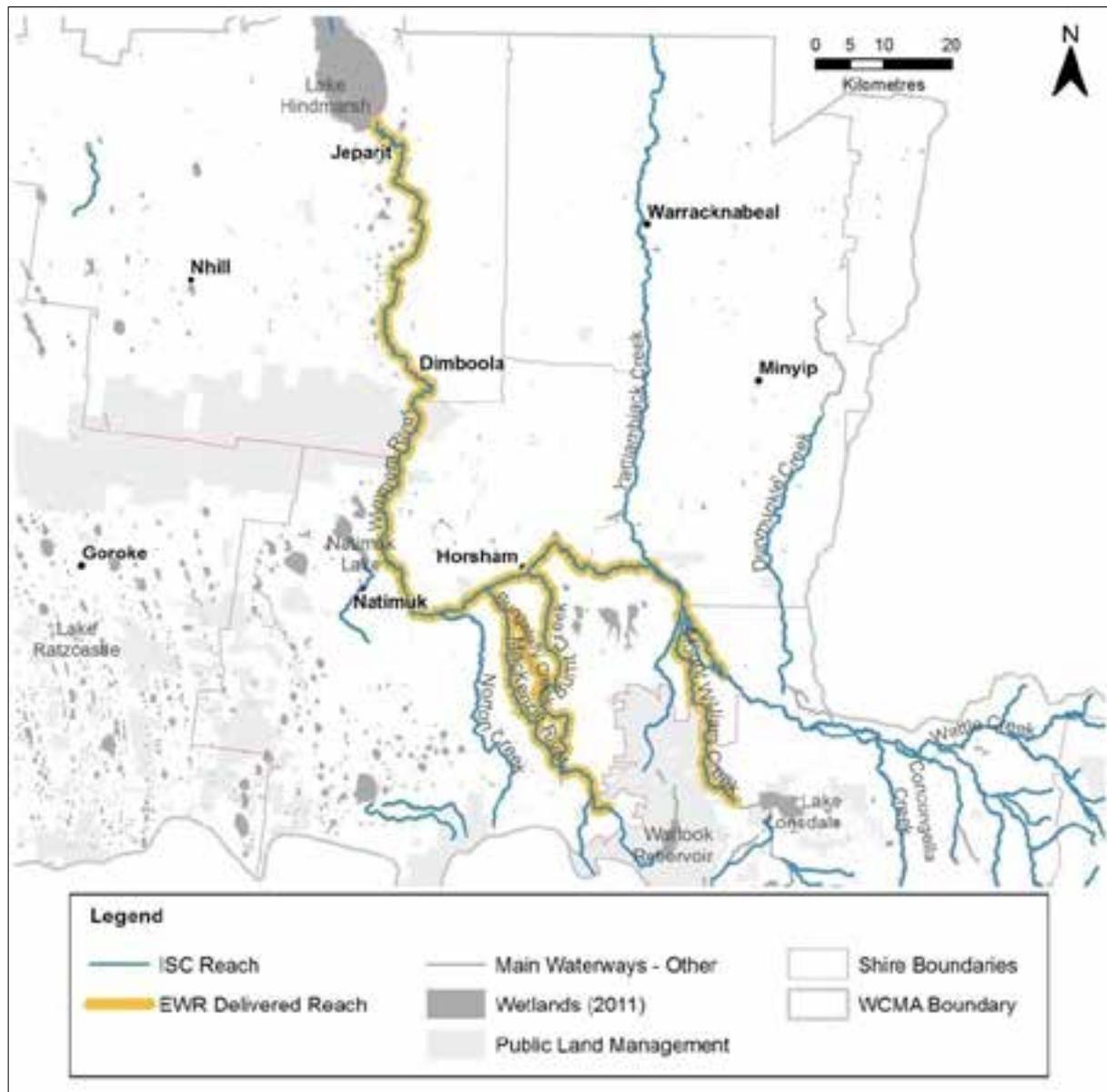


Figure 5 Waterways where environmental water releases took place during the life of the Wimmera Waterway Health Strategy

Learnings from the Past – better communicating decisions and outcomes

The key learnings for EWR management relate to the use of regulated environmental water allocations. There are strong views from some areas of the community regarding the use of environmental water and the impact this has on the recreational values of storages; however this needs to be contextualised in terms of wider water resource management considerations. Additionally there is continual improvement required in informing the community about the basis for environmental water decision making and the prioritisation process required based on water availability and environmental values.

Challenges for the Future – increasing scrutiny and changing climate

The sourcing and use of environmental water will always be a matter of intense public scrutiny and the challenge will be increasing the community's understanding of and confidence in environmental water management. There will also need to be ongoing research into how to best make use of environmental water and monitoring to show what difference it makes. Lastly the main difficulty will be to maximise the volume of the EWR to best protect the community values of waterways in dry climate scenarios.

Water Quality

The objectives were 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 *State Environment Protection Policy (Waters of Victoria)* 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; and
- Reduce stream salinities and the impact of salinity on waterway health.

Positive Outcomes – arresting the water quality decline in some areas

The combination of CMA activities such as improved riparian and wetland buffer management, channel and EWR management combined with wetter conditions has brought about sustained improvements in water quality. In the lower Wimmera River, pools that were completely hypersaline and unable to support anything but a handful of halophytic bacteria and macroinvertebrate species now support diverse and abundant fish and macroinvertebrate communities. In the upper catchment, monitoring has shown a fall in saline groundwater levels beyond what would naturally be the case due to salinity mitigation actions (Hocking et al., 2012).

Lessons Learnt – the need to build resilience to reduce poor water quality impacts

Given water quality is heavily dependent on runoff into waterways; drought and flood conditions highlighted the severe water quality issues within the region. During the drought, hypersaline groundwater intrusions and excessive nutrients led to fish deaths in numerous locations whilst during floods blackwater events also killed large numbers of fish. Therefore there is a need to build resilience in aquatic communities to enable them to better bounce back from such stresses. Furthermore isolated pollution events (e.g. from contaminants entering a waterway directly or via stormwater) need to have better prevention and response measures to minimise their impacts.

Future Challenges – improved planning and implementation of actions to improve water quality is critical

Given ongoing variation in climatic conditions there will always be a need to deal with a variety of water quality issues whether they are brought about by droughts or floods. Ensuring research outcomes focus on the most effective actions must be a priority, whether they be determining optimum riparian management practices which have benefits at a catchment scale or looking at localised interventions (e.g. groundwater pumping). Planning processes to minimise the water quality impacts of stormwater and drainage activities also needs to be considered.

Significant Flora and Fauna

The objectives were to:

- Enhance the diversity and populations of native aquatic flora and fauna; and
- Protect and enhance threatened flora and fauna species and communities that rely on healthy waterways, floodplains and wetland systems.

Positive Outcomes – increasing knowledge and populations

Monitoring has shown steady improvement in the population of threatened fish species (namely Freshwater Catfish) following the return of water after the floods of 2010 and 2011. The large volume of water in Lake Hindmarsh and other wetlands meant that large numbers of migratory threatened bird species returned. The recovery and recruitment of the Wimmera Bottlebrush in the lower MacKenzie River was also a positive outcome. Vegetation monitoring undertaken as part of the Index of Wetland Condition and Victorian Environmental Flows Monitoring and Assessment Program methodologies led to the identification of a number of new locations of threatened flora species.

The drought conditions highlighted a couple of key issues for threatened species management, the contraction of the Wimmera River to a series of isolated pools meant that direct actions outside the *Wimmera WHS* to protect Freshwater Catfish was required however funding and permitting issues meant that they were unable to be achieved and placed this species at severe risk in the catchment.

Future Challenges – increasing threats from invasive species

The explosion of carp numbers following the floods and increased environmental flows from 2009 onwards presents a major challenge to threatened fish communities given their spread and competition for resources and habitat. A number of options are being explored to reduce their impact within the catchment although evidence suggests that direct physical interventions (e.g. carp removal) are costly and have a limited impact and a more holistic approach is required. Drier climatic conditions also present challenges in protecting water-dependent threatened species. Reduced funding for programs that help manage threatened species also poses a challenge in effectively managing threats.

Communication, Education and Engagement

A large number of objectives were established for this program and involved educating stakeholders about the need to undertake the actions to improve waterways as well as enhancing the transfer of knowledge between stakeholders such as partner agencies, user and community groups including indigenous groups.

Positive Outcomes – benefits of community – CMA knowledge sharing are showing

Waterwatch delivered a very comprehensive education program within schools as well as providing valuable water quality data through the many Waterwatch volunteers. This in turn led to a significant number of a diverse cross-section of the community that were well-informed around waterway health issues as well as providing meaningful information to the CMA around waterway condition. Longitudinal landholder attitude surveys have shown that the level of understanding of waterway values and threats continues to increase throughout the region.

Lessons Learnt – more effort is required to increase awareness of key issues

Extremes of drought and flood made waterway health issues front and centre in the community's mind and many actions such as floodplain, EWR and in-stream habitat management were seen as contentious by some parts of the community for differing reasons. It highlights that there is still a lot of work required to inform the community about the broader value of waterway health as well as being responsive to specific concerns. However it should be noted that landholder attitude surveys

demonstrate that the overwhelming majority of landholders understand the benefits of these actions in order to maintain and improve waterways across the region.

Challenges for the Future – adapting to new technology

The extremely high value placed by the community upon the region's waterways means that an engaged and informed community is fundamental to achieving goals around waterway health into the future. Landholder understanding about specific issues like gully erosion and wetland cropping is steadily improving although there is still significant scope for improvement.

The provision of adequate sources of funding to engage with and educate the community on a meaningful and ongoing basis will be critical. It will also be important to be flexible and adaptive in the way this is delivered, using new technology such as text messages, apps or social media.

Adaptive Management Framework

The *Wimmera WHS* highlights that an effective adaptive management framework consists of:

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

Positive Outcomes – a solid data set has been developed to inform decision making

Whilst Monitoring, Evaluation and Reporting (MER) processes are continually changing, there has been an ongoing commitment to quantify the extent and impact of CMA activities. This involves a number of reporting and planning processes that enables project managers to evaluate the success of their projects and look at what aspects need to be improved.

Lessons Learnt – confounding factors and magnitude of works makes it difficult to demonstrate outcomes

Monitoring change in the environment due to CMA works is an inherently difficult process as there are a large number of confounding factors such as the impacts of extreme events that influence outcomes. Furthermore the establishment of baseline condition and subsequent supply of monitoring data was lacking in a number of cases due to limitations around funding.

Challenges for the Future – the need to quantify outcomes and ensure best practice

The provision of funding to establish baselines and monitor condition over time will be a major challenge as well as ensuring sufficient research is being undertaken to reduce or verify assumptions and quantify how activities whether it be constructing a fence or releasing environmental water are having a positive impact on the region's environment. There are many opportunities to seek efficiencies and share learnings between agencies around the effectiveness of management activities given that they are widespread across the state.

Appendix 5 Waterway Values and Threats

The following tables are taken from the Aquatic Value Identification and Risk Assessment Summary of Metrics for Values and Threats (Riverness, 2011).

Table 1. Environmental values of Victorian waterways

River Reaches	Wetlands
<p>FORMALLY RECOGNISED SIGNIFICANCE</p> <ul style="list-style-type: none"> • National Significance <ul style="list-style-type: none"> ○ Living Murray Icon Sites ○ High Ecological Value Aquatic Ecosystems ○ National Heritage Sites • State Significance <ul style="list-style-type: none"> ○ Heritage Rivers ○ Icon Rivers ○ Essentially Natural Catchments ○ Victorian Parks and Reserves ○ Victorian Heritage Sites <p>REPRESENTATIVENESS</p> <ul style="list-style-type: none"> • Representative Rivers <p>RARE OR THREATENED SPECIES/COMMUNITIES</p> <ul style="list-style-type: none"> • Significant Fauna (Invertebrates) • Significant Fauna (Vertebrates) • Significant Flora • Significant Riparian EVCs <p>NATURALNESS</p> <ul style="list-style-type: none"> • Aquatic Invertebrate Community Condition <ul style="list-style-type: none"> ○ River Reaches • Native Fish * • Riparian Vegetation Condition <p>LANDSCAPE FEATURES</p> <ul style="list-style-type: none"> • Drought Refuges • Important Bird Habitats • Biosphere Reserves 	<p>FORMALLY RECOGNISED SIGNIFICANCE</p> <ul style="list-style-type: none"> • International Significance <ul style="list-style-type: none"> ○ Ramsar Sites ○ East Asian-Australasian Flyway Sites • National Significance <ul style="list-style-type: none"> ○ Nationally Important Wetlands ○ Living Murray Icon Sites ○ High Ecological Value Aquatic Ecosystems ○ National Heritage Sites • State Significance <ul style="list-style-type: none"> ○ Heritage Rivers ○ Essentially Natural Catchments ○ Victorian Parks and Reserves ○ Victorian Heritage Sites <p>REPRESENTATIVENESS</p> <ul style="list-style-type: none"> • Representative Wetlands * <p>RARE OR THREATENED SPECIES/COMMUNITIES</p> <ul style="list-style-type: none"> • Significant Fauna (Invertebrates) • Significant Fauna (Vertebrates) • Significant Flora • Significant Wetland EVCs <p>NATURALNESS</p> <ul style="list-style-type: none"> • Aquatic Invertebrate Community Condition <ul style="list-style-type: none"> ○ Wetlands * • Native Fish * • Wetland Vegetation Condition <p>LANDSCAPE FEATURES</p> <ul style="list-style-type: none"> • Drought Refuges • Important Bird Habitats • Biosphere Reserves

* Indicates value metric not developed

Table 2 Social values of Victorian waterways

River Reaches	Wetlands
<p>ACTIVITY</p> <ul style="list-style-type: none"> • Recreational Fishing • Non-Motor Boating • Motor Boating • Camping • Swimming • Beside Water Activities <ul style="list-style-type: none"> ○ Walking, Hiking, Cycling ○ Sightseeing ○ Picnics/Barbeques • Game Hunting <p>PLACE</p> <ul style="list-style-type: none"> • Heritage <ul style="list-style-type: none"> ○ Pre-European (Aboriginal) Heritage ○ Post-European Heritage • Landscape <p>PEOPLE</p> <ul style="list-style-type: none"> • Community Groups • Use of Flagship Species 	<p>ACTIVITY</p> <ul style="list-style-type: none"> • Recreational Fishing • Non-Motor Boating • Motor Boating • Camping • Swimming • Beside Water Activities <ul style="list-style-type: none"> ○ Walking, Hiking, Cycling ○ Sightseeing ○ Picnics/Barbeques • Game Hunting <p>PLACE</p> <ul style="list-style-type: none"> • Heritage <ul style="list-style-type: none"> ○ Pre-European (Aboriginal) Heritage ○ Post-European Heritage • Landscape <p>PEOPLE</p> <ul style="list-style-type: none"> • Community Groups • Use of Flagship Species

Table 3 Economic values of Victorian waterways

River Reaches	Wetlands
<p>WATER</p> <ul style="list-style-type: none"> • Urban/Rural Township Water Sources • Rural Water Sources for Production • Water Storages • Water Carriers • Wastewater Discharges <p>POWER GENERATION</p> <ul style="list-style-type: none"> • Hydro-Electricity <p>OTHER RESOURCES</p> <ul style="list-style-type: none"> • Commercial Fishing • Extractive Industries • Timber Harvesting and Firewood Collection 	<p>WATER</p> <ul style="list-style-type: none"> • Urban/Rural Township Water Sources • Rural Water Sources for Production • Water Storages • Water Carriers • Wastewater Discharges <p>POWER GENERATION</p> <ul style="list-style-type: none"> • Hydro-Electricity <p>OTHER RESOURCES</p> <ul style="list-style-type: none"> • Commercial Fishing • Extractive Industries • Timber Harvesting and Firewood Collection

Table 4 Summary of threats to Victorian waterways

Rivers/Streams	Wetlands
<p>ALTERED WATER REGIMES</p> <ul style="list-style-type: none"> • Altered Flow Regimes <ul style="list-style-type: none"> ○ Increase in Low Flow Magnitude ○ Reduction in High Flow Magnitude ○ Increase in Proportion of Zero Flow ○ Change in Monthly Streamflow Variability ○ Altered Streamflow Seasonality <p>ALTERED PHYSICAL FORM</p> <ul style="list-style-type: none"> • Bank Instability • Bed Instability (Degradation) <p>POOR WATER QUALITY</p> <ul style="list-style-type: none"> • Degraded Water Quality • Thermal Water Pollution • Disturbance of Acid Sulfate Soils <p>DEGRADED HABITATS</p> <ul style="list-style-type: none"> • Degraded Riparian Vegetation <ul style="list-style-type: none"> ○ Large Trees • Loss of Instream Habitat <ul style="list-style-type: none"> ○ Large Wood ○ Sedimentation • Livestock Access <p>INVASIVE FLORA AND FAUNA</p> <ul style="list-style-type: none"> • Invasive Flora (Riparian) <ul style="list-style-type: none"> ○ Trees ○ Shrub Layer ○ Ground Layer • Invasive Flora (Aquatic) • Invasive Fauna (Terrestrial) • Invasive Fauna (Aquatic) <p>REDUCED CONNECTIVITY</p> <ul style="list-style-type: none"> • Barriers to Fish Migration • Reduced Riparian Connectivity <ul style="list-style-type: none"> ○ Longitudinal Continuity ○ Vegetation width • Reduced Floodplain Connectivity <p>* Indicates threat metric not developed</p>	<p>ALTERED WATER REGIMES</p> <ul style="list-style-type: none"> • Changed Water Regime <p>ALTERED PHYSICAL FORM</p> <ul style="list-style-type: none"> • Reduced Wetland Area • Altered Wetland Form <p>POOR WATER QUALITY</p> <ul style="list-style-type: none"> • Changed Water Properties • Disturbance of Acid Sulfate Soils <p>DEGRADED HABITATS</p> <ul style="list-style-type: none"> • Soil Disturbance <p>INVASIVE FLORA AND FAUNA</p> <ul style="list-style-type: none"> • Invasive Flora (Wetland) • Invasive Fauna (Terrestrial) • Invasive Fauna (Aquatic) <p>REDUCED CONNECTIVITY</p> <ul style="list-style-type: none"> • Reduced Wetland Connectivity*

Appendix 6 Target Setting Assumptions

Target Setting for Waterways

Effective implementation of the *WWS* requires the setting of SMART targets (Specific, Measurable, Achievable, Realistic and Time-based). The challenge is to set these targets based on the level of information available which is in some areas quite limited. These targets also need to follow clear program logic and align with the *DSE Monitoring, Evaluation and Reporting Framework* (DSE, 2012) and are set at three levels:

- Long-term resource condition (8+ years);
- Management outcome (1-8 years); and
- Management outputs (annually)

The *WWS* sets targets for the first two levels with Management Outputs planned for on an annual basis depending on the funding available.

For target setting with the *WWS* there is a need to undertake the following steps:

- Record assumptions;
- Record the process for setting targets;
- Ensure that supporting data is available and reliable; and
- Ensure the process is repeatable.

These steps are outlined as follows:

Target Setting Assumptions

Program logic models have been developed (ARI, 2012) (GHD, 2012) which link management activities that serve to mitigate key threats to waterway condition. The assumption is that the threat will be reduced commensurate to the magnitude of effectively completed management activities (e.g. if all of a reach was revegetated from 5 m out to more than 10 m then the AVIRA threat score for inadequate riparian vegetation quality and extent will reduce from 5 to 4).

Target Setting Process

Target setting for the *WWS* involved developing initial indicative targets based on the likely amount of change to metrics based on the type and magnitude of works that could be feasibly undertaken as well as the time scale of a likely response (e.g. water quality responses will take a long time to determine an overall improvement). These indicative targets were tested and refined through workshops involving Wimmera CMA staff and advisory committees. Important feedback included the need to be upfront with the current status of waterway values and threats as well as documenting the source of the information used to derive the target. Collation of data related to all assets is impractical and so as the targets are based on a conceptual and logical framework, outcomes will not need to be measured for every asset.

Supporting Data for Target Setting Process

Table 1 Rivers and Streams Data Sources for Target Setting

Value	Data Source(s)
Fish	Wimmera CMA regional fish monitoring – ongoing monitoring measuring fish diversity and abundance at sub-catchments across the region on a rolling basis (typically two sub-catchments per year) depending on funding and water availability.
Riparian vegetation	Index of Stream Condition streamside zone data – collected every eight years at a state-wide level.

Value	Data Source(s)
Macroinvertebrates	Index of Stream Condition aquatic life data – collated every eight years with results obtained from: Wimmera CMA regional macroinvertebrate monitoring – occasional monitoring measuring macroinvertebrate diversity at a set number of sites across the region depending on funding. EPA state-wide macroinvertebrate monitoring - occasional monitoring measuring macroinvertebrate diversity at a set number of sites across the region
Instream habitat and channel form	Index of Stream Condition physical form data – collected every eight years at a state-wide level.
Water quality	Index of Stream Condition water quality data – collated every eight years with results obtained from: Regional water monitoring partnership sites – stream gauges collecting flow and various water quality parameters on a continuous basis. Data from these sites can also be used to determine water quality trends over time based on flow. Wimmera CMA water quality monitoring – monthly testing of water quality at creeks and rivers across the region.
Platypuses	Project Platypus and Wimmera CMA Platypus Monitoring – Project Platypus and Wimmera CMA undertake periodic monitoring dependant on available funding. These surveys are typically less than annual in their frequency.
Hydrology	Index of Stream Condition hydrology data – collated every eight years at a state-wide level based on streamflow gauging data and hydrological modelling where gauged data is unavailable.

Threats	Data Source(s)
Invasive fauna	Fish - Wimmera CMA regional fish monitoring – ongoing monitoring measuring fish diversity and abundance at sub-catchments across the region on a rolling basis (typically two sub-catchments per year) depending on funding and water availability. Rabbits/Foxes – Current data is from the <i>WIPAMS</i> , assumption that similar data will be collected when the <i>WIPAMS</i> is renewed (2015).
Excessive erosion and sedimentation	Data on the proportion of stream length impacted by bed and bank degradation is derived every eight years at a state-wide level to inform the Index of Stream Condition Physical Form sub-index. Local knowledge also provides insight into areas where excessive sedimentation is a major threat.
Inadequate riparian vegetation quality and extent	Data on the extent and quality is derived every eight years at a state-wide level to inform the Index of Stream Condition Streamside Zone sub-index. Data on the location and extent of livestock access has been derived from local knowledge.
Modified hydrology	Data on the type and magnitude of modifications to stream hydrology is derived every eight years at a state-wide level to inform the Index of Stream Condition Hydrology sub-index
Invasive flora	Data is provided from a variety of sources: Reaches where high threat weeds are present are contained in CMA GIS databases; and Proportion of weediness (all weeds) is also derived from historical ISC data (2004). Reporting on outcomes regarding invasive flora will be a challenge into the future and it is anticipated that the renewal of the <i>WIPAMS</i> in 2015 will present an opportunity to obtain data on invasive flora affecting waterways.
Degraded water quality	Data is provided from a variety of sources: The most robust data is compiled every eight years at a state-wide level to inform the Index of Stream Condition Water Quality sub-index. This data is only able to be derived at a handful of locations where streamflow gauging stations are located. Less robust information on locations where water quality is derived from Wimmera CMA water quality monitoring and Waterwatch monitoring which involves the monthly testing of water quality at creeks and rivers across the region.

Table 2 Wetlands Data Sources for Target Setting

Value	Data Source(s)
Fish	Targets relate to the value of wetlands for recreational fishing which is largely anecdotally based. Incorporation of the appendix related to recreational fishing could involve an action to obtain data on priority fish communities in wetlands through angler diaries.
Birds	Supports threatened wetland dependant bird species as identified within the DEPI Actions for Biodiversity Conservation (ABC) Database which is receives data on an ongoing basis.
Wetland vegetation	Index of Wetland Condition biota sub-index data – has been collected once at 134 wetlands within the Wimmera CMA region.
Water quality	Index of Wetland Condition water properties data – has been collected once at 134 wetlands within the Wimmera CMA region.
Hydrology	Targets relate to the presence/absence of modifications, namely drains and channels that reduce the frequency and duration of water in natural wetlands. This data has been periodically obtained using aerial photography and LiDAR to quantify the impact and determine trends. In water storages modifications due to impacted stream hydrology upstream can be used to set and assess targets.

Threats	Data Source(s)
Invasive fauna	Rabbits/Foxes – Current data is from the <i>WIPAMS</i> (Wimmera CMA, 2010), assumption that similar data will be collected when the <i>WIPAMS</i> is renewed (2015).
Changed hydrology and wetland form	Targets relate to the presence/absence of modifications, namely drains and channels that reduce the frequency and duration of water in natural wetlands. This data has been periodically obtained using aerial photography and LiDAR. Wetlands receiving water from the Wimmera Mallee Pipeline have data around the recommended water regime which can be compared to that actually provided.
Inadequate wetland vegetation quality and extent	Wetlands with low Index of Wetland Condition biota sub-index and buffer sub-index data that has been collected once at 134 wetlands within the Wimmera CMA region have been used to determine the targets. Data on the location and extent of livestock access has been derived from local knowledge.
Invasive flora	Data is provided from a variety of sources: Reaches where high threat weeds are present are contained in CMA GIS databases Wetland weediness is determined by the IWC Presence of Weeds sub-index at the 134 wetlands assessed
Degraded water quality	Index of Wetland Condition water properties data – has been collected once at 134 wetlands within the Wimmera CMA region.

Appendix 7 Target Setting and Linkages with *Wimmera RCS* and *VWMS*

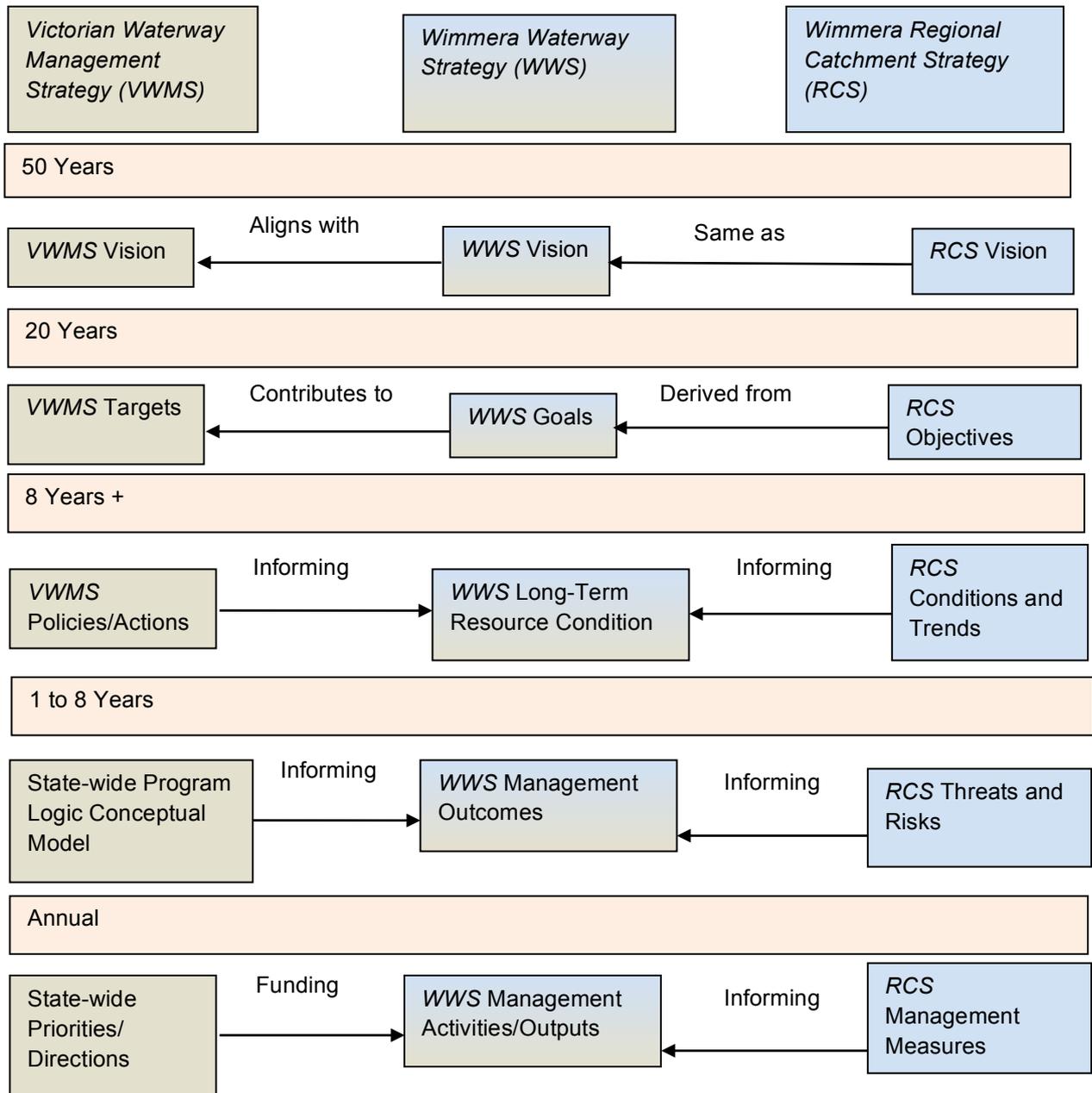
The *WWS* is a critical stage in the implementation of the *Wimmera RCS*, working towards the objectives and management measures for the ‘Wetlands’ and ‘Rivers and Streams’ assets as well as leading to incidental benefits for the ‘Native Vegetation’, ‘Threatened Species’ and ‘Soils’ assets. The following discussion largely relates to how targets and actions in the *WWS* and *Wimmera RCS* link for wetlands, rivers and streams.

Target Setting Process

The target setting process for the WWS involves adhering to guidelines and processes established by the VWMS as well as linking with the strategic objectives and measures in the Wimmera RCS. The linkages are explained in

Figure 1.

Figure 1 Linkages between WWS and other strategies



50 Year Visions for Wimmera RCS, WWS and VWMS

The vision for the WWS is taken from the Wimmera RCS given its applicability and it also contributes to the broader Victorian vision for waterways.

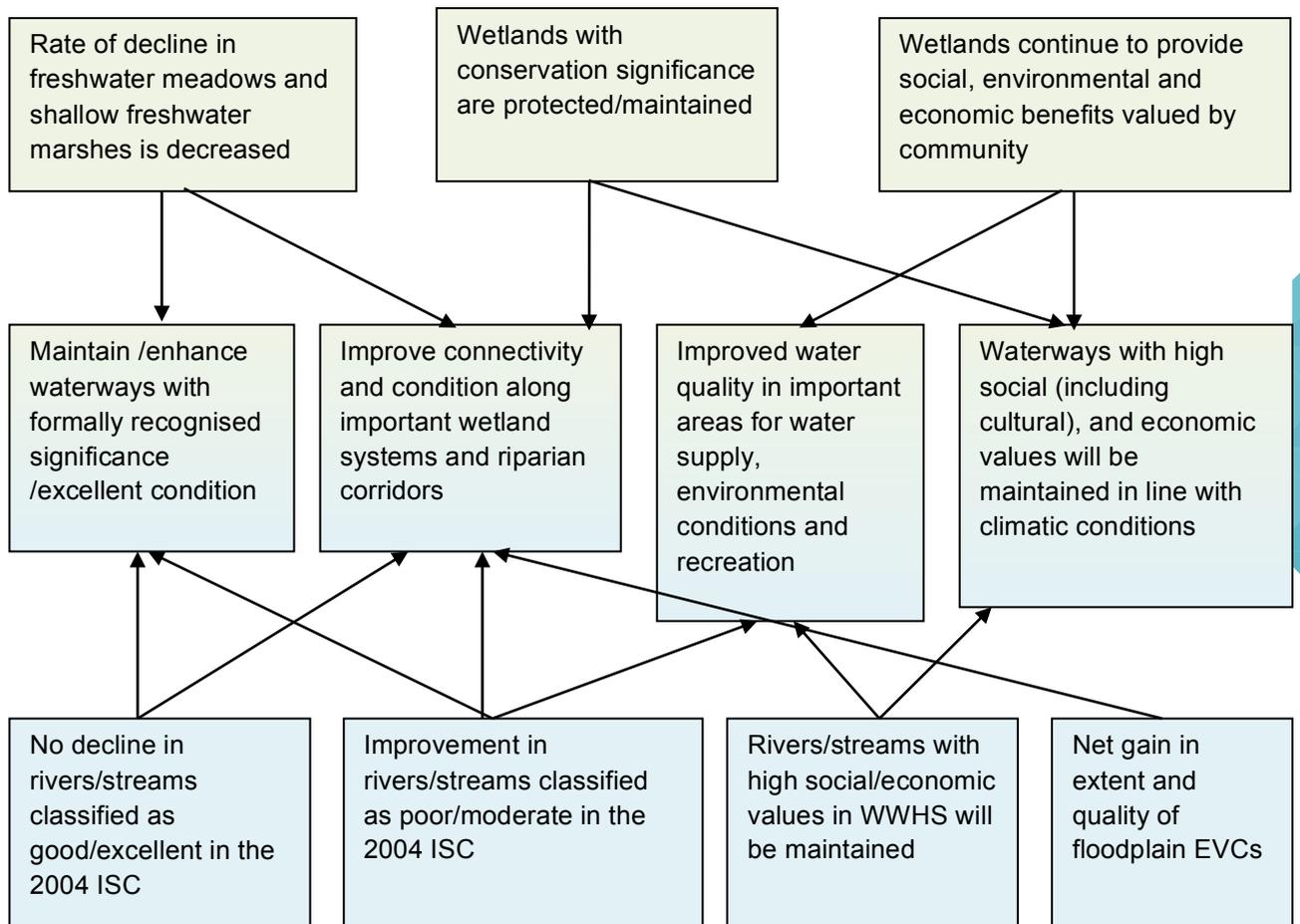
VWMS Vision – Victoria’s rivers, estuaries and wetlands are healthy and well-managed; supporting environmental, social cultural and economic values that are able to be enjoyed by all communities.

Wimmera RCS Vision – A healthy Wimmera catchment where a resilient landscape supports a sustainable and profitable community.

RCS 20 Year Objectives for Rivers, Streams and Wetlands / WWS 20 Year Goals for Waterways/VWMS Targets

As part of the Wimmera RCS development process, 20 year objectives were developed for Wetlands as well as Rivers and Streams. These were then refined to more detailed 20 year goals for waterways as part of the WWS to facilitate the prioritisation of works for waterways in strategy. Figure 2 following illustrates the strong linkages between the 20 years objectives and goals within the two documents. The VWMS targets relate to the maintenance/improvement of priority reaches and wetlands which were identified in the Wimmera as part of the WWS.

Figure 2 Linkages between Wimmera Regional Catchment Strategy Objectives for Wetlands (Green) and Rivers and Streams (Blue) and Wimmera Waterway Strategy Goals (Green/Blue)



APPENDICES

WWS greater than eight year targets - Long-term resource condition changes/Wimmera RCS conditions and trends/VWMS Policies and Actions

Targets have been developed that can be measured following the end of the life of the WWS that relate to the values that have been identified for waterways. Whilst they mostly revolve around environmental indicators like fish, water quality and vegetation condition, they also underpin the social and economic values of waterways, for example healthy fish communities provide benefits for anglers and good water quality will benefit water supplies for farms, towns and industries. Almost all of these values are included in the AVIRA dataset for waterways in the region. Condition and trend data from the Wimmera RCS in part informed the development of these targets. The policies and actions established in the VWMS will also guide the attainment of these targets.

Table 1 Waterway values with greater than eight year targets in the Wimmera

Fish/Yabbies	Riparian Vegetation
Macroinvertebrates	Instream Habitat and Channel Form
Water Quality	Birds
Platypuses	Hydrology (frequency and persistence of water)
Wetland Vegetation	

WWS One to Eight Year Targets - Management outcomes/Wimmera RCS Threats and risks/DEPI program logic conceptual models

Targets have been developed that can be measured throughout or towards the end of the life of the WWS that relate to threats to the values listed previously in Table 1. Based on the threat data (derived in part from the Wimmera RCS) included in AVIRA and the associations of threats to the values, the key threats for mitigation can be determined. These threats have been grouped together where possible and are listed in Table 2 following. Targets have been set that relate to reducing the level of threat where it is high or very high as well as maintaining it at a low level if there is a risk that it will become a higher threat into the future. DEPI has developed program logic conceptual models to inform this (ARI, 2012, GHD, 2012).

Table 2 Waterway threats with one to eight year targets in the Wimmera

Invasive Fauna	Degraded Water Quality
Modified Wetland Hydrology and Form	Modified Stream Hydrology
Inadequate Wetland Vegetation Quality and Extent	Inadequate Riparian Vegetation Quality and Extent
Invasive Flora	Excessive Erosion and Sedimentation

WWS Annual Management Outputs/ RCS Management Measures

In order to achieve the longer-term targets, it is necessary to specify the works that will be required to enable that. Within the Wimmera RCS, a series of management measures (activities) were listed for wetlands, rivers and streams (

Figure 3) that would, if strategically implemented at a sufficient scale, lead to the attainment of the 20 year objectives. No detail was provided around the scale and specifics of these management measures in the Wimmera RCS, however in the WWS, there is the listing of these as management outputs. How these management outputs/measures lead to the targets specified over the longer term (eight years and more) is outlined in the program logic models developed for rivers, streams and wetlands (GHD, 2012, ARI, 2012). The types of outputs described in the WWS are listed in Table 3 and are defined based on the DEPI specified definitions of standard outputs (DEPI, 2013d) The funding of these outputs will largely be sourced from the Victorian and Federal governments and will be reviewed on an annual basis as part of the adaptive planning framework.

Table 3 Types of outputs listed in the WWS.

Riparian and wetlands management agreements including: <ul style="list-style-type: none"> • Fencing; • Revegetation • Restoring wetland hydrology (building sills/banks); and • Invasive plant and animal control. 	Planning scheme activities such as: <ul style="list-style-type: none"> • Promoting relevant planning scheme amendments; and • Responding to planning referrals.
Erosion control structures (e.g. rock chutes)	Monitoring (e.g. fish, water quality, platypus)
Environmental water releases	Investigations
Strategic planning	Invasive plant control (e.g. spraying, removal)
Invasive animal control (e.g. rabbit ripping)	

Figure 3 Management Measures for Rivers, Streams and Wetlands from the Wimmera RCS 2013-2019 (Wimmera CMA, 2013)

<p><i>Rivers and Streams</i></p> <p>For riparian land:</p> <ul style="list-style-type: none"> • Establish a regional network of managed and maintained riparian zones with high environmental value. • Apply best practice management in the riparian zone to improve habitat for flora and fauna. <p>For in-stream habitat and channel-form:</p> <ul style="list-style-type: none"> • Undertake on-ground management actions targeting bed and bank erosion, sedimentation, gully erosion and potential landslips with a priority in the upper catchment. • Restore diversity, habitats, connectivity and movement of in-stream material, through stabilisation and restoration of channels, banks, substrate and riparian vegetation. • Apply best practice management for in-stream habitat to help native aquatic species such as native fish and platypus. <p>For water quality:</p> <ul style="list-style-type: none"> • Reduce the impact of salinity on waterway health. • Limit nutrients, sediments and other pollutants entering and being remobilised. • Work towards meeting State Environment Protection Policy (Waters of Victoria) criteria for water quality. • 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. <p>For adequate flows:</p> <ul style="list-style-type: none"> • Deal adaptively to climatic impacts on streamflows. • Achieve minimum environmental water needs of priority rivers and streams under historical climatic conditions. • Provide environmental water releases to improve water quality & enable diversity of aquatic and water-dependent flora and fauna ecosystems; and maintain channel form. • Seek additional environmental water where available such as through improving efficiency of water delivery or other water recovery activities. • Prevent additional flow-stress impacts such as intense water-extraction or land-use-change activities (e.g. concentrated areas of new farm dams or forestry development). <p>For aquatic ecosystems:</p> <ul style="list-style-type: none"> • Reduce impacts of exotic fish species on aquatic ecosystems. <p>For the floodplain:</p> <ul style="list-style-type: none"> • Improve our knowledge of Wimmera floodplains and their flood characteristics. • Manage floodplains to minimise flood risk and damage to people and property.
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- Enhance ecological values of floodplain environs.

Wetlands

- Review, update and implement the region's waterway strategy.
- Actively protect all high conservation-value wetlands from threatening processes and sustain them in good or excellent condition.
- Increase the number of freshwater meadows and shallow freshwater marshes that are permanently protected and managed according to best practice by 200 wetlands.
- Increase the number of private land managers implementing best practice wetland management.
- Prevent negative impacts to wetlands from new developments by working with local governments to implement wetland specific planning scheme overlays.



Lake Lawloit, September 2013 (Photo: G. Fletcher)



Yanac Swamp, September 2013 (Photo: G. Fletcher)

Appendix 8 Waterways of the Wimmera CMA Region assessed in the WWS

It should be noted that it is understood that all waterways have Aboriginal cultural heritage values and the available information is insufficient to determine the relative value of waterways based on Aboriginal cultural heritage. Waterways classified below as high value for heritage relates to post-European heritage.

Table 1: Reaches (values classified as high marked with an 'x')

Reach Name	Number	ENVIRONMENTAL				SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources
Outlet Creek	15~1	X	X			X	X	X		
Wimmera River	15~2	X	X	X		X	X	X		
Wimmera River	15~3	X	X	X		X	X	X		
Wimmera River	15~4	X	X	X	X	X	X	X		X
Wimmera River	15~5	X	X	X	X	X	X	X		
Wimmera River	15~6	X	X	X	X	X	X	X		
Wimmera River	15~7		X	X	X	X	X	X		
Wimmera River	15~8		X	X	X	X	X	X		
Wimmera River	15~9		X	X	X	X	X	X	X	
Wimmera River	15~10		X	X		X	X	X	X	
Wimmera River	15~11		X	X	X	X	X	X	X	
Wimmera River	15~12		X	X	X	X	X	X	X	
Norton Creek	15~13	X	X			X	X	X		
MacKenzie River	15~14		X		X	X	X	X		
MacKenzie River	15~15		X	X	X	X	X	X	X	X
MacKenzie River	15~16	X	X	X	X	X	X	X	X	
Boggy Creek	15~17	X	X	X		X	X	X	X	X

Reach Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Burnt Creek	15~18		X			X		X			
Burnt Creek	15~19		X	X		X		X	X		
Yarriambiack Creek	15~21	X	X		X	X		X			
Yarriambiack Creek	15~22	X	X		X	X		X			
Yarriambiack Creek	15~23		X			X		X			
Yarriambiack Creek	15~25		X			X		X			
Golton Creek	15~26		X			X		X			
Golton Creek	15~27	X	X	X		X		X			
Mount William Creek	15~28		X	X		X		X	X		
Mount William Creek	15~29		X	X		X		X	X		
Mount William Creek	15~30		X			X			X		
Mount William Creek	15~31	X	X	X		X		X	X		
Fyans Creek	15~32		X	X		X		X	X	X	
Fyans Creek	15~33	X	X			X		X	X		
Fyans Creek	15~34	X	X	X		X		X	X		
Barney Creek	15~35	X	X	X		X		X	X		
Basin Creek	15~36		X						X		
Unnamed Creek	15~37		X						X		
Millers Creek	15~38	X	X			X		X	X		
Nine Mile Creek	15~39		X						X		
Sugarloaf Creek	15~40		X						X		
Salt Creek	15~41		X						X		
Salt Creek	15~42		X					X	X		
Georges Creek	15~44	X	X					X	X		

Reach Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Sheepwash Creek	15~45		X						X		
Dunmunkle Creek	15~46		X			X					
Dunmunkle Creek	15~47					X				X	
Concongella Creek	15~48		X			X		X	X		
Concongella Creek	15~49	X	X			X		X	X		
Allenvale Creek	15~50		X						X		
Concongella Creek	15~51	X	X				X	X	X		
Malakoff Creek	15~52								X		
Wattle Creek	15~53		X						X		
Heifer Station Creek	15~54		X			X			X		
Heifer Station Creek	15~55		X						X		
Heifer Station Creek	15~56		X		X				X		
Morl Creek	15~57								X		
Melakoff creek	15~58		X			X			X		
Sandy Creek	15~59		X		X				X		
Howard Creek	15~60		X		X			X	X		
Blind Creek	15~61					X			X		
Unnamed Creek	15~62								X		
Unnamed Creek	15~63		X						X		
Seven Mile Creek	15~64		X						X		
Six Mile Creek	15~65		X					X	X		
Tributary of Astons Creek	15~66								X		
Astons Scour	15~67	X					X	X	X		
Shays Creek	15~68								X		

Reach Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Shays Creek	15~69									X	
Mount Cole Creek	15~70		X	X		X				X	
Spring Creek	15~71									X	
Glenlofty Creek	15~72			X						X	
Glenlofty Creek	15~73		X	X	X					X	
Nowhere Creek	15~74		X	X					X	X	
Spring Creek	15~75			X					X	X	
Glenpatrick Creek	15~76		X	X						X	
Mt Talbot Creek	15~87	X	X				X			X	
Station Creek	15~88	X	X							X	
Natimuk Creek	15~89		X		X		X				
Yanac Creek	15~90										
Morl Creek	15~92		X							X	
Unnamed Creek	15~93		X		X					X	
Unnamed Creek	15~94				X		X			X	
Thompson Creek	39~1		X								
Yalla Creek	39~2		X								
Kojak Creek	39~3										
Mosquito Creek	39~4		X	X	X						X
Mosquito Creek	39~5		X								X

Table 2: Wetlands (values classified as high marked with an 'x')

Wetland Name	Number	ENVIRONMENTAL				SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources
	7123010050	X								
	39~4~W1	X								
	39~4~W2	X								
	39~4~W3		X							
	39~4~W4		X							
	7123114043	X								
	39~2~W2									
	7123132988	X								
	39~3~W1	X								
	39~5~W1	X		X						
	39~2~W6	X								
	7123222023	X		X						
	39~2~W7	X								
	7123226050	X								
	39~2~W8									
	7123251944	X		X						
Kurrayah Swamp	39~~W18	X					X			
Lake Wallace	7123259020						X			X
	39~~W20	X								
	7123262989	X								
	39~~W21									
	7123370020	X		X						
	7123404984	X		X						

Wetland Name	Number	ENVIRONMENTAL				SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources
	7123442002									
	39~~W6		X							
	39~~W1									
Benayeo Swamp	39~~W3		X							
	39~~W4		X							
	39~~W5									
	39~2~W4		X	X						
	39~~W2									
Newlands Lake	7124044080						X			
	39~~W7									
	7124056066									
	7124069158									
	7124077201									
	7124088222		X							
	39~~W8		X	X						
	39~~W9		X							
	7124108097									
	712411217		X							
	39~2~W1		X							
	7124112053									
	7124114227									
	7124126083									
	39~~W10		X							
	39~2~W3									
Lake Bringalbert	39~~W11		X				X			

Wetland Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
	39~~W12										
	7124152315		X			X					
	7124154309		X								
	39~~W13	X			X						
Wauru Swamp	39~~W14		X			X					
	39~~W15		X		X						
Boorookpi Swamp	7124198346					X					
	7124204242		X								
	7124211074		X								
	7124212067		X								
Lake Charlegrark	7124213305								X		
	7124221337		X								
	39~2~W5		X								
	7124236430										
	7124239107		X		X						
	7124240322										
	39~~W16		X						X		X
	7124254060										
Lake Yampitcha McCossien Swamp	39~~W17		X		X				X		
	7124256067		X						X		
	39~~W19		X								
	7124264267										
Lake Carpolac	39~~W22		X		X				X		
	39~~W23										

Wetland Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Broughtons Swamp	39~~W24		X		X						
	7124303133					X					
Fish Hole Swamp	39~~W25		X								
	39~~W26				X						
	39~~W27		X								
	39~~W28										
	7124336173		X		X						
	39~~W30		X								
Lake Awonga	7124358082		X								
	39~~W29		X								
	7124367299		X								
	39~~W31	X				X			X		
	7124390178										
	7124403152		X						X		
	39~~W32		X						X		
	7124422237		X		X						
	7124423117		X								
	7124427212										
	7124436179										
	7223480948										
	7223509937										
	7223653016										
	7223658000										
White Lake	15~5~W4	X				X			X		X

Wetland Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
	7223661944										
Bitter Swamp	15~5~W5	X	X		X	X					
	7223685038										
	7223723995										
Toolondo Reservoir	15~88~WS1		X			X		X		X	
	7223875044										
Little Donkey Woman	39~~W33		X			X					
Lake Koynock	39~~W34		X			X					
	7224465424										
	7224467203										
O'Keefe Swamp	7224473115					X					
	7224484109										
	7224486090										
	39~~W35										
	7224519181										
	39~~W36		X		X	X		X		X	
	15~5~W1		X								
	7224593203										
	7224596302										
	15~5~W2										
	15~5~W3		X							X	
	7224613241										
	7224651213										
	7224671188										

Wetland Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Avocet Lake	15~5~W6 7224674054	X	X		X	X		X			
Saint Marys Lake	15~5~W7	X	X		X	X					
Hately's Lake	7224683335					X					
Friedman's Salt Lake	7224702356										
	15~5~W8			X	X	X					
	7224713405										
	7224715369										
	7224721063										
	7224721420										
	7224722263					X					
	7224730389										
	7224733191										
Lake Carchap	15~5~W9		X	X	X						
Heard Lake	15~5~W10	X	X		X	X				X	
Mitre Lake	15~5~W11	X	X		X	X	X				
	7224743186					X					
Parker Swamp/Telfer	15~5~W12	X	X	X	X	X					
	7224753396										
	7224757144										
	7224777093										
	7224804153										
	7224807146										
	7224807458										

Wetland Name	Number	ENVIRONMENTAL					SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources	
Lake Wyn Wyn	15~5~W13	X	X		X	X		X			
	7224812053										
	7224812109										
	7224812145										
Oliver Lake	15~5~W14	X	X	X	X			X			
	7224833449										
	7224836486										
Lake Natimuk	15~89~W1	X	X		X	X		X		X	
Nhill Lake	7225583781					X		X			
Nhill Swamp	7225585772					X		X			
	7225738763										
Lake Hindmarsh	15~1~W1	X	X		X	X		X			
Pink Lake	15~3~W1	X	X			X		X		X	
Ross Lake	7226833365					X		X			
Lake Albacutya	15~91~W1	X	X		X	X		X			
Wartook Reservoir	15~16~WS1	X	X		X	X		X		X	
	7324007473										
	7324084545										
Dooen Swamp	7324120410					X		X			
Green Lake	15~18~WS1		X			X		X		X	
Dock Lake	15~18~WS2		X			X		X			
Pine Lake	15~18~WS3		X			X		X			
Darlot Swamp	7324211439					X		X			
Lake Taylor	15~18~WS4		X		X	X		X		X	

Wetland Name	Number	ENVIRONMENTAL				SOCIAL			ECONOMIC	
		Formally Recognised Significance	Rare or Threatened Species/Communities	Naturalness	Special Features	Recreation	Heritage (excl indig)	People	Water Use	Other Resources
Sawpit Swamp	7324291407					X				
Lake Marma	7324307460					X		X		
	15~6~W1		X							
Dip Swamp	7324936104								X	
	15~5~W15		X							
Krong Swamp	7325152078									
Pinedale Swamp	7325333033									
Crow Swamp	7325994944					X				
Lake Bellfield	15~33~WS1	X	X		X	X			X	
Lake Fyans	15~30~WS1		X		X	X			X	
Lake Lonsdale	15~29~WS1		X			X			X	
Wal Wal Swamp	7424403214									
Mutton Swamp	7424457384					X				
Harcoans	7424538579									
Challambra Swamp	7425384867									
Challambra Swamp	7425387864									
Carapugna Swamp	14~10~W11		X							

Appendix 9 Relevant Targets from *Wimmera Invasive Plant and Animal Strategy 2010-2015*

Wimmera Heritage River Corridor (Lower Wimmera River and Outlet Creek and Lakes Hindmarsh and Albacutya)

- Reduce bridal creeper density to < 10% cover
- Eliminate other invasive plants from priority areas
- Maintain rabbit densities at < 3 per spotlight km (or <1 active warren entrance per ha).

Grampians Pyrenees Arc – Upper Catchment (apart from Grampians National Park and surrounds (see below)

- Maintain rabbit densities at < 3 per spotlight km (or <1 active warren entrance per ha).
- Eliminate gorse and blackberry from high value influencing streams
- Reduce bridal creeper density to < 10% cover where directly threatening high value assets
- Remove broom, boneseed and other invasive plants where directly threatening high value assets.

Grampians National Park and Surrounds (reaches and wetlands in and adjacent to the Grampians National Park)

- Reduce fox density in core protected area of the central Grampians.
- Remove bridal creeper, coastal (sallow) wattle and other environmental weeds where they significantly impact the diversity and structure of native vegetation.

MacKenzie River Area (MacKenzie River, Burnt Creek, Bungalally Creek)

- Maintain rabbit densities at < 3 per spotlight km (or <1 active warren entrance per ha).
- Remove capeweed, bridal creeper and other weeds where they significantly impact native vegetation in the riparian zone.

Threatened Ecological Vegetation Communities in the South-West Wimmera (wetlands and reaches in the West Wimmera Shire south of the Little Desert)

- Maintain rabbit densities at < 3 per spotlight km (or <1 active warren entrance per ha).
- Reduce bridal creeper density to < 10% cover where directly threatening high value assets
- Remove other invasive plants where directly threatening high value assets.



Wimmera River upstream of Jeparit, April 2009 (Photo: Hugh Christie)

