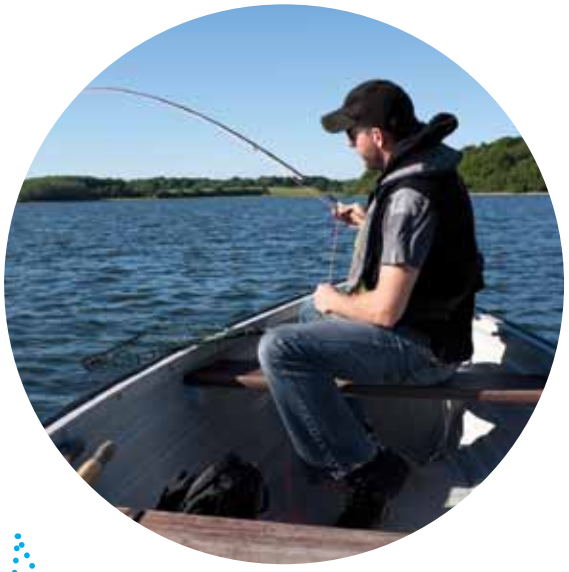
NORTH EAST Waterway Strategy

2014



VISION: OUR WATERWAYS ARE VALUED, HEALTHY AND WELL-MANAGED; SUPPORTING ENVIRONMENTAL, SOCIAL, CULTURAL AND ECONOMIC VALUES.

Key Stages developing the Strategy

- **AUGUST 2011 – JANUARY 2013** *Population of AVIRA database*
  Selected peak bodies, community groups and government stakeholders provided assistance in populating the Aquatic Value Identification and Risk Assessment database (AVIRA) database by identifying the values of and threats to waterways in North East Victoria.
- **DECEMBER 2012 – MARCH 2013** *Review of the Regional River Health Strategy*
  A review of the North East Regional River Health Strategy (2006) was conducted to inform the development of this Strategy.
- **DECEMBER 2012 – JULY 2013** *Catchment Conversations*
  Community members, peak bodies and government stakeholders participated in catchment-wide conversations about goals for waterway management, and stressors on and values of waterways. Conversations held in 13 different locations with 150 community members participating. Engagement with schools through Student Environment Days.
- **FEBRUARY 2013 – DECEMBER 2013** *Indigenous Engagement*
  Ongoing discussions with Office of Aboriginal Affairs Victoria and local Traditional Owners to identify values of and threats to waterways as perceived by the Indigenous community, for consideration in the development of the Strategy.
- **SEPTEMBER 2013** *Stakeholder Workshop*
  Presentation to community groups, peak bodies and government stakeholders informing them of current thinking around the development of the Strategy and encouraging feedback on goals and waterway systems. Participants encouraged also to share their strategic actions for the next eight years to ensure integrated catchment management and provide a forum to identify partnership opportunities.
- **OCTOBER 2013 – FEBRUARY 2014** *Staggered Release of Ideas*
  Regular updates provided to community on the development of the Strategy, encouraging feedback and comments on waterway management in the North East.
- **APRIL 2014** *Make a Submission*
  Catchment-wide consultation to Catchment Conversations encourage discussion and comment on the Strategy. Conversations held in 9 different locations with 80 community members participating.
- **MAY - JULY 2014** *Incorporation of Comments into Draft*
  Comments, suggestions and ideas received from the consultation considered in a review of the draft Strategy.
- **SEPTEMBER 2014** *Ministerial Approval*
  The regionally-approved version of the Strategy submitted by the North East CMA Board on behalf of the region to the Victorian Government for approval.

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Acknowledgement of Traditional Owners

The North East Catchment Management Authority and our community acknowledge the Traditional Owners of land in the North East catchment and strongly respect the rich culture and intrinsic connection the Traditional Owners have to the land.

State Government Victoria

NORTH EAST Regional Catchment Strategy

NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

Facilitating and coordinating the implementation of the Strategy on behalf of our catchment community

Chair's Foreword

Why we need the North East Waterway Strategy

Water and waterways are an intrinsic part of North East Victoria's identity, lifestyle and economic prosperity. A diverse network of regulated and unregulated waterways flows across our region, linking communities, ecosystems and industries.

Like many other parts of Australia, our North East catchment community is looking for ways to integrate and sustainably manage water resources and value the services that water provides to our region. We need to address and manage a range of challenges associated with the future health and use of our waterways, including increased water demand, urban planning, environmental flows, flooding impacts and climate change.

The *North East Waterway Strategy* has been developed to ensure our waterways are valued, healthy and well-managed. It is designed to encourage and support people who are making decisions about waterway management activities in the North East. Specifically, it considers environmental, economic, cultural and social factors and highlights stressors and challenges in the region that may impact on waterway health.

As the agency responsible for waterway health in the region, the North East Catchment Management Authority (CMA) led the development of this Strategy on behalf of the catchment community.

Over the course of two years North East CMA undertook targeted engagement with local communities, scientists, and representatives from all tiers of government to:

- identify Priority Waterways
- develop a program of works
- develop regional strategic actions for maintaining and improving waterways and
- provide a process for identifying priorities for Government investment in the health of waterways.

The *North East Waterway Strategy* offers a strong and unifying vision and practical plan of action to guide the planning, development and management of waterways across the region until 2022.

Lyn Coulston
Chair - North East Catchment Management Authority

Acronyms and Glossary

ARI	Average Recurrence Interval
AVIRA	Aquatic Value Identification and Risk Assessment database
CMA	Catchment Management Authority
EPA	Environment Protection Authority
EVC	Ecological Vegetation Class
EWMP	Environmental Water Management Plan
EWR	Share of water resource set aside to maintain environmental water values of a water system
DEPI	Department of Environment and Primary Industries
Habitat	The natural home or environment of an animal, plant, or other organism
ISC	Index of Stream Condition
IWC	Index of Wetland Condition
Floodplain	Low-lying land adjacent to river or stream
Landscape	Linked systems of people an nature as identified in the North East RCS
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
MER	Monitoring evaluation and reporting
NERWS	North East Regional Wetland Management Strategy
RCS	(North East) Regional Catchment Strategy
Reach	A length of stream, typically 20 to 30 kms
Strategy	The North East Waterway Strategy
Stressor	Drivers or threats that shift a system towards a less desirable state
SWSC	Special Water Supply Catchments
VWMS	Victorian Waterway Management Strategy
Waterways	Rivers, streams, their associated floodplains (including floodplain wetlands) and non-riverine wetlands
Wetland	A waterway subject to permanent or temporary inundation

This Strategy underpins the North East RCS and outlines the regional goals for waterway management. It provides an integrated catchment planning framework for waterways within our region and is the primary guide for priority setting, maintenance and improvement of waterways in our region. The North East has adopted the following vision for the management of the region's waterways:

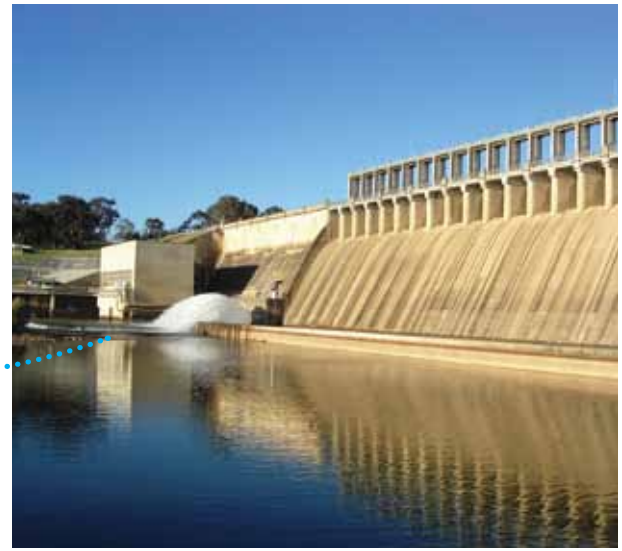
Our waterways are valued, healthy and well-managed; supporting environmental, social, cultural and economic values.

Key Insights

Research and targeted engagement undertaken during the development of the *North East Waterway Strategy* highlighted that:

- The waterways of North East Victoria are unique, valued and linked to the region's communities and economies
- We need to work with the dynamics in the climate to maintain resilient waterways
- Even with droughts, floods and social and economic changes, the North East region and its communities are generally resilient. The community and its environment have the ability to adapt, accommodate and manage shocks or stressors and disturbances. The CMA also has a framework in place for the response and recovery phases
- Without a sustained management effort, our waterways will decline in value, affecting social, environmental and economic aspects of our community
- Some challenges and stressors are beyond our control or influence
- Community-driven solutions are needed to accommodate and adapt to the likely climate extremes and seasonal variability
- Remote communities particularly need targeted waterway management programs as these communities have a strong connection to waterways and the way they value and use these resources contributes to water resources for downstream communities and
- A framework for supporting community led action and activities will need to deal with Federal and State, Regional and local challenges and address conflicting values surrounding use and management of waterways.

Contents



PART A

PART B

PART C

Executive Summary

The North East region of Victoria comprises approximately 2% of the geographic area of the Murray-Darling Basin, yet the region's water resources contribute around 40% of the water in the Murray-Darling Basin system.

The *North East Waterway Strategy* sets a vision for management of waterways across the North East catchment until 2022.

It is designed as a single, planning and reference document for waterway management in the region serviced by the North East CMA.

The Strategy is designed to support people who need to make decisions about management of rivers, floodplains and wetlands across the catchment.

For this reason, the Strategy was created using key values and information identified by the community, scientists, business and government agencies. As the agency responsible for waterway health in the region, the North East CMA led the development of this Strategy on behalf of the catchment community.

Specifically, the Strategy seeks to guide and support the management of waterways in North East Victoria by:

- Providing strategic context regarding waterways in North East Victoria and identifying a regional vision, goals and principles.
- Discussing approaches to waterway management – the Strategy sets out new ideas and affirms some past actions for managing waterways.
- Describing the Whole of Region and eight specific sub regional Waterway Systems, based on their hydraulic boundaries, geomorphology, river dynamics and catchment condition. The eight sub region Systems are the Upper Murray, Upper Mitta Mitta, Lower Mitta Mitta, Kiewa, Upper Ovens, King, Lower Ovens and Murray Plains.
- Outlining Strategic Actions for each of these systems over the next eight years. Collectively, these Actions can provide base level protection, maintenance and management for all waterways in the region.
- Identifying Priority Waterways and describing waterway management activities for these.

The Strategy includes new regional and State data and takes a flexible management approach to account for climate and seasonal variability and natural events such as bushfire, drought and floods.

The information and suggested actions included in this Strategy are consistent with and cross-linked to several other regional strategies, including the North East RCS - the primary integrated strategy for managing land, water and biodiversity in the North East.

PART A

- Introduction
- Strategic Context

1. Introduction

Purpose

The *North East Waterway Strategy (*'Strategy') is the single planning document for waterway management in the North East Catchment Management Authority (CMA) region for the next eight years. The Strategy outlines regional goals for waterway management that align with the objectives for waterways described in the Regional Catchment Strategy (RCS). Priority Waterways have been determined and a strategic regional work program of management activities for Priority Waterways has been developed to guide investment over the eight year period. The term 'waterway' is used throughout the Strategy to mean rivers, their associated floodplains (including floodplain wetlands) and non-riverine wetlands. However, the use of the term 'waterway' in this Strategy does not replace other important definitions of the term (for example, the specific definition of 'waterway' in the *Water Act 1989*).

The Strategy replaces the *North East Regional River Health Strategy (2006)* and incorporates the priorities identified within the *North East Regional Wetland Management Strategy (2009*).

Scope and Intent

The Strategy is designed not only to meet the North East CMA's obligations under relevant legislation but also to encourage and support participation by land managers, resource managers and other members of the community in waterway management and activities. It establishes a multi-disciplinary framework to assist decisions on waterway management in the North East, taking into account water quality, water regime, in-stream and riparian plants and animals, fisheries, recreation, wetland habitats, cultural heritage, and the connection between the waterways and their landscapes.

The Strategy:

- Sets the vision for management of waterways in the North East region
- Describes the threats and challenges that need to be addressed and the opportunities available
- Builds on the achievements of and lessons from the past
- Provides a framework for action that any individual, group or organisation can use to guide future waterway management decisions in the region
- Reinforces the clear link between the management of and productive uses and values associated with waterways and
- Reinforces the CMA's commitment to engage with the community in the management of waterways in the region.

The Strategy includes a range of long-term (twenty-year) goals and medium-term (one to eight-year) management outcomes and management activities that recognise:

- The value of the region's waterways to the community
- The strong connection that regional communities and associated economies have to the region's unique and diverse waterways
- The balance required to ensure we live within the sustainable limits of the environment and
- The need for active participation by those concerned about our natural environment and its ongoing maintenance or improvement – from the wider community, land managers and volunteer groups, to the agricultural industry and governments.

In developing this Strategy, the North East CMA has worked with the State Government, regional agencies and boards involved in natural resource management, local communities and other key stakeholders to:

- Identify high value waterways (based on their environmental, social, cultural and economic values)
- Determine Priority Waterways and set directions for their management
- Develop a Strategic and Lead Action framework for maintaining and improving waterways
- Develop a regional work program for Priority Waterways to guide investment over the next eight years and
- Provide a consistent, defensible process for identifying priorities for Government investment in the health of waterways.

New regional and state data sets have been included to help make more informed management decisions. The management approach used is flexible to account for climate and seasonal variability and natural events such as bushfire, drought and flood.

Structure

The Strategy is comprised of three major parts.

Part A:

1. Introduction
2. Strategic Context

Part B:

3. Regional Vision, Goals and Principles
4. Approach
5. Waterway Systems
6. Monitoring, Evaluation, Reporting and Adaptive Management

Part C

7. Strategic and Lead Actions for Waterway Systems and Work Program for Priority Waterways

Appendices 1, 2, 3

References

Table 1 describes the major components of the Strategy and related information included in other local action or management planning documents.

What IS in the Strategy?
> Vision for the region's waterways (Part B)
> High level goals for waterways to help prioritise waterways and management activities (Part B)
> High level principles that allow for a flexible, holistic and seasonally adaptive approach to waterway management (Part B)
> The approach for identifying priorities e.g. risk-based assessment of spatially defined waterways (Part B)
> A description of the waterway systems in the region and the associated values, stressors and priorities for management (Part C)
> Waterway management services and associated Strategic and Lead Actions required to maintain the values of the region's waterways (Part C)
> An eight-year regional work program for Priority Waterways that sets out management activities, output targets and implementation approach to achieve regional goals (Part C)
What IS NOT in the Strategy?
> Land and non waterway dependant biodiversity assets of region-wide significance (covered by North East RCS)
> High level examination of landscapes to understand stressors and appropriate intervention measure (covered by North East RCS)
> Detailed activity planning, budgets and onground works programs (included in the annual planning processes)

Implementing the Strategy

Using Part B

Part B includes the Vision, Goals and Principles for the Strategy and will aid in the implementation of the North East RCS. For example, the twenty year condition objective for rivers and wetlands in the RCS is "Whilst conserving the environment, we will maintain and enhance the health and condition of water resources and their long term productivity." The Goals and Principles in this Strategy help to define what is meant by health and condition of the region's water resources.

Using Part C

Within each waterway system, Strategic and Lead Actions for proactive waterway management have been identified. The use of the waterway systems construct and associated Strategic and Lead Actions are designed to assist in identifying how waterways interrelate with the region's landscapes and communities.

Part C also includes a wide range of management activities, some of which will guide direct onground works and activities, while others will highlight where further investigation and analysis are required. The type of management activities will depend on the issue, the level of understanding of that issue, and the urgency in which onground works are required.

It is envisaged that community groups, funding bodies, government organisations and land managers will use Part C of the Strategy to identify priority management activities to maintain and improve the health of waterways in the North East region. The roles and responsibilities of those involved in the planning and implementation of activities will be guided by the situation, the system context context, and the information presented in Table 2 and within each system section.

The regional work program takes into account the full range of tools and approaches available for waterway management, including market-based instruments, government investment in onground works or environmental water management, research, community awareness-raising and information provision, and regulation.

The program has been developed based on a 'typical year'. Should extreme shock (stressor) to the system such as drought, flood or bushfire occur, adaptation may be required to reprioritise the delivery of specific management activities in light of changed conditions and/or risks.

2. Strategic Context

Policy

The Department of Environment and Primary Industries (DEPI) is primarily responsible for oversight of the Victorian Waterway Management Program and establishing a state policy framework for waterway management. Regional implementation of the Program is led by the catchment management authorities (CMAs). CMAs have specific responsibilities for waterway management under the *Water Act 1989*.

In 2013 DEPI released the *Victorian Waterway Management Strategy* (VWMS) outlining the state policy 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 fits into the broader Government vision for the management of water in the State to ensure that rivers, estuaries and wetlands are managed in accordance with relevant Victorian Government legislation and policies.

Under the *Water Act 1989* the North East CMA is required to produce a Regional Waterway Strategy for the North East region. This Strategy replaces the *North East Regional River Health Strategy* (NERRHS) (2006) and adopts the priorities set out in the ***North East Regional Wetland Management Strategy*** (2009) and presents a single, integrated management framework for waterway management in North East Victoria.

The Strategy provides the necessary link between the objectives of the State and of the community of North East Victoria, and is an integral part of the Victorian legislative framework to manage the State's waterways.

The policy framework for the development of the Strategy is outlined in the VWMS 2013 (*www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/strategy-and-planning*), and the required content is outlined in the *Regional Waterway Strategy Guidelines* provided by the former Department of Sustainability and Environment in December 2012. The guidelines provide a minimum set of requirements for the approval of a Regional Waterway Strategy by the Minister for Environment and Climate Change and the Minister for Water.

In addition to the requirements of the *Water Act 1989*, development of the Strategy is also informed by a suite of other State, Federal and international legislation and policies (see Appendix 1 – Guidance Material used in the Development of this Strategy).

Several regional strategies, including the *North East Regional Catchment Strategy* (RCS) (2013), *North East Regional River Health Strategy* (2006), *North East Regional Wetland Management Strategy* (2009), *North East Regional Floodplain Management Strategy Review - 'Flooding Challenges in a Changing Climate' (2009)* and the *Northern Region Sustainable Water Strategy* (2009) also inform the Strategy. The RCS, the primary integrated strategy for managing land, water and biodiversity in the North East, identifies priority areas and a program of measures to protect and manage those resources. The long-term objectives and priorities in the RCS that relate to waterways will be implemented through this Strategy. *The Northern Region Sustainable Water Strategy* (2009) sets out the long-term plan to secure the water future of the Northern region of Victoria. It identifies threats to water availability and identifies policies and actions to help water users, water corporations and catchment management authorities manage and respond to those threats over the next 50 years.

The Strategy is the new centre-piece of an integrated waterway management planning framework for rivers and wetlands (Figure 1). It will be used to inform investment into multi-year projects and annual work programs and environmental water management plans (EWMP).

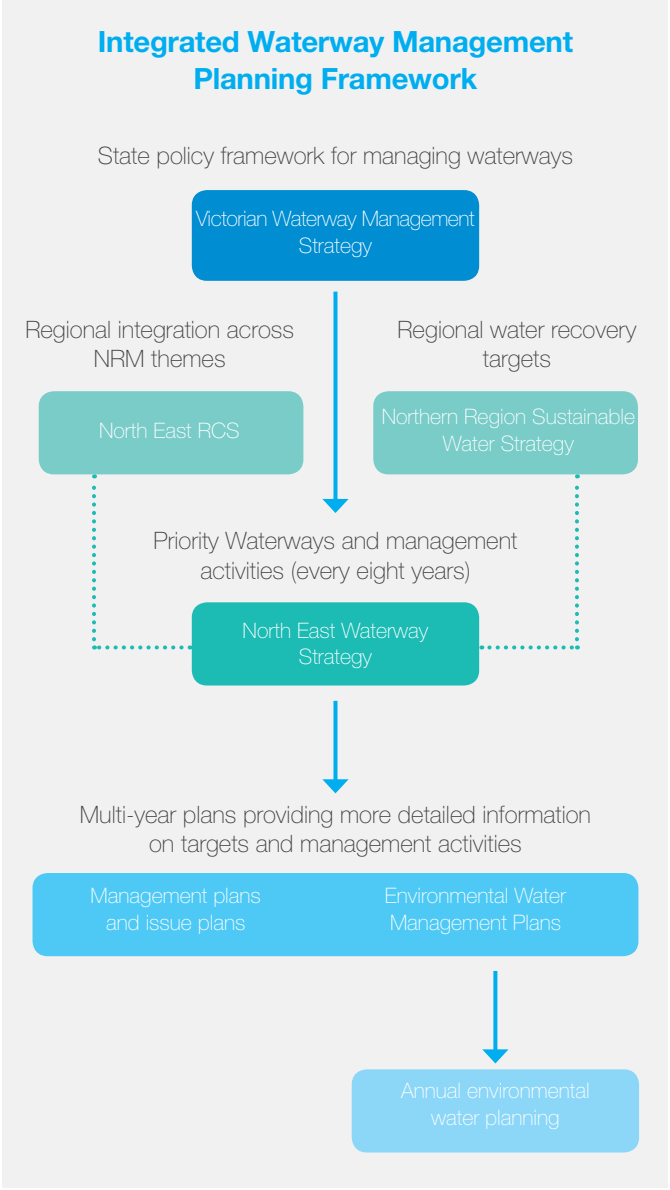


Figure 1 Victoria's Integrated Waterway Management Planning Framework (VWMS 2013)

Roles and Responsibilities

The North East CMA, other organisations and the North East community share responsibility for managing the region's waterways. Table 2 sets out the main roles and responsibilities for each.

Table 2 Roles and Responsibilities in Waterway Management

Organisation	Roles and responsibilities linked to waterways management
North East CMA (CMA)	Has delegated responsibilities under the ***Water Act 1989*** including: > 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 water management and facilitating delivery of environmental water > developing and coordinating regional floodplain management plans > regulating the effects of drainage schemes on waterways > responding to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms > undertaking community participation, practice change and awareness programs
Department of Environment and Primary Industries (DEPI)	Lead agency for waterway management. 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: > sustainable management of Victoria's water resources > management of biodiversity > management of public land, including Crown frontages. Responsible for their administration, including their licensing for riparian management and for grazing and ensuring compliance with licence conditions. 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 > management of fisheries and recreational fishing in waterways to optimise economic and social value while ensuring the sustainability of resources > overseeing the management of biosecurity, including aquatic invasive species
Environment Protection Authority Victoria (EPA)	Responsible for the protection and improvement of Victoria's environment including: > identifying the beneficial uses of water environments and the level of environmental quality needed to protect them through the ***State Environmental Protection Policy (Waters of Victoria)*** > setting statutory standards for acceptable water quality and indicators of water quality > investigating water quality incidents classified as 'pollution'
Parks Victoria (PV)	Management of parks and conservation reserves in which many waterways are located including some Heritage River Areas in Victoria (*Heritage Rivers Act 1992*)
Victorian Environmental Water Holder (VEWH)	Management of Victoria's environmental water entitlements under the *Water Act 1989* to improve the environmental health of rivers, wetlands and floodplains.

Table 2 Roles and Responsibilities in Waterway Management ***continued***

Organisation	Roles and responsibilities linked to waterways management
Commonwealth Environmental Water Holder (CEWH)	Management of Commonwealth environmental water entitlements under the *Water Act 2007* to meet specific environmental objectives, taking into account the operation constraints and opportunities of managing regulated river systems.
Office of Aboriginal Affairs Victoria	Administration of legislation that protects Aboriginal cultural heritage
Murray–Darling Basin Authority (MDBA)	Primary roles as outlined in the ***Water Act 2007*** (Cth) include: > 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
Water Corporations (Goulburn Murray Water (GMW) and North East and East Gippsland Regional Water Corporations)	Established under the Victorian ***Water Act 1989***. Provide a range of water services to customers within their service areas such as irrigation, domestic and stock water supply services, bulk water supply services and urban water and wastewater services in the North East region. In addition, GMW are responsible for managing the emergency response to Blue-Green Algae blooms in the region.
Local Councils (Alpine Shire, Indigo Shire Council, Towong Shire, Rural City of Wangaratta, City of Wodonga, Moira Shire Council, East Gippsland Shire Council, Mansfield and Benalla Shire Council)	Roles and responsibilities including: > incorporating waterway and catchment management objectives, priorities and actions into strategic and statutory planning processes > undertaking elements of floodplain management in accordance with the renewed Victorian Floodplain Management Strategy (VFMS) > developing and implementing urban stormwater plans > managing on-site domestic wastewater systems > managing sections of waterways where formal agreements are in place > managing rural drainage where appropriate
Land Managers	Under the ***Catchment and Land Protection Act 1994:*** > protecting water resources > avoiding causing or contributing to land degradation which causes or may cause damage to land of another owner > conserving soil > eradicating regionally prohibited weeds and preventing the growth and spread of regionally controlled weeds > preventing the spread of, and as far as possible eradicating, established pest animals
Individuals and Community	Community members have an important role in protecting waterway health by avoiding and reporting pollution, reducing resource consumption and contributing to environmental management processes.
Community Groups	Community groups (such as Landcare, Waterwatch and 'friends' groups) participate in regional planning, priority setting and the implementation of regional work programs, participate in monitoring waterway condition and undertake projects.
Industry	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.

Regional Overview

The North East Catchment Region is an area of almost two million hectares and includes three major catchments: the Upper Murray, Kiewa and Ovens (Figure 2). The region is bounded by the Murray River and NSW border in the north, the Victorian Alps in the east and south and the Warby Ranges in the west. The Murray River is a NSW waterway and is not included in the North East Region.

The region includes the local council municipalities of Wodonga, Indigo, Wangaratta, Alpine and Towong, plus parts of Moira, Mansfield, Benalla and East Gippsland shires and has two major urban centres (Wangaratta and Wodonga) with smaller settlements spread across the region. Key industries include agriculture (dairy, beef, wool, cropping and horticulture), forest industries, tourism and value-added processing industries, particularly in the region's two largest centres of Wangaratta and Wodonga. The region has a population of around one hundred thousand.

More than 55% of the North East Region consists of public land, encompassing over 200 parks and reserves. These areas are vital for regional biodiversity, offering varying protection to indigenous plants and animals and important ecosystems. Natural resource assets in the region are a major drawcard for visitors including some of the best recreational fishing opportunities in Victoria and skiing at the Falls Creek and Mount Hotham ski fields.

Figure 2 North East Region.

Regional Water Assets

Water Resources

The region has significant ground and surface water resources. 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*.

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 the environment.

The Murray-Darling Basin reforms and adjustments to water resource allocation are outside the scope of the Strategy (see www.water.vic.gov.au and www.mdba.gov.au for more information).

The North East is rich in water assets: from alpine wetlands and river valleys leading down to the Murray River floodplain. Whilst comprising only 2% of the total Murray-Darling Basin area, the North East contributes a significant proportion of the inflows into the Murray-Darling Basin. Therefore, maintaining the quality of the water and supply reliability, and unregulated contributions is critical to downstream users.

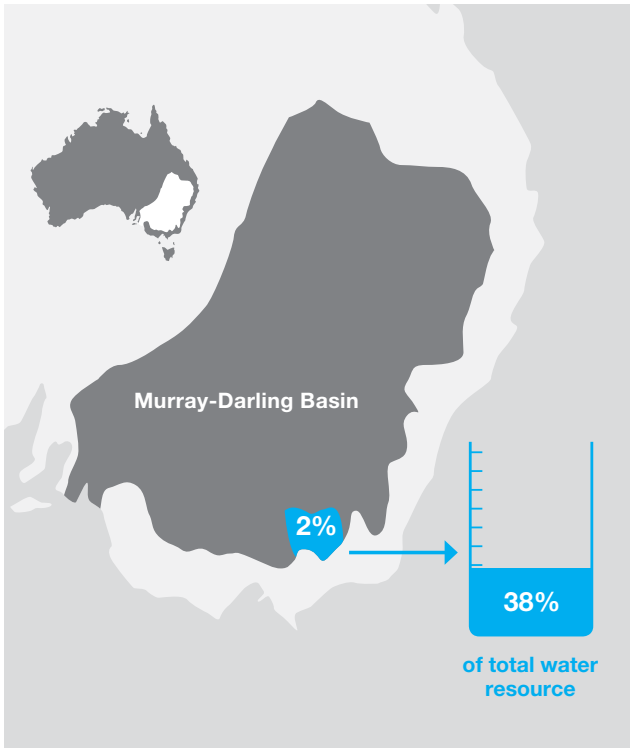


Figure 3 North East Region average Water Resource Contribution to Total Murray–Darling Basin water resources.

Table 3 North East CMA Region – Major Water Assets

Length of streams	10,602 km of designated waterways
Total area of wetlands and wetland Ecological Vegetation Classes	49,000 hectares approximately (source: *Wetland Inventory Assessment)*
Murray-Darling Basin Contribution	38% (of the total water supplied to the Murray-Darling Basin) from the: > Upper Murray and Mitta Mitta Rivers Basin > Kiewa Basin > Ovens River Basin
Special Water Supply Catchments	80% of the North East region has been classified as Special Water Supply Catchments (SWSCs). SWSCs provide water resources to a reservoir or water storage used primarily for domestic water supply purposes. For more information see http://vro.depi.vic.gov.au/dpi/vro/vrosite.nsf/pages/dwsc_water_supply_catchprotect
Groundwater Management Areas	> Upper Murray Groundwater Management Area (GMA) > Kiewa GMA (planned to come into effect late 2014) > Mullindolingong GMA (narrow area covering the Kiewa River valley bottom between the Murray River in the north and Mount Beauty in the south planned to be revoked once Kiewa GMA in place) > Upper Ovens Water Supply Protection Area (combined with surface water) > Lower Ovens GMA
Water Supply Protection Area	Upper Ovens Water Supply Protection Area (Upper Ovens River upstream of the confluence with the Buffalo River near Myrtleford – with a Plan covering both ground and surface water resources)
Hydro-electricity Generation	> Seven hydro-electric power stations: > Kiewa hydro-electric scheme – East Kiewa and West Kiewa branches of the Kiewa River, Rocky Valley and Pretty Valley dams (largest in the state - four power stations with a total capacity of 400 MW) > Dartmouth Hydroelectric Power Station - Lake Dartmouth (180 MW capacity) > Hume Reservoir (60 MW capacity) (on Murray River - NSW) > Lake William Hovell (1.6 MW capacity)

The region provides significant water storage and includes 14 Special Water Supply Catchments. A summary of storages and waterways regulated within the region is presented in Table 4, while the capacity of the storages and their primary purpose is presented in Table 5.

Groundwater

Groundwater resources in the Ovens, Upper Murray, Kiewa and Mitta Mitta catchments are managed by Goulburn-Murray Water (GMW) consistent with the requirements of the *Water Act (1989*), associated Ministerial policies and management instruments. GMW has delegated responsibility for licensing bore construction and the take and use of groundwater, and leads the development and implementation of groundwater management plans. State policy and guidance on groundwater planning and licensing is provided by the Department of Environment and Primary Industries on behalf of the Minister for Water.

Groundwater in the North East Region is highly valued. It is used for domestic and stock, irrigation, industrial and commercial purposes; and provides supplementary urban supply to a number of towns including Wangaratta and Bright.

Groundwater base flow supports groundwater dependent ecosystems (GDEs) that rely on it to meet some or all of their water needs, such as significant areas of the North East Victoria's wetland habitats. It also supports significant waterway dependent fauna such as the Alpine Tree Frog, Murray Cod, Trout Cod, Golden Perch and Macquarie Perch.

Groundwater pumping can impact on groundwater discharging to streams, wetlands and springs, so resource management planning takes into account the connectivity between groundwater and surface water resources.

Management plans have been developed, or are under development, in the Upper Ovens River Water Supply Protection Area as well as the Lower Ovens, Kiewa and Upper Murray Groundwater Management Areas. These plans put in place catchment scale management arrangements and consider the impacts of groundwater pumping on streams, GDEs and other important environmental values. The plans are developed in consultation with stakeholders and community members to be an adaptive management framework; and aim to protect existing groundwater users, river flows and environmental features, while at the same time supporting the sustainable development of groundwater resources.

The North East Region is part of the Murray-Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray-Darling Basin Plan (MDBP). A key feature of the MDBP is the requirement to develop water resources plans by 2019.

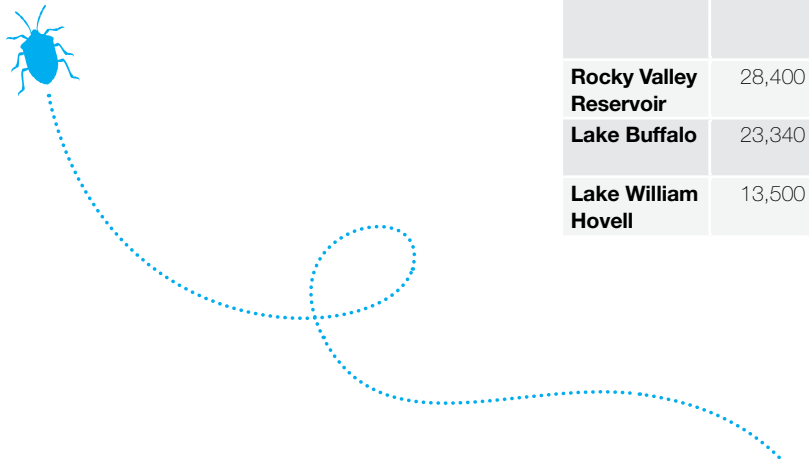
There are currently five Groundwater Management Areas (GMA) in the region. The determination of a GMA is the first step towards producing a Local Management Plan for each area to ensure that groundwater resources are managed in an equitable and sustainable manner, taking into account the connectivity between surface water and groundwater (for more information see www.depi.vic.gov.au/water/groundwater/managing-groundwater).

Table 4 Summary of Storages and Regulated Streams in the North East

Waterway System	Storages	Streams Regulated by these Storages
Upper Murray	Lake Hume	Murray River-inflows also regulated by Snowy Mountains Hydro-electric Scheme
Upper Mitta Mitta	Lake Dartmouth	Mitta Mitta River
Kiewa	Rocky Valley and Pretty Valley Dams, Lake Guy, Clover Dam, West Kiewa River storages (managed by AGL hydro for power generation releases)	Kiewa River including east and west branches
King	Lake William Hovell	King River
Upper Ovens	Lake Buffalo	Buffalo River below Lake Buffalo and the Ovens River downstream junction with Buffalo River.
	Lake Catani and The Reservoir, (Mount Buffalo)	Eurobin Creek and Crystal Brook

Table 5 Major Surface Water Storages in the North East

Storage	Capacity (ML)	Primary Purpose
Dartmouth Dam	3,856,232	Bulk water supplies for irrigation, domestic and stock and urban consumption
Lake Hume	3,005,157	Reserve storage for bulk water supplies for irrigation, domestic and stock and urban consumption
Rocky Valley Reservoir	28,400	Hydro-electricity generation
Lake Buffalo	23,340	Bulk water supplies for irrigation, domestic and stock and urban consumption
Lake William Hovell	13,500	Bulk water supplies for irrigation, domestic, stock and urban consumption



Waterways in the North East - Condition

The environmental condition of waterways is determined by key drivers such as habitat, water regimes, water quality, vegetation and connectivity. Broader catchment condition, land use, natural events like floods and bushfires, development and climate change can all directly influence the environmental condition and values of waterways. Waterway management needs to consider how both natural and anthropogenic (ie human impact via farming practices, recreation, urban development etc.) factors impact on waterway condition and, therefore, on the values of waterways.

The condition of the region's waterways is monitored under a Statewide program which uses two specifically developed Indices of Condition:

- The Index of Stream Condition (ISC) and
- The Index of Wetland Condition (IWC).

Index of Stream Condition

The ISC is an integrated measure of river condition and assesses changes in flow, water quality, aquatic life, physical form and riparian vegetation. The ISC was first used to benchmark the condition of Victoria's rivers in 1999, followed by ISC assessments in 2004 and 2010. The 2010 statewide ISC report (http://www.depi.vic.gov.au/water/water-resource-reporting/Third-Index-of-Stream-Condition-report), which provides a snapshot of river health for approximately 29,000 km of major rivers and streams in Victoria, was released in October 2013. For the North East region, the report indicated that there had been no substantial change in river conditions since the 2004 report, with 43% of stream length assessed as good to excellent. This is encouraging, considering that the 2010 coincided with the severe Millennium Drought (from 1997-2009). The key findings for the North East region are provided below in Figure 4.

Index of Wetland Condition

The IWC assessment is a statewide method used to assess the condition of Victoria's natural wetlands. In 2009/10 the first IWC assessment was undertaken. It covered 587 high value wetlands (identified as wetlands of international and national importance-based on environmental, cultural and scientific values), of which 71% were on public land and 29% on private land. In 2011 an assessment of a sample of the remaining 12,400 wetlands in Victoria was undertaken. Condition assessments are scheduled to be undertaken at eight-year intervals (DSE 2012, DEPI 2013).

The results of the IWC assessments across the North East region (Figure 5) showed that 24% of high value wetlands were in excellent condition, 33% were in good condition, 26% were in moderate condition, 14% were in poor condition and 2% were in very poor condition. The assessments were undertaken at the end of a period of thirteen years of below average rainfall (1996 to 2009) which indicates that the wetlands have evolved under a variable climate and have a degree of resilience. It is important to note that the wetlands assessed in the North East region only represented a small percentage of the high value wetlands identified in the *North East Regional Wetland Management Strategy (2009)*.

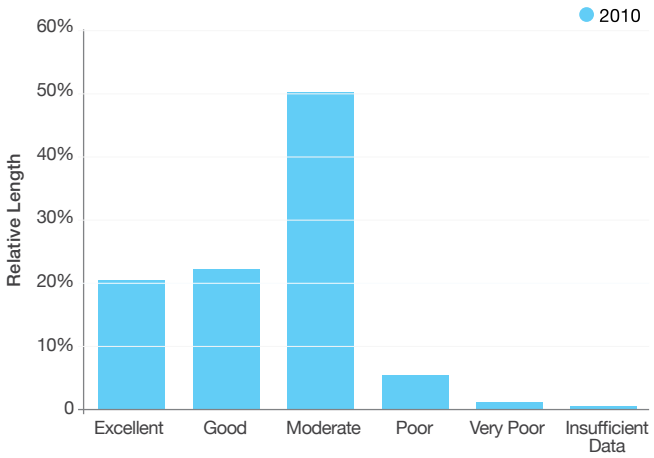


Figure 4 Index of Stream Condition - North East Region

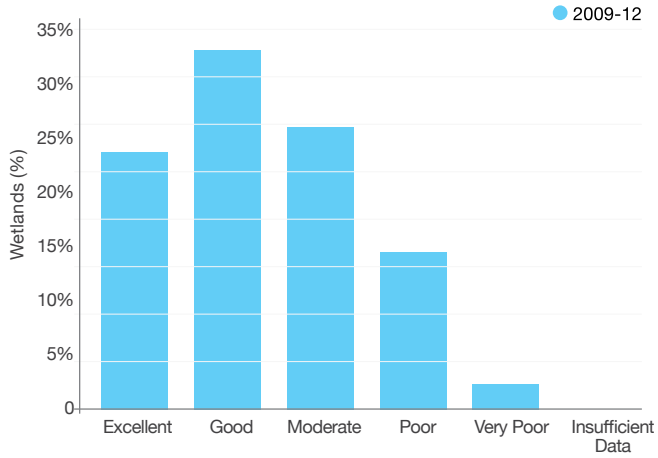


Figure 5 Index of Wetland Condition - North East Region

Waterways - Values

Waterways are important natural assets that support diverse populations of animals and plants as well as providing significant social, economic and cultural benefits to communities. The following section describes the values of waterways in the North East region.

Formal Waterway Recognition

A number of waterways in the North East have been recognised as being of national or state significance due to their specific characteristics. These valued waterways and their significance are detailed below in Tables 6 and 7.

Table 6 Waterways of National Significance – Wetlands (Environment Australia 2001)

Nationally Important Wetlands	> Sections of the Mitta Mitta River above Lake Dartmouth > Sections of the Ovens River from Killawarra to the confluence with the Murray River > Alpine wetlands including - Alpine bogs, Alpine peatlands, Davies Plain and Mount Buffalo Peatlands > Murray River Floodplain wetland - Ryans Lagoon > Murray River Plains Perched Wetland - Black Swamp > Artificial wetlands - Lake Hume and Lake Dartmouth

The Murray River, although a NSW river, is an Icon Site under the Murray-Darling Basin Plan. The North East region provides water to the Murray River via tributaries such as the Kiewa, Ovens and Mitta Mitta Rivers.

Table 7 Waterways of State Significance

Heritage Rivers	> Mitta Mitta River > Ovens River
Icon Rivers	> Lower Ovens River
Representative Rivers	> Snowy Creek > Lightning Creek > Koetong Creek > Lower Ovens River

Environmental Values

Environmental water – Water resources from Lake Hume and Lake Dartmouth are used for consumptive use and the storage and delivery of environmental water to the Murray River and floodplain wetlands (e.g. Barmah-Millewa Forest) and to other connected systems.

Water quality – The region contains some of the most intact water regimes and highest water quality in the State which sustain a number of environmental values. This is due to the high and reliable rainfall, relatively low proportion of hydrological development (e.g. dams and weirs) and extensive forest coverage across the region.

Wetlands as drought refuges – The region contains a variety of wetland types including freshwater meadows, shallow freshwater marshes, alpine wetlands and riverine billabongs. These represent significant areas of the State's most depleted wetland habitats and some are among the least represented in Victoria's protected area network. Significant areas of permanent artificial water storages, including Lake Hume and Lake Dartmouth and the upper end of Lake Mulwala, also occur within the region. These wetlands and storages are critical for the conservation of biodiversity and for ecological productivity, and are important sites for migratory water birds and for providing refuges for animals in time of drought (e.g. large native fish).

Rare or threatened species and communities – the region supports many threatened, significant and endemic species that are waterway dependent. Some of these are listed under the national *Environment Protection and Biodiversity Conservation Act 1999* and some under the Victorian *Flora and Fauna Guarantee Act 1988*. The region contains important flora and fauna species that are waterway dependent such as the threatened Alpine Tree Frog, Murray Cod and Golden Perch, waterway birds such as egrets, bitterns, herons and cormorants, endangered species such as the Trout Cod and Macquarie Perch, and rare species of Alpine flora (e.g. peatlands). These values are described in more detail in the information on the waterway systems (Section 5). For more information on the threatened and endemic species and their rankings, or listings, under each Act please refer to www.comlaw.gov.au and www.legislation.vic.gov.au.

Definitions:

Heritage Rivers are rivers of very high nature conservation, recreational, social or cultural value, or because of a combination of these values.

Icon Rivers are Heritage Rivers which stand out because of their high level of conservation value, naturalness of flow, the relative intactness of the entire river system and their significance for larger systems.

Representative Rivers are in an ecologically healthy condition that can be used to represent the major river classes that once occurred naturally across Victoria based on geomorphic and hydrological criteria.

Social Values

Recreational activities – Popular pursuits in and along many of the waterways in the North East include boating, fishing, swimming, camping and walking. Recreational fishing is an important secondary use for many water storage dams including Lake Hume and Lake Dartmouth. Some dams are also used for sporting events such as the annual Mile High Dragon Boat Championships at Rocky Valley Dam and the King Valley Challenge which includes a 12 km paddle on Lake William Hovell.

Landscapes – The diverse and aesthetic appeal of the North East landscapes and their associated liveability support the regions vibrant communities (e.g. Mitta Mitta Valley is listed by the National Trust).

Community groups – Many community groups such as Waterwatch, Landcare, 'friends' groups and angling clubs are involved with improving the health of the North East waterways.

Cultural Values

Aboriginal cultural heritage – The waterways of the North East are highly significant to Aboriginal people and support cultural, economic, social and environmental values. In recognition of this, most waterways in this Strategy have been listed as an Area of Cultural Sensitivity with some containing scar trees, artefact scatters, quarry sites, grinding grooves and fish traps.

Economic Values

Irrigation water for agricultural production – Water for irrigation is sourced mainly from the Mitta Mitta (including Dartmouth Dam), Kiewa, King, Ovens and Murray Rivers (including Lake Hume) to irrigate pasture mostly for dairy production and horticulture crops including viticulture. In addition, significant irrigation water for agricultural production is also sourced from groundwater in the region and this is likely to increase in response to further decreases in volume and reliability of surface water supplies. With an estimated gross value of agricultural production in the Murray-Darling Basin (MDB) of $15 billion per annum (MDBA 2014) the water supplied to the MDB from within the North East has a major economic value.

Urban/rural township water – 80% of the North East has been classified as Special Water Supply Catchments (SWSC) which provides water resources used primarily for domestic water supply purposes. Lake Hume and Dartmouth Dam provide significant storage for urban requirements downstream of the Murray River.

Tourism and Recreation – In Victoria in 2008-09 direct expenditure related to recreational fishing was valued at $2.3 billion (Ernst & Young, 2009). For example, many waterways in the North East are considered premier fishing waters.

The History of Waterway Management in the Region

River management practices have changed significantly over the last 70 years. In the past, practices in the North East were aimed at meeting the needs of the time – effective delivery of water, stock access to water, and protection against floods.

In the late 1940s, landholders lobbied the then State Rivers and Water Supply Commission to have various areas declared River Improvement Districts. This was largely because they were concerned about erosion of farming land, and individuals were undertaking their own works in any way they saw fit. As a result, River Improvement Trusts – operated by local committees – were set up in various locations in the North East to work on local waterway issues.

Each River Improvement Trust had its own specific objectives, area of responsibility and accountability. The Trusts did not work together at the broader catchment scale.

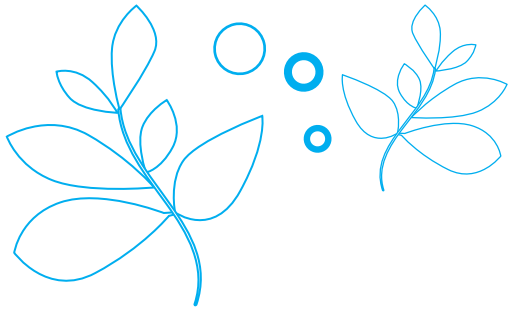
Much has changed since those early years of waterway management, with modern Waterway Management Authorities (which existed prior to the establishment of the CMAs) taking a broader overall stream health management focus which embraced a wider range of environmental, social and economic objectives.

In July 1997 the Victorian Government established ten regional catchment authorities – including the North East Catchment Management Authority – to work with the community, government and funding organisations to protect and enhance land, water and biodiversity resources in their regions.

In 2006 the *North East Regional River Health Strategy (NERRHS)* was released to provide strategic direction for the management of rivers in the region. The vision for rivers identified in the strategy was:
"Our rivers are managed to support ecological health whilst meeting our social and economic needs".

In 2009 the *North East Regional Wetland Strategy (NERWS)* was released to provide strategic direction for the management of wetlands in the region. The vision identified in the strategy was:
"to ensure that wetlands on public and private land are protected, rehabilitated, managed and used sustainably so that, collectively, they provide the complete range of ecological, biodiversity, community, social and economic values for present and future generations of the region and for the wider Australian and international community".

These visions acknowledged that, not only environmental considerations, but also the needs of the community, should be taken into account in planning the management of rivers.



Past Achievements

This Strategy supersedes the NERRHS that was developed in 2006. Some of the past waterway management achievements include:

- **Fire recovery** – rehabilitation of waterways, sediment control and stabilisation works
- **Flood recovery** – emergency works for stabilisation of waterways
- **Community Partnerships** – working with landholders to undertake stock exclusion fencing, weed control, planting native trees, grasses and shrubs to help stabilise river banks and restore riparian vegetation, re-snagging and improving fish passage
- **Native fish demonstration reach project on the Ovens River** – fish surveys, weed control, riparian revegetation and re-snagging techniques to improve river health, aquatic habitat and boost native fish populations, particularly Murray Cod and Trout Cod
- **Wetlands** – development of the NERWS to guide future management of wetlands
- **Large Scale River Restoration** – integrated large scale restoration activities to reduce environmental threats and deliver benefits to the community and flora and fauna living along the Ovens River (Black and grey willow eradication and management, sediment and avulsion management and community education)
- **Filling in knowledge gaps** - studies to quantify the Environmental Water Reserve objectives in the Kiewa and Ovens River Valleys, monitoring stream condition, monitoring of works
- **Healthy waterways** – development and implementation of Waterway Action Plans (WAPs) in partnership with the community to help set the strategic direction for river health works in priority areas
- **Waterwatch** – supporting adult volunteers in monthly water quality monitoring, training and awareness activities and education linked to waterway health and
- **Education** - SEED (Student Environment Education Directory) – online teachers resource and hands-on student environment days (http://www.seed.vic.gov.au/).

Review of the North East Regional River Health Strategy (NERRHS) 2006

In 2013 the North East CMA conducted a review of the NERRHS to inform the development of this Strategy. Following are the key findings of the review and how these findings were responded to in this Strategy.

- **Strong community engagement is an essential part of waterway management**

  Community education and involvement are critical for maintaining or improving waterways. Waterwatch and the Schools Environment Education Development (SEED) program are particularly effective in the region. There are opportunities to develop tools that will increase the value and usability of data collected by Waterwatch and other volunteers. More community consultation is required at the local level, about local issues, and to provide information on how to implement waterway strategies. Broad statements are not useful for individual landholders.

  Response: Listening and responding to the knowledge and experience of the local community supports effective decision-making. Therefore, community participation is a critical component in the development and implementation of this Strategy, and addressed in the guiding principles and whole of region Strategic Actions. It is hoped that the local community will take ownership of this Strategy and use the content to guide planning and management related to waterways.

- **Urban water supply is important**

  The 2006 NERRHS focused on water use for irrigation. The Strategy needs to also address the supply of water for urban supply and allow for the fact that the quality, quantity and timing of water required for different uses varies greatly.

  Response: Maintaining or improving water quality in priority water supply catchments is a goal of this Strategy. Urban water supply as a value of waterways is included in this Strategy. Risks to this value have been incorporated into the identification of Strategic and Lead Actions and the Priority Waterway management activities (Part C).

- **Wetlands need to be considered**
  There is a need to focus on wetlands and their role in the landscapes. Wetland connection to waterways is very important for their health.

  Response: Issues relating to wetlands, and the aquatic and terrestrial ecosystems that they support, are addressed in this Strategy.

- **Rivers and bank erosion**
  Bank erosion caused by stock, system power (hydraulics), sediment dynamics, vegetation cover and introduced species is a significant occurrence in North East waterways.

  Response: The risk of unmanaged stock access and introduced species to waterway health has been incorporated into the identification of priority management activities. In addition, the dynamic nature of streams and the important role that appropriate levels of erosion plays is recognised through taking a waterway 'system' approach. This Strategy has outlined a management approach that includes activities for erosion and sediment management rather than erosion control.

- **Adaptive and flexible planning and delivery are essential**
  The 2006 NERRHS was useful for guiding investment in river management. However, effective natural resource management should be based on both priorities from an asset resource point of view and the communities priorities based on their values.

  Response: Integrated catchment management requires flexibility and adaptation to changing climate variability, including flooding, bushfire and drought, investment dynamics and community values. This Strategy factors in monitoring, evaluation and reporting programs to enable adaptive planning and delivery.

- **Partnerships are critical**
  Whilst the North East CMA regularly utilised the 2006 NERRHS to determine priorities and plan works, its use by other agencies and community groups varied widely. The renewed Strategy needs to better describe how Local Councils, water coporations, conservation groups and farmers can work together to manage waterways.

  Response: This Strategy recognises the critical role partnerships with communities play in achieving its vision. Many of the Strategic Actions are based on working with the relevant stakeholders to achieve the Strategy goals.

- **The focus needs to be changed from a 'reach'**
  The 2006 NERRHS focused on work at the reach level and 'protecting the best'. The renewed Strategy needs to take a 'whole of system' approach based on systems as well as individual assets.

  Response: Often local level planning for management activities needs to be at the reach level, however it also needs to consider the system it is within. Reaches and wetlands have been assessed to identify priorities, and then considered within a system construct. This Strategy takes a 'systems' approach. This approach recognises the connections within a system rather than focusing only on individual reaches. For example, it recognises that sedimentation and erosion processes and management direction are best considered at the system scale.

- **There needs to be reduced focus on detailed costings**
  The 2006 NERRHS allocated specific budgets to itemised actions (e.g. over $70 million dollars of costed actions). Whilst this assisted with Government budget processes, from a community perspective, the costed items set up an expectation of investment and associated Government ownership of waterway management. It also focused effort on Government budget processes rather than considering all funding and management opportunities.

  Response: This Strategy provides estimates of the type and scale of management activities required to achieve management outcomes. However, the individual Strategic Actions, Lead Actions and Management Activities identified in this Strategy have not been costed.

- **The Regional Waterway Strategy needs to be easy to access**
  The 2006 NERRHS contains excellent technical information but the language is unnecessarily complex and many of the tables are difficult to interpret. This complexity may have been the cause of poor Strategy adoption by some stakeholders.

  Response: Every endeavour has been made to make this Strategy a useful document for all stakeholders involved in waterway management.

- **The effectiveness of actions guided by the Regional Waterway Strategy needs to monitored**
  The 2006 NERRHS contains a monitoring program to monitor the success of the strategy. The priority actions and associated resources were appropriate, however, their implementation and integration with onground activities were not ideal.

  Response: Monitoring and evaluation is a critical component of this Strategy, and addressed in the guiding principles and Whole of Region Strategic and Lead Actions.

Regional River Health Strategy 2006: Showcasing Achievement

Large Scale Restoration along the Ovens River

The Victorian Government's Large Scale River Restoration program (2006–2010) aimed to significantly improve the health of Victoria's rivers, floodplains and estuaries through the coordination of integrated large-scale restoration activities on priority river systems to maximise river health outcomes for investment, and to demonstrate to and inform the community of the effectiveness of investment in river health.

The Ovens River is one of two rivers listed in the *Victorian River Health Strategy (2002)*, that requires special management because of its environmental values. It contributes 14% of the total flow in the Murray-Darling Basin, is critical for environmental flows in the Murray River, and sustains a vibrant forest and wetlands system in the lower reach.

In December 2008, an independent consultant, GHD, reviewed the river health work undertaken in the Ovens Basin through the Large Scale River Restoration program. The project for the Ovens River had involved an integrated approach to reducing threats and enhancing habitat. The key partners in the program were the Victorian Government, adjacent landholders, the Murray-Darling Freshwater Research Centre, Parks Victoria, State Crown Land Management, the Arthur Rylah Institute, CSIRO and North East CMA.

GHD's audit concluded that the nature of the works, combined with a focus on reducing threats posed by sediment export and seeding willow populations, were likely to lead to long-term, positive changes in the Ovens River. This audit highlighted that:

- The River Tender program had assisted with the large scale protection of high quality remnant vegetation along the Ovens
- A series of works, such as the CMA using large wood as an alternative for bank stabilisation, had helped to improve river management
- The project delivered benefits for threatened species such as the Murray Cod and Macquarie Perch
- There was active management of Black and Grey willow populations across the system which are a significant ongoing stressor to river health in the Lower Ovens and
- The development and implementation of Waterway Action Plans provided an opportunity to communicate with landholders and other local stakeholders.

Challenges and Opportunities in the North East

A number of challenges are likely to impact the extent to which the communities of the North East can influence the management of the region's waterways:

- Increasing population and development in urban and surrounding landscapes
- Decreasing population in the agricultural landscapes
- Increasing expectations in the community for "clean, green" produce
- Increasing levels of volunteer burnout
- Increasing climate variability, particularly more frequent extreme events
- Reducing "terms of trade" for agricultural producers
- Increasing use of land for lifestyle purposes and
- Changing expectations for the use of natural resources such as for increased recreation and tourism.

The Strategy has taken these challenges into account in determining the desired condition of waterway systems in the North East and in identifying the Strategic and Lead Actions essential for their management.

Community Input to the Strategy

The CMA recognises the knowledge, skills and expertise of the local community and the value of their input in identifying issues and informing decisions and options within the region.

The CMA values the knowledge, skills and expertise available in the catchment community. As a result, the CMA sought to actively encourage widespread input into development of the Strategy.

The CMA used Innovation and Collaboration Principles set out in the North East RCS to foster new ideas through an inclusive discussion around the challenges and opportunities for waterways.

Over a two year period, the CMA worked with a range of

groups to identify information and issues that inform decision-making regarding waterway management in the region.

The CMA sought to develop a comprehensive understanding of community expectations, attitudes and behaviours towards waterways in the region.

During 2012 and 2013 the CMA invited the North East community to take part in a series of 'catchment conversations' in locations across the region. Initial conversations were held in 13 separate locations with over 150 community members. In addition, a number of schools were involved at two Student Environment Days (with over 400 students participating). The aim of the conversations was to discover the values and aspirations people have for their waterways, as well as their concerns. A summary of the community consultation stages involved in the renewal of the Strategy is presented in Figure 6.

The CMA utilised feedback gathered through multiple face-to-face and online conversations to develop goals for waterway management, identify stressors and community values about waterways.

In April 2014 the CMA invited the catchment community to review and test the draft Strategy. It devised an overarching campaign theme and offered a range of processes to encourage maximum participation in the consultation process. The CMA sought to engage with people in non-traditional venues, including the Tallangatta Lifestyle Expo, the Alpine Shire offices and Sam Miranda Winery. This proved to be a successful strategy with almost 80 people attending 'Catchment Conversation' events held as part of the public consultation process. These activities are summarised in Table 8.

Table 8 Summary of activities involved during the public consultation phase of the Strategy renewal

Goal	Activities to Encourage Comments And Submissions
Build awareness of the consultation period	**Devised user-friendly theme and look for consultation** > "You use it, you drink it, you play in it" theme developed and applied to banners, posters, postcards, web based resources **Actively used media to generate interest in consultation** > Distributed media releases around consultation events/opportunities > Arranged photo opportunities with partners to build awareness > Regular postings to Facebook and CMA website throughout consultation **Conduct briefings** > Updated regional NRM staff to encourage involvement
Offer flexible, relevant and comprehensive suite of engagement opportunities	**Hosted face-to-face/interactive events in a range of locations.** *'Catchment Conversations'* held at : > Willow Park, Wodonga > DEPI Research Centre, Rutherglen > Embankment Drive, Mt Beauty > Livingstone Creek Park, Omeo > Alpine Shire Council office, Bright > Sam Miranda Winery, Oxley > Tarawingee Reserve, Ovens River > Tallangatta Farm Expo > Festival grounds/reserve, Nariel Creek **Arranged 'have your say' opportunities with partners** > 'Pop-up' displays and comment boxes made available at business and Local Councils locations, including Alpine Valleys Leadership Forum (Wodonga) , Rural Supplies (Myrtleford) and the Alpine Shire Council office **Offered web/technology based comment opportunities** > Email submissions: necma@necma.vic.gov.au > Web submissions > 24hr phone line with out-of-hours message service **Offered written submissions** > Postal and 'walk in' responses gathered by CMA
Offer support information to guide interested people through the technical content	**Devised and distribute variety of support resources** > Summary information sheet with map of catchment and focus on three key questions > Distributed weekly e-bulletins to all who previously contributed to the Strategy development and those on the CMA contact database (approx. 2,500 people) > Utilised the customer relationship management system to report back and track – ie provide written feedback to those who provided contact details.

'Key themes' emerging from draft Strategy consultation process

These key themes emerged at 'Catchment Conversation' events held in the catchment:

Our community values urban waterways

- **WODONGA** - Urban waterways are important. They are a great way to connect with nature.

Collaborative approaches are needed

- **OMEO** - The restoration works delivered on Livingstone Creek have been really successful and we are keen to see works in this area continue.
- **MT BEAUTY** - We need to build local knowledge into the decision-making process when making management decisions.
- **CORRYONG** - A collective approach to waterway management activities is needed.

Volunteers are valuable

- **TALLANGATTA** - Landcare participation across the region is positive

There is a disconnect with local waterways

- **RUTHERGLEN** - We could use an icon species to help build greater ownership and more appreciation of the natural environment we live in.

Natural disasters need to be factored into the Strategy

- **MT BEAUTY** - We need to acknowledge the impact of the floods, drought and bushfires on our local environment.
- **CORRYONG** - The Flood Recovery program has been very positive.

We need to factor in social and economic needs

- **BRIGHT** - Enhancing the recreational values and creating public awareness is a high priority. How do we manage environmentally responsible touring and protect waterways particularly in peak periods?
- **TALLANGATTA** – Recreational fishing is important.
- **CORRYONG** - Local waterways provide adventures of discovery for children and visitors to the region. The diversity of the waterways in the Upper Murray is beautiful.

Works on waterways need to be maintained

- **BRIGHT** - Willow works need to be followed up to ensure they are being maintained properly.
- **CORRYONG** - We need a continued focus on waterway management along Corryong / Nariel Creek.

We need to address plant and animal pest issues

- **BRIGHT** - More emphasis is needed to deal with pest plants and animals and how the community can deal with these in the long term.
- **CORRYONG** - The commitment of landholders to keep up the blackberry control across properties and along the waterways is really important.
- **TALLANGATTA** - More riparian vegetation along waterways is needed and better management of woody weeds.

Willows are an issue of concern

- **CORRYONG** - We would like to see willow debris blockages removed from waterways before they create erosion issues.

More information is needed about wetlands

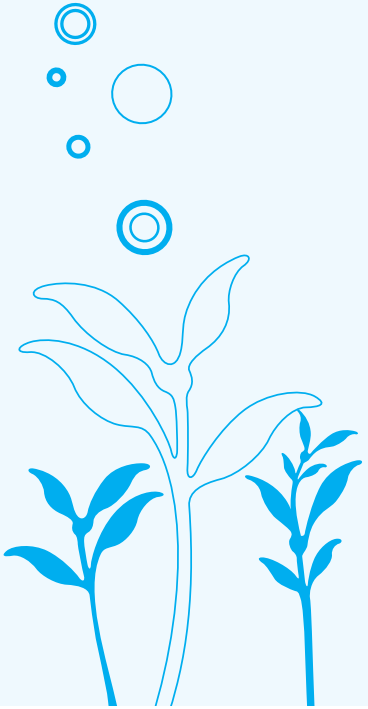
- **TALLANGATTA** - There is an interest in more information being available around wetland management.

Fish health is a high priority

- **TALLANGATTA** - Healthy fish populations and water quality are important priorities. Need to remove barriers to fish passage.
  Native fish in waterways are highly valued.

People want to find ways to protect water quality

- **TALLANGATTA** - It's important to exclude stock from waterways to protect water quality.



Major consultation stages

Population of AVIRA database

- Selected peak bodies, community groups and government stakeholders input in populating the Aquatic Value Identification and Risk Assessment (AVIRA) database
- Community input to collect knowledge on identifying values of and threats to waterways in North East Victoria

Regional Waterways Strategy concept developed

- Review of the NERRHS
- What can we learn?
- A more in-depth understanding sought

Catchment Conversations

- Conversations held in 13 different locations with 150 community members participating
- Ongoing discussions with Office of Aboriginal Affairs Victoria and local Traditional Owners to identify values of and threats to waterways as perceived by the Indigenous community
- Engagement with schools through Student Environment Days

Stakeholder Workshop

- Workshop involving community groups, peak bodies and government stakeholders on the development of the Strategy and encouraging feedback on goals and waterway systems

Staggered Release of Ideas and Feedback

- Testing of ideas with opportunity to provide feedback through staged release of waterway systems Strategic Actions

Catchment Conversations on draft Strategy

- Catchment-wide consultation to encourage discussion and comment on the draft Strategy
- Conversations held in 9 different locations with almost 80 community members participating

Incorporation of Comments into draft Strategy

- Comments, suggestions and ideas received from the consultation considered in a review of the draft Strategy

Ministerial Approval

- The regionally-approved version of the Strategy submitted by the North East CMA Board on behalf of the region to the Victorian Government for approval.

Figure 6 Summary of Major Consultation Stages involved in renewing the Strategy

Some of the comments received during the renewal of the Strategy were:

"I don't hear frogs any more." ***Wangaratta***

"We want to see a collaborative approach to river management." ***Moyhu***

"In 20 years time I want our local waterway to have very good water quality." ***Yackandandah***

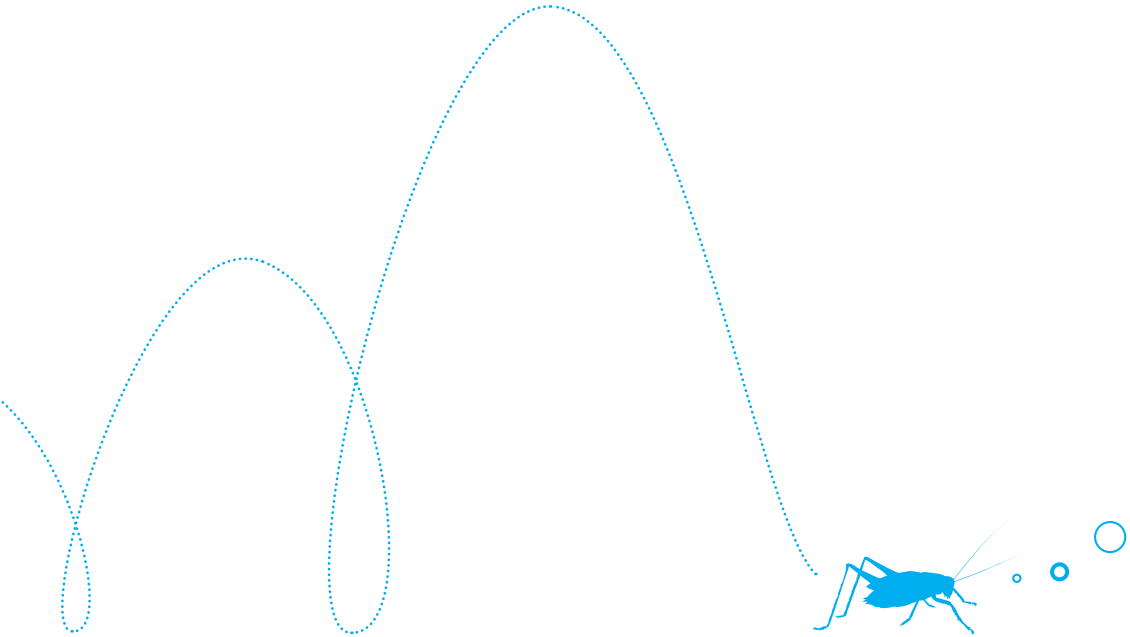
"I want to see less Broom along our waterways." ***Omeo***

"Organisations seem to be working to the same goal, but not working together." ***Bright***

"Our waterways we can destroy, or we can cherish, the choice is ours." ***Thowgla***

There is already strong community commitment to improving the condition of waterways across the region. This is evident in the uptake of partnership projects, active participation in Waterwatch and Landcare programs and the emergence of urban Landcare and 'friends' (community-based) groups. It is imperative to maintain and build on this active community participation.

Therefore, this Strategy includes Strategic and Lead Actions and priority management activities (Part C) that encourage the community to actively participate in the integrated management and protection of natural resources and cultural heritage. Community involvement in these activities will draw on their connectedness to their environment and support the achievement of the Strategy goals and its high level principles (see 3. Regional Vision, Goals and Principles).



PART B

- Regional Vision, Goals and Principles
- Approach
- Waterway Systems
- Monitoring, Evaluation and Reporting and Adaptive Management

3. Regional Vision, Goals and Principles

Vision

The North East has adopted the following (fifty-year) vision for the management of the region's waterways:

> Our waterways are valued, healthy and well-managed; supporting environmental, social, cultural and economic values.

Goals

The high level (twenty-year) goals for the management of waterways in the North East are:

1. Maintain or improve populations of threatened species and communities that are dependent upon waterways in the North East region.
2. Maintain or improve the connectivity within and between the different types of waterways.
3. Maintain or improve water quality in priority water supply catchments.
4. Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state.
5. Raise awareness of and protect the social and cultural heritage values of waterways.

The primary purpose of these goals is to help filter and prioritise where management efforts should be targeted through an assessment of the values, stressors, risks and feasibility. These goals, in conjunction with the principles below, have been used to identify Priority Waterways and waterway-related management activities.

Statewide Guiding Principles

Achieving the vision for Victoria's waterways requires long-term commitment from the Government and communities, coupled with effective investment in regional waterway management programs across the state. The management approach for working towards this vision is guided by the following principles as outlined in the WWMS (2013):

- **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 waterway management and this participation can help foster increased stewardship of waterways.
- **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 and the strong influence of land use and catchment condition on waterway condition.
- **Appropriate tools** – the full complement of tools and approaches will be considered to improve waterway condition including direct Government investment in onground works, grant and incentive programs, management agreements, market-based instruments, information and extension programs and regulation.
- **Value for money** – Government will direct investment to regional priority management activities that provide the most efficient and effective long-term improvements in waterway condition and the greatest community gain.
- **Regional Waterway Strategies** – facilitate regional decision-making with community input and use a risk-based approach to identify high value waterways and priority management activities. They will:
  - consider environmental, social, cultural and economic values of waterways
  - be holistic and integrate onground works with environmental water management
  - ensure efficient and effective management of environmental water
  - include maintenance as a vital activity to secure both past and future investment in onground works
  - be flexible in response to seasonal climatic variation and plan for the potential impacts of climate change.
- **Evidence-based decision-making** – best available knowledge will underpin decision making, policy and waterway management programs.
- **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.

Regional Principles

These statewide guiding principles have been used to help identify the regional principles. The below regional principles have been used to guide the direction of integrated waterway management in the region:

1. Maintain or improve the environmental condition of all Priority Waterways.
2. Maintain or improve appropriate recreational access to waterways whilst maintaining environmental condition.
3. Maintain or improve surface water and groundwater resource sharing and access whilst maintaining environmental condition.
4. Ensure land use and development provides for the protection of, and minimises impact on, waterways.
5. Maintain past natural resource investment outcomes.

Program Logic

The program logic for the Strategy is illustrated in Figure 7. This has been adapted from the program logic for the Victorian Waterway Management Program (DEPI 2013). It describes how each year, specific management activities (outputs) are delivered 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. Part C of this Strategy contains the outputs and management outcomes, Strategic and Lead Actions and Resource Condition Targets in more detail.

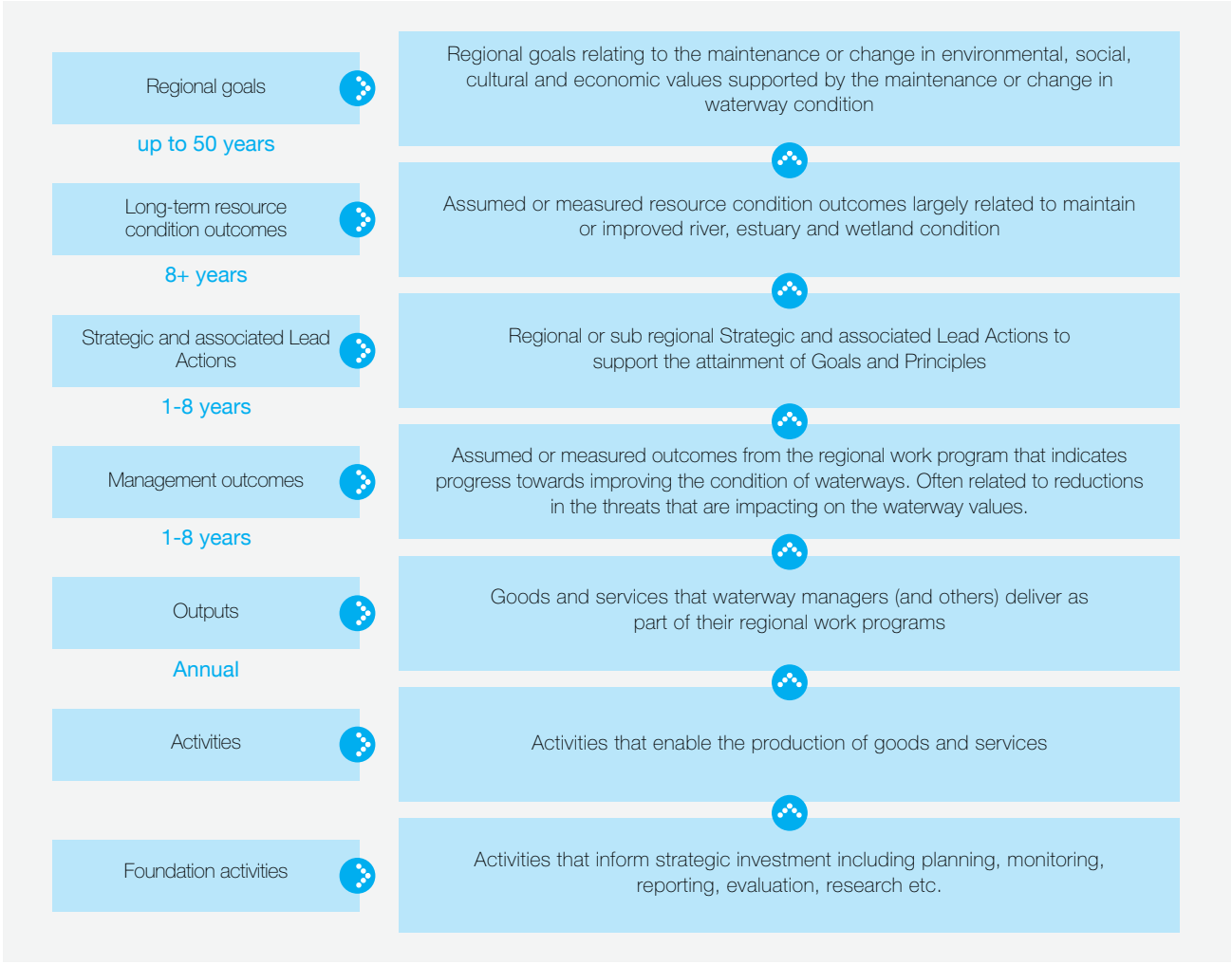


Figure 7 Program logic for the Strategy - adapted from VWMS (2013)

4. Approach

In the past, natural resource management focused on managing threats over large geographic areas (e.g. salinity). The focus now is for public investment to be targeted to those parts of the landscape that are high value, rather than trying to manage threats across larger areas. This approach (known as the asset-based approach) identifies important areas based on their values (e.g. environmental, social, cultural and economic) and allows development of integrated programs to address threats. This approach also provides the basis for identifying priorities for investment.

This Strategy has built on this location-based, asset-based approach and associated priorities for management. The systems-based approach taken in this Strategy considers the totality of the individual assets in the whole system and applies resilience thinking. In addition, the system based approach also aggregates and integrates 'like' management challenges and options. The need for a system-based approach was identified in the review of the *North East Regional River Health Strategy 2006* and to progress the resilience thinking approach taken in the North East RCS (see Section 2 Strategic Context). This enhanced approach:

- Better recognises the values of, the stressors on, and changes in waterway systems and their interconnectedness, e.g. what happens upstream can have an impact downstream
- Recognises that effective waterway management should be based on both priorities from an asset resource point of view and the communities priorities based on their values, and
- Enables integrated waterway and catchment management across diverse communities, economies and landscapes.

The System-Based Approach

To help the community access this information and build a picture of the overall values, connections, influences and stressors occurring, the region was divided up into systems.

Individual waterways are not stand-alone assets but belong to interconnected waterway systems that have diverse communities, economies and landscapes. In addition to considering individual assets within each system, the system-based approach takes into account the five Landscapes identified in the North East RCS to determine priority management activities. Each of these Landscapes (Urban, Lifestyle, Agriculture, Forest and Alpine) is a dynamic system with interacting social and ecological components. Consequently, each Landscape warrants different objectives to achieve natural resource management outcomes. Importantly, these Landscapes do not have clearly delineated boundaries, reflecting their dynamic nature over time and the self determining nature of peoples identity and associated value systems. Irrespective of this, the approach recognises that people and their values are seen as an integral part of the system. The Strategy divides the region's waterways into eight systems, based on their hydraulic boundaries, geomorphology, river dynamics and catchment conditions (those similar or interconnected):

1. Upper Murray System
2. Upper Mitta Mitta System
3. Lower Mitta Mitta System
4. Kiewa System
5. Upper Ovens System
6. King System
7. Lower Ovens System
8. Murray Plains System

For the purposes of regional waterway management, a ninth "system" – to recognise and capture region-wide strategic and management issues – has also been identified. The RCS landscape context has been used for each waterway system to help describe the interactions between waterways and people.

Strategic and Lead Actions

In each system a set of Strategic and Lead Actions have been identified. The Strategic and Lead Actions are provided to help make sense of the management challenges within the systems and achieve the goals and principles of this Strategy. Overall this systems-based approach is designed to increase the accessibility and uptake of waterway management activities. For more information on the nine waterway systems see Section 5 Waterway Systems.

Determining Priority Waterways

When assessing priorities for the management of waterways and waterway systems, the CMA has used the asset based approach to look at the values of and the stressors on each individual asset (river reach or wetland). The Aquatic Value Identification and Risk Assessment (AVIRA) database contains information about the values and stressors (threats) associated with selected waterways and was used to support the regional prioritisation process. The information within AVIRA has been obtained from the community, as well as specialist knowledge, strategic plans and other scientific sources.

Priority waterways are considered a priority for action in the eight-year period of this Strategy. They are considered more important for management activities due to their high environmental, social, cultural and economic value and risks to those values.

The first step for determining Priority Waterways is to identify high value waterways using criteria outlined in the Victorian Waterway Management Strategy. Every waterway in the in the North East region was categorised as high value. To view a list of high value waterways and their associated values , refer to Appendix 2.

To refine the number of waterways for management attention over the next eight years, a subset of these waterways were selected by identifying those with values that aligned to the regional goals (see Appendix 3). Further assessment of these waterways was then undertaken to determine:

> the stressors (threats) to the values of these waterways

> the level of risk to these values

> the technical feasibility of addressing these risks.

From this process, the Priority Waterways for management activities in the North East region were determined. Due to the limited number (and associated data) of wetlands in the AVIRA database, any priority wetlands identified in the North East Regional Wetland Strategy 2009 that were not in AVIRA, were included as priority waterways for this Strategy.

A summary of the regional priority setting process is shown in Figure 8. For a full list and maps of Priority Waterways refer to Part C.

Identifying Management Activities

The Strategies goals and the risk assessment process were used to identify the link between values that are associated with the designation of Priority Waterways and activities to maintain or improve those values. Management outcomes and Resource Condition Targets for Priority Waterways have also been developed and are provided in Part C. Whilst this approach is robust and identifies priorities for management and investment, it cannot predict changes in investment preferences, changes in stressors, or climate changes which may trigger a need to alter priorities.

Therefore, the Strategy provides for adaptive management to accommodate and guide managers in recalibrating management activities throughout the life of the Strategy (see Section 6).

The process for identifying Priority Waterways, management activities and targets is summarised in Figure 8.

Gather Data and Information
> Community input
> Waterway manager and user knowledge

Identify Vision, Regional Goals and Principles
> Local knowledge, AVIRA, RCS, NERRHS and VWMS

Identify High Value Waterways
> Criteria and Guiding Principles from the VWMS
> AVIRA
> North East Regional Wetland Strategy

Identify Waterway Systems
> Description, values and high value waterways, stressors and strategic issues
> Local knowledge and AVIRA
> Define link between goals, values and threats to waterways

Identify Strategic and Lead Actions and Priority Waterways
> Identify waterways with values related to regional goals
> Identify stressors (threats) to the values of these waterways
> Risk assessment of stressors on these waterways
> Integrating other considerations - association and feasibility assessment of potential actions, looking at the system context, local knowledge and other regional strategies and plans with AVIRA
> Determine Priority Waterways

Identify Management Activities and Targets for Priority Waterway
> Use of conceptual models to select appropriate management activities
> Management activities and a work program for Priority Waterways (long term Resource Condition Targets, Management Outcomes and Management activities) to reduce threats to Priority Waterways

Identify Investment Priorities
> Prioritisation of maintenance and improvement (critical/feasible) activities based on feasibility, risk and potential level of investment

Figure 8 Process for Identifying Priority Waterways , management activities and targets

Information and Data

The regional priority-setting process relies on information about values, threats and risks. It is vital that this information is collected and described in a consistent way and, where possible, that the information is based on real data (ie data collected from onground monitoring activities). For example, DEPI's Water Measurement Information System stores data for flow and water quality. This type of information is stored in the AVIRA database developed by DEPI. The database contains information about the values and threats associated with selected river, estuary and wetland assets throughout Victoria. It also includes a standardised risk assessment procedure that provides an automated assessment of the level of risk to all values present in a waterway.

AVIRA has been used in a number of ways to inform the development of this Strategy, including to determine the Priority Waterways in the region and to build a picture of the overall environmental, social cultural and economic values and threats of the waterways in the region. The Strategy development process assumes that information collected within the AVIRA database is correct. In addition, it assumes that the AVIRA risk assessment process will adequately identify the important risks to waterways in the region.

The Priority Waterways were developed by considering the results of the risk analysis and the 'other considerations' such as association and feasibility assessment of potential actions, looking at the system context, local knowledge and other regional strategies and plans. Broad categories of management activities were then determined for the Priority Waterways, using the criteria described in the VWMS (reproduced in Table 9) and an understanding of the link between activities and outcomes (ie conceptual models). Targets were developed for the Priority Waterways, using the goals, guiding principles, the risk analysis and the 'other considerations'.

Table 9 Summary of the Priority Waterway setting process (adopted from VWMS 2013)

System	Low risk to values	High risk to values
Priority Waterways	Management activities to maintain waterway condition	Management activities to reduce threats to waterway condition
Other Waterways	Not a priority within the eight-year planning period	Management activities only if they: > reduce threat to high value waterways > provide connectivity > protect public infrastructure or reduce risks from extreme events > maintain or strengthen community commitment to improving the condition of local waterways > are required to meet statutory or regulatory obligations

5. Waterway Systems

The system-based approach used to develop this Strategy will guide the management of waterways in the region to achieve the regional goals and principles. Nine waterway systems have been identified in the region – one Whole of Region System and eight sub-catchment systems - Upper Murray System, Upper Mitta Mitta System, Lower Mitta Mitta System, Kiewa System, Upper Ovens System, King System, Lower Ovens System and Murray Plains System (Figure 9). The Strategy describes each of these systems and the Values, Priority Waterways, Strategic Issues, System Stressors and proactive and targeted Strategic and Lead Actions.

The Strategic and Lead Actions set out in this Strategy primarily focus on maintenance and improvements in environmental condition that provide public benefits, including addressing environmental, cultural, social, and economic values where they are of regional importance (for example, water sources for domestic use or production). Private individual benefits (for example, profits from grazing livestock in riparian areas) will be supported where they do not compromise the public benefits.

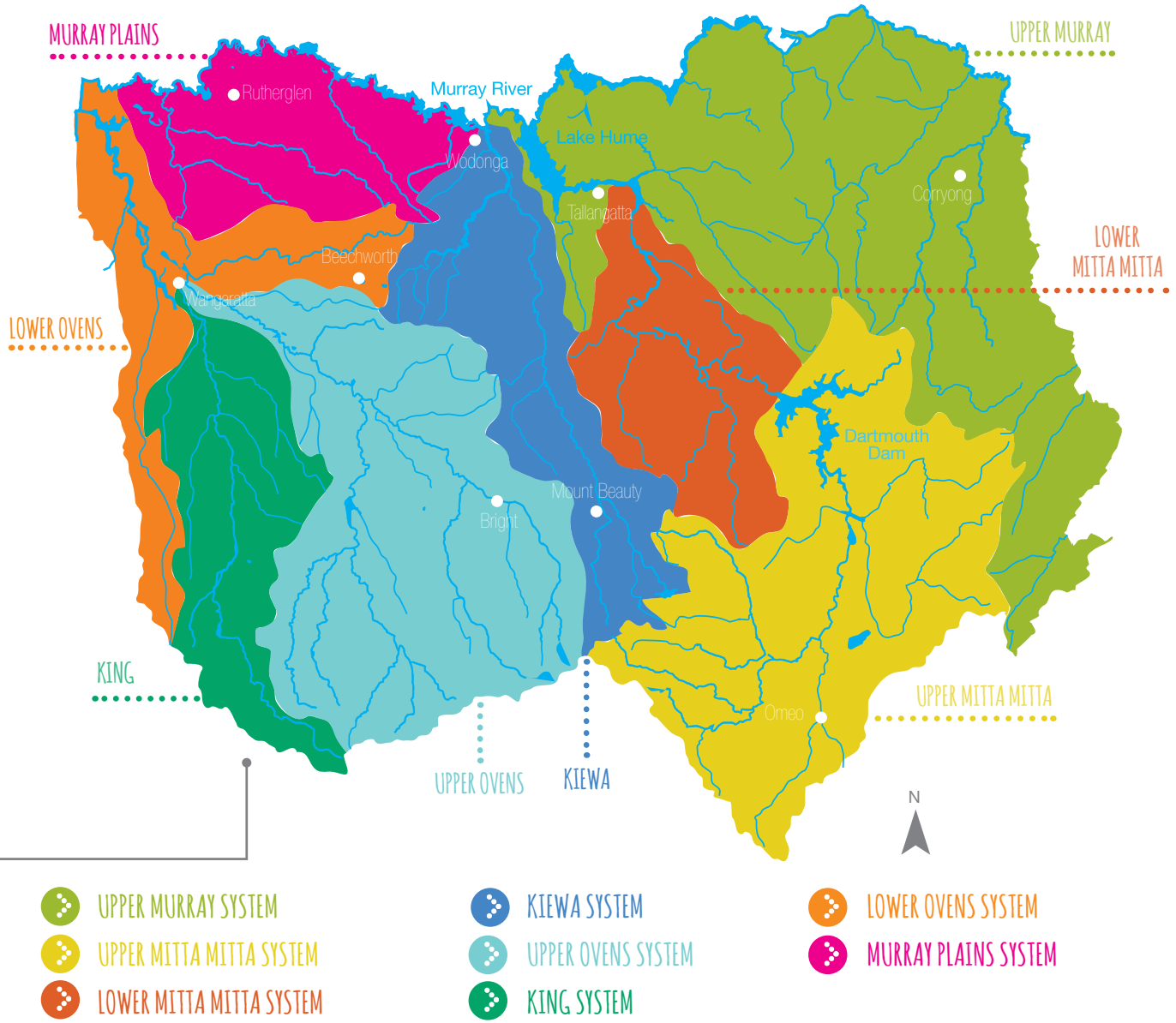


Figure 9 Eight Sub Regional Waterway Systems in North East Victoria

The eight individual waterway systems incorporated in the Whole of Region system are predominantly based on biophysical boundaries (ie they follow catchment boundaries and major hydrological processes). This system-based approach:

- Helps make sense of the interconnection between people and the waterways
- Provides context for the community's capacity for management and how this can be harnessed, built on and released depending on the Landscape they identify with
- Helps create a narrative, or story, of the waterways and
- Helps to link this narrative to the key priorities for proactive and targeted management at the waterway system level.

The Whole of Region Strategic Actions also apply to each of the individual systems.

Each of the following waterway system sections in Part C of the Strategy contain:

- **A general description** - of the system
- **The condition** - of the system
- **The values** – environmental, social, cultural and economic – of the system
- **The Priority Waterways** - in the system
- **The strategic issues** - for the system
- **The system stressors** – identified with regard to the Priority Waterways and the characteristics of the system – that affect the system's values
- **The Strategic and Lead Actions** –are informed by the stressors to the system's values. These are higher level actions that regional stakeholders may work towards if regional investment was significantly reduced.
- **Work Program (activities)** - for waterways in that system.

6. Monitoring, Evaluation and Reporting and Adaptive Management

Monitoring, Evaluation And Reporting (MER)

Ongoing monitoring and evaluation allow us to learn from our previous experience and to change our approaches to reflect the knowledge gained during their implementation. This is central to the management of our waterways using an adaptive management framework. The eight-year adaptive management cycle of the Victorian Waterway Management Program shown in Figure 10 relates to all aspects of the Strategy, from planning through to implementation of onground works. Embedding this cyclical and interactive approach allows us to better understand the efficiency and effectiveness of management interventions and helps build our knowledge base to improve target-setting, ultimately supporting the continual improvement of waterway management.

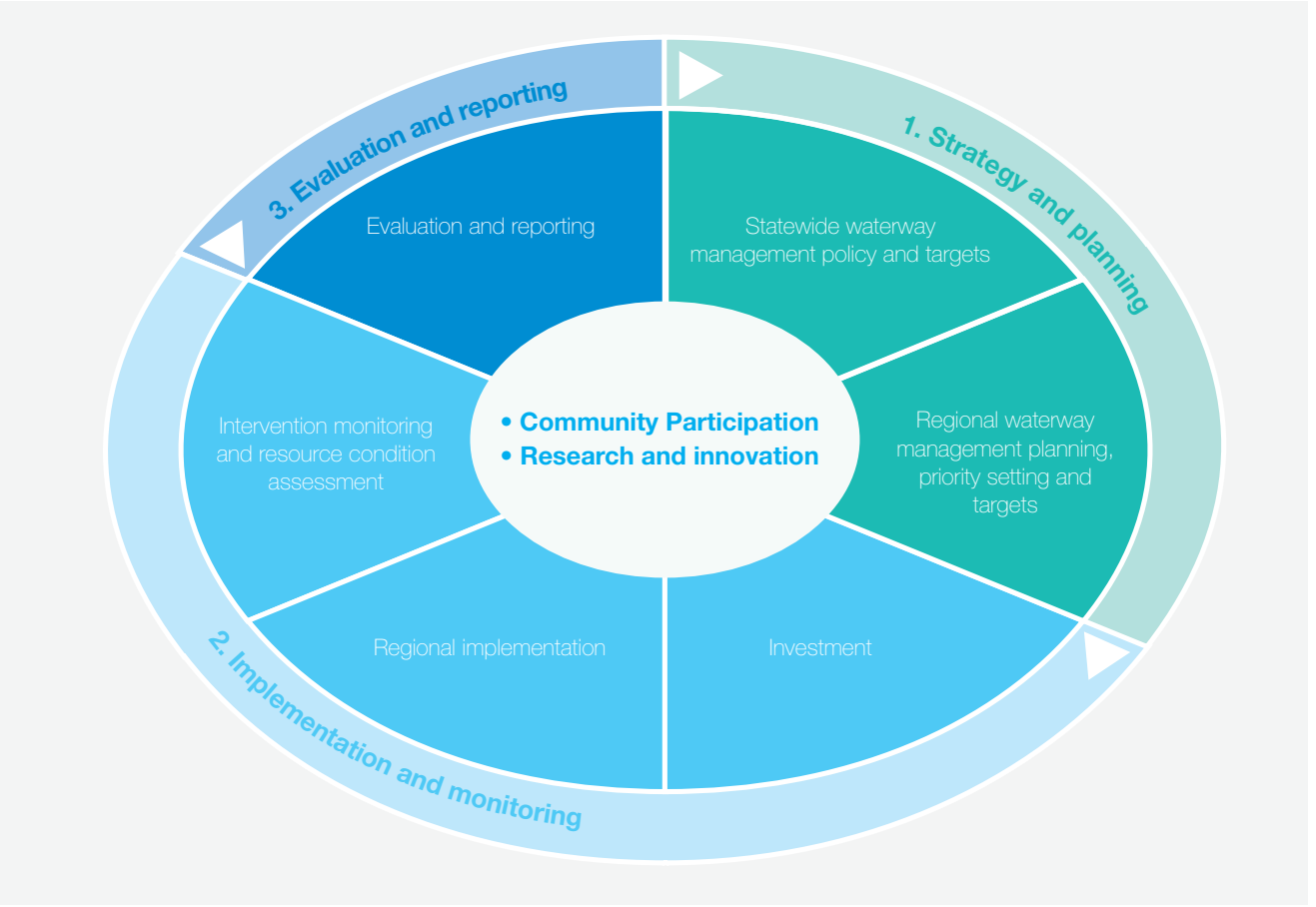


Figure 10 Eight-year adaptive management cycle of the Victorian Waterway Management Program (DEPI 2013)

The relationship between the adaptive management cycle and the management of waterways in the North East region is outlined below.

Strategy and Planning

This Strategy provides direction for regional waterway management activities for an eight-year period and sets regional targets. The program logic, and conceptual models, used for the development of the Strategy identifies the relationship between the activities - management outcomes - long term resource condition outcomes and goals that underpin Strategic Actions (Section 4 - Approach).

Additional conceptual models to define the relationships between outputs, management outcomes and long-term resource condition change may be developed to support evaluation and adaptive management. In partnership with research institutions, the community and policy makers knowledge gaps will be identified and reduced.

Monitoring

Monitoring the resource condition of waterways in the North East is vital in understanding the broader patterns and changes in the condition of waterways. This information assists the assessment of the success of implementing previous management activities to identify where management intervention may be required.

Resource condition information will be collected and managed in several ways, including from the Index of Stream Condition and the Index of Wetland Condition assessments, Victorian Water Quality Monitoring Network and Waterwatch. However, as with all activities, it is important to note that monitoring on resource condition is subject to available resources.

Evaluation

The North East CMA continuously evaluates the effectiveness of management activities as part of its adaptive management and ongoing improvement approach. A set of evaluation questions will be developed for the Strategy to address the following five categories (DSE 2012):

- **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
- **Legacy** - after the activity/program ends

The process of developing conceptual models and evaluation questions will demonstrate areas where critical knowledge gaps exist. Research will be directed to investigating those relationships where there is little scientific evidence, or the confidence in the evidence is low.

A formal evaluation of the Strategy will be undertaken mid-way through the implementation of this Strategy. At the time of preparation of the next Regional Waterway Strategy an independent review will be undertaken.

Reporting

Reporting is an important tool to ensure accountability for the investment into waterway management activities and provide information for stakeholders and the community. 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. Reporting will also occur through various mechanisms, including the North East CMA Annual Report and reports to funding bodies (e.g. report cards) and will support reporting of management outcome targets for the VWMS in 2016 and 2020.

A list of the Strategic and Lead Actions needed to maintain and improve the condition of the system to achieve the Strategies goals and principles associated with MER are contained in Part C.

Adaptive Management

This Strategy provides a regional work program to guide investment over an eight-year period, aimed at progression towards achieving the high level 20-year goals. The program consists of a suite of activities which have been identified according to best available knowledge of the physical, social and economic environments and the relationship between outputs, management outcomes and long-term resource condition outcomes (e.g. based on conceptual models). It is essential that we adapt and respond as our understanding improves.

Monitoring, reporting and evaluation are important parts of the adaptive management cycle that allows us to monitor changes in the landscape system (physical, social, economic), improving our knowledge and confidence about the effectiveness of management activities. As part of an adaptive management approach the North East CMA will review the interim progress of the implementation of the Strategy to ensure we are on the right track.

Of equal importance, extreme events, such as major floods and bushfires, can have significant impacts on the landscape and may not necessarily align with the MER framework and timing. Should it become apparent, with defensible scientific evidence, that environmental objectives can no longer be met (as a result of irreversible change in climate, water availability, land use or population) amendment of the objectives will be considered as part of the renewal and redevelopment of this Strategy in consultation with the community (DEPI 2013). The North East CMA is committed to responding to the context and adapting its waterway management approach, works program and priorities as deemed appropriate.

The cost effectiveness of interventions and level of investment also affects the management activities that can be implemented.

The longer term approach taken to adapt regional waterway management objectives according to context and level of available investment is outlined in Figure 11.

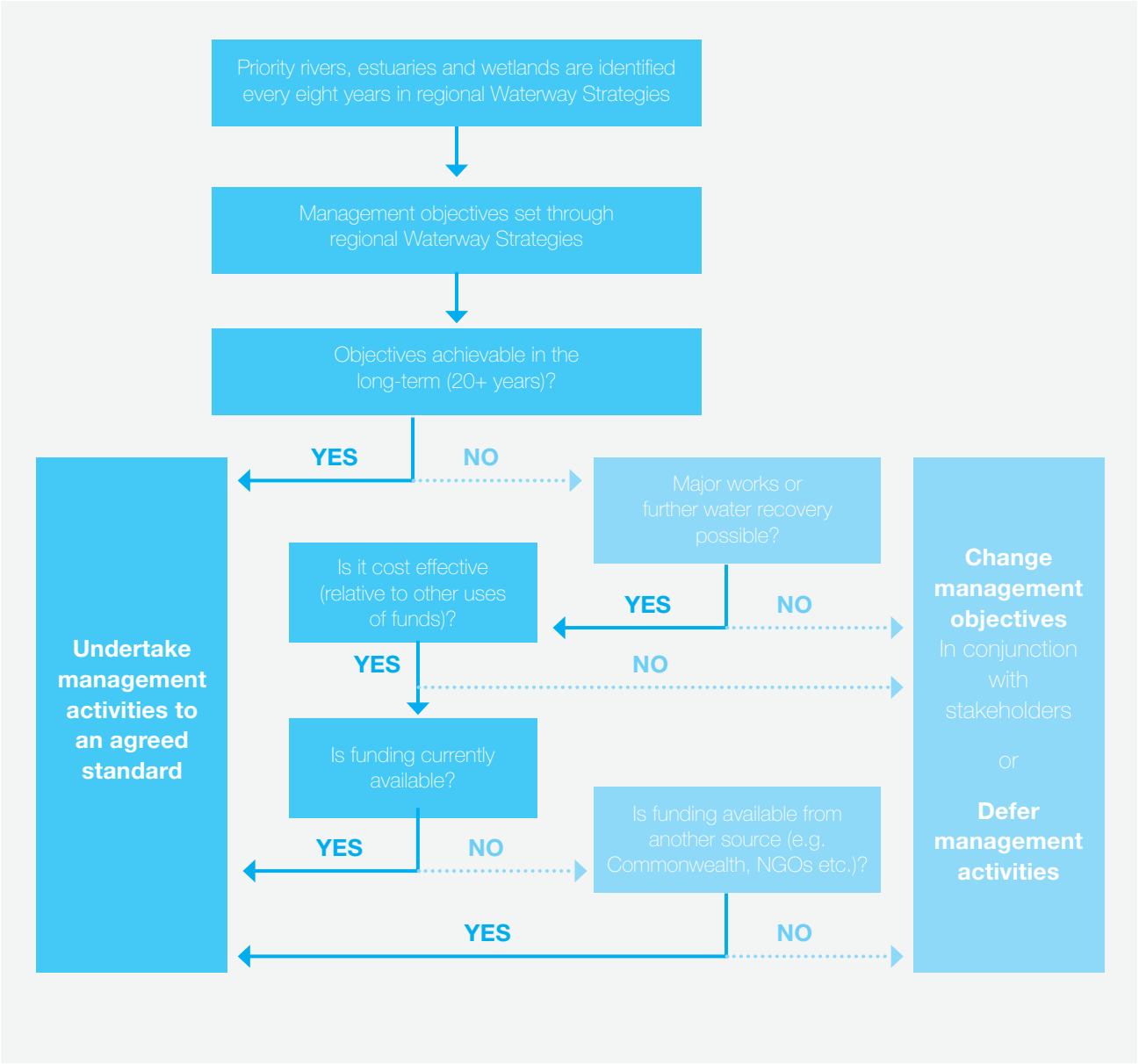


Figure 11 The VWMS approach taken to adapt regional waterway management objectives (DEPI 2013)

Further guidance on the management activities for Priority Waterways is outlined in Part C.

Knowledge Gaps and Research

To align with the Victorian Waterway Management Program the Strategy will support research that:

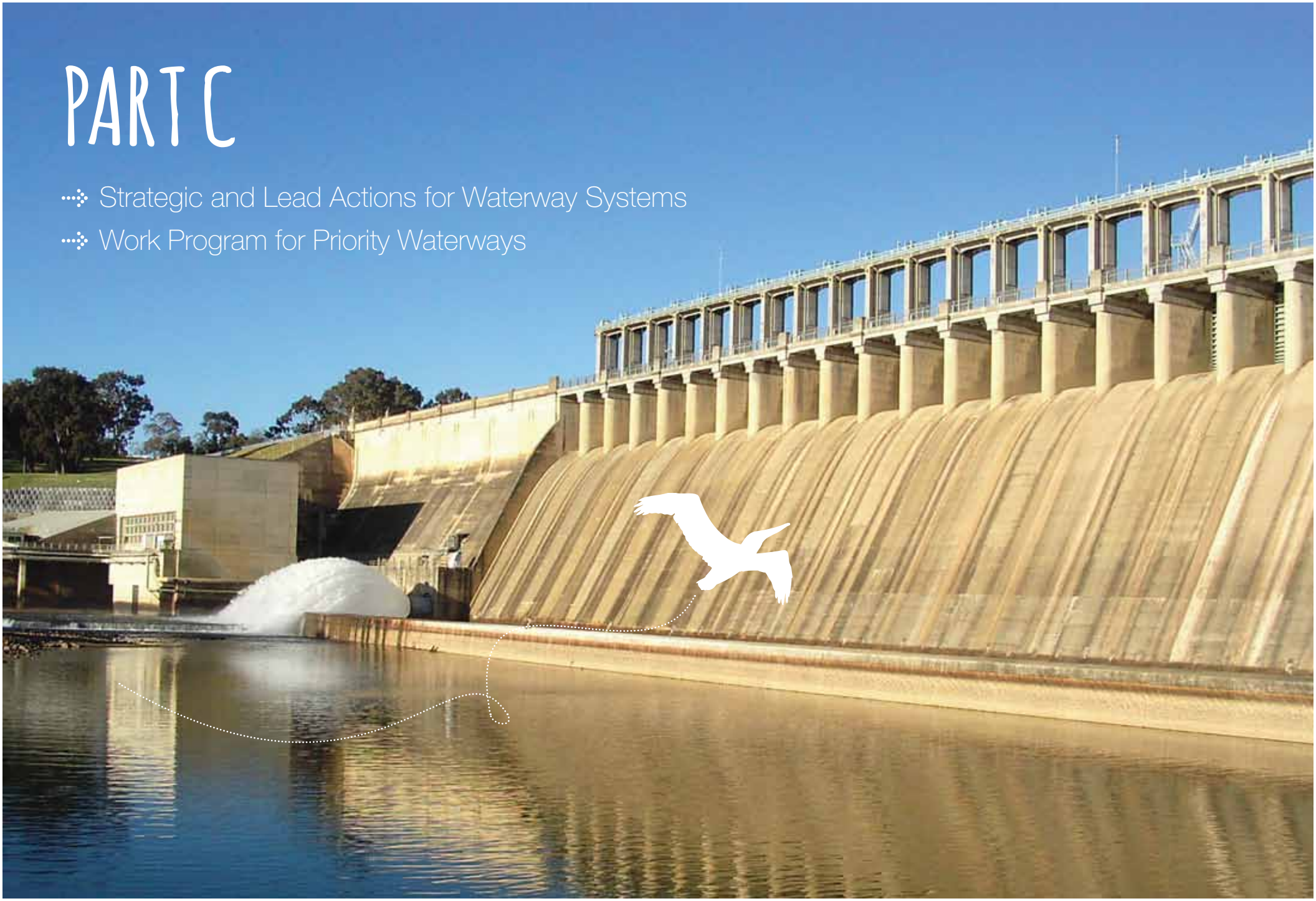
- provides essential knowledge to address critical short-term and/or strategic long-term knowledge gaps. The resulting research findings will be incorporated into policy and management
- targets knowledge gaps or low confidence in the relationships between outputs, management outcomes and long-term resource 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 in which there is significant Victorian Government investment (for example, riparian revegetation).

A list of Strategic and Lead Actions and specific management activities relating to knowledge gaps and research are contained in Part C.

PART C

- Strategic and Lead Actions for Waterway Systems
- Work Program for Priority Waterways

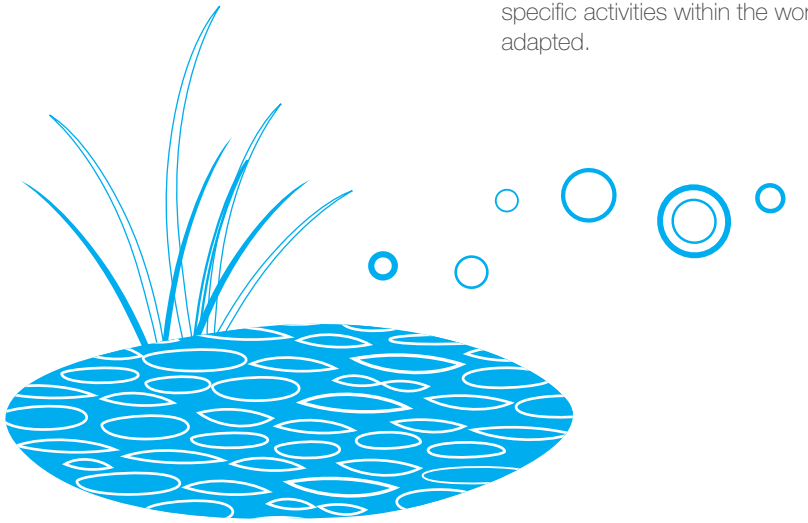


7. Strategic and Lead Actions for Waterway Systems and Work Program for Priority Waterways

This section of the Strategy contains the Strategic and Lead Actions and the regional work program for Priority Waterways. The tables presented for each of the systems set the targets and estimate of the type and scale of management activities required to achieve management outcomes for key stressors to the values. The management outcomes and associated activities identified are consistent with the regional principles and Strategy goals. As the targets are based on a conceptual and logical framework, outcomes will not need to be measured for every asset.

The regional work program has been developed based on a 'typical year'. The work program identifies specific activities for investment on Priority Waterways. Strategic Actions have been set at a high level to enable adaptation without significantly altering the intent of the Strategy.

Importantly, the management activities listed need to be considered as part of an integrated program. The management activities identified for each system have considered the full range of tools and approaches available for waterway management, including market-based instruments, government investment in onground works or environmental water management, research, community awareness-raising and information provision, and regulation.



Integrated Management and Adaptive Approach

When utilising the work program it is important to integrate the sub regional system Strategic and Lead Actions with the Whole of Region Strategic and Lead Actions.

The scale and type of management activities will need to be adapted to the level of investment available, community interest, condition of waterway and past investments. The completion of activities is subject to available resources.

Factors such as the cost-effectiveness, risk, feasibility and condition of the waterway have been considered with the context of the systems to identify Priority Waterways and associated management activities (see Section 4 Approach). The quantity allocated to each of the management activities, has been provided to guide both multi-year projects and the annual investment process. Detailed activity planning, budgets and onground works programs will be undertaken though the annual planning processes. When considering the implementation of the identified activities the Strategic and Lead Actions should be used to help make sense of the system involved.

As the Strategy has adopted an adaptive management approach to waterway management in the region, should events such as extreme flood, drought or bushfire occur during the life of the delivery of these activities, delivery of specific activities within the works program may need to be adapted.

Scale and Location of activities

Rivers and wetlands are prioritised at different scales, based on how information on values and risks was collected. Rivers are prioritised at a 'reach' scale, the length of which is based on the natural features of the river or the adjacent land use. Reaches used in the development of this Strategy are those used for Index of Stream Condition monitoring. Wetlands are treated as separate entities or groups/complexes (e.g. spring soak, floodplain wetlands). The priority wetlands within the *North East Regional Wetland Strategy (2009)* have been adopted and identified. The location of priority reaches and wetlands is shown in Figure 12 and Figure 13 respectively.

Estimated costing of activities

The total estimated cost for the eight-year work program in each system has been provided. This is an estimated budget only and it does not include costing for all activities identified within the work program. Assumptions have been made in estimating the budget and these include items such as cost share, project management costs, operational costs, materials and labour. As a number of the management activities are contingent and related to each other or need to scale in response to unscheduled events the estimate is just that, an estimate.

The aggregated costings for activities in each System are indicative only. There is no commitment to funding of activities and funding will be sought through usual investment opportunities. Importantly a large number of activities are only considered feasible with a high level of investment. Under any investment scenario the implementation of the Strategy needs to maximise onground outcomes with a focus on Priority Waterways and integration of whole of region actions.

The work programs provided for each of the wetland complexes are examples only and do not cover every wetland within the wetland complex. Significant additional activities may be required to manage wetlands within the complexes. As information about other wetlands within the complexes is gathered and opportunities arise to manage the priority wetlands, detailed work programs for other wetlands may be developed and funding sought for these.

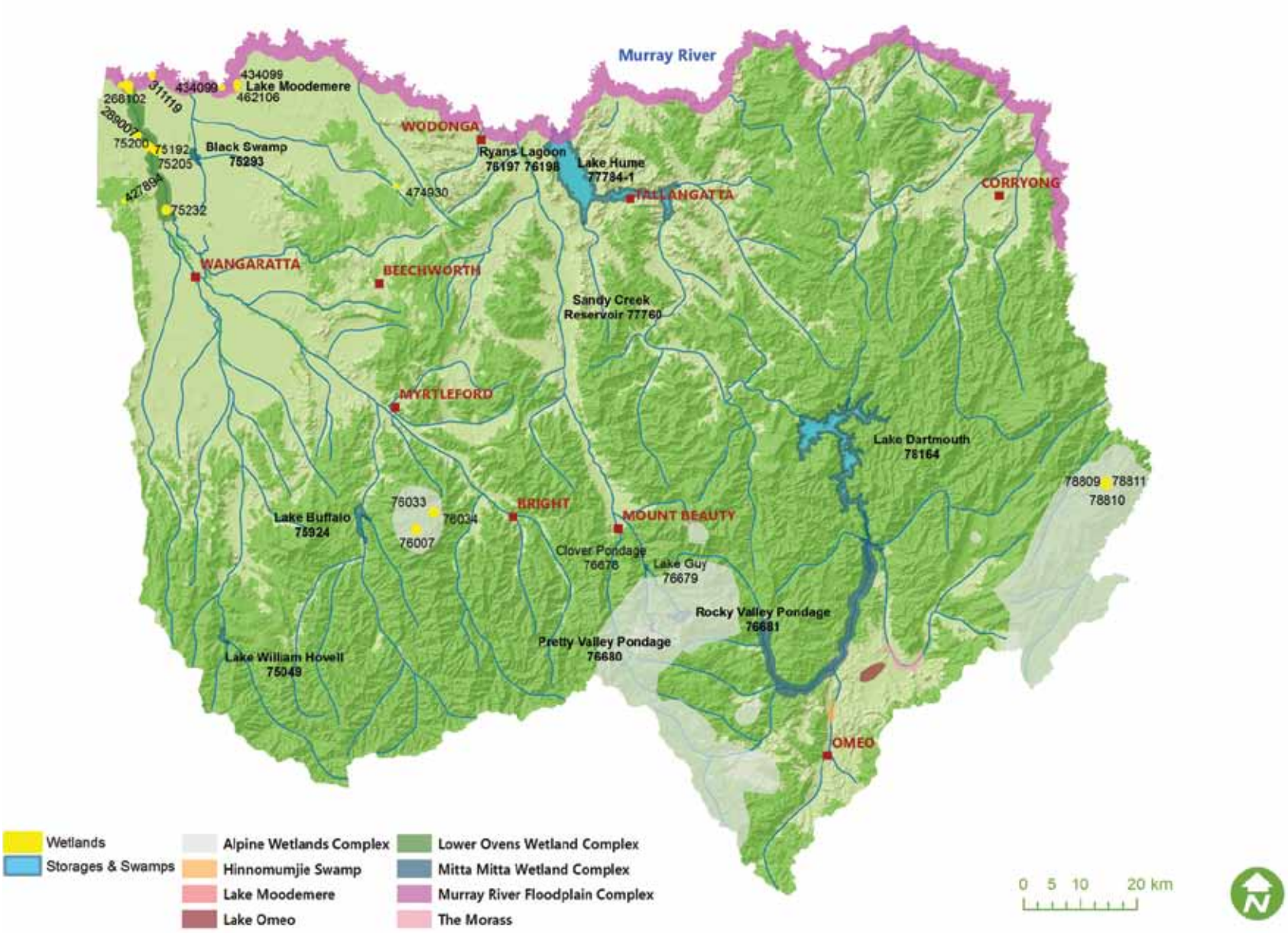


Figure 12 Map of Priority Waterways – Wetlands

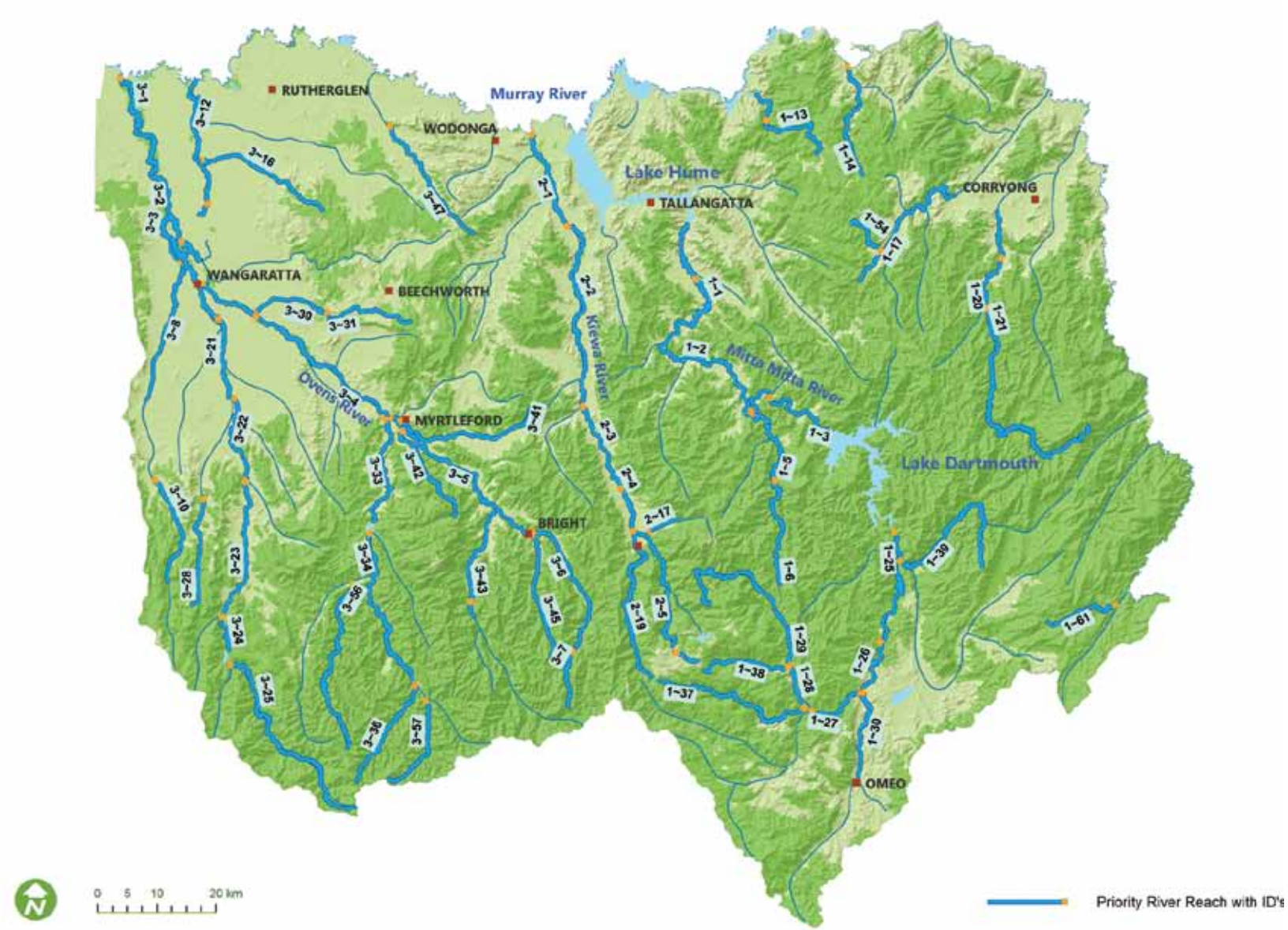


Figure 13 Map of Priority Waterways – Reaches

WHOLE OF REGION SYSTEM

System Description

The North East Region (Figure 14) as a whole can be defined as a system within the Murray-Darling Basin. It provides social, cultural, environmental and economic benefits to the Basin and, therefore, should be assessed and managed to maintain and improve those values. Some of the issues that impact on these values cannot be managed by taking a sub-catchment approach. Therefore, the Strategic Actions required at the regional scale addressed under the Whole of Region System will need to be integrated with the Strategic Actions identified for each of the eight other waterway systems.

Condition

For information on condition of waterways in the region, refer to the sub-region systems.

Values

Waterways are important natural assets that support diverse populations of animals and plants as well as providing significant social, economic and cultural benefits to communities. The following section describes the values of waterways in the Whole of Region System.

KEY FEATURES:

- Total Area **1,957,000 ha** with a population of ~ **100,000**
- **10,602 km** of waterways
- **55%** Public Land
- Contributes **38%** of the Water Resources for the **Murray–Darling Basin**
- **80%** of the region classified as **Special Water Supply Catchments.**

Figure 14 Whole of Region System

Environmental

A number of waterways in the North East have been recognised as being of national or State significance due to their specific characteristics, including their environmental value (refer Section 2).

The region contains a variety of wetland types including freshwater meadows, shallow freshwater marshes, alpine wetlands and riverine billabongs. These represent significant areas of the State's most depleted wetland habitats and some are among the least represented in Victoria's protected area network. Significant areas of permanent artificial water storages, including Lake Hume and Lake Dartmouth, also occur within the region. These wetlands and storages are critical for the conservation of biodiversity and for ecological productivity and are important sites for migratory water birds and for providing refuges for animals in time of drought.

The region also contains important flora and fauna species that are waterway dependent such as the threatened Alpine Tree Frog, Murray Cod and Golden Perch, waterway birds such as egrets, bitterns, herons and cormorants, endangered species such as the Trout Cod and Macquarie Perch, and rare species of Alpine flora. These values are described in more detail in each of the other eight System sections.

Social

Recreational activities, including boating, fishing, swimming, camping and walking are popular pursuits in and along many of the waterways in the North East. Recreational fishing is an important secondary use for many water storage dams including Lake Hume and Lake Dartmouth.

Cultural

The waterways of the North East are highly significant to Aboriginal people. Most waterways in this Strategy have been listed as an Area of Cultural Sensitivity with some containing scar trees, artefact scatters, quarry sites, grinding grooves and fish traps.

Economic

Irrigation water is used for agricultural production, and is sourced mainly from the Mitta Mitta (including Dartmouth Dam), Kiewa, King, Ovens and Murray Rivers (including Lake Hume) to irrigate pasture mostly for dairy production and horticulture crops including viticulture. With an estimated gross value of agricultural production in the Murray-Darling Basin (MDB) of $15 billion per annum (MDBC 2014), the water supplied to the MDB from within the North East, has a major economic value. In Victoria direct expenditure related to recreational fishing was valued at $2.3 billion in 2008-09 (Ernst & Young 2009). Given the North East region is considered a premier location for fishing in Victoria, the economic value of waterways is significant.

Priority Waterways

For information on Priority Waterways in the region, refer to the sub-region systems.

Strategic Issues

- Community capacity to manage waterways for environmental, social, cultural and economic values
- Protection of cultural heritage values
- Impact of recreational use on waterways
- Capacity to respond to major flooding
- Capacity to respond to community expectations and historical context
- Use of regulation, legislation and statutory processes to achieve waterway outcomes and
- Maintenance of previous investment in waterway management.

Stressors

Details of stressors on individual waterways within the region are included in each of the sub-region systems. Stressors to the whole region include:

- Climate variability and the potential impacts of climate change
- Inappropriate development
- Potential for conflict between managing for social and economic benefits of recreational activities and managing for environmental values and
- Impacts of flooding on social, cultural and economic values

The above stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided below.

Whole of Region Strategic Actions

Whole of Region Strategic and Lead Actions (REG) fall into the following eight broad categories. The summary of the Whole of Region Strategic Actions for waterway management are set out in Table 10. Whilst all of these are important, a subset of Lead Actions have been identified as essential activities that will be pursued as a priority for implementation subject to resourcing constraints. These Lead Actions are identified by 💧

Table 10 Consolidation of Whole of Region Strategic and Lead Actions

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Community participation - North East Victoria faces a number of catchment-wide challenges that cannot be met by any one organisation or person. Community involvement in natural resource management is key to building awareness of and connection to waterways and empowering people to take a more active and shared role in maintaining the environment.					
REG – SA1 Facilitate and coordinate community involvement in the management, use and protection of waterways.	REG - LA1.1	Undertake social research into waterway management to: > Improve understanding of community uses, expectations, attitudes and behaviours towards waterways > Inform regional planning of waterway work programs > Help guide and assess community engagement and education activities.	Waterways that maintain or strengthen community commitment to improving the condition of local waterways		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA1.2	Build capacity within communities to participate in the care of their waterways and catchment.	Waterways that maintain or strengthen community commitment to improving the condition of local waterways	💧	CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA1.3	Build capacity within communities to work in a voluntary and co-operative approach with land managers to manage weeds (e.g. willow and blackberry) to improve the condition of the region's waterways.	Waterways that maintain or strengthen community commitment to improving the condition of local waterways		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA1.4	Build capacity within communities to work with water service providers and landholders in a voluntary but targeted approach to reduce stock access to waterways upstream of drinking water offtakes.	Build capacity within communities to work with water service providers and landholders in a voluntary but targeted approach to reduce stock access to waterways upstream of drinking water offtakes.		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA1.5	Build awareness of waterway values and uses to encourage experiences, appreciation, advocacy and ultimately conservation (e.g. adopt a waterway, photo point, oral history, demonstration areas)	Waterways that maintain or strengthen community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA1.6	Target capacity building waterway management programs in remote communities that recognises their values, uses and associated connection to waterways and their associated management contributions.	Waterways in remote communities		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management action.*

Continued *Table 10 Consolidation of Whole of Region Strategic and Lead Actions*

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Cultural heritage - A large proportion of the Aboriginal cultural values of the North East Region's waterways are yet to be officially recorded. Hence, Aboriginal cultural heritage, cultural resources and values, and the ability to allow cultural practice to be maintained and integrated with the future management of this system are an ongoing challenge. The systematic removal of Aboriginal people from this area in the mid to late 1900s severely impacted on the local traditional knowledge of this region, resulting in knowledge gaps within the local Aboriginal community in reference to caring for waterways. The Strategic and Lead Actions below will seek to build capacity incrementally within the local Aboriginal community that will assist their participation in the future management of waterways. It will also assist Aboriginal people to reconnect and strengthen their cultural connection, continue cultural practice through access to traditional resources, and encourage inclusive cultural heritage management.					
REG – SA2 Continue the involvement of the Traditional Owner groups and community members in planning and management activities for waterways.	REG - LA2.1	Develop and implement networking and demonstration programs to connect the Indigenous, Landcare and agricultural community to the waterways, each other and landscapes of the region by integrating traditional ecological knowledge into natural resource management.	Where there is community commitment to improving the condition of local waterways.	💧	CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA2.2	Increase the identification of significant Cultural heritage sites through specialist surveys and encouragement of community notification of potential sites.	Where there is community commitment to improving the condition of local waterways and as required to meet statutory or regulatory obligations		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA2.3	Build the capacity of the Traditional Owners and NRM facilitators to participate in waterway management.	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA2.4	Identify and encourage the recording of traditional ecological knowledge associated with waterways to strengthen local knowledge.	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
Recreational use of waterways - It is important that the environmental condition of North East Victoria's waterways is maintained and improved to ensure that valuable recreational opportunities exist into the future. In some cases, managing for social and economic benefits of recreational activities can conflict with managing for environmental values. Recreational users and groups are important stakeholders in waterway management.					
REG – SA3 Support appropriate recreational use of the waterways in the region whilst maintaining their environmental condition.	REG - LA3.1	Work closely with the recreational fishing sector to improve the recreational fishing experience.	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
	REG - LA3.2	Build on existing community and Government partnerships to maintain a balance between conservation, recreation and tourism to achieve mutual benefits.	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA3.3	Encourage and support community involvement in planning for, and management of, the recreational use of waterways.	Where there is community commitment to improving the condition of local waterways.	💧	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations

Continued *Table 10 Consolidation of Whole of Region Strategic and Lead Actions*

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Continued **REG – SA3** Support appropriate recreational use of the waterways in the region whilst maintaining their environmental condition.	REG - LA 3.4	Support habitat management works in popular recreational fishing river reaches or to meet critical habitat needs for threatened species.	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA 3.5	Encourage and support efforts for improve control of invasive plant and animal species (e.g. Carp musters).	Where there is community commitment to improving the condition of local waterways.		CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
Flooding – Integrated Approach - Waterway processes that can pose risks to public infrastructure include erosion, sedimentation, floods and avulsion. The North East region is highly susceptible to flooding, with localised flooding occurring most years. Major catchment flooding events, that reset the 1:100 ARI, have occurred in the region at least six times in the last 25 years, the most recent event being in 2010. In response to this, there is a need to better integrate floodplain management with waterway management to: > Consider waterway processes and their implications for broad-scale risk to public infrastructure > Protect public infrastructure or reduce risks from extreme events > Coordinate the collection of new, and manage historical, flood information to improve the management of waterways and > To encompass the environmental considerations including lateral connectivity and ecosystem function and their impact on floodplain replenishment in times of climate change.					
REG - SA4 Consider waterway processes and their implications for broad-scale risk to public infrastructure in the region in the development of integrated regional waterway and floodplain management programs.	REG - LA4.1	Develop a regional floodplain strategy in accordance with the Victorian Floodplain Management Strategy (in development).	Region Wide	💧	CMA, DEPI, Emergency Response Agencies, Government, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, Water Corporations
Regulation, legislation and statutory processes - Taking a regulatory approach to waterway management is an essential part of an integrated management program, implemented through provisions in legislation, statutory processes or through the land use and development planning system.					
REG – SA5 Implement water resource regulation, legislation and statutory processes to improve waterway values.	REG - LA5.1	Manage environmental water for the region through development and implementation of EWMPs.	Where required. e.g. Commonwealth environmental water entitlement in Ovens System		CMA, Community, Community Groups, DEPI, Government, Land Managers, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA5.2	Develop or review water resource sharing arrangements to integrate Environmental Water Resource (EWR) objectives.	Where required e.g. implementation of Upper Ovens WMP, Bulk Entitlement and licensing arrangements, local management plans, groundwater management plans, licence transfers and renewals.	💧	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA5.3	Manage works licensing for waterways.	Where required to meet statutory or regulatory obligations.	💧	CMA, DEPI, Land Managers, Local Councils, Water Corporations

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management action.*

Continued *Table 10 Consolidation of Whole of Region Strategic and Lead Actions*

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Continued **REG – SA5** Implement water resource regulation, legislation and statutory processes to improve waterway values.	REG - LA5.4	Manage rural drainage in line with the proposed Victorian Rural Drainage Strategy.	Where required to meet statutory or regulatory obligations.	💧	CMA, DEPI, Land Managers, Local Councils, Water Corporations
	REG - LA5.5	Provide advice to Councils on individual planning applications associated with waterways.	Where required to meet statutory or regulatory obligations.		CMA, DEPI, Land Managers, Local Councils, Water Corporations
	REG - LA5.6	Encourage a voluntary and co-operative approach to change Crown licence agreements with land managers who undertake activities to maintain or improve the region's waterways values.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA5.7	Provide protection for key waterways through Land Use Planning.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA 5.8	Maintain cross-border and inter regional cooperation on waterway management.	Murray River and associated floodplain		CMA, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, VEWH, Water Corporations
Maintenance of previous investment in waterway management - The function of physical works can be impaired over time if they are not regularly maintained. If this occurs, past management effort could be undone with possible negative effects on the high values and the overall health of waterway systems. Therefore, surveillance and maintenance of existing investments and efforts of waterway works are critical to ensure that investment in past onground works is secured.					
REG – SA6 Maintain the outcomes from past investment through effective surveillance and maintenance of existing onground works.	REG - LA6.1	Develop and maintain a register of works on waterways.	Region-wide		CMA, Community, Community Groups, DEPI, Emergency Response Agencies, Government, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, VEWH, Water Corporations
	REG - LA6.2	Develop protocols for surveillance and maintenance of previous onground works.	Region-wide	💧	CMA, DEPI, Land Managers, Local Councils, PV, Water Corporations
	REG - LA6.3	Implement protocols for surveillance, focused on Priority Waterways, and maintenance of previous onground works.	Where required		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
Monitoring, Evaluation and Reporting and Adaptive Management - See Section 6 - Monitoring, Evaluation and Reporting and Adaptive Management					
REG – SA7 Monitor and evaluate resource condition and the effectiveness of management activities to improve natural resource management.	REG - LA7.1	Determine evaluation questions to support the monitoring and evaluation of outputs, management outcomes and long-term resource condition change, and to feedback into future prioritisation as a part of the adaptive management cycle.	Where required		CMA, DEPI, EPA, Research Organisations

Continued *Table 10 Consolidation of Whole of Region Strategic and Lead Actions*

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Continued **REG – SA7** Monitor and evaluate resource condition and the effectiveness of management activities to improve natural resource management.	REG - LA7.2	Undertake targeted monitoring and evaluation of resource condition before, during and after onground waterway management activities.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA7.3	Facilitate a community and government approach to coordinating and monitoring the implementation of this Strategy and effectiveness of management activities to promote cooperation amongst all stakeholders in the management of waterways and resources in the region.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA7.4	Monitor the condition of waterways with a focus on Priority Waterways (e.g. Index of Stream Condition and Index of Wetland Condition).	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Local Councils, PV, Research Organisations, VEWH, Water Corporations
	REG - LA7.5	Maintain and support the Northern Regional Water Monitoring Partnership.	Region-wide		CMA, DEPI, EPA, Emergency Response Agencies, Government, Local Councils, Water Corporations
	REG - LA7.6	NRM partners and the tertiary education sector identify knowledge gaps and report on areas for further waterway research.	Region-wide		Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA7.7	Identify waterway process risks to public infrastructure (e.g. avulsion of rivers and sediment transport) including: > identifying knowledge gaps > providing information to asset owners.	When they are known and where appropriate.		CMA, DEPI, Emergency Response Agencies, Government, Land Managers, Local Councils, PV, Research Organisations, Water Corporations
	REG - LA7.8	Report on monitoring undertaken to support Strategy implementation.	Region-wide		CMA, DEPI
	REG - LA7.9	Consider the findings from social research (e.g. 'My Victorian Waterway' survey results) to help inform the development and implementation of regional waterway management programs.	Region-wide		CMA, Community, Community Groups, DEPI, Peak Body Groups, Research Organisations
	REG - LA 7.10	Review the progress of the implementation of management activities mid-way through the implementation of this Strategy.	Region-wide		CMA, DEPI, Government, Research Organisations, Water Corporations
	REG – LA 7.11	Identify and prioritise types of high value groundwater-dependent ecosystems to inform regional waterway planning processes and water allocation decisions in line with Policy 8.16 of the WWMS 2013.	In systems with high value groundwater-dependent ecosystems		CMA, DEPI, Water Corporations
	REG - LA 7.12	Develop a strategy specific MER plan.	Region Wide		CMA, DEPI

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management action.*

Continued *Table 10 Consolidation of Whole of Region Strategic and Lead Actions*

Strategic Action	Ref.	Lead Action	Waterways	Essential Activity	Implementation Partners**
Adaptive management - See Section 6 - Monitoring, Evaluation and Reporting and Adaptive Management					
REG – SA8 Adopt an adaptive management approach to waterway management in the region.	REG - LA8.1	Implement monitoring, evaluation and reporting procedures to inform an adaptive management approach.	Region-wide		CMA, DEPI
	REG - LA8.2	Monitor changes in the physical, social and economic environments at the systems scale, and adapt waterway management approaches accordingly.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA8.3	Further refine states and associated stressors and interventions at landscape, system, reach and asset scales.	Region-wide	💧	CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA8.4	Review and, where appropriate, adapt management interventions under a seasonally adaptive approach following natural disasters and incidents affecting waterways (e.g. bushfires, floods and algal blooms).	Region-wide and where required		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Land Managers, Local Councils, PV, Water Corporations
	REG - LA8.5	Respond to natural disasters and incidents affecting waterways (e.g. bushfires, floods and algal blooms).	Region-wide and where required		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
	REG - LA8.6	Ensure natural disasters and incidents affecting waterways (e.g. bushfires, floods and algal blooms) considerations are incorporated into waterway planning and delivery activities.	Region-wide and where required		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA8.7	Encourage the use of innovation and collaboration to monitor and manage waterways.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG - LA8.8	Encourage the use and collection of knowledge (e.g. classification and condition) of Priority Waterways	Region-wide		CMA, DEPI
	REG - LA8.9	Review interim progress of the implementation of this Strategy against objectives and adapt waterway management approaches if necessary.	Region-wide		CMA, DEPI
	REG - LA8.10	Review knowledge gained during implementation of this Strategy, and an assessment of achievements and progress against the Strategy targets.	Region-wide		CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
	REG – LA 8.11	Undertake an independent review at the completion of the implementation period of this Strategy.	Region-wide		CMA, DEPI
Estimated cost of activities for the Whole of Region System* $10,997,500					

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management action.*

UPPER MURRAY SYSTEM

System Description

The Upper Murray System (Figure 15) includes all rivers that drain into the north arm of Lake Hume and into the Murray River upstream of Lake Hume and the floodplain of the Upper Murray River. The floodplain wetlands along the Murray River and Lake Hume are significant features of this system. The Murray River is regulated by flows out of the Snowy Mountains Hydro-electric Scheme and joins the high water mark of Lake Hume just downstream of Burrowye.

The major Victorian rivers in the system are Tallangatta Creek, Koetong Creek, Burrowye Creek, Walwa Creek, Corryong Creek, Nariel Creek, Thougla Creek, Omeo Creek and Limestone Creek.

The land-form is hilly throughout much of the system, except near the township of Corryong and along the Murray River to the north, where there is a large expanse of valley floor and floodplain. The Alpine area around Davies Plain is relatively flat and has a large number of wetlands.

The hydrology of the system is relatively intact, with persistent base flows from Alpine and Forest Landscapes. The summer base flows in some of the smaller tributaries are reduced by urban and rural demands. The Hydrology of the Murray River (a NSW waterway) is regulated by the Snowy Mountains Hydroelectric Scheme. All of the waters in the system flow into Lake Hume and are stored for release into the Murray River.

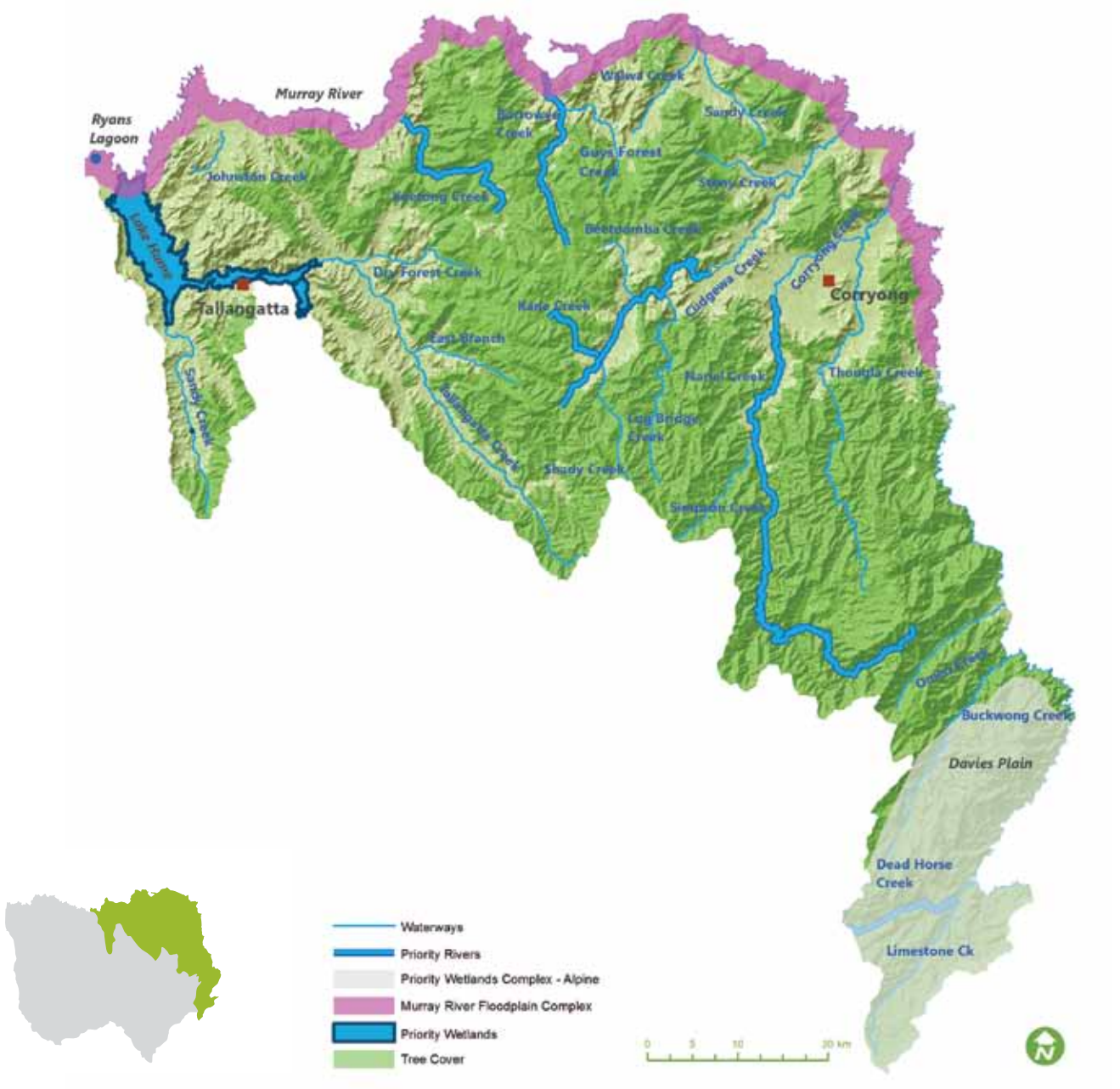


Figure 15 Upper Murray System

Landscape lens

The majority of this system is a Forest Landscape with some parts in Alpine Landscapes. A number of wilderness areas (Wabba Wilderness Park, Davies Plain Wilderness Area, Cobberas Wilderness Area) occur in the Forested and Alpine Landscapes of the Upper Murray system.

The valley floors and the floodplain of the Murray River are mainly occupied by Agricultural Landscapes, (predominantly beef and dairy farming and some high value horticulture). There are also extensive tracts of pine plantations.

The major Urban Landscape centres are located at Tallangatta and Corryong, and a number of smaller townships lie along the rivers. Lifestyle Landscapes are located around areas of rural living throughout the system, with concentrations around the urban centres.

Condition

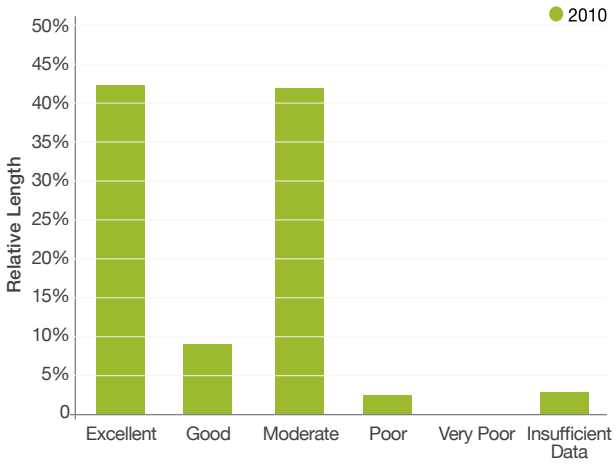


Figure 16 Index of Stream Condition – Upper Murray System

Values

Environmental

Koetong Creek, Cudgewa Creek, Corryong Creek and Nariel Creek contain threatened fish species including Murray Cod, Flat-Headed Galaxias and Trout Cod. Wetlands and riparian zones surrounding Lake Hume in Johnston Creek contain populations of threatened bird species (e.g. Great Eastern Egret). Further along the Murray River corridor, other bird species (e.g. Australasian Shoveller) are found in Stony Creek, and Great Eastern Egrets in Kane Creek.

There are records of threatened amphibians in Burrowye and Koetong Creek (Booroolong Tree Frog), Nariel Creek (Spotted Tree Frog) and Kane Creek (Brown Toadlet). Threatened fauna occurring in alpine wetlands (on Davies Plain and elsewhere in the Upper Murray system) include Broad-toothed Rat, Latham's Snipe and Alpine Water Skink. The threatened invertebrates, Alpine Spiny Crayfish and Murray Spiny Crayfish have been found in Cudgewa Creek, with the Alpine Spiny Crayfish also found in Nariel Creek and Dead Horse Creek.

Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways. Some fish communities in the Upper Murray are missing many of the downstream species which would have historically occurred there, caused by the presence of Lake Hume. In the upper forested areas, the macroinvertebrate community and riparian vegetation community are generally in good to excellent condition.

Alpine wetlands, in the form of peatlands, occur in several upper parts of the Upper Murray System, not just on Davies Plain (e.g. on The Cobberas; in the upper Limestone Creek catchment). Wetlands within Davies Plain, Lake Hume and Ryans Lagoon are listed as nationally important wetlands. For wetland location refer to: Figure 12 Map of Priority Waterways – Wetlands.

Social

The Murray River, Lake Hume, and the larger tributaries in the system (e.g. Nariel Creek) are significant areas for recreational fishing, boating and swimming and waterside activities such as walking and camping. Numerous other areas scattered throughout the system are also popular for a variety of social activities including camping, swimming and sightseeing. Community involvement in parts of the Upper Murray system is strong, with various community groups engaged in supporting waterway management.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. The range of cultural sites recorded within this system is diverse. The area within Lake Hume is of particular significance due to its diversity of site types and artefacts that are regionally unique and of importance to Australia's heritage. The floodplain wetland and riverine environment of the Upper Murray River is significant to Aboriginal people as the former location of significant resources (e.g. food and fibre).

Economic

The availability of a secure and perennial water supply drives many major economic values in the system. Many reaches supply water for urban and rural townships as well as sources for agricultural production. Specifically, the water resources of the system are used for these urban supplies - Nariel Creek for Corryong; Murray River for Walwa; Lake Hume for Tallangatta. Lake Hume is a major supplier of water resources to downstream systems and generates hydro-electricity. The high rainfall, regulated stream flows and groundwater resources support a diverse array of agricultural production, mainly dairy and grazing. Lifestyle-based tourism associated with waterways, especially recreational fishing, is another major economic source in the system, including for service towns such as Tallangatta and Corryong. The waterways, the aesthetic appeal of the forested landscapes, greenness and large trees, the limited industrial infrastructure, and the fertile agricultural land support high land values within the system.

Major softwood plantations and harvesting activities are found in the northern part of the system around Koetong Creek, Burrowye Creek and Guys Forest Creek.

Priority Waterways

Table 11 Upper Murray System – Priority River Reaches and Floodplains

Priority Waterway #	Name
1-13	Koetong Creek
1-14	Burrowye Creek
1-17	Cudgewa Creek
1-20	Nariel Creek
1-21	Nariel Creek
1-54	Kane Creek
1-61	Dead Horse Creek

Table 12 Upper Murray System – Priority Wetlands

Priority Waterway #*	Name
77784-1	Lake Hume
77760	Sandy Creek Reservoir
78810	Davies Plain Wetland 1
78811	Davies Plain Wetland 2
78809	Davies Plain Wetland 3
76197	Ryans Lagoon 1
76198	Ryans Lagoon 2
	Alpine Wetland Complex

** Some Priority Waterways do not have unique number identifiers*

Strategic Issues

- Need to share water resources with NSW and the associated operation of the Snowy Mountains Hydro-electric scheme and maintenance of the integrity of the Upper Murray floodplain
- Bushfire potential
- Maintenance of the viability of agricultural production
- Declining populations
- Maintaining a high yield and quality of water resources
- Potential for increase in earth resources activity
- Use of the waterways for recreational purposes and
- Managing for threatened species in the tributaries.

Stressors

Table 13 Upper Murray System - Stressors

Stressor	Waterways Impacted
Reduced summer base flows in unregulated rivers due to extraction for irrigation, commercial use, urban supply and stock domestic uses	Nariel Creek and Corryong Creek
Unnatural flows in the Murray River due to the operation of the Snowy Mountains Hydro-electric Scheme	Murray River
Livestock access to waterways	Waterways in the Agriculture, Forest and Lifestyle Landscapes
Historical disturbances such as land clearing and gold mining	Johnston Creek, Walwa Creek, Burrowye Creek and Guys Forest Creek
Invasive weeds	Whole of System
Introduced invasive tree species (mainly willows)	Waterways in the Agriculture and Lifestyle Landscapes
Invasive pest animals	Whole of System
Barriers to fish passage	Murray River, Johnston Creek, Cudgewa Creek and Limestone Creek
Impact of climate changes on stream flows and fire frequency	Whole of System
Pressures from recreation and tourism	Murray River, Nariel Creek, Lake Hume

The stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the system waterways. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided.

Table 14 Upper Murray System – Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
UMU SA1	Maintain the quality of inflows into the Murray River and Lake Hume and associated floodplains and wetlands and the Agricultural Landscape values by undertaking targeted management activities on the tributaries.	●	●●●	●●●	●	
UMU SA2	Support targeted protection of the iconic waterways within the Alpine Landscapes.	●●●	●●			
UMU SA3	Maintain or improve the recreational values of Priority Waterways through management activities undertaken in partnership with the community.		●●	●●●	●●●	●●

Table 15 Upper Murray System –Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
UMU LA 1.1	Implement an integrated catchment management approach to manage the dynamics of the waterways, vegetation cover and buffers, invasive weeds and, ultimately, nutrient and sediment ingress into Lake Hume.	●		●	Nariel Creek, Corryong Creek, Koetong Creek, Burrowye Creek, Kane Creek, Cudgewa Creek, Dead Horse Creek, Thougla Creek, Davies Plain Wetlands, Alpine wetland complex, Ryans Lagoon, Lake Hume, Murray River
UMU LA 1.2	Refine the strategic bushfire management program to minimise the impact of major bushfires on human life, communities and infrastructure, maintain an effective water yield and maintain or improve the resilience of the waterways.	●		●	Nariel Creek, Corryong Creek, Koetong Creek, Burrowye Creek, Kane Creek, Cudgewa Creek, Dead Horse Creek, Thougla Creek, Davies Plain Wetlands, Alpine wetland complex, Ryans Lagoon, Lake Hume, Murray River
UMU LA 2.1	Continue programs connecting the wider community to the Alps and the Nationally-listed Alpine wetlands.	●			Davies Plain Wetlands, Alpine wetland complex
UMU LA 2.2	Management of the threats posed by pest plants and animals on Alps and the Nationally-listed Alpine wetlands.		●	●	Davies Plain Wetlands, Alpine wetland complex
UMU LA 3.1	Improve in-stream habitat.			●	Lake Hume, Nariel Creek, Cudgewa Creek
UMU LA 3.2	Improve riparian vegetation condition.			●	Lake Hume, Nariel Creek, Cudgewa Creek
UMU LA 3.3	Improve fish passage by barrier management.			●	Cudgewa Creek
UMU LA 3.4	Improve public access to waterways.			●	Lake Hume, Nariel Creek, Cudgewa Creek

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 16 Upper Murray System – Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	A sustainable population of Trout Cod in Koetong Creek is maintained.
2	The waterway and riparian zones throughout Kane Creek maintain populations of Great Eastern Egrets.
3	Wetlands in the Upper Murray maintain populations of high priority threatened bird species.
4	Sustainable populations of Alpine Tree Frog and Alpine Water Skink at Davies Plain are maintained.
5	A sustainable population of Booroolong Tree Frog in Burrowye Creek is maintained.
6	A sustainable population of Spotted Tree Frog in Nariel Creek is maintained.
7	A sustainable population of Brown Toadlet in Kane Creek is maintained.
8	A sustainable population of Murray Spiny Cray in Cudgewa Creek is maintained.
9	Sustainable populations of Alpine Spiny Cray in Cudgewa Creek, Nariel Creek and Dead Horse Creek are maintained.
10	Murray Cod and Golden Perch move from the Murray River into the Cudgewa Creek as part of their life cycle.
11	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
12	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
13	Water quality and quantity in Corryong Creek is suitable for an urban/rural township source and for agricultural production.
14	Water quality and quantity in Lake Hume and Sandy Creek Reservoir are suitable for an urban/rural township source and for agricultural production.
15	Access to waterways for recreational fishing, boating, swimming and near-waterway activities is maintained.
16	Waterways maintained in excellent condition (as per ISC and IWC assessments).
17	Wetland vegetation at Davies Plain is maintained in good to excellent condition.

KEY FEATURES:

- Total area of **330 square kilometres**
- **Over 60%** of the Upper Murray catchment is used for forestry or conservation
- Major water users include **Snowy Hydro Ltd, local councils and water utilities, and sheep and cattle graziers**
- The NSW portion of the catchment **occupies one third of this area** (5,200 km^2)
- **Elevations** range from **2000 m** around the alpine peaks in the east, to **150 m** at Lake Hume.

Table 17 Upper Murray System – Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
78810, 78811, 78809, Alpine wetland complex	UMU SA: 1 UMU LA: 1.1, 2.1, 2.2	3, 4, 9, 17	MO-1	Nationally endangered ecological community, Alpine Sphagnum Bogs and Associated Fens, maintained	MA-1	Conduct surveillance and maintain control of pest (invasive) plants	10 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
78810, 78811, 78809, Alpine wetland complex			MO-2	Reduced impact from pest animals (invasive terrestrial species)	MA-2	Conduct surveillance and maintain control of pest animals (invasive terrestrial species)	250 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
1-13, 1-54, 1-61		1, 9, 14, 16	MO-3	Reduced impact from pest plants	MA-3	Conduct surveillance and control of new and emerging pest plants (invasive) on priority reaches in excellent (ISC) condition and Thougla Creek (1-22 & 1-23)	100 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
1-14, 1-17, 1-20, 1-21, 1-54, 77760, 76197, 76198	UMU SA: 1, 3 UMU LA: 1.1, 3.1, 3.2	2, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16	MO-4	Controlled livestock access in more than 25% of waterway frontages	MA-4	Install riparian fence	40 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-5	Establish management agreements with landholders	80 ha	CMA, DEPI, Land Managers
1-17, 1-54, 77784-1		11, 12	MO-5	Improved vegetation structure and diversity	MA-6	Establish native vegetation	20 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-7	Establish pest plant (invasive terrestrial shrub) control in priority reaches and Nariel Creek (1-20, 1-21)	100 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
1-13, 1-17, 1-20, 1-21, 1-54, 7778-1		5, 6, 7, 11, 12	MO-6	Improved vegetation structure and diversity	MA-8	Establish native vegetation	25 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-9	Establish pest plant (invasive terrestrial ground cover) controls in priority reaches, Lake Hume and Nariel Creek (1-20, 1-21)	20 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
1-13, 1-17, 1-21, 1-54		5, 6, 7	MO-7	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-10	Establish pest animal (invasive terrestrial species) control	60 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
1-17	UMU SA: 3 UMU LA: 3.2	10	MO-8	Improved fish passage for desirable species	MA-11	Investigate impact of barrier at Kosch's Weir 401/75/B0009 on fish passage in both reaches of Cudgewa Creek (1-16, 1-17)	1 study	CMA, DEPI, Research Organisations, Water Corporations
					MA-12	Establish feasible works in accordance with investigation recommendations	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations

Continued *Table 17 Upper Murray System – Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
1-20, 1-21, 77784-1	UMU SA: 1, 3 UMU LA: 1.1, 3.1, 3.4	14, 15	MO-9	Suitable water quality and quantity in Lake Hume	MA-13	Implement the Lake Hume Land and On-water Management Plan	1 Plan	CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
			MO-10	Improved appropriate access to waterways for recreational fishing, boating, swimming and near-waterway activities	MA-14	Implement the Lake Hume Land and On-water Management Plan and work with key stakeholders to improve appropriate recreational access to Priority Waterways, Nariel Creek (1-20, 1-21) and Cudgewa Creek (1-16, 1-17)		CMA, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, PV, Water Corporations
			MO-11	Improved management of the upstream catchment and reduce nutrient and sediment impacts	MA-15	Establish Management Agreements to modify agricultural practice change, nutrient and sediment management in catchments upstream of Lake Hume	50 Agreements	CMA, DEPI, Government, Land Managers, Water Corporations
All	UMU SA: 1 UMU LA: 1.2	13, 14	MO-12	Decreased impact of fire on effective water yield and waterway resilience	MA -16	Work with key stakeholders to determine appropriate planned burning regime in the catchments of all Priority Waterways and Nariel Creek (1-20, 1-21), Thougla Creek (1-22 & 1-23) and River Murray	1 Agreement	CMA, DEPI, Emergency Response Agencies, Government, Land Managers, Local Councils, Peak Body Groups, PV, Research Organisations, Water Corporations
Estimated cost of activities for the Upper Murray System* $2,915,000								

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

UPPER MITTA MITTA SYSTEM

System Description

The Upper Mitta Mitta System (Figure 17) comprises the catchment of the Mitta Mitta River upstream of the Dartmouth Dam wall. The main river rises on the slopes of Mount Bogong as the Big River which joins the Cobungra River at Anglers Rest to form the Mitta Mitta River.

The Big River and Mitta Mitta River, from the Big River Bridge on the Omeo Highway to the tail waters of Dartmouth Dam, has been declared a Heritage River, recognised for a number of values including scenic landscapes, canoeing and significant flora and fauna (primarily riparian closed scrub and Macquarie Perch).

Major tributaries in the system include the Bundara River and the Victoria Rivers, and the Livingstone Creek and Morass Creek.

Whilst there is a large section of agricultural freehold land around Omeo and Benambra, the bulk of the land in the system is included in the Alpine National Park.

The hydrology of the system is relatively intact, with persistent base flows from alpine and forested landscapes. The summer base flows in some of the tributaries such as Livingstone Creek are reduced due to urban and rural demands. All of the waters in the system flow into Lake Dartmouth and are stored for release into the Lower Mitta Mitta System and Lake Hume.

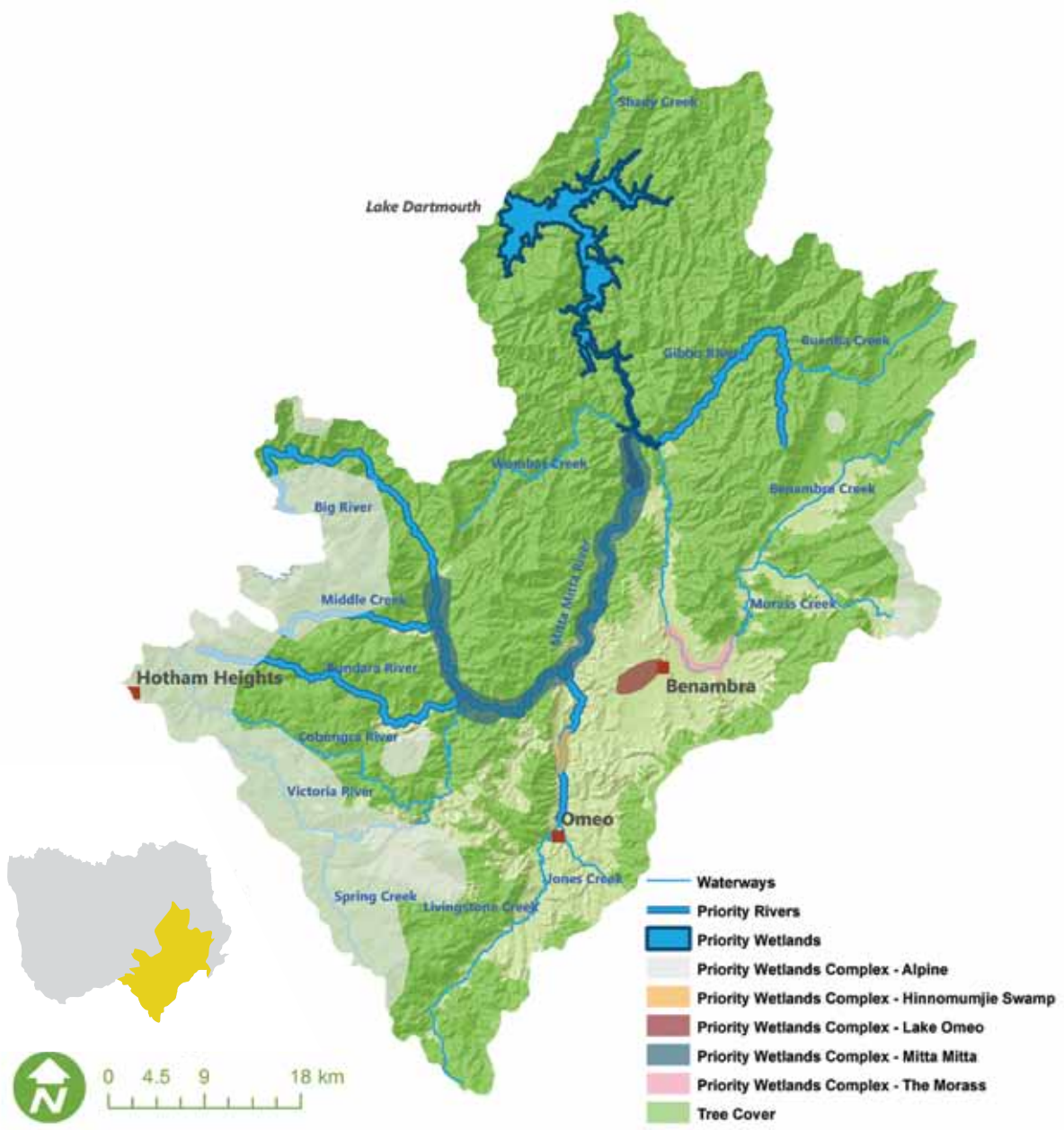


Figure 17 Upper Mitta Mitta System

Landscape lens

The majority of this system consists of Alpine and Forest Landscapes. However, there are small Urban Landscapes at Omeo, Dinner Plain and Benambra. The Agriculture Landscapes tend to be large grazing operations around Omeo and Benambra. The Lifestyle Landscapes are predominantly associated with rural living and natural environment appreciation, and tend to coexist with the Agriculture Landscapes.

Condition

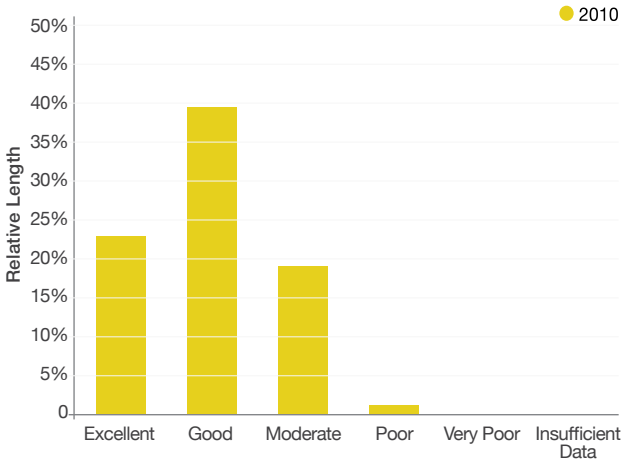


Figure 18 Stream Condition – Upper Mitta Mitta System

Values

Environmental

The threatened migratory fish species, the Macquarie Perch, is found in and upstream of Lake Dartmouth, in Wombat Creek, Livingstone Creek and the Gibbo River. It is only found in discrete populations with the largest population occurring in Lake Dartmouth. The high priority threatened Trout Cod has been recorded in the Mitta Mitta River immediately upstream of the reservoir.

The system contains numerous other records of significant species, including the vulnerable White-bellied Sea Eagle which has been recorded around and upstream of the reservoir, the endangered Spotted Tree Frog in the Big River and the Bundara River. Middle Creek contains the only record of the endangered Alpine Water Skink.

Lake Dartmouth and the Mitta Mitta Heritage River are two of the eight nationally important wetlands listed in the region.

The Alpine Sphagnum Bogs, the Morass, Hinnomunjie Swamp and Lake Omeo wetlands have been identified for the environmental values they support.

Dartmouth Dam influences the fish assemblages, with many of the downstream species not present in the Upper Mitta Mitta waterways. In many of the upper areas, where data are available, the macroinvertebrate community and riparian vegetation community is generally in good to excellent condition.

Social

The Upper Mitta Mitta River is a high value recreational area for fishing, camping and water sports. Other waterways, including Lake Dartmouth, are also particularly popular for recreational fishing (mainly for trout) and are noted in the *North East Regional Fishery Management Plan (2007)* for their value as recreational fisheries. The Big River and Cobungra River are some of the best Brown Trout fishing waters in Victoria.

Lake Dartmouth is a regional attraction for picnics and day tourism. Other recreational activities, mainly camping and walking, are popular throughout much of the system. The alpine and sub-alpine areas are particularly well known to the walking, camping and four wheel driving communities.

Community involvement in the system is strong, but somewhat limited due to the dynamics of the demographic and dispersed populations.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. It is likely that the Mitta Mitta River and Omeo/Benambra Plains area was once important to Aboriginal people as the location of significant resources (e.g. food and fibre).

Economic

The Forest and Alpine Landscape, together with Lake Dartmouth, is a highly significant feature of the system generating a significant amount of tourism through activities such as fishing, hunting, bushwalking, rafting and four wheel driving. The Mitta Mitta River and Lake Dartmouth supply water for many downstream uses. The large forested catchment area above the Lake, combined with high rainfall zones, provides considerable volumes of high quality water for downstream users.

The whole system is nominated in the Lake Hume Special Water Supply Catchment (SWSC). The quantity and reliability of water resources in the system support agricultural production systems, mainly grazing. Hydro-electric power generation at Lake Dartmouth will continue to be an important contributor to the grid.

Priority Waterways

Table 18 Upper Mitta Mitta System – Priority River Reaches and Floodplains

Priority Waterway #	Name
1-25	Mitta Mitta River
1-26	Mitta Mitta River
1-27	Big River
1-28	Big River
1-29	Big River
1-30	Livingstone Creek
1-37	Bundara River
1-38	Middle Creek
1-39	Gibbo River

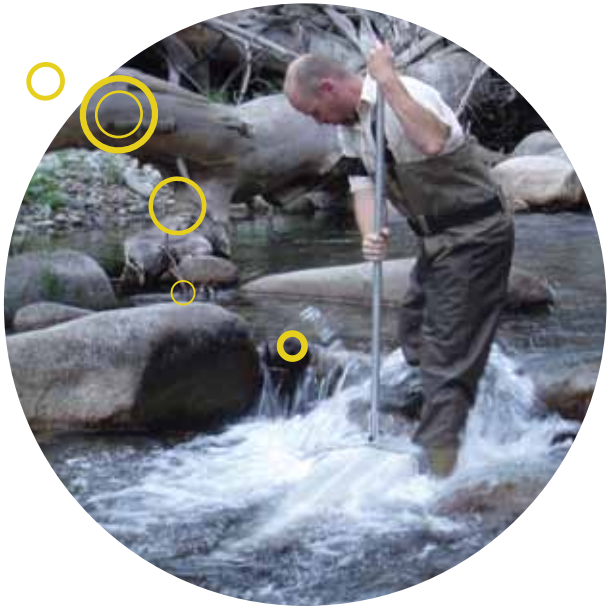


Table 19 Upper Mitta Mitta System - Priority Wetlands

Priority Waterway #*	Name
78164	Lake Dartmouth
	Mitta Mitta River Wetland complex
	Hinnomunjie Swamp
	The Morass
	Lake Omeo
	Alpine Wetland Complex

** Some Priority Waterways do not have unique number identifiers*

Strategic Issues

- Invasive weeds (e.g. Broom, willows) in Forest Landscapes of the Upper Mitta Mitta River
- Maintenance of the capacity to manage the natural resource base in the face of declining population and declining incomes for agricultural production due to reduced terms of trade
- Rainfall shadow in the cleared Agriculture Landscapes and long timeframes associated with vegetation growth
- Remoteness of the community
- Managing for recreational use of waterways and
- Management of waterways in landscapes with large land parcels.

Stressors

Table 20 Upper Mitta Mitta System - Stressors

Stressor	Waterways Impacted
Reduced summer base flows in unregulated rivers due to extraction for urban supply and stock domestic uses	Jones Creek and Butchers Creek
Increased bed and bank erosion	Morass Creek
Livestock access to waterways	Waterways in the Agriculture, Forest and Lifestyle Landscapes
Historical disturbances such as land clearing and gold mining	Livingstone Creek, Jones Creek, Benambra Creek, Victoria River and parts of Morass Creek
Invasive weeds (mainly Broom and blackberries)	Whole of System
Introduced invasive tree species (mainly willows)	Mitta Mitta River, Livingstone Creek, Jones Creek, Cobungra River and Alpine Wetland Complex
Invasive pest animals	Alpine Wetland Complex
Drainage of Alpine Environment for Hydro Electricity	Alpine wetlands on the eastern falls of the Bogong High Plains
Introduced aquatic fauna	Whole of System
Impact of climate changes on water regime and busffire frequency	Whole of System
Pressures from recreation and tourism	Lake Dartmouth, Mitta Mitta River, Big River and Cobungra River
Declining human population leading to lack of active natural resource management	Waterways in the Agriculture Landscape

The above stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided.

Table 21 Upper Mitta Mitta System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
UMM SA1	Support targeted protection of the iconic waterways within the Alpine and Agriculture Landscapes.	3	1	3		
UMM SA2	Protect the high value Heritage-listed Upper Mitta Mitta River and Lake Dartmouth by undertaking targeted waterway management within the Forest and Agriculture Landscapes.		3	3		
UMM SA3	Maintain the recreational values of Priority Waterways through management activities undertaken in partnership with the community.	1	1	3	3	1

Table 22 Upper Mitta Mitta System – Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
UMM LA 1.1	Continue programs connecting the wider community to the Alps and the Nationally-listed Alpine Wetlands.	1			Alpine Wetland Complex
UMM LA 1.2	Management of the threats posed by pest plants and animals on Alps and Nationally-listed Alpine wetlands.		1	1	Alpine Wetland Complex
UMM LA 1.3	Work with the Omeo/Benambra communities on the maintenance or improvement of the priority wetlands.			1	The Morass, Hinnomunjie Swamp, Lake Omeo, Mitta Mitta River Wetland Complex
UMM LA 1.4	Refine the strategic bushfire management program to minimise the impact of major bushfires on human life, communities and infrastructure, maintain an effective water yield and maintain or improve the resilience of the waterways.	1			All Priority waterways
UMM LA 2.1	Address nutrient ingress, stock access, invasive weeds and the dynamics of the watercourses as a long-term strategy to reduce the threats to the Priority Waterway.	1	1	1	Gibbo River, Livingstone Creek, Bundara River, Middle Creek, Big River, Mitta Mitta River, Lake Dartmouth
UMM LA 3.1	Improve in-stream habitat.			1	Mitta Mitta River, Big River, Gibbo River
UMM LA 3.2	Improve riparian vegetation condition.			1	Mitta Mitta River, Big River, Gibbo River, Lake Dartmouth
UMM LA 3.3	Improve fish passage by barrier management.			1	Mitta Mitta River, Big River, Gibbo River
UMM LA 3.4	Improve public access to waterways.			1	Mitta Mitta River, Big River, Gibbo River, Lake Dartmouth

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 23 Upper Mitta Mitta System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	All Heritage River values in the Mitta Mitta and Big Rivers are maintained.
2	A sustainable population of Macquarie Perch in the Mitta Mitta River is maintained.
3	A sustainable population of the Spotted Tree Frog is maintained.
4	A sustainable population of Alpine Water Skink in Middle Creek is maintained.
5	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
6	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
7	Access to waterways for recreational fishing, boating, swimming and near-waterway activities is maintained.
8	Waterways are maintained in excellent condition (as per ISC and IWC assessments).
9	A sustainable population of Macquarie Perch in Dartmouth Reservoir is maintained.
10	A sustainable population of the Vulnerable White-bellied Sea Eagle is maintained around Dartmouth Reservoir.
11	Dartmouth Reservoir remains as a significant drought refuge in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
12	Water quality and quantity in Dartmouth Reservoir are suitable for an urban/rural township source and for rural agricultural production.
13	Wetland vegetation in the Alps is maintained in good to excellent condition.

KEY FEATURES:

- **Lake Dartmouth** is the **highest water storage** in the Murray Darling Basin at **486 m**
- The **heritage listed upper Mitta Mitta River** is one of the **best know recreational fisheries in Victoria**
- Lake Dartmouth and the Mitta Mitta Heritage River are **two of the eight nationally important wetlands listed in the region**.

Table 24 Upper Mitta Mitta System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
Alpine wetland complex	UMM SA: 1, 3 UMM LA: 1.1, 1.2	1, 13	MO-1	Nationally endangered ecological community, Alpine Sphagnum Bogs and Associated Fens, maintained	MA-1	Conduct surveillance and maintain control of pest plants (invasive)	20 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
			MO-2	Reduced impact of pest plant and animal species (invasive terrestrial species)	MA-2	Conduct surveillance and maintain control of pest animals (invasive terrestrial species)	500 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
			MO-3	Improved vegetation structure and diversity	MA-3	Establish pest plant (e.g. invasive terrestrial shrubs) control in priority and associated reaches	40 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
The Morass Hinnomunjie Swamp, Lake Omeo, Mitta Mitta River Wetland Complex	UMM SA 1, 3 UMM LA: 1.3	5, 6	MO-4	Controlled livestock access in more than 25% of waterway frontages	MA-4	Install riparian fence	5 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-5	Establish management agreements with landholders	80 ha	CMA, DEPI, Land Managers
			MO-5	Improved vegetation structure and diversity	MA-6	Establish native vegetation	20 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV
				Improved vegetation structure and diversity	MA-7	Establish pest plants control (invasive terrestrial shrub) in priority wetlands and Livingstone Creek (1-31), Morass Creek (1-41, 1-42)	80 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV
1-25, 1-26, 1-27, 1-28, 1-29, 78164, Mitta Mitta River Wetland Complex	UMM SA: 1, 2, 3 UMM LA: 2.1, 3.2, 3.3, 3.4	1, 2, 3, 5, 6, 7, 8, 9, 10, 12	MO-6	Unstable beds stabilised	MA-9	Establish native vegetation	25 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV
					MA-10	Establish pest plant control (invasive terrestrial shrub) in priority reaches	100 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV
1-30	UMM SA: 1, 2, 3 UMM LA:1.2, 2.1, 3.2	1, 2, 5, 6, 13	MO-7	Unstable beds stabilised	MA-11	Conduct bed stabilisation works in Priority Waterways and Livingstone Creek (1-31), Morass Creek (1-41, 1-42)	3 sites	CMA, DEPI, Land Managers, Local Councils, Water Corporations
			MO-8	Controlled livestock access in more than 50% of waterway frontages	MA-12	Construct riparian fence on Priority Waterways and Livingstone Creek (1-31), Morass Creek (1-41, 1-42)	7 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA - 13	Establish management agreements with landholder	20 ha	CMA, DEPI, Land Managers

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 24 Upper Mitta Mitta System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
1-37, 1-38 1-39	UMM SA: 2, 3 UMM LA: 2.1, 3.2	4, 5, 9	MO-9	Improved vegetation structure and diversity	MA -14	Establish native vegetation	2.5 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups
					MA -15	Establish pest plant control (invasive terrestrial shrub) in priority reaches and Cobungra Creek (1-34)	10 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups
78164	UMM SA: 2, 3 UMM LA: 2.1, 3.2	2, 6, 7, 10, 11, 12	MO-10	Improved and appropriate access to waterways for recreational fishing, boating, swimming and near-waterway activities	MA -16	Establish and Implement the Lake Dartmouth Land and On-water Management Plan and work with key stakeholders to improve appropriate recreational access	1 Plan	CMA, Community, Community Groups, DEPI, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
All	UMM SA: 1 UMM LA: 1.4	5, 11, 12	MO-11	Decreased impact of fire on effective water yield and waterway resilience	MA -17	Work with key stakeholders to determine appropriate planned burning regime in the catchments of all Priority Waterways	1 Agreement	CMA, DEPI, Emergency Response Agencies, Government, Land Managers, Local Councils, Peak Body Groups, PV, Research Organisations, Water Corporations
Estimated cost of activities for the Upper Mitta Mitta System* $2,517,500								

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

LOWER MITTA MITTA SYSTEM

System Description

The Lower Mitta Mitta System (Figure 19) comprises the Mitta Mitta River and tributaries below the wall of Dartmouth Dam to its inflow into Lake Hume. A number of hydro-electric power stations operate downstream of the Dam, with the Dartmouth Pondage being used as a re-regulator of flows.

Immediately below Dartmouth Dam, the River flows through a rocky gorge until its confluence with Watchingorra Creek. It then meanders across a wider cleared valley until it reaches Lake Hume.

The major tributary of the Mitta Mitta River is Snowy Creek, which joins the River at the township of Mitta Mitta. The Creek flows mainly through State Forest with small patches of cleared farmland. Other tributaries – Little Snowy Creek, Fairyknowe Creek and Little Scrubby Creek – run through predominantly Agriculture Landscapes downstream of the township of Mitta Mitta.

The flows within the main stem of the Lower Mitta Mitta River are highly regulated. In winter, water is held back with a minimum passing flow released from Lake Dartmouth. In some summers, the Lake supplies significant water resources to Lake Hume to meet demands further downstream. During these periods, the river runs close to bank full for a number of months. As water is drawn from low level outlets, the water temperature in the Mitta Mitta River is reduced. The tributaries, such as Fairyknowe Creek and Little Scrubby Creek, have reduced summer low flows due to extraction for rural and stock and domestic purposes.

Landscape lens

As there are no major urban centres in the system, the smaller urban communities including Eskdale, Mitta Mitta and Dartmouth, comprise the Urban Landscapes. The Forest Landscape of the Great Diving Range dominates in this system. The valley floors are primarily cleared Agriculture Landscapes supporting predominantly dairy and beef grazing enterprises. Recreation and lifestyle uses (fishing and camping) occur in the Forest and Agriculture Landscapes.

Figure 19 Lower Mitta Mitta System

Condition

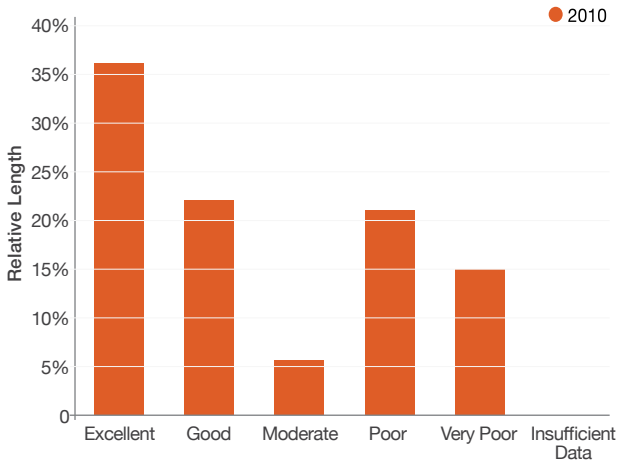


Figure 20 Index of Stream Condition – Lower Mitta Mitta System

Values

Environmental

High priority threatened migratory fish, including Macquarie Perch, Murray Cod, Golden Perch and Flat-Headed Galaxias move into the lower reaches of the Mitta Mitta River from Lake Hume as part of their life cycle. High priority species (e.g. Spotted Tree Frogs and the Alpine Spiny Crayfish) are found in Lightning Creek in the Upper Snowy Creek catchment.

Stands or remnant patches of significant vegetation can be found along most parts of the tributaries of the Mitta Mitta River. The large older trees (sometimes single paddock trees) in the more heavily cleared Agriculture Landscapes are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways.

The macroinvertebrate communities in the Snowy Creek catchment are generally in excellent condition, as is the riparian vegetation. Good riparian vegetation can also be found in the Mitta Mitta Gorge, Little Scrubby and Watchingorra Creek. The native fish communities in the Mitta Mitta River main stem and tributaries contain many of the species expected, but diversity is restricted primarily due to river regulation.

Social

The Mitta Mitta River between Dartmouth Dam and Lake Hume, and the Snowy Creek catchment, are significant areas for recreational fishing, boating and swimming, and waterside activities such as walking and camping. The Dartmouth hydro-electric pondage is also a valuable resource for recreational fishing. The Lower Mitta Mitta River is one of the best Brown Trout fishing waters in North East Victoria due to the cold water and a mainly cobble/gravel substrate.

Community involvement in the Lower Mitta Mitta system is strong, with significant community advocacy for river health works and sustainable agriculture and a number of community groups engaged in supporting waterway management in the system.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. The range of cultural sites recorded within this system is diverse. The floodplain wetland and riverine environment of the Mitta Mitta River is significant to Aboriginal people as it was once the location of significant resources (e.g. food and fibre).

Economic

The availability of a secure and perennial water supply drives many major economic values in the system. The waterways are included in the Lake Hume Special Water Supply Catchment and are used as a water supply for rural townships within the system (e.g. Mitta Mitta, Eskdale) as well as for downstream users.

Lifestyle-based tourism associated with waterways, especially recreational fishing, is another major economic source in the system, including for service towns such as Dartmouth and Mitta Mitta.

Priority Waterways

Table 25 Lower Mitta Mitta System – Priority River Reaches and Floodplains

Priority Waterway #	Name
1-1	Mitta Mitta River
1-2	Mitta Mitta River
1-3	Mitta Mitta River
1-5	Snowy Creek
1-6	Mount Wills Creek (Lightning Creek)

No high value wetlands have yet been identified in the Lower Mitta Mitta System.

Strategic Issues

- Impacts of the operation of Dartmouth Dam on maintaining the integrity of the Mitta Mitta River
- Maintenance of the viability of agricultural production
- Use of the waterways for recreational purposes and
- Managing for threatened species in the tributaries.

Stressors

Table 26 Lower Mitta Mitta System - Stressors

Stressor	Waterways Impacted
Hydrological influence of Lake Dartmouth operations	Mitta Mitta River
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing and gold mining	Mitta Mitta River and Fairyknowe Creek
Invasive weeds	Whole of System
Introduced invasive tree species (mainly willows)	Mitta Mitta River and Fairyknowe Creek
Invasive pest animals	Whole of System
Barriers to fish passage	Snowy Creek and Little Scrubby Creek
Impact of climate changes on water regimes and bushfire frequency	Whole of System
Recreation and tourism pressure	Mitta Mitta River, Snowy Creek, Lake Hume

The above stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided.

Table 27 Lower Mitta Mitta System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
LMM SA1	Maintain the Lower Mitta Mitta River and associated floodplain and wetlands and the Agriculture Landscape values by undertaking targeted management activities.		1	3	1	
LMM SA2	Maintain the recreational values of Priority Waterways through management activities undertaken in partnership with the community.		2	2	2	1

Table 28 Lower Mitta Mitta System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
LMM LA 1.1	Implement an integrated catchment management approach to manage the dynamics of the waterways, vegetation cover and buffers and invasive weeds and ultimately, nutrient and sediment ingress into Lake Hume.	1		1	Snowy Creek, Mitta Mitta River, Mount Wills Creek (Lightning Creek)
LMM LA 1.2	Modify Lake Dartmouth release patterns to maximise environmental benefits whilst minimising the impacts to the bed and banks of the Lower Mitta Mitta River.	1		1	Mitta Mitta River
LMM LA 2.1	Improve in-stream habitat.			1	Lower Mitta Mitta
LMM LA 2.2	Improve riparian vegetation condition.			1	Lower Mitta Mitta River, Snowy Creek, Mount Wills Creek (Lightning Creek)
LMM LA 2.3	Improve fish passage by barrier management.			1	Snowy Creek
LMM LA 2.4	Improve public access to waterways.			1	Lower Mitta Mitta River, Snowy Creek

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 29 Lower Mitta Mitta System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	A sustainable population of Spotted Tree Frogs in Mount Wills Creek (Lightning Creek) is maintained.
2	A sustainable population of the Alpine Spiny Crayfish in Mount Wills Creek (Lightning Creek) is maintained.
3	The aquatic invertebrate community condition meets all biological objectives for rivers and streams.
4	Riparian vegetation condition is maintained in excellent condition.
5	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
6	Water quality and quantity is suitable for an urban/rural township source and for agricultural production.
7	The ability to efficiently transfer water from Lake Dartmouth to Lake Hume is maintained.
8	Murray Cod, Macquarie Perch, Golden Perch and Flat-Headed Galaxias move from the Murray River as part of their life cycle.
9	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
10	Recreational fishing remains popular and is sustainable.
11	Waterways are maintained in excellent condition (as per ISC and IWC assessments).
12	Access to waterways for recreational fishing, boating, swimming, and near waterway activities is maintained.

KEY FEATURES:

- The valley floor associated with Lower Mitta Mitta River **support some of the best Agricultural Landscapes** in the region
- The Lower Mitta Mitta River is one of the **best Brown Trout fishing waters** in Victoria
- The **transfer of water** from **Lake Dartmouth to Lake Hume is critical** to supporting Murray River **Regulated systems**
- **Community involvement** in the Lower Mitta Mitta system is strong, with **significant community advocacy** for river health works and sustainable agriculture.

Table 30 Lower Mitt Mitta System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
1-1, 1-2, 1-3	LMM SA: 1, 2 LMM LA: 1.1, 1.2, 2.1,	5, 6, 8, 9, 10, 11	MO-1	Controlled livestock access in more than 25% of waterway frontages	MA-1	Construct riparian fence on Priority Waterways and Little Snowy Creek (1-4), Fairyknowe Creek (1-45), Little Scrubby Creek (1-46) and Watchingorra Creek (1-47)	20 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-2	Establish management agreements with landholders	40 ha	CMA, DEPI, Land Managers
	LMM SA: 1, 2 LMM LA: 1.1, 1.2, 2.1, 2.2, 2.3, 2.4	7, 8, 10	MO-2	Maintenance and management of dynamic waterways	MA-3	Investigate fluvial geomorphology in Priority Waterways	1 Study	CMA, DEPI, Land Managers, Research Organisations
					MA-4	Establish plan in consultation to address bed and bank instability (as a result of sustained high flows)	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-5	Implement in accordance with Plan	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
		7, 8, 10, 12	MO-3	Adequate water regime downstream of Lake Dartmouth	MA-6	Establish plan to undertake adaptive management and research into flow manipulations to maximise environmental benefits	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
1-5, 1-6	LMM SA: 2 LMM LA: 2.1, 2.2	1, 2, 3, 4, 5, 11	MO-4	Decreased impact of pest plant and animal species (invasive shrub species)	MA-7	Conduct surveillance and establish pest plants (invasive) control on Priority Waterways and Snowy Creek West Branch (1-48)	200 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-5	Improved vegetation structure and diversity	MA-8	Establish pest plant control to less than 10% cover (invasive species)	20 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
1-1, 1-2, 1-3, 1-5	LMM SA: 2, 2.4	10, 12	MO-6	Improved appropriate access to waterways for recreational fishing, boating, swimming and near-waterway activities	MA-9	Implement Management Plan for recreation access and activities on Priority Waterways	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
1-5	LMM SA: 2 LMM LA: 2.3	10, 11, 12	MO-7	Improved fish passage for desirable species	MA-10	Investigate impact of barrier on Snowy Creek	1 study	CMA, DEPI, Land Managers, Research Organisations, Water Corporations
					MA-11	Establish feasible works in accordance with investigation recommendations	1 No.	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
Estimated cost of activities for the Lower Mitta Mitta System* $2,385,000								

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

KIEWA SYSTEM

System Description

The Kiewa System (Figure 21) comprises the entire catchment of the Kiewa River upstream of its confluence with the Murray River.

The Kiewa River rises on the slopes of the Great Dividing Range between Mt. Bogong and Mt. Hotham as two main branches, the East and West Branches which join below the town of Mount Beauty to form the Kiewa River proper. The East Branch begins upstream of the alpine resort of Falls Creek where it is impounded in the Rocky Valley storage. This branch, which flows through a steep-sided valley, is heavily utilised for hydro-electric power generation, with a series of power stations including the McKay Creek and Clover Power Stations. A series of pondages (including Clover Dam and Lake Guy), tunnels and aqueducts store and deliver water to these stations. The West Branch is relatively unregulated and flows in a narrow valley through forested land until it is diverted into the hydro-electric power system.

Below Mount Beauty, the valley widens, and the river flows along the valley floor through agricultural landscapes until meeting the Murray River east of Wodonga. Major tributaries of the Kiewa River include Mountain Creek (which flows into the East Branch near Mount Beauty), Running Creek (in the mid-section of the valley) and Yackandandah Creek (at the lower end of the system near the township of Kiewa).

Despite the number of hydro-electric power stations in the system, the hydrology of most of the Kiewa River and tributaries remains intact. The flow component most affected in the Kiewa system is the summer low flows. In the main stem of the Kiewa River downstream of the hydro-electric power scheme the summer low flows are higher than natural due to the current electricity market profile which uses hydro-electric power in summer. The tributaries, such as Running Creek and Yackandandah Creek, have reduced summer low flows due to extractions for urban, rural and stock and domestic purposes.

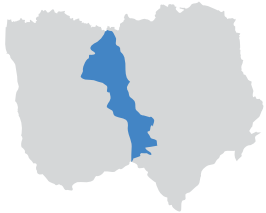


Figure 21 Kiewa System

Landscape lens

Forest Landscapes dominate the East Branch and the West Branch above Mount Beauty, and Alpine Landscapes are found in the headwaters of the catchment, particularly in the East Branch. The majority of the floodplain of the mid to lower catchment is an Agriculture Landscape, with Forest Landscapes occurring in the upper reaches and along the valley sides. Lifestyle Landscapes are scattered throughout the system around these waterways, predominantly within commuting distance of Wodonga. The major Urban Landscape centre of Wodonga is at the bottom of the system, with smaller urban areas scattered throughout the system (e.g. Tangambalanga and Mount Beauty). Wodonga's targeted future growth areas are in this system, focused around the Lower Kiewa River and Middle Creek.

Condition

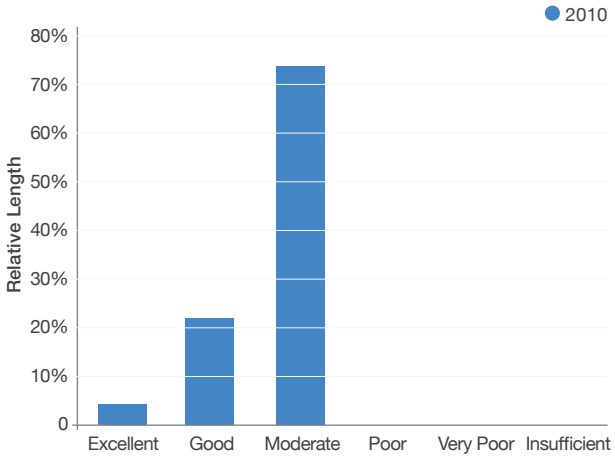


Figure 22 Stream Condition – Kiewa System

Values

Environmental

High priority threatened migratory fish (Murray Cod and Golden Perch) are found in the Kiewa River to just upstream of Running Creek, moving into the system from the Murray River as part of their life cycle. Wetlands and riparian zones in the lower reaches contain populations of threatened bird species (Great Eastern Egret, Azure Kingfisher and Nankeen Night Herons). The East and West Branches of the Kiewa River contain populations of high priority threatened amphibians (Alpine Tree Frog, Spotted Tree Frog) and invertebrates (EPBC listed Alpine Stonefly).

Threatened species are also found around the pondages, with records of the Alpine Water Skink at Pretty Valley and the Alpine Bog Skink at Rocky Valley and the Bogong High Plains. Many rare species of alpine wetland flora are found in and around Rocky Valley and the Bogong High Plains. The alpine wetlands, known as the Alpine Sphagnum Bogs and Associated Fen are of national significance.

Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways.

The macroinvertebrate community is in good to excellent condition in many reaches, but is relatively poor in the lower parts of three tributaries (Middle Creek, Yackandandah Creek and Running Creek). The native fish communities in the main stem and tributaries up to Mount Beauty contain many of the species expected, but diversity is restricted in the upper catchment due to barriers to fish movement. The condition of the riparian vegetation is good to excellent in the upper reaches but declining, with distance, downstream.

Social

The system has a number of highly valued recreation activities associated with waterways including: fishing, kayaking, skiing and bushwalking in alpine areas. The Kiewa River is particularly popular for recreational fishing (trout and native fish) and was labelled a 'Premier River' under the 'Go Fishing in Victoria' initiative of the Department of Environment and Primary Industries. It is also popular for a variety of other social activities including camping, swimming, bike riding, walking and sightseeing.

All of the hydro-electric power pondages (Rocky Valley, Clover Dam, Lake Guy and Pretty Valley, Mt Beauty) provide valuable recreational resources for fishing, boating, walking and sightseeing.

Community involvement in the Kiewa system is strong, with significant community advocacy for river health works and issues such as the protection of large habitat trees, and a number of community groups and individuals engaged in supporting waterway management throughout the system (e.g. Kergunyah Wetlands).

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. The township of Tangambalanga is significant to Aboriginal people as the location of the first official Aboriginal mission in North East Victoria. An area near the township was gazetted as an Aboriginal reserve in 1862/63. A large proportion of the Aboriginal cultural values of the Kiewa system are yet to be officially recorded.

Economic

The availability of a secure, clean and perennial water resource drives many major economic values in the system, and the supply makes a significant contribution to the Murray River water resources. Hydro-electric power generation in the upper reaches provides both peak and base-load supply. Many reaches supply water for urban and rural townships as well as sources for agricultural production. Specifically, the water resources of the system are used for these urban supplies - West Kiewa River for Mt Beauty, Tawonga, Tawonga south; Frenchman's and Nine Mile Creek for Beechworth and Nine Mile Creek for Yackandandah. The Kiewa system also supports a healthy dairy and horticulture industry due to the reliable supply of water for irrigation. Milk produced in this and surrounding systems has supported a large diary manufacturing plant operating in the township of Kiewa.

Recreational fishing in the Kiewa system is a major economic contributor to the North East. Other tourism activities based in the alpine resorts and around the pondages provide another major economic source in the system, including for service towns such as Mount Beauty and Tawonga. The urban community of Yackandandah, and surrounding lifestyle oriented landscapes, offers high lifestyle appeal. The associated land values and tourism are major economic drivers in the system.

The waterways, the aesthetic appeal of the landscapes, the presence of large trees, small land parcels, and limited industrial infrastructure, support high land values within the system.

Priority Waterways

Table 31 Kiewa System – Priority River Reaches and Floodplains

Priority Waterway #	Name
2-1	Kiewa River
2-2	Kiewa River
2-3	Kiewa River
2-4	Kiewa River
2-5	Kiewa River East Branch
2-17	Mountain Creek
2-19	Kiewa River West Branch

Table 32 Kiewa System – Priority Wetlands

Priority Waterway #*	Name
76678	Clover Pondage
76679	Lake Guy
76680	Pretty Valley Pondage
76681	Rocky Valley Pondage
	Alpine Wetland Complex

** Some Priority Waterways do not have unique number identifiers*

Strategic Issues

- Alpine threatened wetlands
- Seeding willows in East and West Branches of the Kiewa Rivers and associated storages
- Lack of traditional ecological knowledge into the management of the waterways and landscapes of the Kiewa system
- Maintenance of the Kiewa system hydro-electricity generation
- Contribution of major tributaries to the Kiewa River main stem e.g. Yackandandah Creek and sedimentation
- Avulsion in Lower Kiewa River and Finns Creek and
- Urban growth along Middle Creek, Lower Kiewa River and floodplain wetlands.

Stressors

Table 33 Kiewa System - Stressors

Stressor	Waterways Impacted
Hydrological influence of hydro-electric power generation operations	Kiewa River (Incl East and West)
Increased rates of bed instability	Kiewa River, Gap Creek
Waterway avulsions that threaten infrastructure and property	Kiewa River, Finns Creek
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing and gold mining	Middle Creek, Yackandandah Creek, Running Creek, Kinchington Creek
Invasive weeds	Whole of System
Introduced invasive tree species (mainly willows)	Waterways in the Agriculture and Lifestyle Landscapes
Invasive pest animals	Whole of System
Barriers to fish passage	Kiewa River East/West Branch, tributaries in the Agriculture and Lifestyle Landscapes
Floodplain and wetland changed water regime	Lower Kiewa floodplain
Impact of climate changes on water regimes and bushfire	Whole of System
Pressures from recreation and tourism	Kiewa River, Alpine Wetland Complex
Expansion of urban boundaries	Kiewa River, Middle Creek
Conflicting land and water resource uses and associated management practices	Agriculture, Lifestyle and Forest Landscapes

The listed stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided.

Table 34 Kiewa System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
KIE SA1	Support targeted protection of the waterways within the Alpine and Forest Landscapes through continuation of programs protecting the Alpine wetlands and management of the threats posed by seeding willow.	💧💧💧	💧💧💧			
KIE SA2	Working from the top of the catchment, undertake targeted waterway management within the Agriculture and Lifestyle Landscapes to protect the high value Kiewa River.			💧💧💧	💧💧💧	
KIE SA3	Manage the avulsion risk in the Lower Kiewa River.			💧💧	💧💧	💧💧
KIE SA4	Protect environmental values by integrating waterway environmental values into the planned Urban and Lifestyle Landscape growth of Wodonga.				💧💧💧	💧💧💧

Table 35 Kiewa System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
KIE LA 1.1	Continue programs connecting the wider community to the Alps and the Nationally-listed Alpine wetlands.	💧	💧		Alpine Wetlands
KIE LA 1.2	Management of the threats posed by pest plants and animals on Alps and the Nationally-listed Alpine wetlands.		💧	💧	Alpine Wetlands
KIE LA 1.3	Manage the threat posed by seeding willows.			💧	Kiewa River East Branch, Kiewa River West Branch
KIE LA 2.1	Address nutrient ingress, stock access, invasive woody weeds, water use and the dynamics of the watercourses.			💧	Kiewa River, Running Creek, Yackandandah Creek
KIE LA 2.2	Manage sediment ingress to protect the Lower Kiewa River.			💧	Kiewa River, Running Creek, Yackandandah Creek
KIE LA 3.1	Work with the Urban, Agricultural and Lifestyle Landscape communities to better understand and manage priority avulsion processes.	💧			Kiewa River, Finns Creek.
KIE LA 3.2	Develop and implement community-based solutions to potential avulsion processes	💧			Kiewa River, Finns Creek.
KIE LA 4.1	Connect Wodonga's Urban Landscapes and growth areas to waterways and floodplain wetlands.			💧	Lower Kiewa River, Middle Creek, Lower Kiewa Floodplain Wetlands, House Creek
KIE LA 4.2	Support the community and associated groups in Wodonga to build on existing community-driven efforts in and around the Urban Landscape waterways.	💧			Lower Kiewa River, Middle Creek, Lower Kiewa Floodplain Wetlands, House Creek
KIE LA 4.3	Maximise the recreational fishing opportunities along the Kiewa River by increasing by increasing fish habitat and access to the river from Dederang to Killara.			💧	Lower Kiewa River, Middle Creek, Lower Kiewa Floodplain Wetlands, House Creek

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*
2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*
3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 36 Kiewa System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	Nationally endangered ecological communities (Alpine Sphagnum Bogs and Associated Fens) are maintained.
2	Murray Cod and Golden Perch move from the Murray River up to the Running Creek junction as part of their life cycle.
3	Sustainable populations of Alpine Tree Frog and Spotted Tree Frog in the West and East Branch of the Kiewa River are maintained.
4	Sustainable populations of Murray Spiny Cray and Alpine Spiny Cray in the East Branch of the Kiewa River are maintained.
5	A sustainable population of Alpine Water Skink in the East Branch of the Kiewa River is maintained.
6	A sustainable population of Alpine Water Skink at Pretty Valley is maintained.
7	A sustainable population of Alpine Bog Skink at Rocky Valley is maintained.
8	The wetlands and riparian zones throughout the Lower Kiewa maintain populations of high and medium priority threatened bird species.
9	Rare species of alpine wetland flora continue to be found in and around Rocky Valley.
10	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
11	Recreational fishing remains popular and is sustainable.
12	Access to waterways for recreational fishing, swimming and near-waterway activities is maintained.
13	Water quality and quantity throughout the system are suitable for an urban/rural township source, for agricultural production and for hydro-electric generation.
14	Waterways continue to contribute to a large scale hydro-electric power station (>10MW capacity).
15	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
16	Waterways are maintained in excellent condition (as per ISC and IWC assessments).

KEY FEATURES:

- **Mount Bogong** is Victorias highest peak at **1986 m** and supports some of the regions **Nationally-listed Alpine wetlands**
- The Kiewa **hydro-electric scheme** is **largest in the state** with a total capacity of **400 MW**
- The Kiewa System supports some of the most productive Agricultural landscapes in the region with a **healthy dairy and horticulture industry** due to the **reliable supply of water** for irrigation
- Recreational fishing in the Kiewa River is **popular for trout** in the **upper reaches** and **native fish** in the **lower sections**
- The community of Yackandandah, and surrounding **lifestyle oriented landscapes are a unique feature**.

Table 37 Kiewa System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
Alpine wetland complex, 76680, 76681	KIE SA: 1 KIE LA: 1.1, 1.2	1, 6, 7, 9	MO-1	Nationally-endangered ecological community, Alpine Sphagnum Bogs and Associated Fens, maintained	MA-1	Conduct surveillance and maintain pest plant control (invasive) in Priority Waterways and alpine wetlands	20 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
					MA-2	Conduct surveillance and maintain pest animal control (invasive terrestrial species) in Priority Waterways and alpine wetlands	500 ha	CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
76678, 76679	KIE SA: 1, KIE LA: 1.1, 1.2, 1.3	13, 14	MO-2	Waterways continue to contribute to a large scale hydro-electric power station	MA-4	Conduct surveillance and maintain emerging pest plant and animal control (invasive)	800 ha	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
2-5, 2-17, 2-19	KIE SA: 1 KIE LA: 1.3	3, 4, 5, 10	MO-3	Improved vegetation structure and diversity	MA-5	Establish weed control, remove (seeding willow)	85 ha*	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
					MA-6	Establish native vegetation	85 ha*	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
2-1, 2-2	KIE SA: 3 KIE LA: 1.3, 3.1, 3.2	N.A	MO-4	Maintenance and management of sediment and dynamic waterways on infrastructure	MA-7	Conduct study to investigate sources and fates of sediment, flooding and avulsion risk in Priority Waterways and Finns Creek	1 Study	CMA, DEPI, Land Managers, Research Organisations
						Establish plan in consultation to address bed instability, flooding and avulsion risk in Priority Waterways and Finns Creek.	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-9	Install waterway structure in accordance with Plan	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations

* *Assume 50% of total length of waterways*

** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

*** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 37 Kiewa System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
2-1, 2-2, 2-3	KIE SA: 2, KIE LA: 2.1, 2.2	2, 8, 11,13	MO-5	Controlled livestock access in more than 25% of waterway frontages	MA-10	Construct riparian fence in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	185 km*	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-11	Establish management agreement with landholders in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	370 ha*	CMA, DEPI, Land Managers
2-1, 2-2, 2-3, 2-4	KIE SA: 2, KIE LA: 2.1, 2.2	2, 8, 11,13	MO-6	Improved vegetation structure and diversity	MA-12	Establish pest plant controls (woody weeds) in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	200 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
2-3, 2-4, 2-5	KIE SA: 2, KIE LA: 2.1, 2.2	2, 8, 11,13	MO-7	Increased bed and bank stability at sites of active and excessive bank erosion	MA-13	Conduct study to investigate sources and fates of sediment in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	1 Study	CMA, DEPI, Land Managers, Research Organisations
					MA-14	Establish works in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	1 No.	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-15	Install waterway structure in Priority Waterways, Yackandandah Creek (2-10, 2-11, 2-12) and Running Creek (2-15, 2-16)	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
2-1, 2-2	KIE SA: 4 KIE LA: 4.1, 4.2	11, 12	MO-8	Improved connectivity of urban areas to waterways and floodplains	MA-16	Establish a Plan in consultation to connect Wodonga's Urban Landscapes and growth areas to Priority Waterways, floodplain wetlands and Middle Creek (2-8, 2-9)	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-17	Support community and associated groups to improve connectivity and access to Priority Waterways, floodplain wetlands and Middle Creek (2-8, 2-9)	3 Groups	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups
					MA-18	Establish an agreement with key stakeholders to deliver integrated water cycle management outcomes in growth areas near Priority Waterways, floodplain wetlands and Middle Creek (2-8, 2-9)	1 Agreement	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations

Continued *Table 37 Kiewa System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
2-1, 2-2	KIE SA: 4 KIE LA: 4.3	11, 12	MO-9	Improved appropriate access to waterways for recreational fishing, boating, swimming and near-waterway activities	MA-19	Conduct surveillance and maintain appropriate access in Priority Waterways and Middle Creek (2-8, 2-9) and Lower Kiewa Floodplain Wetlands	80 ha	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-20	Establish plan in consultation to improve recreation opportunities in Priority Waterways and Middle Creek (2-8, 2-9) and Lower Kiewa Floodplain Wetlands	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-21	Install waterway structure/s in accordance with plan to improve in-stream woody habitat	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
Estimated cost of activities for the Kiewa System $5,167,500**								

* *Assume 50% of total length of waterways*

** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

*** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

UPPER OVENS SYSTEM

System Description

The Upper Ovens System (Figure 23) comprises the Ovens River and tributaries upstream of the junction with the King River.

The Ovens River and its two major tributaries (Buffalo and Buckland Rivers) all rise in the Alpine National Park between Mt Hotham and Mt Cobbler. The Ovens River itself begins as two branches (east and west) near Mt. Hotham, which join and flow northwards before reaching the town of Bright. Below Bright, flowing north-west, the River is then joined by the Buckland River near Porepunkah and the Buffalo River near Myrtleford. The River continues north-west until meeting the King River at Wangaratta at the lower end of the system. Small urban centres (Harrietville, Bright, and Porepunkah) are situated along the Ovens River.

The Upper Ovens River catchment is characterised by high quality (albeit regularly fire-affected) native forests within National Park and State Forest lands and softwood forests on the slopes. Agricultural and lifestyle properties occupy the narrow valley floor.

The water regime of the Upper Ovens System is mostly natural, with flows in summer reduced by consumptive demand. The Buffalo River and Ovens River are semi-regulated downstream of the storage on the Buffalo River – Lake Buffalo. The water stored in Lake Buffalo is used to supplement flows in the mid and Lower Ovens River for irrigation and Wangaratta's water supply. In most years, there is a bulk release from Lake Buffalo to the downstream Murray System.

The importance of the connectivity of the ground and surface water resource in the upper part of the system has been recognised in the Upper Ovens Water Supply Management Plan.

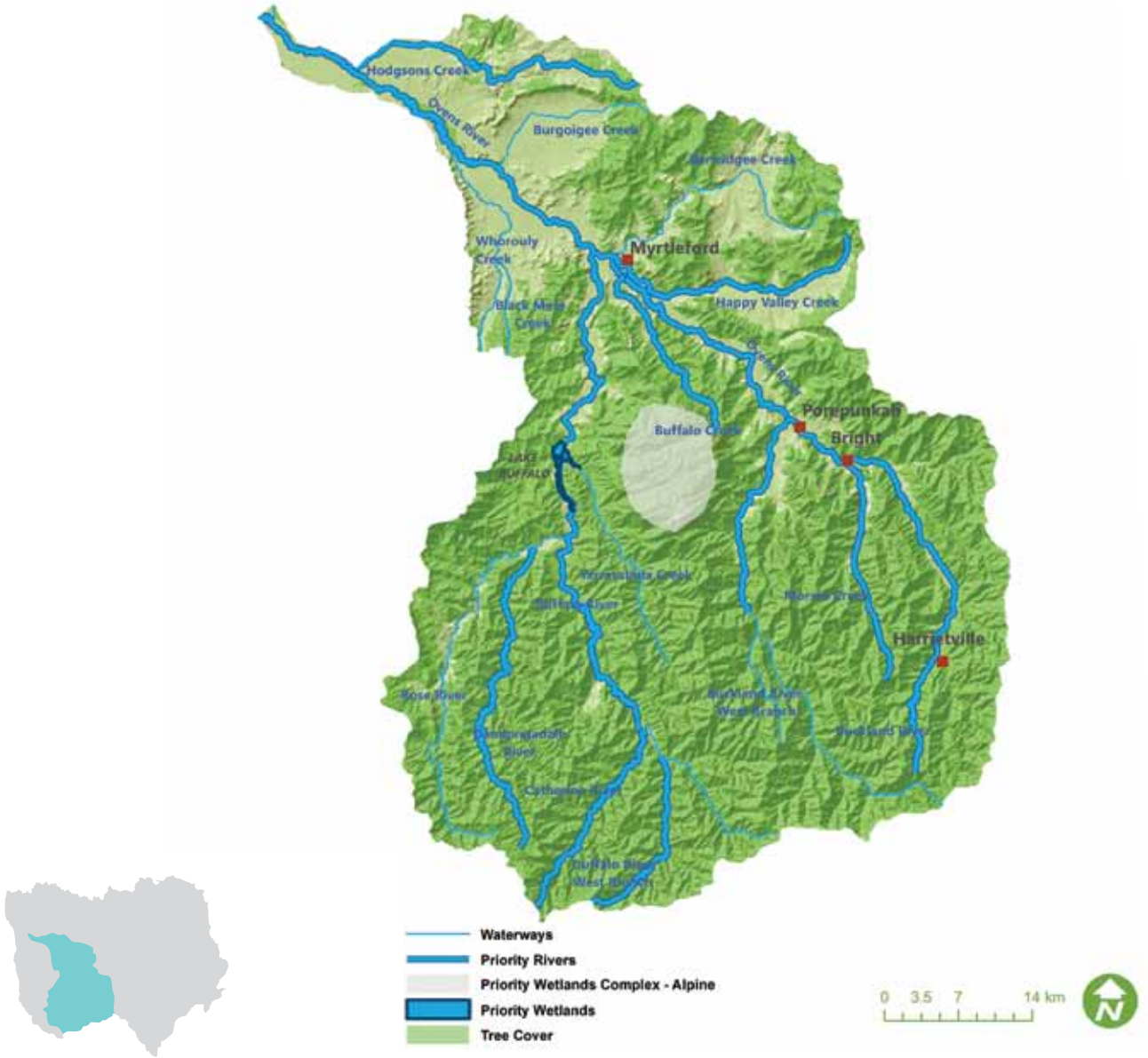


Figure 23 Upper Ovens System

Landscape lens

Alpine Landscape environments can be found on the Buffalo Plateau and Mt. Hotham. Forest Landscapes border the upper reaches of the Ovens River and its tributaries above Bright for most of their length on one or both sides.

Near Bright, cultivated lands and pine plantations begin to appear and, from Myrtleford downstream, there is more intensive agricultural production on the valley floor. The multiple valleys support a diverse array of Agriculture Landscapes, with the main land uses in the catchment being cropping, grazing for beef production, horticulture (including nuts, hops, wine grapes and apples), aquaculture and pine plantations.

The Upper Ovens System includes a number of Urban Landscapes, including Bright and Myrtleford, and numerous smaller settlements associated with waterways such as Ovens and Wandiligong. The lower part of the system abuts the eastern part of Wangaratta just above the confluence with the King River.

Lifestyle Landscapes abound throughout the system, attracting people from outside the North East including major cities.

Condition

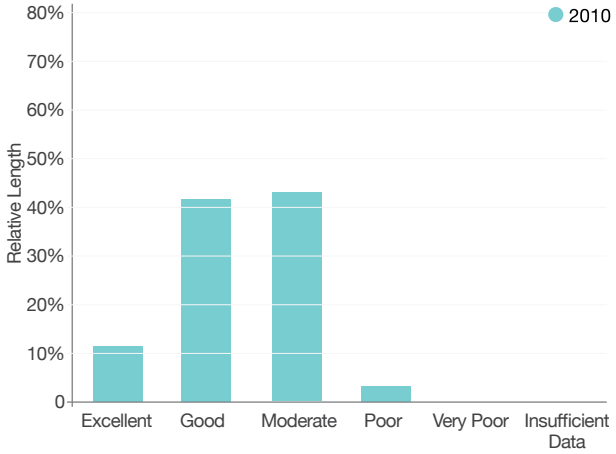


Figure 24 Stream Condition – Upper Ovens System

Values

Environmental

The conservation value, natural water regime, and the relative intactness of the majority of the Ovens River system make it unique in the Murray-Darling Basin. The high priority threatened migratory fish species Golden Perch and Murray Cod are found in the Ovens River up to Porepunkah, with Macquarie Perch in the Buffalo River catchment. Flat-Headed Galaxias, a medium priority threatened migratory fish can be found between Porepunkah and Bright in the Ovens River. Trout Cod, a high priority endangered non-migratory fish are found in the Ovens River up to Porepunkah and in the Buffalo River. The endangered Spotted Tree Frog has been found in Buffalo Creek.

Significant birds are associated with waterways and riparian zones in the valley up to Porepunkah, and Hodgson Creek and Happy Valley Creek areas, where billabongs and other wetlands are common. These include threatened species of egrets, treecreepers, parrots, kingfishers, herons, sea-eagles and cormorants. Lake Buffalo supports three species of threatened waterfowl, Freckled, Hardhead and Musk Duck. More common water-dependent species such as Azure Kingfishers are relatively abundant along the waterways.

Platypus are also relatively abundant along the waterways, due in part to the relative clarity of the water and habitat. The strip of vegetation around the waterways in the system are significant regional wildlife corridors and refuges, providing a conduit for migrating forest-woodland birds e.g. robins, whistlers, warblers and flycatchers moving between the foothill forests and the woodlands of the plains. Many species such as Dollarbirds also use this riparian habitat for breeding.

Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways. The Mount Buffalo Peatlands is one of the eight nationally important wetlands listed in the region. The macroinvertebrate community is good to excellent in larger waterways (Ovens River, Upper Buffalo River and Upper Buckland River) but generally poor in tributaries flowing through agricultural land.

Social

A large number of the waterways in the Upper Ovens System are significant areas for recreational fishing, swimming and boating. Areas scattered throughout the catchment are popular for walking, camping and sightseeing. The Australian Alps Walking Track passes across the head of the catchments and is frequently used by bushwalkers, as are the high altitude sections of the Dandongadale River, Buffalo West River and Buckland West River. The upper sub-alpine areas are particularly well known for walking, camping and four wheel driving activities, with numerous tracks in the public estate. Lake Buffalo is a regional attraction for picnics and day tourism. The Ovens Valley has a mature and well-promoted food and wine industry.

Active community involvement in the system is strong, with numerous groups engaged in supporting waterway management.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. In addition the floodplain wetlands and riverine environment of the Ovens River is significant to Aboriginal people as it was once the location of food and fibre resources. A large proportion of the Aboriginal cultural values of the Upper Ovens System are yet to be officially recorded.

Economic

Tourism associated with waterways is a major economic resource. The forest and alpine landscapes, the waterways, and Lake Buffalo, as significant features of the system, generate a significant amount of tourism such as fishing, hunting, bushwalking, rafting and four wheel driving. The large forested catchment area above Lake Buffalo, combined with high rainfall zones, yields considerable volumes of high quality water.

The availability of a secure, clean and perennial water resource drives many major economic values in the system and contributes significantly to the Murray River water resources. The reliability of the water resources from this system provides a competitive advantage, and has resulted in a large and diverse agricultural industry, primarily horticulture, grazing and dairy. Many reaches supply water for urban and rural townships as well as sources for agricultural production. Specifically, the water resources of the system are used for these urban supplies – Ovens River for Harrietville, Bright, Wandiligong, Porepunkah; Buffalo Creek for Myrtleford; Lake Buffalo for Wangaratta.

The waterways, the aesthetic appeal of the landscape, the presence of large trees, small land parcels, and limited industrial infrastructure support high land values within the system.

Major internationally recognised wineries are situated in the valley. Food and wine festivals draw thousands of visitors to the valley each year and play a significant role in the region's economic activity.

Commercial timber harvesting is currently limited to softwood plantations, particularly around the Myrtleford and Bright area and in the Buffalo River valley.

Priority Waterways

Table 38 Upper Ovens System – Priority River Reaches and Floodplains

Priority Waterway #	Name
3-4	Ovens River
3-5	Ovens River
3-6	Ovens River
3-7	Ovens River (East Branch)
3-30	Hodgsons Creek
3-31	Hodgsons Creek
3-33	Buffalo River
3-34	Buffalo River
3-36	Catherine River
3-41	Happy Valley Creek
3-42	Buffalo Creek
3-43	Buckland River
3-45	Morses Creek
3-56	Dandongadale River
3-57	Buffalo River West Branch

Table 39 Upper Ovens System – Priority Wetlands

Priority Waterway #	Name
76034	Mt Buffalo Peatlands - Crystal Bog[1]
76033	Mt Buffalo Peatlands - Crystal Bog[2]
75924	Lake Buffalo
76007	Mt Buffalo Peatlands - Bunyip Bog

Strategic Issues

- Population increase and agricultural and lifestyle land use pressures
- Maintenance and management of tourism values
- Rapid and powerful climatic events (storms, fire, floods)
- Waterways recovering from gold mining and tobacco plantations
- Integration of Lake Buffalo operation with the unregulated and groundwater allocation framework
- Dynamics of the Ovens River and avulsions (e.g. Deep Creek/Tarrawingee, Myrtleford breakaway) and
- Managing for threatened species in the Ovens River and Buffalo River.

Stressors

Table 40 Upper Ovens System - Stressors

Stressor	Waterways Impacted
Reduced summer base flows	Ovens River, Barwidgee Creek, Buffalo Creek and Happy Valley Creek
Waterway avulsions that threaten infrastructure and property	Myrtleford Breakaway, Deep Creek
Sedimentation	Ovens River, Barwidgee Creek
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing, gold mining, desnagging, gravel extraction and waterway straightening	Ovens River and tributaries
Invasive weeds	Whole of System
Introduced invasive tree species (mainly willows)	Waterways in the Agriculture and Lifestyle Landscapes
Invasive pest animals	Whole of System
Lack of in-stream habitat	Ovens River between Porepunkah and Harrietville, Lower Buffalo and Buckland Rivers
Barriers to fish passage	Ovens River (Tea Garden Creek Weir, weirs at Porepunkah and Bright), Lake Buffalo dam wall
Floodplain and wetland changed water regime	Ovens River between Porepunkah and Myrtleford, Ovens River at Markwood
Lack of conjunctive management of all water resources in connected groundwater/surface water systems	Ovens River – downstream of Buffalo River junction
Impact of climate changes on stream flows and fire frequency	Whole of System
Pressures from recreation and tourism	Whole of System
Expansion of urban boundaries	Ovens River around Bright and Myrtleford, Happy Valley Creek at Myrtleford
Conflicting land and water resource uses and associated management practices	Agriculture, Lifestyle and Forest Landscapes

The above stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated work Program for the Priority Waterways for this system are provided.

Table 41 Upper Ovens System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
UOV SA1	Protect the high value Ovens River and associated tributaries and Alpine Wetlands.	2	2	3	3	2
UOV SA2	Work with the Urban and Lifestyle Landscape communities in and around Harrietville, Bright and Myrtleford to connect urban landscapes and communities to their waterways.			1	3	3
UOV SA3	Manage the potential avulsion risk on the Ovens River.			3	3	3
UOV SA4	Protect the iconic Ovens River and associated floodplain, by undertaking targeted management activities within the Agriculture and Lifestyle Landscapes.	1	1	3	3	1

Table 42 Upper Ovens System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
UOV LA 1.1	Maintain a robust and integrated water sharing and allocation system that recognises the connection between ground and surface water resources.	1		1	Whole of system
UOV LA 1.2	Improve and build awareness of the co-benefits of waterway management.	1		1	Whole of system
UOV LA 1.3	Undertake improvements to in-stream habitat, riparian condition and fish passage.	1	1	1	Whole of system
UOV LA 1.4	Restore populations of Macquarie Perch.	1	1	1	Ovens River, Buffalo River, Lake Buffalo
UOV LA 1.5	Improve floodplain vegetation as a long-term strategy that accommodates the dynamics of the watercourses.			1	Ovens River, Buckland River, Buffalo River
UOV LA 1.6	Manage fish populations, nutrient and sediment ingress and the threats posed by pest plants and animals.	1			Ovens River, Buckland River, Buffalo River, Lake Buffalo, Rose River, Catherine River, Dandongadale River
UOV LA 1.7	Manage recreational and water resource access.	1			Ovens River, Buckland River, Buffalo River, Buffalo Creek, Lake Buffalo, Rose River, Catherine River, Dandongadale River
UOV LA 1.8	Undertake strategic water resource management that maximises all values associated with those resources.	1		1	Buffalo and Ovens River e.g. CEWO entitlement in Lake Buffalo and Ovens to Murray System transfers
UOV LA 2.1	Build awareness of the co-benefits of waterway management.	1			Ovens River, Buckland River, Buffalo River, Morses Creek, Lake Sambell, Lake Catani, Mt Buffalo Wetlands

Continued *Table 42 Upper Ovens System - Lead Actions for Priority Waterways*

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
UOV LA 2.2	Improve the recreational values of the waterways.			●	Ovens River, Buckland River, Buffalo River, Morses Creek, Lake Sambell, Lake Catani, Mt Buffalo Wetlands
UOV LA 2.3	Support the community and associated groups to build on existing community-driven efforts to improve the values of waterways.	●			Ovens River, Buckland River, Buffalo River, Morses Creek, Lake Sambell, Lake Catani, Mt Buffalo Wetlands
UOV LA 2.4	Maximise recreational fishing opportunities through appropriate management of in-stream habitat, barrier management and fish population.	●			Ovens River, Buckland River, Buffalo River, Morses Creek, Lake Sambell, Lake Catani
UOV LA 2.5	Improve public access to waterways.			●	Ovens River, Buckland River, Buffalo River, Morses Creek, Lake Sambell, Lake Catani
UOV LA 3.1	Work with the Urban, Agriculture and Lifestyle Landscape communities to better understand and manage avulsion processes.			●	Ovens River at the Myrtleford Breakaway, Deep Creek
UOV LA 3.2	Develop and implement community-based solutions to potential avulsion processes.			●	Ovens River at the Myrtleford Breakaway, Deep Creek
UOV LA 4.1	Create connected landscape scale corridors and refuges around and between the Alpine National Park, the Chiltern-Mt. Pilot National Park and Warby Ovens National Park by focusing on the waterways.			●	Whole of Region

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 43 Upper Ovens System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	The water regime in the Ovens River remains in excellent condition with adequate flows to meet environmental objectives.
2	A sustainable population of Spotted Tree Frog in Buffalo Creek is maintained with increases in distribution and abundance.
3	A sustainable population/s of Trout Cod in the Ovens River and Buffalo River is maintained.
4	Murray Cod and Golden Perch move along the Ovens River upstream of Wangaratta as part of their life cycle.
5	A sustainable population of Macquarie Perch in the Buffalo River is maintained with increases in distribution and abundance.
6	Macquarie Perch move from the Buffalo River into the Ovens River reaches down to Wangaratta as part of their life cycle.
7	The waterway and riparian zones of the Ovens River up to Porepunkah, and in Hogdson Creek and Happy Valley Creek maintain populations of high and medium priority threatened bird species.
8	A sustainable population of Flat-Headed Galaxias upstream of Porepunkah is maintained with increases in distribution and numbers.
9	Stands of significant Ecological Vegetation Classes continue to be found along many reaches in the system.
10	The aquatic invertebrate community condition meets all biological objectives for rivers and streams.
11	Waterways are maintained in excellent condition (as per ISC and IWC assessments).
12	Riparian vegetation condition is maintained in good to excellent condition.
13	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
14	Access to waterways for recreational fishing, boating, swimming and other near-waterway activities is maintained.
15	Water quality and quantity are suitable for an urban/rural township source and for agricultural production.
16	Stands of significant Ecological Vegetation Classes continue to be found around Upper Ovens wetlands.
17	Lake Buffalo continues to supports a distinct group of threatened birds, particularly three species of ducks (Freckled, Hardhead and Musk).
18	Threatened wetland flora species are secure.
19	Wetland vegetation condition is maintained in excellent condition.
20	Upper Ovens wetlands remain as significant drought refuges in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
21	Water quality and quantity in Lake Buffalo are suitable for an urban/rural township source and for agricultural production.

KEY FEATURES:

- **The Alps, Hotham Resort, Mt Buffalo and the Nationally-listed Alpine wetlands are icons** for the region and beyond.
- The relationship to waterways in the **lifestyle and urban landscapes** around Harrietville, Bright, Porepunkah and Myrtleford provide for some the **most picturesque** landscapes in Victoria
- The **diverse array of Agriculture Landscapes** support cropping, grazing, horticulture (including nuts, hops, wine grapes and apples), aquaculture and pine plantations.
- Recreational fishing is popular for **trout in the upper reaches** and **native fish in the lower sections**.

Table 44 Upper Ovens System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
3-4, 3-5, 3-6, 3-7, 3-33, 3-34, 3-41, 3-42, 3-43, 3-45, 3-56, 3-57	UOV SA: 1 UOV LA : 1.1, 1.3, 1.4, 1.7, 1.8	1, 3, 4, 5, 6, 10, 11, 13, 16, 19, 20	MO-1	Water regime retained in near-natural condition	MA-1	Implement the Upper Ovens River Streamflow Management Plan	1 Plan	CMA, Community, DEPI, Government, Land Managers, Local Councils, Water Corporations
			MO-2	Adequate water regime downstream of Lake Buffalo	MA-2	Implement Ovens System Bulk Entitlement Operating Agreement	1 Plan	CMA, Community, DEPI, Land Managers, Water Corporations
					MA-3	Establish Environmental Water Management Plan for Ovens System water shares	1 Plan	CMA, Community, DEPI, Government, Land Managers, Local Councils, VEWH, Water Corporations
3-30, 3-31	UOV SA: 1 UOV LA: 1.1, 1.2, 1.3, 1.8	1, 7, 13, 16, 19, 20	MO-3	Water resource-sharing arrangements are maintained	MA-4	Implement Local Management Rules	1 Plan	CMA, Community, DEPI, Land Managers, Water Corporations
3-5, 3-6, 3-43, 3-45, 3-56	UOV SA: 1,2,4 UOV LA: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.3, 2.4, 4.1	3, 8, 10, 13, 15	MO-4	Controlled livestock access in more than 50% of waterway frontages	MA-5	Construct riparian fence	63 km*	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-6	Establish management agreements with landholders	80 ha	CMA, DEPI, Land Managers
			MO-5	Unstable banks stabilised	MA-7	Undertake bank stabilisation works in Priority Waterways and Barwidgee Creek	10 sites	CMA, DEPI, Land Managers
			MO-6	Suitable water quality and quantity in the Ovens River	MA-8	Establish management agreements with land managers	80 ha	CMA, DEPI, Land Managers
			MO-7	Improved vegetation structure and diversity	MA-9	Establish control of pest plants to less than 10% cover (invasive species - seeding willows - Black and Pussy)	63 ha*	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
3-5, 3-6, 3-43,	UOV SA: 1, 2, 4 UOV LA: 1.2, 1.3, 1.5, 1.6, 2.1, 2.2, 2.3, 2.5, 4.1	7, 12, 14	MO-8	Impact of pest plant (invasive shrub species) and animal species decreased	MA-10	Establish control of pest plants (terrestrial shrub flora - blackberries)	40 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
3-5, 3-6	UOV SA: 1, 2 UOV LA: 1.2, 1.3, 1.5, 1.6, 2.1, 2.2, 2.3, 2.5	7, 9, 10, 12, 13, 15,	MO-9	Decrease the impact of pest plant and animal species (invasive terrestrial species)	MA-11	Establish control of pest animals (invasive terrestrial species)	40 ha	CMA, DEPI, Government

* *Assume half the reach length*

** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

*** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 44 Upper Ovens System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
3-5, 3-6, 3-56	UOV SA: 1, 2 UOV LA: 1.1,	3, 4, 8, 10, 11, 13, 15	MO-10	Improved fish passage for desirable species	MA-12	Establish feasible works and operating plans for weirs (Bright No. 2 and Porepunkah Weirs and stream gauge)	3 plans	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
			MO-11	Improved large in-stream wood habitat	MA-13	Establish in-stream habitat	6 sites	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
3-57	UOV SA: 1 UOV LA: 1.2, 1.3, 1.4, 1.6, 2.1	9, 12, 21	MO-12	Reduced impact from pest plants	MA-14	Conduct surveillance and control of new and emerging pest (invasive) plants with key agencies	28 ha	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-15	Establish surveillance and control of new and emerging pest (invasive) plants with volunteers	28 ha	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups
3-5, 3-6, 3-41	UOV SA: 1, 2 UOV LA: 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 2.3, 2.4, 2.5, 3.1, 3.2, 4.1, 4.2	3, 4, 7, 8, 9, 10, 14, 15	MO-13	Improved connectivity of urban areas to waterways and floodplains	MA -16	Establish a plan in consultation to connect Urban Landscapes and growth areas to Priority Waterways, floodplain wetlands and Barwidgee Creek (1-39) - around Bright, Porepunkah and Myrtleford	3 plans	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA -17	Support community and associated groups to improve connectivity and access to Priority Waterways, floodplain wetlands	4 Groups	CMA, Community, Community Groups, DEPI, Land Managers
					MA - 18	Establish an agreement with key stakeholders to deliver integrated water cycle management outcomes in growth areas near Priority Waterways and floodplain wetlands	1 Agreement	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups CMA, DEPI, Land Managers

Continued *Table 44 Upper Ovens System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
3-4, 3-30, 3-31	UOV SA: 1, 2, 4 UOV LA: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.3, 2.4, 4.1	3, 7, 9, 10, 12, 13, 14, 15	MO -14	Suitable water quality and quantity in the Ovens River	MA-19	Establish management agreements with land managers	20 ha	CMA, DEPI, Land Managers
			MO -15	Controlled livestock access in more than 50% of waterway frontages	MA-20	Construct riparian fence	15 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-21	Establish management agreements with landholders	40 ha	CMA, DEPI, Land Managers
			MO -16	Improved vegetation structure and diversity	MA-22	Establish pest plant control to less than 10% cover (invasive species - seeding willows - Black and Pussy)	26 ha	CMA, DEPI, Land Managers
			MO -17	Decreased impact of pest plant and animal species (invasive shrub species)	MA-23	Establish pest plant control (terrestrial shrub flora -blackberries)	10 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO -18	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-24	Establish pest animal control (invasive terrestrial species)	10 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
3-4, 3-5, 3-33	UOV SA: 1, 2 UOV LA: 1.1,	3, 4, 5, 6,	MO -19	Improved fish passage for desirable species (Trout Cod, Murray Cod, Macquarie Perch)	MA-25	Establish feasible works and operating plan for Tea Garden Creek Weir on Ovens River	1 Plan	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
			MO -20	Improved appropriate access to waterways for recreational fishing, boating, swimming, and near waterway activities	MA-26	Develop and implement Management Plans for recreational activities (e.g. fishery for Trout Cod in the Ovens River and its tributaries)	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
3-33, 75924, 3-36	UOV SA: 1, 2, 4 UOV LA: 1.1, 1.2,1.3, 1.4, 1.6, 1.7, 2.1, 2.3, 2.4, 4.1	3, 5, 6, 9, 10, 11, 12, 17, 21	MO-21	Adequate water regime downstream of Lake Buffalo	MA-27	Implement Ovens System Bulk Entitlement Operating Agreement	1 Agreement	CMA, DEPI, Water Corporations
					MA-28	Implement Ovens System Bulk Entitlement Operating Agreement	1 Plan	CMA, DEPI, Water Corporations
			MO -22	Suitable water quality and quantity in the Buffalo River	MA-29	Establish management agreements with land managers	10 ha	CMA, DEPI, Land Managers

* *Assume half the reach length*

** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

*** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 44 Upper Ovens System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners***
			MO -23	Controlled livestock access in more than 50% of waterway frontages	MA-30	Construct riparian fence on Priority Waterways and Rose River (3-37, 3-38) and Dandongadale River (3-56)	6 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-31	Establish management agreements with landholders	10 ha	CMA, DEPI, Land Managers
			MO-24	Improved vegetation structure and diversity	MA-32	Establish management agreements with land managers around Lake Buffalo and Buffalo River	30 ha	CMA, DEPI, Land Managers, Water Corporations
76034, 76033, 76007	UOV SA: 1 UOV LA: 1.2,1.3, 1.7	11, 16, 18, 19, 20	MO-25	Nationally-endangered ecological community, Alpine Sphagnum Bogs and Associated Fens, maintained	MA-33	Conduct surveillance and maintain control of pest (invasive) plants - seeding willows (Black and Pussy)	20 ha	CMA, DEPI, Land Managers, Water Corporations CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
			MO-26	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-34	Conduct surveillance and maintain control of pest animals (invasive terrestrial species)	100 ha	CMA, DEPI, Land Managers, Water Corporations CMA, Community, Community Groups, DEPI, Government, Indigenous Peoples and Bodies, NRM Organisations, Peak Body Groups, PV, Research Organisations
3-42	UOV SA: 1 UOV LA: 1.1,1.2, 1.3,	2, 9, 12, 13, 15, 18,	MO-27	Improved vegetation structure and diversity	MA-35	Establish pest plant control to less than 10% cover (invasive species - seeding willows - Black and Pussy)	14 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups, PV
			MO-28	Decreased impact of pest plant (invasive shrub species) and animal species	MA-36	Establish pest plant control (terrestrial shrub flora -blackberries)	10 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups, PV
3-4, 3-5, 3-6, 3-43, 3-45, 76034, 76033, 76007	UOV SA: 2, 4 UOV LA: 2.1, 2.2, 2.3, 2.4, 2.5	9, 14, 16, 19	MO-29	Improved appropriate access to waterways for recreational fishing, boating, swimming, and near waterway activities	MA-37	Implement Management Plans to improve the recreational values of the waterways on Priority Waterways and Lake Catani	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
Estimated cost of activities for the Upper Ovens System $10,467,500**								

* *Assume half the reach length*

** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

*** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

KING SYSTEM

System Description

The King System (Figure 25) includes all of the catchment of the King River upstream of the confluence with the Ovens River.

The King River rises on the slopes of Mt Buggery in the Great Dividing Range and initially flows north-westwards until it flows into Lake William Hovell. Over this length, the river forms the border of the Alpine National Park. Below Lake William Hovell, the river turns roughly northwards and flows through a narrow valley to the town of Moyhu where the valley opens out.

The landscape of the Upper King River upstream of Edi is characterised by fertile river flats and a fast moving, cobble-based river bed. This area contains many of the valley's vineyards, as well as dairy operations, cattle grazing and fodder production areas. Historically, much of this valley was utilised for tobacco production, which was a large and profitable industry for several decades until its closure in 2008.

The River then continues north until joining with the Ovens River in Wangaratta. In the narrower part of the valley from Lake William Hovell to Moyhu, the river flats are largely cleared and utilised for a variety of agricultural purposes, both grazing and high value specialised horticulture (e.g. grapes, berries and chestnuts). There are also several large dairy operations between Whitfield and Moyhu.

Major tributaries include Evans Creek upstream of Lake William Hovell, and the King River West Branch, Hurdle Creek, Boggy Creek, Black Range Creek and Factory Creek downstream of the Lake.

Figure 25 King System

Landscape lens

The King River valley is renowned for Lifestyle Landscapes, with rural lifestyle properties close to the Urban Landscape of Wangaratta. Food and wine tourism, water-based recreation (e.g. fishing), and scenic Agriculture and Forest Landscapes are found throughout the valley. At the lower end, the River forks east and west and flows beside the Urban Landscape of Wangaratta. The eastern fork is bounded by a levee bank which protects urban properties in the Wilson Road area and the western fork traverses below houses to the east of Murdoch Road.

The wide floodplain below Moyhu is almost entirely cleared for agriculture, predominantly cattle grazing with occasional vineyards. Lifestyle Landscapes are scattered throughout the system. Land with a connection to a waterway within commuting distance of Wangaratta (e.g. Oxley and Milawa) is in particular demand for rural living.

The steeper sides of the valleys remain in Forest Landscapes. Forests also dominate upstream of Lake William Hovell, with the very upper section of the system lying in the sub-Alpine Landscape.

Condition

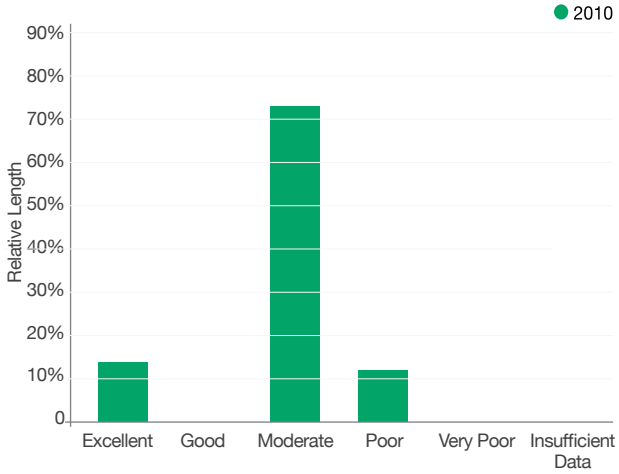


Figure 26 Index of Stream Condition – King System

Values

Environmental

Koetong Creek, Cudgewa Creek, Corryong Creek and high priority threatened migratory fish, including Murray Cod, are regularly encountered as far upstream as Lake William Hovell, with historical references to them occurring well above the current location of the lake. The endangered Trout Cod has been recently recorded as far upstream as Whitfield, although is more common in lower reaches of the King River. The endangered Macquarie Perch, once common throughout the system, is still recorded infrequently in the reaches immediately around Lake William Hovell. The endangered Growling Grass Frog has been found in the mid-reaches upstream of Cheshunt.

Significant water-dependent birds are found in the wetlands and riparian areas in all reaches, for example, species of egrets, shovelers, bitterns, geese and treecreepers, kingfishers, herons and sea-eagles lower down in the system, and White-Bellied Sea Eagles in the upper reaches associated with Lake William Hovell. Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways.

The more or less continuous strip of River Red Gum woodland, and associated larger patches of aquatic vegetation, provides a significant regional wildlife corridor – a conduit for migrating forest woodland birds e.g. robins, whistlers, warblers and flycatchers moving between the foothill forests and the woodlands of the plains. Many species (e.g. Dollarbirds) also use this riparian habitat for breeding. One of the best and most publicly accessible examples of the riparian vegetation is the old-growth Kaluna woodland on the edge of Wangaratta where the east and west forks of the King River converge.

The macroinvertebrate community in the King River varies from excellent to very poor. The native fish community of the system are only in moderate condition due to many possible causes such as in-stream habitat quality. The bed of the Upper King River and its tributaries is made up of large cobbles and river rocks. It only becomes sandy and silty in the downstream areas of this system. Along with other factors this contributes to a very strong connection between the ground and surface water resources, a good habitat for smaller native fish species, and a dynamic river in the mid-reaches.

Social

A large number of the waterways in the King River system are significant areas for recreational activities such as fishing, swimming, rafting and boating; and popular areas for walking and camping are scattered throughout the catchment. The upper sub-alpine areas are particularly well known for walking, deer-stalking, camping and four wheel driving activities, with numerous tracks crossing the Upper King River and Evans Creek. Lake William Hovell is a regional attraction for picnics and day tourism.

Community involvement in the system is strong, with many active community groups engaged in supporting waterway management.

The King Valley has a mature and well-promoted food and wine industry. Major internationally-recognised wineries are situated in the valley. Food and wine festivals draw thousands of visitors to the valley each year.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. In addition, the floodplain wetland and riverine environment of the King River is significant to Aboriginal people as it was once the location of the significant resources (e.g. food and fibre). A large proportion of the Aboriginal cultural values of the King System is yet to be officially recorded.

Economic

The Forest Landscape above and immediately below Lake William Hovell is a highly significant feature of the system and generates a significant amount of tourism through activities such as fishing, hunting, bushwalking, rafting and four wheel driving. The large forested catchment area above Lake William Hovell, combined with high rainfall zones, yields considerable volumes of high quality water.

The King River and Lake William Hovell supply water for urban (Whitfield, Moyhu and Oxley) and rural uses along the King River from Cheshunt to Wangaratta. The availability of a secure and perennial water supply drives many major economic values in the system. The significant and reliable nature of the numerous water resources supports a diverse array of agricultural production systems such as dairy, horticulture and grazing. Opportunistic hydro-electric power generation at Lake William Hovell will continue to be an important contributor to the grid.

The King River Valley offers the first major river system with ready access to upland river-related recreational pursuits easily accessed from the Hume Freeway for people travelling northwards from Melbourne. Activities such as trout fishing, four wheel driving, rafting, bushwalking and deer-stalking, combined with the picturesque nature of the Valley and the reputation of its food and wine industry, draw large numbers of people from within and outside the Valley.

Lifestyle-based tourism associated with waterways is another major economic source in the system, including for service towns such as Whitfield and Oxley. The waterways, the aesthetic appeal of the landscape, the presence of large trees, small land parcels, and limited industrial infrastructure support high land values within the system.

The commercial timber harvesting in the Bungamero softwood plantation located in the Hurdle Creek sub-catchment is another economic resource.

Priority Waterways

Table 45 King System – Priority River Reaches and Floodplains

Priority Waterway #	Name
3-21	King River
3-22	King River
3-23	King River
3-24	King River
3-25	King River
3-28	Boggy Creek

Table 46 King System - Priority Wetlands

Priority Waterway #	Name
75049	Lake William Hovell

Strategic Issues

- Seeding willows in forested landscapes of the Upper King River
- Operation of Lake William Hovell and integration of water resource allocation frameworks
- Dynamic waterways and associated agricultural production on the floodplain
- Avulsion in Lower King River into Croppers Creek and
- Managing for threatened species in the King River and associated floodplain wetlands.

Stressors

Table 47 King System - Stressors

Stressor	Waterways Impacted
Stream power in steep catchments	Upper King River
Elevated flows in summer to match irrigation demands	King River downstream of Lake William Hovell
Reduced summer base flows	Hurdle Creek, Boggy Creek
Waterway avulsions that threaten infrastructure and property	King River, Croppers Creek at Oxley
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing, desnagging and waterway straightening	Lower King River, Black Range Creek, Boggy Creek
Changed geomorphology following the 1993 floods	Black Range Creek, Hurdle Creek, Boggy Creek
Invasive weeds	Whole of System
Introduced invasive tree species (mainly willows)	Waterways in the Agriculture and Lifestyle Landscapes
Invasive pest animals	Whole of System
Barriers to fish passage	King River (Lake William Hovell), King River at Docker gauge
Floodplain and wetland changed water regime	King River
Impact of climate changes on stream flows and fire frequency	Whole of System
Pressures from recreation and tourism	Whole of System
Expansion of urban boundaries	King River at Wangaratta
Conflicting land and water resource uses and associated management practices	Agriculture and Lifestyle Landscapes

The listed stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided.

Table 48 King System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
KIN SA1	Support targeted protection of the iconic waterways in the Forest Landscape through the management of the threats posed by seeding willow on waterways.		💧💧💧			
KIN SA2	Explore the dynamic nature of the King River and Upper King River tributaries with the Agriculture and Lifestyle Landscape communities to develop a robust and enduring management arrangement that works with the biophysical, land tenure, waterway and floodplain functions (e.g. connectivity, storage and capacity).			💧💧💧	💧💧💧	
KIN SA3	Manage the potential avulsion risks in the lower sections of the system.			💧💧💧	💧💧💧	💧💧
KIN SA4	Undertake a targeted and integrated catchment management approach within the Agriculture and Lifestyle Landscapes to protect the high value King River and Boggy Creek.			💧💧💧	💧💧💧	

Table 49 King System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
KIN LA 1.1	Work in partnership with key agencies and research organisations to eradicate seeding willow.	💧		💧	Upper King River above and including Lake William Hovell
KIN LA 1.2	Build volunteer participation in the Seeding Willow Eradication Program.	💧			Upper King River above and including Lake William Hovell
KIN LA 2.1	Develop and run a process that creates community-based solutions to the issues caused by dynamic rivers.	💧		💧	Upper King River, Black Range Creek, Boggy Creek
KIN LA 2.2	Develop strategies to minimise the impacts of stream power and flooding on infrastructure, avulsion threats, improve stream health and stabilise sediment loads.			💧	Upper King River, Black Range Creek, Boggy Creek
KIN LA 3.1	Work with the Urban, Agriculture and Lifestyle Landscape communities to better understand and manage avulsion processes.	💧		💧	King River, Croppers Creek, Boggy Creek
KIN LA 3.2	Develop and implement community-based solutions to potential avulsion processes.			💧	King River, Croppers Creek, Boggy Creek
KIN LA 4.1	Improve and build awareness of the co-benefits of waterway management.	💧			King River, major tributaries of King River (e.g. Boggy and Hurdle Creeks)
KIN LA 4.2	Undertake improvements to in-stream habitat, riparian condition and fish passage.			💧	King River, major tributaries of King River (e.g. Boggy and Hurdle Creeks)

Continued *Table 49 King System - Lead Actions for Priority Waterways*

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
KIN LA 4.3	Improve floodplain vegetation as a long-term strategy that accommodates the dynamics of the watercourses.			●	King River, major tributaries of King River (e.g. Boggy and Hurdle Creeks)
KIN LA 4.4	Manage nutrient and sediment ingress and the threats posed by pest plants and animals.	●			King River, major tributaries of King River (e.g. Boggy and Hurdle Creeks), Lake William Hovell
KIN LA 4.5	Manage recreational and water resource access.	●			King River, major tributaries of King River (e.g. Boggy and Hurdle Creeks), Lake William Hovell
KIN LA 4.6	Undertake strategic water resource management that maximises all values associated with those resources.	●			King River eg CEWO entitlement in Ovens System

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

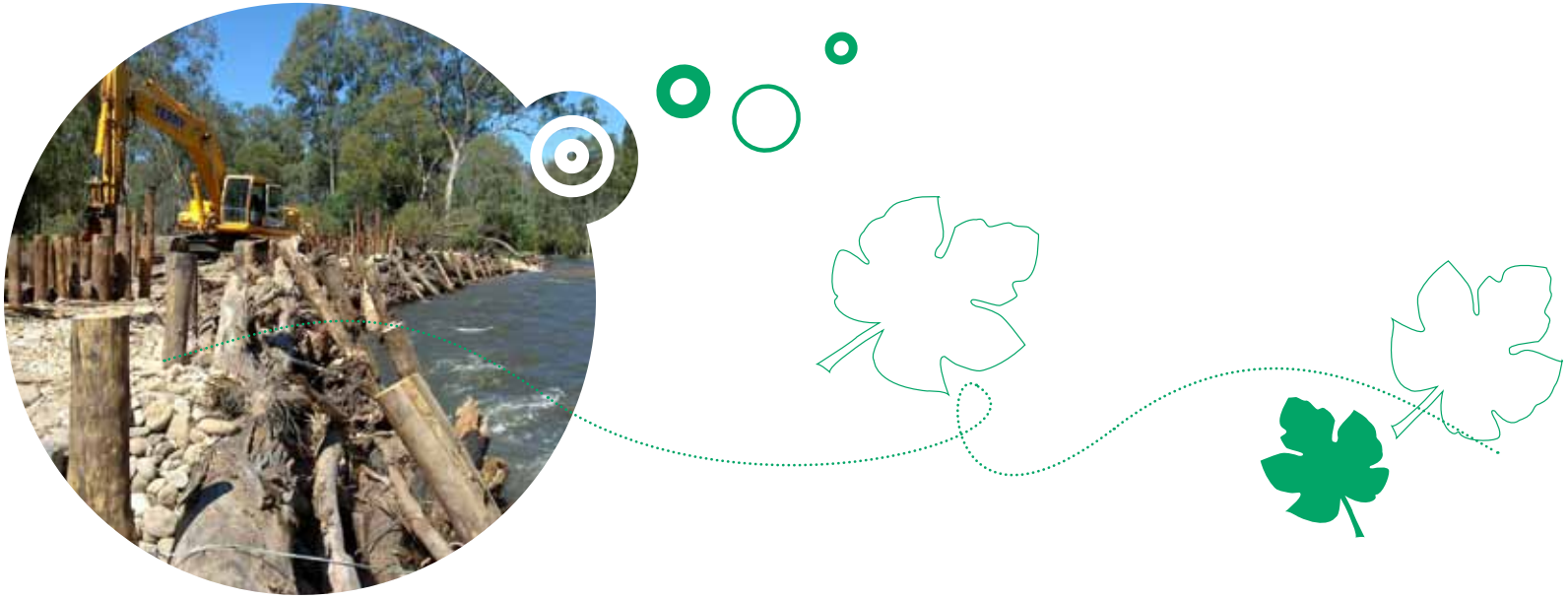


Table 50 King System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	Murray Cod and Macquarie Perch move from King River to the Ovens River and other directly connected waterways as part of their life cycle.
2	A sustainable population of Growling Grass Frog upstream of Cheshunt is maintained.
3	Populations of high and medium priority threatened bird species (Australasian Shoveler, Magpie Goose, Eastern Great Egret, Brown Treecreeper, Little Bittern) are found in waterways and riparian zones.
4	Stands of significant Ecological Vegetation Classes continue to be found along reaches and wetlands.
5	Recreational fishing remains popular and is sustainable.
6	Access to waterways for boating, and near-waterway activities is maintained.
7	Water quality and quantity are suitable as an urban/rural township source and for agricultural production.
8	Riparian vegetation condition is maintained in good to excellent condition.
9	Drought refuges remain in place and are in a suitable condition to protect a wide range of taxa through dry periods.
10	The aquatic invertebrate community condition meets all biological objectives for rivers and streams.
11	Waterways are maintained in excellent condition (as per ISC and IWC assessments).

KEY FEATURES:

- The **Agricultural landscapes are diverse** with fertile river flats and hills supporting **vineyards, dairy, grazing** and **fodder production**.
- The fast moving, cobble-based river beds in the valley floor are **highly dynamic** and **support strong fisheries and Agriculture**.
- **Lifestyle-based tourism** associated with waterways is another **major economic source** in the system, including for service towns such as Whitfield and Oxley.

Table 51 King System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners****
75049, 3-25	KIN SA: 1 KIN LA: 1.1, 1.2	4, 10, 11	MO-1	Reduced impact from pest plants	MA-1	Conduct surveillance and control of new and emerging pest (invasive) plants with key agencies	20 km	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
					MA-2	Establish surveillance and control of new and emerging pest (invasive) plants with volunteers	20 km	CMA, Community, Community Groups, DEPI, Government, NRM Organisations, Peak Body Groups, PV, Research Organisations
75049, 3-21, 3-22, 3-23, 3-24, 3-25	KIN SA: 4 KIN LA: 4.4, 4.5	5, 6	MO-2	Decreased impact of pest plant and animal species (invasive aquatic species)	MA-3	Establish pest animal control (invasive aquatic species)	150 km*	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
75049, 3-23, 3-24, 3-25	KIN SA: 4 KIN LA: 4.4, 4.5	5, 6	MO-3	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-4	Establish pest animal control (invasive terrestrial species)	190 ha*	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
3-23, 3-24, 3-25	KIN SA: 2 KIN LA: 2.1, 2.2	4, 5, 6, 7, 8, 9, 10	MO-4	Maintenance and management of dynamic waterways	MA-5	Investigate sources and rates of sediment, flooding and avulsion risk in Priority Waterways and Boggy Creek (3-27, 3-28), Black Range Creek (3-29) and King River West Branch (3-53)	1 No.	CMA, DEPI, Land Managers, Research Organisations
					MA-6	Establish plan in consultation to address bed instability, flooding and avulsion risk in Priority Waterways and Boggy Creek (3-27, 3-28), Black Range Creek (3-29) and King River West Branch (3-53)	1 No.	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-7	Implement in accordance with plan	NA	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
3-21, 3-22, 3-28	KIN SA: 3 KIN LA: 3.1, 3.2	4, 5, 6, 7, 8, 9, 10	MO-5	Maintenance and management of dynamic waterways	MA-8	Investigate sources and rates of sediment and avulsion risks in Priority Waterways and Croppers Creek and Boggy Creek (3-27, 3-28)	1 No.	CMA, DEPI, Land Managers, Research Organisations
					MA-9	Establish plan in consultation to manage avulsion risks in Priority Waterways and Croppers Creek and Boggy Creek (3-27, 3-28)	1 No.	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA-10	Implement in accordance with plan	NA	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations

* *Total length of reach x 20m (10m either side)*

** *75% of total reach length*

*** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

**** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 51 King System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners****
3-21, 3-22, 3-23, 3-24, 3-25, 3-28	KIN SA: 2, 4 KIN LA: 2.2, 4.1, 4.2, 4.3, 4.4	2, 3, 7, 8, 10	MO-6	Controlled livestock access in more than 75% of waterway frontages	MA-11	Construct riparian fence in Priority Waterways, Hurdle Creek (3-26) and Boggy Creek (3-27, 3-28)	180 km**	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-12	Establish native vegetation in Priority Waterways, Hurdle Creek (3-26) and Boggy Creek (3-27, 3-28)	720 ha**	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-13	Establish management agreement with landholders in Priority Waterways, Hurdle Creek (3-26) and Boggy Creek (3-27, 3-28)	720 ha**	CMA, Land Managers
3-22, 3-23, 3-24	KIN SA: 4 KIN LA: 4.2	1	MO-7	Improved fish passage for desirable species	MA-14	Conduct study to investigate impact of barrier at stream gauging station 403/1-28/B0025 on fish passage	1 Study	CMA, DEPI, Research Organisations, Water Corporations
					MA-15	Establish feasible works in accordance with investigation recommendations	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
3-22, 3-23, 3-24	KIN SA: 4 KIN LA: 4.2, 4.3, 4.5, 4.6	1, 3, 9	MO-8	Adequate water regime downstream of Lake William Hovell	MA-16	Implement Ovens System Bulk Entitlement Operating Agreement	1 Agreement	CMA, DEPI, Water Corporations
					MA-17	Establish Environmental Water Management Plan	1 Plan	CMA, Community, DEPI, Government, Land Managers, Local Councils, VEWH, Water Corporations
75049, 3-21, 3-22, 3-23, 3-24, 3-25, 3-28	KIN SA: 4 KIN LA: 4.5	5, 6	MO-9	Appropriate access to waterways maintained for recreational fishing, boating, swimming and near-waterway activities	MA -18	Conduct surveillance and maintain appropriate access in Priority Waterways, Hurdle Creek (3-26) and Boggy Creek (3-27, 3-28)		CMA, Community, DEPI, Government, Land Managers, Local Councils, VEWH, Water Corporations, PV
Estimated cost of activities for the King System* $5,962,500**								

* *Total length of reach x 20m (10m either side)*

** *75% of total reach length*

*** *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour were used to inform the estimate.*

**** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

LOWER OVENS SYSTEM

System Description

The Lower Ovens System (Figure 27) comprises the Ovens River and associated tributaries downstream of Wangaratta. The major tributaries include the west flowing Reedy Creek and north-west flowing Fifteen Mile Creek. Collectively, these tributaries and the upstream Ovens and King Rivers, influence the structure and function and, in particular, the response to stressors within the Lower Ovens system.

The area where the headwaters of the Fifteen Mile Creek rise is dominated by hardwood logging coupes in native forests and softwood plantations (*Pinus radiata*). The balance of forests is in State Forest and in private land. All of the Upper Fifteen Mile Creek Forest Catchment was severely burnt during the drought year bushfires of 2006-07. This has had a lasting impact on the catchment in terms of vegetation change and sediment contribution. After the fires, the softwood plantations were mass cleared and replanted.

The Lower Ovens River from Killawara to Lake Mulwala was declared a Heritage River due to the quality of the River Red Gum forests which surround much of the lower section, the scenery, the significant fauna, the recreational fishing opportunities (e.g. Murray Cod), and the high diversity of the native fish communities. The river is one of the largest semi-unregulated waterways in the State. This section of the River has also been declared a Wetland of National Importance.

The floodplain surrounding the Ovens River is relatively flat, with numerous billabongs and anabranches around Bundalong, Peechelba and Killawarra. The whole Lower Ovens wetland complex is listed on the Directory of Important Wetlands in Australia. It is partly encompassed in the Warby-Ovens National Park which was created in June 2010 to assist in protecting and enhancing the remaining River Red Gum forests in Victoria.

Figure 27 Lower Ovens System

Landscape lens

Wangaratta represents the largest urban centre in the Lower Ovens System and the second largest within the North East region. Agriculture Landscapes (mostly grazing) dominate in the upper part of the system along the Ovens River near Wangaratta and much of the Reedy Creek and Fifteen Mile Creek. With distance downstream, the floodplain narrows and retains a more natural vegetation cover where flooding is more common and other land uses are less viable. The lower part of the Ovens System is mostly Forest Landscape dominated by River Red Gums. The Lifestyle Landscapes are well represented across the system, with scenic landscapes and recreation opportunities, and land around waterways within commuting distance of Wangaratta in demand. People from outside the system travel extensively across the system to take advantage of the lifestyle opportunities. Wangaratta's targeted future growth areas are in this system, focused around the waterways on the western and southern edge of Wangaratta.

Condition

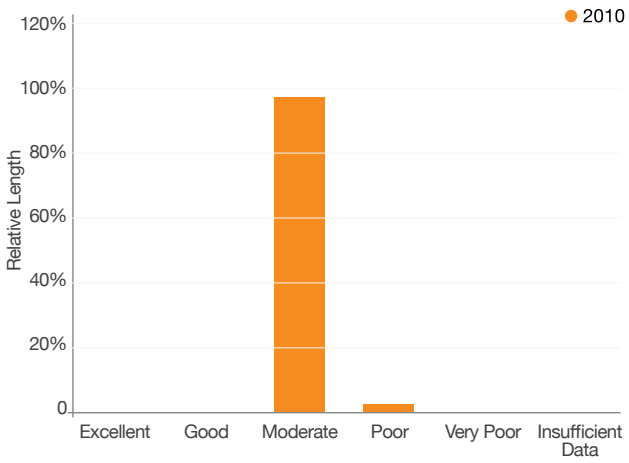


Figure 28 Index of Stream Condition – Lower Ovens System

Values

Environmental

High priority threatened migratory fish, including Murray Cod, Golden Perch and Fly-specked Hardyhead move from the Murray River into the Ovens River reaches up to Wangaratta as part of their life cycle. The largely non-migratory endangered Trout Cod is also found in the Lower Ovens River. Golden Perch is also found in a number of wetlands.

The wetlands, particularly at Bundalong South, and riparian zones throughout the system contain populations of threatened bird species such as egrets, herons, cormorants, bitterns and treecreepers. Near the Murray River, high priority threatened frogs (Giant Bullfrog and Growling Grass Frog) are associated with the river and surrounding wetlands.

The Ovens Heritage River is one of the eight nationally important wetlands listed in the region.

Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The relatively intact River Red Gum canopy associated with Lower Ovens River is considered one of the healthiest in the Murray-Darling Basin.

The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways.

Due to the poor condition of the macroinvertebrate community (except in the upper reaches of Fifteen Mile Creek) and the numerous stressors on the wetlands, none of the reaches or wetlands can be considered as in natural or near-natural condition. The fish communities of the river reaches are only in moderate condition, although the quality of the riparian vegetation is generally high.

Social

The system attracts people from both within and outside the area taking advantage of the recreational pursuits associated with the waterways in the system such as fishing, boating, kayaking, water skiing and bushwalking. The Ovens River is particularly popular for recreational fishing and the Lower Ovens/Murray River weir pool associated with Lake Mulwala is one of the best fishing locations in the State. Wetlands in the lower reach are also popular boating and swimming areas.

Community involvement in the System is strong, with active community groups engaged in supporting waterway management.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scarred trees and artefact scatters. The township name 'Wangaratta' has its origins in indigenous language meaning 'meeting of the waters'. Another commonly understood meaning is "where the cormorants stand" hence the stylised cormorant on the Rural City of Wangaratta's logo. The floodplain wetland and riverine environment of the Ovens River is significant to Aboriginal people as it was once the location of the significant resources (e.g. food and fibre). A large proportion of the Aboriginal cultural values of the Lower Ovens System are yet to be officially recorded.

Economic

The availability of a secure, clean and perennial ground and surface water resource drives many major economic values in the system, and the Ovens System contributes significantly to the water resources of the Murray River. The water that flows out of the Ovens System is regulated by the largest weir pool on the Murray regulated river systems, Lake Mulwala. These water resources contribute significantly to the reliability and the variability of the water regime for the Murray River, and support many downstream uses (e.g. irrigation, urban supply, and watering of environmental icon sites such as Barmah-Millewa Forest).

The Ovens River and its major tributaries supply water for urban and rural townships such as Wangaratta, Milawa, Glenrowan and Peechelba. Beechworth also sources its town water supply from a Lower Ovens River tributary (Spring Creek). The reliability of the water supply provides a competitive advantage and supports a diversity of agricultural enterprises.

The waterways, the aesthetic appeal of the landscape, the presence of large trees, small land parcels, and limited industrial infrastructure support high land values within the System.

Recreation-based tourism, in particular, recreational fishing and water-skiing in the Lower Ovens System, is a major economic contributor to the North East.

Priority Waterways

Table 52 Lower Ovens System – Priority River Reaches and Floodplains

Priority Waterway #	Name
3-1	Ovens River
3-2	Ovens River
3-3	Ovens River
3-8	Fifteen Mile Creek
3-10	Fifteen Mile Creek

Table 53 Lower Ovens System - Priority Wetlands

Priority Waterway #**	Name
75153	LORWC* – Lower Ovens 1 (Bundalong)
75156	LORWC* – Lower Ovens 2 (Bundalong)
75154	LORWC* – Lower Ovens 3 (Bundalong)
75158	LORWC* – Lower Ovens 4 (Bundalong South)
75162	LORWC* – Lower Ovens 5 (Bundalong South)
75164	LORWC* – Lower Ovens 6 (Bundalong South)
75166	LORWC* – Puzzle Bend
75170	LORWC* – Lords Bend
75178	LORWC* – Talbots Bend
75432	LORWC* – Lower Ovens 10 (Peechelba Nth)
75192	LORWC* – Lower Ovens 11 (Peechelba Nth)
75200	LORWC* – Lower Ovens 12 (Peechelba Nth)
75205	LORWC* – Lower Ovens 13 (Peechelba Nth)
75211	LORWC* – Lower Ovens (Boorhaman)
75232	LORWC* – Lower Ovens (Killawarra) 2
75220	LORWC* – Lower Ovens (Killawarra) 1
	LORWC* – Lake Mulwala Weir Pool
	LORWC* – Woods Bend
	LORWC* – Parolas Bend
427894	Spring Soak
289007	Shallow Marsh
311119	Deep Marsh

* *LORWC - Lower Ovens River Wetland Complex*

** *Some Priority Waterways do not have unique number identifiers.*

Strategic Issues

- Management of the Heritage-listed Ovens River for its major use (e.g. recreation) and environmental values (eg the largest wetland complex in the North East) including the tributaries as these are major stressors (e.g. sediment)
- Building resistance around the Heritage-listed Ovens River to maintain and improve landscape-scale connections (e.g. vegetation and hydrology) and
- Urban growth around creeks and the Heritage-listed Ovens River and the associated community connection with waterways.

Stressors

Table 54 Lower Ovens System - Stressors

Stressor	Waterways Impacted
Sedimentation	Ovens River, Fifteen Mile Creek, One Mile Creek
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing, gold mining, drainage schemes, waterway straightening and weir structures	Fifteen Mile Creek, Reedy Creek
Invasive weeds	Whole of System
Introduced invasive tree species	Waterways in the Agriculture, Lifestyle and Urban Landscapes
Degraded riparian tree communities	Lower Fifteen Mile Creek, Reedy Creek
Invasive pest animals	Whole of System
Barriers to fish passage	Ovens River at Wangaratta, Lower Fifteen Mile Creek, Lower Reedy Creek.
Floodplain and wetland changed water regime	Ovens floodplain and wetlands
Lack of conjunctive management of all water resources in connected groundwater/surface water systems	Lower Ovens River and associated tributaries
Impact of climate changes on water regimes and bushfire frequency	Whole of System
Recreation and tourism pressure	Whole of System
Expansion of urban boundaries	Ovens River (and tributaries) around Wangaratta
Gross litter	Ovens River (and tributaries) around Wangaratta
Conflicting land and water resource uses and associated management practices	Agriculture, Lifestyle and Urban Landscapes

The stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated work Program for the Priority Waterways for this system are provided.

Table 55 Lower Ovens System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
LOV SA1	Protect the Heritage-listed Lower Ovens River and listed wetlands by undertaking targeted management activities within the Agriculture and Lifestyle Landscapes.		💧💧	💧💧💧	💧💧💧	
LOV SA2	Work with the Urban and Lifestyle Landscape communities to maintain and improve waterway values in and around Beechworth and Wangaratta.		💧		💧💧💧	💧💧💧
LOV SA3	Support targeted protection of the iconic waterways within the largest wetland complex in the North East region, through continuation of programs protecting environmental refuges, recreational values and water resources.		💧💧💧	💧	💧	💧

Table 56 Lower Ovens System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
LOV LA 1.1	Manage the integrated challenges of sediment and nutrient ingress, invasive woody weeds, water resource sharing, waterway capacity and flooding from Reedy Creek and Fifteen Mile Creek (including the One Mile Creek and Three Mile Creek) systems.	💧	💧	💧	Reedy Creek, Fifteen Mile Creek, One Mile Creek, Three Mile Creek
LOV LA 1.2	Create connected Landscape scale corridors and refuges around and between the Murray River Corridor, Warby-Ovens National Park and the Chiltern Mt Pilot National Park by focusing on the waterways.			💧	Reedy Creek, Fifteen Mile Creek, One Mile Creek, Three Mile Creek, spring soak wetlands and associated waterways
LOV LA 2.1	Connect Wangaratta's urban landscapes and growth areas to waterways.	💧		💧	Ovens River, One Mile Creek and Three Mile Creek, Fifteen Mile Creek, Reedy Creek, King River
LOV LA 2.2	Support the community and associated groups of Wangaratta to build on existing community-driven efforts in and around the Urban Landscape.	💧		💧	Ovens River, One Mile Creek and Three Mile Creek, Fifteen Mile Creek, Reedy Creek, King River
LOV LA 2.3	Maximise the recreational opportunities, such as fishing, boating, bike riding and walking.	💧		💧	Ovens River, One Mile Creek and Three Mile Creek, Fifteen Mile Creek, Reedy Creek, King River
LOV LA 2.4	Manage the in-stream barriers to fish passage in the Ovens River.	💧		💧	Ovens River
LOV LA 2.5	Reduce the impacts of urbanisation through delivering whole of water cycle services.	💧		💧	Ovens River, One Mile Creek and Three Mile Creek, Fifteen Mile Creek, Reedy Creek, King River
LOV LA 3.1	Build awareness of the co benefits of waterway management and improve the recreational values of the waterways.	💧		💧	Lower Ovens River/Murray River weir pool complex

1 *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

2 *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

3 *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 57 Lower Ovens System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	All Heritage River values in the Lower Ovens River are maintained.
2	A sustainable population of Trout Cod is maintained in the Ovens River below Wangaratta.
3	Murray Cod, Golden Perch and Fly-specked Hardyhead move from the Murray River into the Ovens River reaches up to Wangaratta as part of their life cycle.
4	High priority threatened frog species (Giant Bullfrog and Growling Grass Frog) continue to be associated with the Ovens River close to the River Murray.
5	The river and riparian zones throughout the Lower Ovens maintain populations of high and medium priority threatened bird species (e.g. Eastern Great Egret, Brown Treecreeper, King Quail, Superb Parrot).
6	Wetland 75164 (Lower Ovens 6 near Bundalong South) continues to support a group of medium priority threatened bird species.
7	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
8	Current condition of large riparian trees is maintained in the Ovens River.
9	Current level of in-stream wood is maintained in the Ovens River.
10	Water quality and quantity in the Ovens River is suitable for urban/rural townships and for agricultural production.
11	Drought refuges remain in place and are in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
12	A sustainable recreational fishery in the Ovens River is maintained.
13	Access to waterways for recreational fishing, swimming and near waterway activities is maintained.
14	Water quality and quantity in Fifteen Mile Creek is suitable for an urban/rural township and for agricultural production.
15	A sustainable population of Golden Perch in the Lower Ovens wetlands is maintained.

KEY FEATURES:

- The **Heritage listed** and iconic Ovens River and floodplain is **significant to Aboriginal people as a location for food and fibre** resources
- The junction of the Ovens and Murray Rivers is the **largest riverine wetland complex in the region** and part of **largest mid river Storage on the Murray River.** This complex supports some of the **best inland native fisheries in the Murray-Darling Basin**
- The Ovens River floodplain and associated waterways forms an important **connection between the Murray River Corridor, Warby-Ovens National Park and the Chiltern-Mt Pilot National Park**
- The regions 2nd largest Urban Landscape of Wangaratta and surrounds are strongly connected to the **Warby-Ovens National Park.**

Table 58 Lower Ovens System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
3-1, 3-2, 3-3, 3-8, 3-10	LOV SA: 1, 3 LOV LA: 1.1, 1.2, 3.1	1, 2, 3, 9, 10, 11, 12, 14	MO-1	Suitable water quality and quantity in the Ovens River	MA-1	Construct riparian fence in Reedy Creek and Fifteen Mile Creek Priority Waterways and Reedy Creek (3-17, 3-18, 3-19, 3-20) and Fifteen Mile Creek (3-8, 3-9, 3-10, 3-11)	7 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA–2	Establish management agreements with landholders	30 ha	CMA, DEPI, Land Managers
			MO-2	Suitable water quality and quantity in the Ovens River	MA-3	Establish management agreements with land managers	20 ha	CMA, DEPI, Land Managers
			MO-3	Decreased impact from sand slug into Ovens River	MA-4	Update and implement the Reedy Creek and Fifteen Mile Creek Waterway Action Plans	2 plans	CMA, Community, Community Groups, DEPI, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
			MO-4	Reduced bed instability	MA-5	Conduct bed stabilisation works in Priority Waterways and Fifteen Mile Creek (3-9, 3-11), and One Mile Creek and Three Mile Creek	3 sites	CMA, DEPI, Land Managers, Local Councils, Water Corporations
			MO-5	Reduced bed instability	MA-6	Conduct bank stabilisation works in Priority Waterways and Fifteen Mile Creek (3-9, 3-11), and One Mile Creek and Three Mile Creek	6 sites	CMA, DEPI, Land Managers, Local Councils, Water Corporations
			MO-7	Suitable water quality and quantity in the Fifteen Mile Creek	MA-7	Establish management agreements with land managers	15 ha	CMA, DEPI, Land Managers
3-1, 3-2, 3-3, 3-8, 3-10, Lower Ovens wetland complex	LOV SA: 1, 3 LOV LA: 1.1, 1.2, 2.2, 2.3, 3.1	1, 2, 3, 11, 12	MO-8	Improved vegetation structure and diversity	MA -8	Establish management agreements with land managers around and between the Murray River Corridor, Warby-Ovens National Park and the Chiltern-Mt. Pilot National Park	30 ha	CMA, DEPI, Land Managers, PV
			MO-9	Controlled livestock access in more than 75% of waterway frontages	MA-9	Construct riparian fence	20km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-10	Establish management agreements with land managers	30 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-10	Decreased impact of pest plant and animal species	MA-11	Establish pest plant control (Black Willow) in priority reaches and One Mile Creek and Three Mile Creek	30 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, ma*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 58 Lower Ovens System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
			MO-11	Improved and appropriate access to waterways for recreational fishing, boating, swimming, and near waterway activities	MA-12	Implement Management Plans for recreation access and activities on Priority Waterways and One Mile Creek, Three Mile creek, Reedy Creek and King River	1 Plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
3-3	LOV SA: 1, 2 LOV LA: 2.4	2, 3	MO-12	Improved fish passage for desirable species (Trout Cod, Murray Cod, Golden Perch)	MA-13	Establish feasible works and operating plan for weir on Ovens River at Wangaratta	1 No.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
3-3, 3-8	SA: 1, 2 LA: 1.1, 2.1, 2.2, 2.3, 2.5, 3.1	1, 2, 3, 9, 10, 11, 12,13, 14	MO-13	Improved connectivity of urban areas to waterways and floodplains	MA -14	Establish a plan in consultation to connect Wangaratta's Urban Landscapes and growth areas to Priority Waterways, floodplain wetlands and the Ovens River, One Mile Creek and Three Mile Creek, Fifteen Mile Creek, Reedy Creek and the King River	1 plan	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
					MA -15	Support community and associated groups to improve connectivity and access to Priority Waterways and floodplain wetlands	2 Groups	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups
					MA-16	Establish an agreement with key stakeholders to deliver integrated water cycle management outcomes in growth areas near Priority Waterways, floodplain wetlands	1 Agreement	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups, Research Organisations, Water Corporations
427894, 289007, 311119	LOV SA: 1, 2, 3 LOV LA: 1.2, 2.2, 2.3, 2.4, 3.1	4, 5, 6, 7, 11,15	MO - 14	Controlled livestock access to 25% wetland buffers	MA-17	Establish management agreements with land managers of wetlands	10 ha	CMA, DEPI, Land Managers, PV
			MO - 15	Decreased impact of pest plant and animal species	MA-18	Establish control of pest plants around wetlands	40 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
Estimated cost of activities for the Lower Ovens System* $7,685,000								

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, ma*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

MURRAY PLAINS SYSTEM

System Description

The Murray Plains System (Figure 29) consists of a number of tributaries that flow into the Murray River from the east of the Ovens River/Murray River junction to Wodonga, including Black Dog Creek, Whim Creek, Diddah Diddah Creek, Indigo Creek and House Creek.

The creeks rise in the foothills in or around the Box-Ironbark Forests of the Barambogie Ranges (including Chiltern Mt Pilot National Park) and flow west and/or northwards onto the floodplain of the Murray River. The floodplain land use throughout is predominantly dry-land cropping and grazing, with some viticulture bordering the Murray River.

Black Swamp, a nationally important wetland, lies at the junction of the Daddah Daddah and Diddah Diddah Creeks.

The creeks in the system are largely ephemeral channels, flowing only after rain and retreating to small pools during dry summers. A rural drainage overlay exists in the catchment of the Black Dog Creek and its tributaries.

Figure 29 Murray Plains System

Landscape lens

Wodonga is the largest urban centre associated with Murray Plains System (and in the North East region). Rutherglen and Chiltern are the other main urban centres within the system which is dominated by Agriculture Landscapes. The system's Forest Landscapes (of Box-Ironbark) are located in the headwaters of the creeks. Lifestyle Landscapes (rural living and tourism) are centred on Chiltern and Rutherglen and based around their natural scenery and wineries. The Forest Landscape of the Murray River corridor along the north of the System consists of a vibrant and dynamic section of the Murray River, with healthy River Red Gum communities and numerous wetlands. Wodonga's targeted future industrial land growth areas are in this system, focused around Barnawartha.

Condition

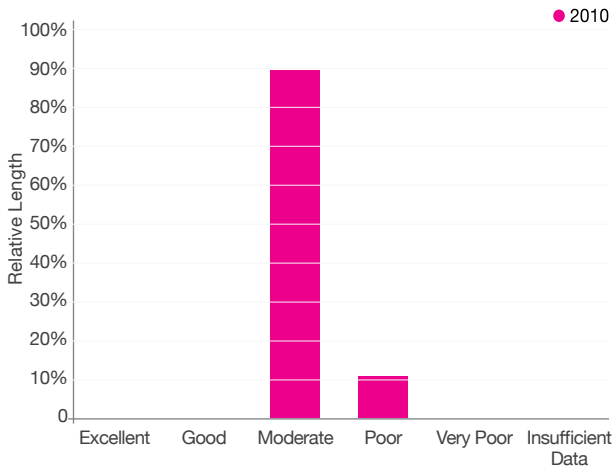


Figure 30 Index of Stream Condition – Murray Plains System

Values

Environmental

The high priority threatened migratory fish, Murray Cod and Golden Perch move from the Murray River into the lower parts of Black Dog Creek as part of their life cycle. The threatened Trout Cod is also found in Black Dog Creek, whilst the endangered Macquarie Perch has been recorded in Indigo Creek.

The Lower Black Dog Creek, House Creek and Black Swamp, and the upper reaches of the remaining tributaries, contain populations of high and medium priority threatened bird species including significant species of egrets, herons, cormorants, bitterns, spoonbills and ducks. Near the Murray River, high priority threatened frogs (Giant Bullfrog and Growling Grass Frog) are associated with the river and surrounding wetlands.

Black Swamp is one of the eight nationally important wetlands listed in the region.

Stands or remnant patches of significant vegetation can be found along most parts of the waterways. The relatively intact River Red Gum canopy associated with the Murray River is considered one of the healthiest in the Murray-Darling Basin.

The large older trees (sometimes single paddock trees) within the system are noteworthy, as they play an important habitat role in the system connecting larger patches of remnant vegetation to the waterways.

Social

The system attracts people from both within and outside the area. People regularly take advantage of the recreational pursuits associated with the waterways in the system (fishing, boating, kayaking, water-skiing and bushwalking). The Murray River is particularly popular for recreational fishing and the Lower Ovens/Murray River weir pool associated with Lake Mulwala is considered one of the best freshwater fishing locations in the State. Recreational activities in the system revolve around nature based tourism linked to the Murray River, Lake Moodemere and the Chiltern Mt. Pilot National Park, together with food and wine tourism around the well-established vineyards in the region. There is also a very strong focus on tourism based on the area's heritage values.

Community involvement in the Indigo Creek, Black Dog Creek and Diddah Diddah Creek areas is strong, with active community groups engaged in supporting waterway management.

Cultural

There is physical evidence of Aboriginal cultural values within the system along the waterways in the form of scar trees and artefact scatters. The floodplain wetland and riverine environment of the Murray River is significant to Aboriginal people as it was once the location of significant resources (e.g. food and fibre). This was a high resource zone due to the wetland systems and the Murray River and, hence, reliable country for food and water. Early explorers witnessed large gatherings of Aboriginal people on the Chiltern Plains and at Lake Moodemere. A large proportion of the Aboriginal cultural values of the Murray Plains System are yet to be officially recorded.

Economic

Agricultural production, manufacturing and tourism are the main economic drivers in the system, with vineyards, cropping and grazing being the main land-use industries. Many reaches supply water for urban and rural townships as well as sources for agricultural production. Specifically, the water resources of the system are used for these urban supplies - Wodonga Creek/Murray River for Wodonga and connecting towns including Barnawartha, Chiltern, Springhurst, Baranduda and Kiewa; Murray River supplies Wahgunyah. The waterways, the aesthetic appeal of the landscape, the presence of large trees, small land parcels and limited industrial infrastructure support high land values within the system. Recreation-based tourism associated with the waterways in the Murray Plains System contributes to economic activity.

Priority Waterways

Table 59 Murray Plains System – Priority River Reaches and Floodplains

Priority Waterway #	Name
3-12	Whim Creek
3-16	Diddah Diddah Creek
3-47	Indigo Creek
	Murray River Floodplain Complex (inc wetlands)

Table 60 Murray Plains System - Priority Wetlands

Priority Waterway #*	Name
75293	Black Swamp
	Lake Moodemere

** Some Priority Waterways do not have unique number identifiers.*

Data for aquatic macroinvertebrate communities are largely missing in the system. The fish community is only in moderate condition whilst the quality of the riparian vegetation is generally high.

Strategic Issues

- Management of the Murray River Floodplain for water conveyance, primary production and environmental values (e.g. floodplain wetlands)
- Building resistance into the Murray River Floodplain though a landscape scale connections program (e.g. vegetation and hydrology)
- Urban and industrial growth around rivers and the associated community connection with waterways and
- Rural drainage overlay in the catchment of the Black Dog Creek and its tributaries. Drainage management greatly influences waterway works and management in this area.

Stressors

Table 61 Murray Plains System - Stressors

Stressor	Waterways Impacted
Regulated water regime of the Murray River	Murray River anabranches, floodplain wetlands
Livestock access to waterways	Waterways in the Agriculture and Lifestyle Landscapes
Historical disturbances such as land clearing, gold mining, drainage schemes and waterway straightening	Whim, Diddah Diddah Creek and Daddah Daddah Creek, mid Black Dog Creek and Upper Indigo Creek
Invasive weeds	Whole of System
Degraded riparian tree communities	Black Dog Creek and Indigo Creek
Introduced aquatic fauna	Whole of System
Barriers to fish passage	Upper parts of the Black Dog Creek and Indigo Creek
Changed water regimes of floodplains and wetlands	Murray floodplain and wetlands e.g. Lake Moodemere, wetlands within the black dog drainage area
Impact of climate changes on stream flows and fire frequency	Whole of System
Pressures from recreation and tourism	Whole of System
Expansion of urban boundaries	Murray floodplain around Wodonga
Conflicting land and water resource uses and associated management practices	Agriculture, Lifestyle and Urban Landscapes

The stressors were used to build a picture of the overall values, connections and functions of the system and to determine a set of Strategic and Lead Actions for the management of the waterways in the system. These Actions help make sense of the management challenges outlined. The Actions have been developed with the aim of achieving the goals and principles of the Strategy with a focus on the Priority Waterways within the system. The Strategic and Lead Actions and associated Work Program for the Priority Waterways for this system are provided below.

Table 62 Murray Plains System - Strategic Actions for Priority Waterways and relevance to Landscape system

Strategic Action #	Strategic Actions – Landscape Context	Relevance of Strategic Action to Landscape Systems				
		Alpine	Forest	Agriculture	Lifestyle	Urban
MPL SA1	Work with the Urban and Lifestyle Landscape communities to maintain and improve waterway values.				●●●	●●●
MPL SA2	Support targeted protection of the priority wetlands within the Murray Plains System.		●●	●●	●●	●
MPL SA3	Protect the iconic Murray River and associated floodplain by undertaking targeted management activities within the Agriculture and Lifestyle Landscapes.			●●●	●●●	

Table 63 Murray Plains System - Lead Actions for Priority Waterways and Investment Scenario guidance

Lead Action #	Lead Actions – Investment Scenarios	Maintain[1]	Critical[2]	Feasible[3]	Relevant Waterways
MPL LA 1.1	Connect Wodonga's Urban Landscapes and growth areas to the waterways.	●		●	Murray River and floodplain wetlands, House Creek
MPL LA 1.2	Support the community and associated groups of Wodonga to build on existing community-driven efforts in and around the Urban Landscape waterways.	●		●	Murray River and floodplain wetlands, House Creek
MPL LA 1.3	Maximise the recreational opportunities (fishing, boating, bike riding, walking) associated with waterways.	●		●	Murray River and floodplain wetlands, Lake Moodemere, House Creek
MPL LA 1.4	Reduce the impacts of urbanisation through delivering whole of water cycle services.	●		●	Murray River and floodplain wetlands, House Creek
MPL LA 2.1	Undertake activities with the community to protect environmental refuge values and recreational values (e.g. bird and vegetation observation).	●		●	Black Swamp, Lake Moodemere, spring soaks
MPL LA 2.2	Manage water resource-sharing arrangements to balance social, economic and environmental values.	●		●	Black Swamp, Lake Moodemere, spring soaks
MPL LA 3.1	Create connected landscape scale corridors and refuges around and between the Murray River Corridor, the Warby-Ovens National Park and the Chiltern Mt Pilot National Park by focusing on the waterways.			●	Whim Creek, Diddah Diddah Creek, Indigo Creek, Black Dog Creek, Black Swamp, White Swamp and seasonally herbaceous wetlands, Black Dog Drainage area, Murray River floodplain.

[1] *Management activities required to maintain past investment in Priority Waterways (e.g. surveillance, risk management, regulations and compliance, education, and community involvement through Whole of Region activities).*

[2] *Critical management activities required to maintain and/or improve condition of Priority Waterways (e.g. activities to maintain drought refuges for endangered species in a Heritage River). The level of effort and works would increase with higher levels of investment.*

[3] *Feasible and cost-effective management activities that could be undertaken if a high level of investment was available (e.g. onground works, research and field trials).*

Table 64 Murray Plains System - Long-term Resource Condition Targets

Resource Condition Target #	Long-term Resource Condition Targets
1	A sustainable population of Trout Cod in Whim Creek is maintained.
2	A sustainable population of Macquarie Perch in Whim Creek is maintained.
3	Murray Cod and Golden Perch move from the Murray River into Whim Creek and Indigo Creek as part of their life cycle.
4	High priority threatened frog species (Giant Bullfrog and Growling Grass Frog) increase in distribution, and produce young.
5	The waterway and riparian zones throughout the system contain populations of high and medium priority threatened bird species (Eastern Great Egret, Australasian Bittern, Nankeen Night Heron).
6	Stands of significant Ecological Vegetation Classes continue to be found along many reaches and wetlands in the system.
7	Water quality and quantity are suitable for an urban/rural township source.
8	The ability to efficiently transfer water in Diddah Diddah Creek is maintained.
9	Diversity and abundance of high priority threatened bird species is maintained at Black Swamp (egrets, herons, cormorants, bitterns, spoonbills and ducks).
10	Stands of significant Ecological Vegetation Classes continue to be found around Black Swamp.
11	Black Swamp remains as a significant drought refuge in a suitable condition to protect a wide range of water-dependent taxa through dry periods.
12	Access to waterways for recreational fishing, swimming and near-waterway activities is maintained.

KEY FEATURES:

- The Murray River and its floodplain wetlands are **significant to Aboriginal people as a location of food and fibre** resources
- **Wodonga is the largest Urban centre** in the region and it connection to the urban waterways is a testament to a **strong history of town planning**
- **Black Swamp, a nationally important wetland**, lies at the junction of the Daddah Daddah and Diddah Diddah Creeks
- The **relatively intact River Red Gum canopy** associated with the Murray River Floodplain is considered **one of the healthiest** in the Murray-Darling Basin
- Recreational and lifestyle activities revolve around **nature based tourism** linked to the Murray River, Lake Moodemere and the Chiltern Mt Pilot National Park, together with **food and wine tourism** around the well-established vineyards in the Rutherglen region.

Table 65 Murray Plains System - Management Outcomes and Activities

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
3-12	MPL SA: 3 MPL LA: 3.1	1, 2, 3, 4, 5	MO-1	Improvement in low flow water resource sharing regime	MA-1	Work with the various land managers to identify projects to reduce water extraction stress in Priority Waterways and Black Dog Creek (3-13, 3-14)	1 study	CMA, Community, DEPI, Land Managers, Water Corporations
3-47	MPL SA: 1 MPL LA: 1.1, 1.2, 1.3, 1.4	1, 2, 3, 4, 5, 6, 7, 12	MO-2	Improved and appropriate access to waterways for recreational fishing, boating, swimming, and near waterway activities	MA-2	Implement Management Plans for recreation access and activities on Priority Waterways and Indigo Creek (3-46), House Creek (2-7), Middle Creek (2-8, 2-9), Murray River and floodplain wetlands, Lake Moodemere)	1 Plan	CMA, Community, DEPI, Government, Land Managers, Local Councils, VEWH, Water Corporations, PV
			MO-3	Local community engaged in land management changes	MA-3	Further develop and implement Black Dog Creek and Indigo Creek Waterway Action Plans	2 Plans	CMA, Community, Community Groups, DEPI, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
			MO-4	Unstable banks stabilised	MA-4	Undertake bank stabilisation works in Priority Waterways and Indigo Creek (3-46)	6 sites	CMA, DEPI, Land Managers CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-5	Controlled livestock access in more than 50% of waterway frontages	MA-5	Construct riparian fence on Priority Waterways and Indigo Creek (3-46)	7 km	CMA, DEPI, Land Managers
					MA–6	Establish management agreements with landholders	30 ha	CMA, DEPI, Research Organisations, Water Corporations CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
			MO-6	Improved fish passage for desirable species	MA-7	Investigate impact of barrier at Ford 403/10/ B0096 on fish passage	1 study	CMA, DEPI, Research Organisations, Water Corporations
					MA-8	Establish feasible works in accordance with recommendations	1 no.	CMA, DEPI, Government, Land Managers, Local Councils, Water Corporations
3-12, 3-16, 3-47	MPL SA: 3 MPL LA: 3.1	5, 6, 7	MO-7	Improved vegetation structure and diversity	MA-9	Establish management agreements with land managers around and between the Murray River Floodplain Corridor, Warby-Ovens National Park and the Chiltern-Mt. Pilot National Park on Priority Waterways and White Swamp and seasonally herbaceous wetlands	30 ha	CMA, DEPI, Land Managers, PV

Continued *Table 65 Murray Plains System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
Murray River floodplain Complex (inc wetlands), Lake Moodemere	MPL SA: 1 MPL LA: 1.1 1.2, 1.4	4, 5, 6, 12	MO-8	Murray River floodplain maintained	MA-10	Contribute to the Murray River Floodplain Advisory Group to determine priories for management	1 No.	CMA, Community, Community Groups, DEPI, EPA, Emergency Response Agencies, Government, Indigenous Peoples and Bodies, Industry, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, VEWH, Water Corporations
					MA-11	Establish pest animal controls (invasive terrestrial species) in priority (invasive terrestrial species) in Priority Waterways and Black Dog Creek (3-13, 3-14)	40 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-9	Improved waterways functions and values associated with growth in urban and lifestyle land uses around Wodonga	MA-12	Further develop the Wodonga Urban Waterway Action Plan to incorporate the Murray River and floodplain (including wetlands) and House Creek	1 plan	CMA, Community, Community Groups, DEPI, Land Managers, Local Councils, NRM Organisations, Peak Body Groups, PV, Research Organisations, Water Corporations
					MA-13	Implement programs to support the community and associated groups of Wodonga to build on existing community driven efforts	NA	CMA, Community, Community Groups, DEPI, Government, Land Managers, Local Councils, Peak Body Groups
					MA-14	Incorporate water sensitive urban design in all future urban development plans	1 Agreement	CMA, DEPI, Government, Land Managers, Local Councils, Research Organisations, Water Corporations
3-12, 3-16	MPL SA: 2, 3 MPL LA: 3.1	1, 2, 3, 4, 5, 6, 7, 8	MO -10	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-15	Establish pest animal controls (invasive terrestrial species) in Priority Waterways	30 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-11	Improvement in water regime	MA-16	Work with the various land and water managers to identify projects to improve the water regime	NA	CMA, Community, DEPI, Land Managers, Water Corporations
			MO-12	Unstable banks stabilised	MA-17	Undertake bank stabilisation works in Priority Waterways and Black Dog Creek (3-13, 3-14, 3-15)	6 sites	CMA, DEPI, Land Managers
			MO-13	Controlled livestock access in more than 50% of waterway frontages	MA-18	Construct riparian fence on Priority Waterways and Black Dog Creek (3-13, 3-14, 3-15)	7 km	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
					MA-19	Establish management agreements with landholders	30 ha	CMA, DEPI, Land Managers

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour and were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Continued *Table 65 Murray Plains System - Management Outcomes and Activities*

Priority Waterways #	Strategic/ Lead Action #	Resource Condition Target #	Management Outcome		Management Activity		Quantity	Implementation Partners**
			MO-14	Suitable water quality and quantity in the Diddah Diddah Creek	MA-20	Establish management agreements with land managers	15 ha	CMA, DEPI, Land Managers
75293	MPL SA: 2, 3 MPL LA: 2.1, 2.2, 3.1	9, 10, 11	MO - 15	Improved water regime	MA-21	Work with the various land managers in Diddah Diddah Creek to identify projects to improve water regime in Priority Waterways and Lake Moodemere, spring soaks, White Swamp and seasonally herbaceous wetlands	10 ha	CMA, Community, DEPI, Land Managers, Water Corporations, PV
			MO-16	Improved vegetation structure and diversity	MA-22	Establish pest plant species control on Priority Waterways and Lake Moodemere, spring soaks, White Swamp and seasonally herbaceous wetlands	10 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
			MO-17	Decreased impact of pest plant and animal species (invasive terrestrial species)	MA-23	Establish pest animal controls (invasive terrestrial species) on Priority Waterways and Lake Moodemere, spring soaks, White Swamp and seasonally herbaceous wetlands	10 ha	CMA, Community, Community Groups, DEPI, Land Managers, NRM Organisations, Peak Body Groups
Estimated cost of activities for the Murray Plains System* $4,902,500								

* *Unit costs, past levels of investment and assumptions around cost share, project management costs, operational costs, materials and labour and were used to inform the estimate.*

** *The implementation partners listed are an indication of those who would typically be involved in the progression of the management activities.*

Appendix 1

Guidance Material used in the Development of this Strategy

Federal and State government legislation, policies, strategies and initiatives relevant to the preparation of the Strategy and considered during the development of this Strategy are listed below.

Legislation

- *Aboriginal Heritage Act 2006*
- *Climate Change Act 2010*
- *Catchment and Land Protection Act 1994*
- *Coastal Management Act 1995*
- *Conservation, Forests and Lands Act 1987*
- *Environment Protection Act 1970*
- *Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)*
- *Fisheries Act 1995*
- *Flora and Fauna Guarantee Act 1988*
- *Heritage Rivers Act 1992*
- *National Parks Act 1975*
- *Native Title Act 1993*
- *Sustainable Forests (Timber) Act 2004*
- *Traditional Owner Settlement Act 2010*
- *Water Act 1989*
- *Water Act 2007 (Cwlth)*
- *Wildlife Act 1975*

Policies, Strategies and Initiatives

- *Directory of Important Wetlands of Australia, 2001*
- *Intergovernmental Agreement on a National Action Plan for Salinity and Water Quality, 2000*
- *North East Regional Catchment Strategy, 2013*
- *North East Regional Floodplain Management Strategy Review - 'Flooding Challenges in a Changing Climate' (2009)*
- *North East Regional Wetland Management Strategy, 2009*
- *North East Regional River Health Strategy, 2006*
- *Northern Region Sustainable Water Strategy, 2009*
- *National Water Initiative, 2004*
- *National Water Reform, 1994*
- *State Environment Protection Policy (Waters of Victoria), 2002*

Appendix 2

Summary of High Value Waterways

Reaches

The waterways (reaches and wetlands) in the North East within the AVIRA database were categorised using the criteria listed in the *Victorian Waterway Management Strategy* (2013). The waterways listed in Table 66, are the are the reaches identified as High Value in the North East Region. These reaches are all considered to have cultural value.

Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
LOWER MITTA	Mitta Mitta River	1~1			✓		✓	✓	✓	✓	✓		
LOWER MITTA	Mitta Mitta River	1~2			✓	✓	✓	✓	✓	✓	✓		
LOWER MITTA	Mitta Mitta River	1~3			✓	✓	✓	✓	✓	✓	✓		
LOWER MITTA	Little Snowy Creek	1~4			✓	✓	✓	✓	✓		✓		
LOWER MITTA	Snowy Creek	1~5		✓	✓	✓	✓	✓	✓		✓		
LOWER MITTA	Lightning Creek	1~6	✓	✓	✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Sandy Creek	1~7			✓		✓	✓	✓		✓		
UPPER MURRAY	Tallangatta Creek	1~8			✓		✓	✓	✓		✓		
UPPER MURRAY	Tallangatta Creek	1~9			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Dry Forest Creek	1~10				✓	✓		✓		✓		
UPPER MURRAY	Dry Forest Creek	1~11				✓	✓	✓	✓		✓		
UPPER MURRAY	Johnston Creek	1~12			✓		✓	✓	✓		✓		
UPPER MURRAY	Koetong Creek	1~13		✓	✓	✓	✓	✓	✓		✓		✓
UPPER MURRAY	Burrowye Creek	1~14			✓	✓	✓	✓	✓	✓	✓		✓
UPPER MURRAY	Walwa Creek	1~15					✓	✓	✓		✓		
UPPER MURRAY	Cudgewa Creek	1~16			✓		✓	✓	✓	✓	✓		
UPPER MURRAY	Cudgewa Creek	1~17	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER MURRAY	Log Bridge Creek	1~18			✓	✓	✓		✓		✓		
UPPER MURRAY	Corryong Creek	1~19			✓	✓	✓	✓	✓	✓	✓		
UPPER MURRAY	Corryong Creek	1~20			✓	✓		✓	✓		✓		
UPPER MURRAY	Wheeler Creek	1~21			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Thougla Creek	1~22				✓	✓	✓	✓		✓		
UPPER MURRAY	Thougla Creek	1~23			✓	✓	✓	✓	✓		✓		

Continued *Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
UPPER MURRAY	Omeo Creek	1~24			✓	✓	✓	✓	✓		✓		
UPPER MITTA	Mitta Mitta River	1~25	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Mitta Mitta River	1~26	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Big River	1~27	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Big River	1~28	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Big River	1~29	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Livingstone Creek	1~30			✓		✓	✓	✓		✓	✓	
UPPER MITTA	Livingstone Creek	1~31			✓	✓		✓	✓		✓	✓	
UPPER MITTA	Jones Creek	1~32							✓		✓	✓	
UPPER MITTA	Cobungra River	1~33			✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Cobungra River	1~34				✓	✓	✓	✓		✓	✓	
UPPER MITTA	Victoria River	1~35			✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Spring Creek	1~36			✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Bundara River	1~37			✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Middle Creek	1~38			✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Gibbo River	1~39	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Morass Creek	1~40	✓		✓	✓	✓	✓	✓		✓	✓	
UPPER MITTA	Morass Creek	1~41	✓				✓	✓	✓		✓	✓	
UPPER MITTA	Morass Creek	1~42				✓	✓	✓	✓		✓	✓	
UPPER MITTA	Benambra Creek	1~43			✓	✓	✓		✓		✓	✓	
UPPER MURRAY	Limestone Creek	1~44	✓		✓	✓	✓	✓	✓		✓		
LOWER MITTA	Fairyknowe Creek	1~45					✓		✓		✓		
LOWER MITTA	Little Scrubby Creek	1~46			✓	✓	✓	✓	✓		✓		
LOWER MITTA	Watchingorra Creek	1~47			✓	✓	✓	✓	✓		✓		✓
LOWER MITTA	Snowy Creek West Branch	1~48			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Tallangatta Creek East Branch	1~49			✓		✓	✓	✓		✓		
UPPER MURRAY	Guys Forest Creek	1~50			✓				✓	✓	✓		✓

Continued *Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
UPPER MURRAY	Sandy Creek	1~51			✓			✓	✓		✓		
UPPER MURRAY	Stony Creek	1~52			✓		✓	✓	✓	✓	✓		
UPPER MURRAY	Beetoomba Creek	1~53			✓		✓	✓	✓	✓	✓		
UPPER MURRAY	Kane Creek	1~54			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Reedy Creek East Branch	1~55			✓	✓	✓	✓	✓	✓	✓		✓
UPPER MURRAY	Shady Creek	1~56				✓	✓		✓		✓	✓	✓
UPPER MURRAY	Simpson Creek	1~57			✓	✓	✓	✓	✓		✓		
UPPER MITTA	Wombat Creek	1~58			✓	✓	✓	✓	✓		✓	✓	✓
UPPER MITTA	Buenba Creek	1~59			✓	✓	✓	✓	✓		✓	✓	✓
UPPER MURRAY	Buckwong Creek	1~60			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Dead Horse Creek	1~61			✓	✓	✓		✓		✓		
KIEWA	Kiewa River	2~1			✓		✓	✓	✓	✓	✓		
KIEWA	Kiewa River	2~2			✓	✓	✓	✓	✓	✓	✓		
KIEWA	Kiewa River	2~3			✓	✓	✓	✓	✓	✓	✓		
KIEWA	Kiewa River	2~4			✓	✓	✓	✓	✓	✓	✓		
KIEWA	Kiewa River East Branch	2~5	✓		✓	✓	✓	✓	✓		✓	✓	✓
KIEWA	Rocky Valley Creek	2~6	✓			✓	✓	✓	✓		✓	✓	✓
KIEWA	House Creek	2~7			✓		✓	✓	✓	✓			
KIEWA	Middle Creek	2~8			✓		✓	✓	✓	✓			
KIEWA	Middle Creek	2~9				✓	✓		✓	✓			
KIEWA	Yackandandah Creek	2~10			✓	✓	✓		✓	✓			
KIEWA	Yackandandah Creek	2~11			✓	✓	✓	✓	✓		✓		
KIEWA	Yackandandah Creek	2~12	✓		✓	✓		✓	✓		✓		✓
KIEWA	Back Creek	2~13			✓	✓		✓	✓		✓		
KIEWA	House Creek	2~14			✓	✓	✓	✓	✓		✓		
KIEWA	Running Creek	2~15				✓	✓	✓	✓		✓		
KIEWA	Running Creek	2~16			✓	✓	✓	✓	✓		✓		✓

Continued *Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
KIEWA	Mountain Creek	2~17			✓	✓	✓	✓	✓		✓		
KIEWA	Mountain Creek	2~18	✓		✓	✓	✓	✓	✓		✓		
KIEWA	Kiewa River West Branch	2~19	✓		✓	✓	✓	✓	✓		✓	✓	✓
KIEWA	Kinchington Creek	2~20			✓	✓			✓		✓		
LOWER OVENS	Ovens River	3~1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Ovens River	3~2	✓	✓	✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Ovens River	3~3	✓	✓	✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Ovens River	3~4	✓	✓	✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Ovens River	3~5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
UPPER OVENS	Ovens River	3~6	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
UPPER OVENS	Ovens River	3~7	✓	✓	✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Fifteen Mile Creek	3~8			✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Fifteen Mile Creek	3~9			✓	✓	✓		✓		✓		
LOWER OVENS	Fifteen Mile Creek	3~10			✓	✓	✓	✓	✓		✓		
LOWER OVENS	Fifteen Mile Creek	3~11				✓	✓	✓	✓		✓		✓
MURRAY PLAINS	Whim Creek	3~12			✓	✓	✓	✓	✓				
MURRAY PLAINS	Black Dog Creek	3~13			✓	✓	✓	✓	✓	✓			
MURRAY PLAINS	Black Dog Creek	3~14	✓		✓	✓	✓	✓	✓	✓			
MURRAY PLAINS	Black Dog Creek	3~15	✓		✓	✓	✓	✓	✓	✓			
MURRAY PLAINS	Diddah Diddah Creek	3~16			✓		✓	✓	✓	✓	✓		
LOWER OVENS	Reedy Creek	3~17	✓		✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Reedy Creek	3~18	✓		✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Reedy Creek	3~19	✓		✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Reedy Creek	3~20			✓		✓	✓	✓	✓	✓		
KING	King River	3~21	✓		✓	✓	✓	✓	✓	✓	✓		
KING	King River	3~22			✓	✓	✓	✓	✓	✓	✓		
KING	King River	3~23			✓	✓	✓	✓	✓	✓	✓		
KING	King River	3~24	✓		✓	✓	✓	✓	✓	✓	✓		

Continued *Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
KING	King River	3~25	✓		✓	✓	✓	✓	✓		✓	✓	✓
KING	Hurdle Creek	3~26			✓	✓	✓	✓	✓		✓		✓
KING	Boggy Creek	3~27			✓		✓	✓	✓		✓		
KING	Boggy Creek	3~28			✓	✓	✓	✓	✓		✓		
KING	Black Range Creek	3~29			✓	✓	✓	✓	✓		✓		
UPPER OVENS	Hodgsons Creek	3~30	✓		✓		✓		✓		✓		
UPPER OVENS	Hodgsons Creek	3~31	✓		✓	✓	✓	✓	✓		✓		
UPPER OVENS	Burgoigee Creek	3~32	✓		✓		✓	✓	✓		✓		✓
UPPER OVENS	Buffalo River	3~33	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Buffalo River	3~34			✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Buffalo River	3~35	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Catherine River	3~36	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Rose River	3~37			✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Rose River	3~38				✓	✓	✓	✓		✓		
UPPER OVENS	Barwidgee Creek	3~39			✓			✓	✓	✓	✓		
UPPER OVENS	Barwidgee Creek	3~40			✓			✓	✓	✓	✓		
UPPER OVENS	Happy Valley Creek	3~41			✓		✓	✓	✓	✓	✓		✓
UPPER OVENS	Buffalo Creek	3~42	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Buckland River	3~43	✓		✓	✓	✓	✓	✓	✓	✓		✓
UPPER OVENS	Buckland River	3~44	✓		✓	✓	✓	✓	✓		✓		
UPPER OVENS	Morses Creek	3~45			✓	✓	✓	✓	✓	✓	✓		✓
MURRAY PLAINS	Indigo Creek	3~46			✓	✓	✓	✓	✓	✓			
MURRAY PLAINS	Indigo Creek	3~47			✓		✓		✓	✓			
LOWER OVENS	Whim Creek	3~48					✓		✓		✓		
UPPER OVENS	Whorouly Creek	3~49			✓		✓	✓	✓		✓		
UPPER OVENS	Black Mare Creek	3~50			✓	✓		✓	✓		✓		
KING	Factory Creek	3~51			✓		✓		✓		✓		
KING	Meadow Creek	3~52			✓			✓	✓		✓		

Continued *Table 66 High value waterways (reaches) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
KING	King River West Branch	3~53			✓	✓	✓	✓	✓		✓		
KING	Evans Creek	3~54			✓	✓	✓	✓	✓		✓		
UPPER OVENS	Yarrarabula Creek	3~55			✓	✓	✓	✓	✓		✓		
UPPER OVENS	Dandongadale River	3~56			✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Buffalo River West Branch	3~57	✓		✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Buckland River West Branch	3~58			✓	✓	✓	✓	✓		✓		

Wetlands

The waterways listed in Table 70 below are the wetlands identified as High Value in the North East Region. These wetlands are all considered to have cultural value.

Table 67 North East High Value Wetlands (IWC only) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
UPPER MITTA	Lake Dartmouth	78164			✓	✓	✓	✓	✓	✓	✓		
UPPER MURRAY	Lake Hume	77784-1			✓		✓	✓	✓	✓	✓		
UPPER MURRAY	Sandy Creek Reservoir	77760			✓	✓	✓	✓	✓	✓	✓		
UPPER MURRAY	Davies Plain Wetland1	78810			✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Davies Plain Wetland2	78811		✓	✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Davies Plain Wetland3	78809	✓	✓	✓	✓	✓	✓	✓		✓		
UPPER MURRAY	Ryans Lagoon1	76197			✓		✓	✓	✓		✓		
UPPER MURRAY	Ryans Lagoon2	76198			✓		✓	✓	✓		✓		
KIEWA	Clover Pondage	76678			✓	✓	✓	✓	✓		✓		
KIEWA	Lake Guy	76679				✓	✓		✓		✓		
KIEWA	Pretty Valley Storage	76680				✓	✓	✓	✓		✓		
KIEWA	Rocky Valley Storage	76681			✓		✓	✓	✓		✓		
LOWER OVENS	Lower Ovens1 (Bundalong)	75153		✓	✓	✓	✓	✓	✓		✓		✓

Continued *Table 67 North East High Value Wetlands (IWC* only) and their associated values identified through VWMS criteria*

Waterway			Environmental Values					Social Values			Economic Values		
System	Name	No.	Formally Recognised Significance	Representativeness	Rare or Threatened species/ communities	Naturalness	Landscape Features	Activity	Place	People	Water	Power Generation	Other Resources
LOWER OVENS	Lower Ovens2 (Bundalong)	75156			✓	✓	✓	✓	✓	✓	✓		✓
LOWER OVENS	Lower Ovens3 (Bundalong)	75154					✓	✓	✓		✓		
LOWER OVENS	Lower Ovens4 (Bundalong Sth)	75158			✓		✓	✓	✓	✓	✓		
LOWER OVENS	Lower Ovens5 (Bundalong Sth)	75162	✓		✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Lower Ovens6 (Bundalong Sth)	75164			✓	✓	✓		✓		✓		
LOWER OVENS	Puzzle Bend	75166			✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Lords Bend	75170			✓	✓		✓	✓		✓		
LOWER OVENS	Talbots Bend	75178			✓	✓	✓	✓	✓		✓		
LOWER OVENS	Lower Ovens10 (Peechelba Nth)	75432				✓	✓	✓	✓		✓		
LOWER OVENS	Lower Ovens11 (Peechelba Nth)	75192			✓	✓	✓	✓	✓		✓		
LOWER OVENS	Lower Ovens12 (Peechelba Nth)	75200			✓	✓	✓	✓	✓		✓		
LOWER OVENS	Lower Ovens13 (Peechelba Nth)	75205	✓		✓	✓	✓	✓	✓		✓	✓	
LOWER OVENS	Lower Ovens (Boorhaman)	75211	✓		✓	✓	✓	✓	✓	✓	✓		
LOWER OVENS	Lower Ovens (Killawarra)2	75232			✓	✓	✓		✓		✓		
LOWER OVENS	Lower Ovens (Killawarra)1	75220			✓	✓	✓	✓	✓	✓	✓		
UPPER OVENS	Crystal Bog	76034			✓	✓		✓	✓		✓		
UPPER OVENS	Crystal Bog2	76033			✓	✓	✓	✓	✓		✓		
UPPER OVENS	Lake Buffalo	75924			✓	✓	✓	✓	✓		✓		
UPPER OVENS	Bunyip Bog	76007	✓		✓	✓	✓	✓	✓		✓	✓	
MURRAY PLAINS	Black Swamp	75293				✓	✓	✓	✓		✓		
KING	Lake William Hovell	75049			✓	✓	✓	✓	✓		✓		

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Appendix 3

Summary of Priority Waterways - Reaches and Wetlands

Reaches

As a part of the regional prioritisation process (see Section 4 - Approach), fifty-seven reaches in the region (41% of all reaches) were classified as Priority Waterways. The Strategy goals that relate to each priority waterway are shown in Table 68.

Table 68 Priority Reaches and alignment to Strategy Goals

System	Name	Number	Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state	Maintain or improve populations of threatened species and communities that are dependent upon North East waterways	Maintain or improve the connectivity within and between the different types of waterways	Raise awareness of and protect the social and cultural heritage values of waterways	Maintain or improve water quality in priority water supply catchments
LOWER MITTA MITTA SYSTEM	Mitta Mitta River	1-1			✓		✓
	Mitta Mitta River	1-2			✓		✓
	Mitta Mitta River	1-3			✓		✓
	Snowy Creek	1-5	✓				
	Lightning Creek	1-6	✓	✓			
UPPER MURRAY SYSTEM	Koetong Creek	1-13	✓	✓	✓		
	Burrowye Creek	1-14		✓			
	Cudgewa Creek	1-17		✓			
	Corryong Creek	1-20					✓
	Wheeler Creek	1-21		✓			
	Kane Creek	1-54		✓			
	Dead Horse Creek	1-61		✓			
UPPER MITTA MITTA SYSTEM	Mitta Mitta River	1-25	✓	✓			
	Mitta Mitta River	1-26	✓				
	Big River	1-27	✓				
	Big River	1-28	✓				
	Big River	1-29	✓				
	Livingstone Creek	1-30			✓		
	Bundara River	1-37		✓			
	Middle Creek	1-38		✓			
	Gibbo River	1-39			✓		

Continued *Table 68 Priority Reaches and alignment to Strategy Goals*

System	Name	Number	Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state	Maintain or improve populations of threatened species and communities that are dependent upon North East waterways	Maintain or improve the connectivity within and between the different types of waterways	Raise awareness of and protect the social and cultural heritage values of waterways	Maintain or improve water quality in priority water supply catchments
KIEWA SYSTEM	Kiewa River	2-1			✓		✓
	Kiewa River	2-2			✓	✓	✓
	Kiewa River	2-3			✓		✓
	Kiewa River	2-4			✓		✓
	Kiewa River East	2-5		✓	✓		✓
	Mountain Creek	2-17					✓
	Kiewa River West	2-19		✓			✓
LOWER OVENS SYSTEM	Ovens River	3-1	✓	✓	✓		✓
	Ovens River	3-2	✓		✓		✓
	Ovens River	3-3	✓	✓	✓		✓
	Fifteen Mile Creek	3-8					✓
	Fifteen Mile Creek	3-10					✓
UPPER OVENS SYSTEM	Ovens River	3-4	✓	✓	✓		✓
	Ovens River	3-5	✓		✓		✓
	Ovens River	3-6	✓		✓	✓	✓
	Ovens River	3-7	✓		✓	✓	
	Hodgsons Creek	3-31					✓
	Buffalo R.	3-33		✓	✓	✓	✓
	Buffalo River	3-34			✓	✓	
	Hodgsons Creek	3-30			✓		
	Catherine River	3-36	✓				
	Happy Valley Creek	3-41		✓			

Continued *Table 68 Priority Reaches and alignment to Strategy Goals*

System	Name	Number	Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state	Maintain or improve populations of threatened species and communities that are dependent upon North East waterways	Maintain or improve the connectivity within and between the different types of waterways	Raise awareness of and protect the social and cultural heritage values of waterways	Maintain or improve water quality in priority water supply catchments
UPPER OVENS SYSTEM	Buffalo Creek	3-42		✓	✓		✓
	Buckland River	3-43				✓	✓
	Morses Creek	3-45				✓	✓
	Dandongadale River	3-56	✓		✓		
	Buffalo River West	3-57	✓				
KING SYSTEM	King River	3-21		✓	✓	✓	✓
	King River	3-22			✓		✓
	King River	3-23		✓	✓		✓
	King River	3-24			✓		✓
	King River	3-25	✓		✓		
	Boggy Creek	3-28	✓				✓
MURRAY PLAINS SYSTEM	Whim Creek	3-12		✓			
	Diddah Diddah Creek	3-16					✓
	Indigo Creek	3-47		✓			

Wetlands

The thirty-four wetlands in Table 69 are classified as Priority Wetlands based on one or more of the broad value categories. The high score within the value categories and alignment to regional goals were used to identify them as priority waterways (see 4 - Approach).

Table 69 Priority Wetlands and alignment to Strategy Goals

System	Name	Number	Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state	Maintain or improve populations of threatened species and communities that are dependent upon North East waterways	Maintain or improve the connectivity within and between the different types of waterways	Raise awareness of and protect the social and cultural heritage values of waterways	Maintain or improve water quality in priority water supply catchments
MURRAY PLAINS	Black Swamp	75293	✓				
LOWER OVENS	Lower Ovens Complex	75153	✓		✓		
	Lower Ovens Complex	75154	✓		✓		
	Lower Ovens Complex	75156	✓		✓		
	Lower Ovens Complex	75158	✓		✓		

Continued *Table 69 Priority Wetlands and alignment to Strategy Goals*

System	Name	Number	Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state	Maintain or improve populations of threatened species and communities that are dependent upon North East waterways	Maintain or improve the connectivity within and between the different types of waterways	Raise awareness of and protect the social and cultural heritage values of waterways	Maintain or improve water quality in priority water supply catchments
LOWER OVENS	Lower Ovens Complex	75162	✓	✓	✓		
	Lower Ovens Complex	75164	✓		✓		
	Lower Ovens Complex - Puzzle Bend	75166	✓	✓	✓		
	Lower Ovens Complex - Lords Bend	75170	✓		✓		
	Lower Ovens Complex - Talbots Bend	75178	✓		✓		
	Lower Ovens Complex	75192	✓		✓		
	Lower Ovens Complex	75200	✓		✓		
	Lower Ovens Complex	75205	✓		✓		
	Lower Ovens Complex	75211	✓		✓		
	Lower Ovens Complex	75220	✓		✓		
	Lower Ovens Complex	75232	✓		✓		
	Lower Ovens Complex	75432	✓		✓		
KING	Lake William Hovell	75049				✓	✓
UPPER OVENS	Lake Buffalo	75924					✓
	Alpine Wetlands Complex- Bunyip Bog	76007	✓		✓		
	Alpine Wetlands Complex- Crystal Bog[2]	76033	✓	✓	✓		
	Alpine Wetlands Complex- Crystal Bog[1]	76034	✓	✓	✓		
UPPER MURRAY	Murray River Floodplain Complex-Ryans Lagoon[1]	76197	✓				
	Murray River Floodplain Complex-Ryans Lagoon[2]	76198	✓				
	Sandy Creek Reservoir	77760					✓
	Alpine Wetlands Complex- Davies Plains[3]	78809	✓	✓	✓		
	Alpine Wetlands Complex- Davies Plains[1]	78810	✓		✓		
	Alpine Wetlands Complex- Davies Plain[2]	78811	✓		✓		
	Lake Hume	77784-1	✓			✓	✓
KIEWA	Clover Pondage	76678					✓
	Lake Guy	76679					✓
	Pretty Valley Pondage	76680					✓
	Rocky Valley Pondage	76681					✓
UPPER MITTA MITTA	Lake Dartmouth	78164		✓			✓

The wetlands listed in Table 70 below were identified as Priority Wetlands in the NERWS 2009 and adopted as Priority Waterways in this Strategy.

Table 70 Priority wetlands identified through NERWS 2009

System/s	Priority Wetland Name	Number/Reference*
MURRAY PLAINS	Black Swamp	75293
UPPER OVENS, KIEWA, UPPER MITTA MITTA, UPPER MURRAY	Un-named Alpine Wetlands in Alpine Wetland Complex	Alpine Wetlands Complex
LOWER OVENS	Lower Ovens River	Lower Ovens Wetland Complex
LOWER OVENS	Woods Bend	Lower Ovens Wetland Complex
UPPER OVENS	Mt Buffalo Peatlands	Alpine Wetlands Complex
KIEWA	Rocky Valley Storage	76681
UPPER MITTA MITTA	Hinnomunjie Swamp	Hinnomunjie Swamp
UPPER MITTA MITTA	Lake Omeo	Lake Omeo
UPPER MURRAY	Ryans Lagoon	76197, 76198
LOWER OVENS	268102 (Open Water)	Lower Ovens Wetland Complex - 268102
MURRAY PLAINS	434099 (Deep Marsh)	Murray River Floodplain Complex - 434099
LOWER OVENS	311119 (Deep Marsh)	Lower Ovens Wetland Complex - 311119
UPPER MITTA MITTA	Mitta Mitta River	Mitta Mitta River Wetland Complex
LOWER OVENS	Parolos Bend	Murray River Floodplain Complex
MURRAY PLAINS	Lake Moodemere	Murray River Floodplain Complex
MURRAY PLAINS	462106 (Meadow)	Murray River Floodplain Complex - 462106
UPPER MURRAY	Lake Hume	77784-1
UPPER MITTA MITTA	Lake Dartmouth	78164
UPPER MITTA MITTA	The Morass	The Morass
LOWER OVENS	289007 (Shallow Marsh)	Lower Ovens Wetland Complex - 289007
LOWER OVENS	427894/474930 (Spring Soaks)	427894/474930

** Some Priority Waterways do not have unique number identifiers.*

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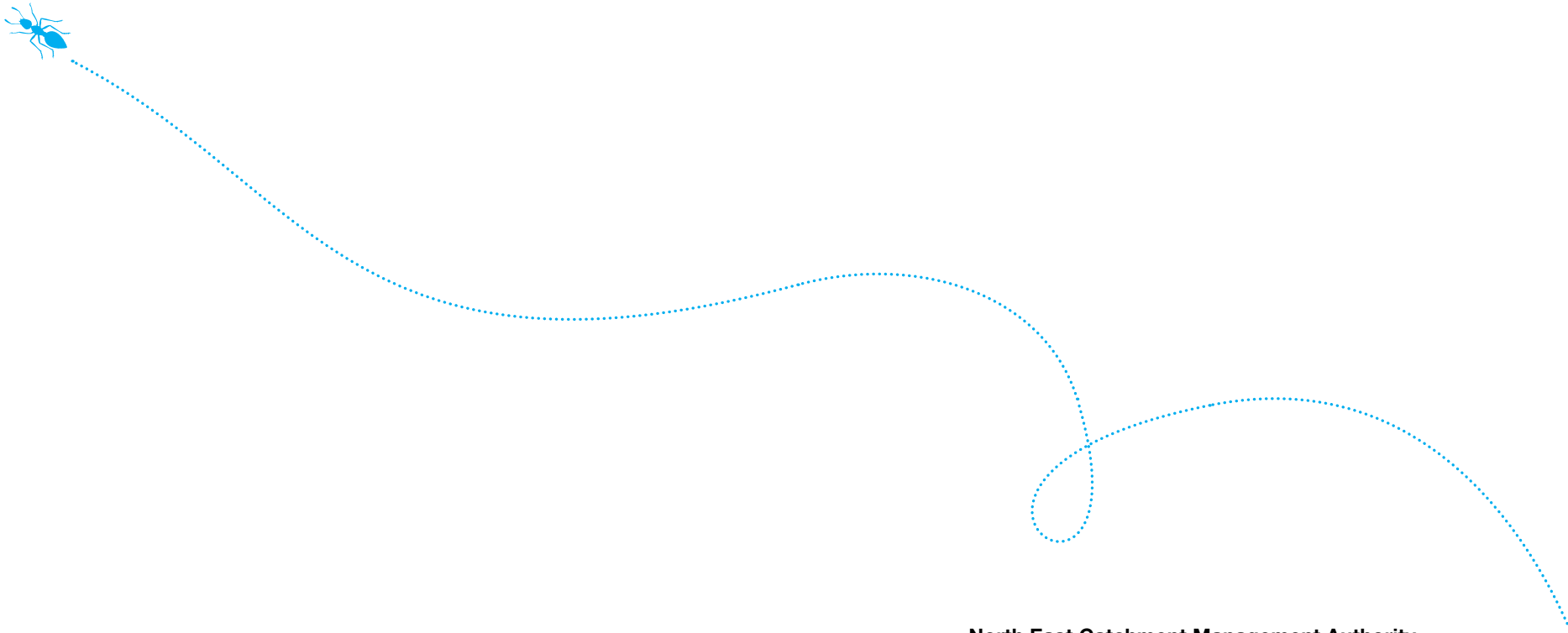

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NORTH EAST Waterway Strategy

NORTH EAST **Regional** Catchment Strategy

NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

Facilitating and coordinating the implementation of the Strategy on behalf of our catchment community