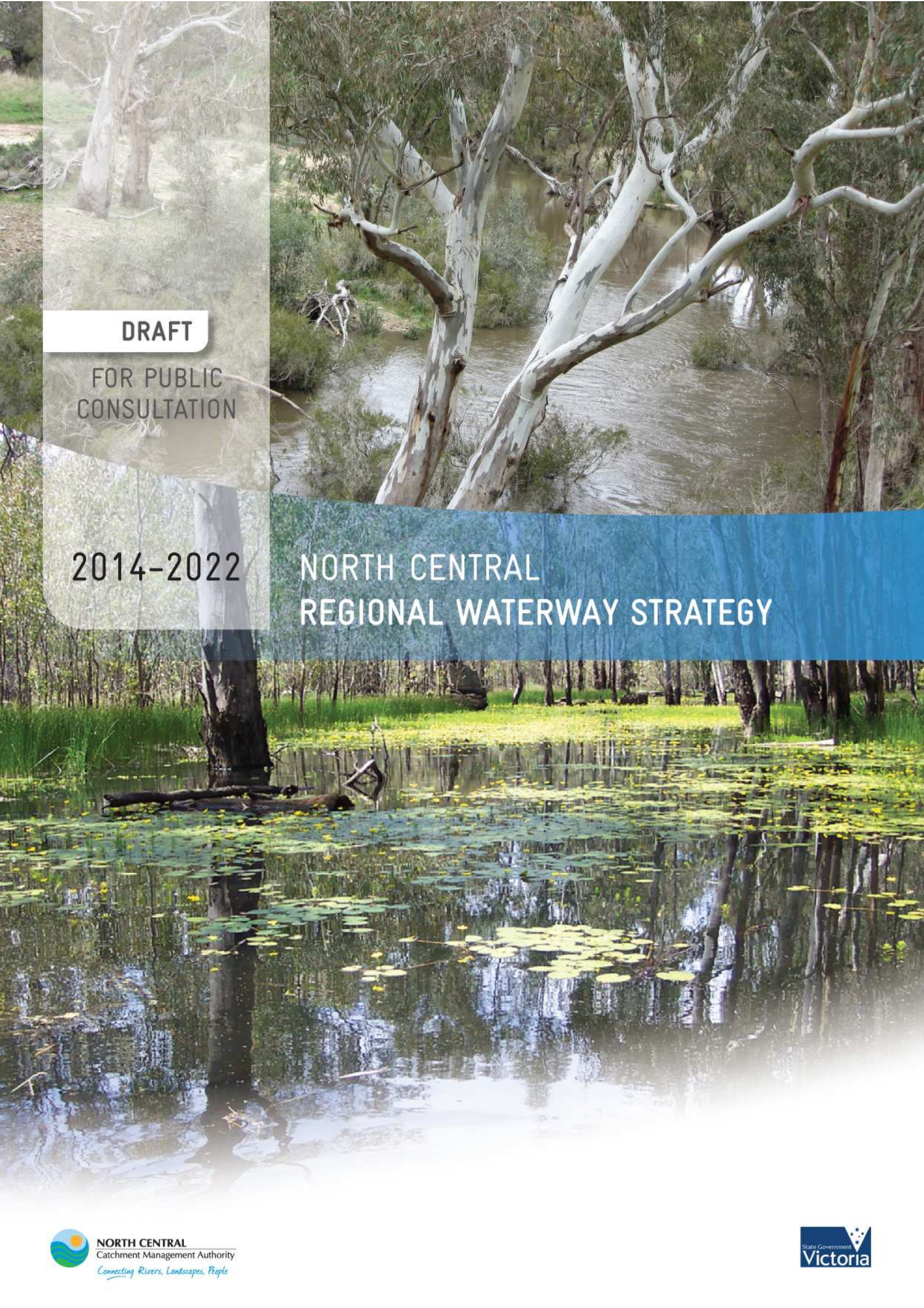

DRAFT

FOR PUBLIC CONSULTATION

2014–2022

NORTH CENTRAL REGIONAL WATERWAY STRATEGY

NORTH CENTRAL
Catchment Management Authority
Connecting Rivers, Landscapes, People

State Government Victoria

Acknowledgement of Country
The North Central Catchment Management Authority acknowledges Aboriginal Traditional Owners within the region, their rich culture and spiritual connection to Country. We also recognise and acknowledge the contribution and interest of Aboriginal people and organisations in land and natural resource management.

Document name: DRAFT 2014-22 North Central Regional Waterway Strategy

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A copy of the draft is also available on www.nccma.vic.gov.au

The North Central Catchment Management Authority wishes to acknowledge the Victorian Government for providing funding for this publication through the Victorian Waterway Management Strategy program.

The North Central Regional Waterway Strategy was guided by a Steering Committee consisting of:

- James Williams (Steering Committee Chair and North Central CMA Board Member)
- Richard Carter (Natural Resource Management Committee Member)
- Andrea Keleher (Department of Environment and Primary Industries)
- Greg Smith (Goulburn-Murray Water)
- Rohan Hogan (North Central CMA)
- Tess Grieves (North Central CMA)

The North Central CMA would like to acknowledge the contributions of the Steering Committee, Natural Resource Management Committee (NRMC) and the North Central CMA Board.

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Executive Summary

The vision for the 2014-2022 North Central Regional Waterway Strategy (RWS) is:

'Waterways and floodplains will be managed sustainably to protect and enhance their diversity and ecological function while also supporting the regional community's economic, recreational and amenity use'. Adopted from the North Central Regional Catchment Strategy Waterway and Wetland Theme visions (North Central CMA, 2013a).

The draft *2014-22 North Central Regional Waterway Strategy (RWS)* provides a framework for the North Central Catchment Management Authority in partnership with other agencies, stakeholders, traditional owners and the regional community to manage the rivers and wetlands with the community over the next eight years. It delivers key elements of the state-wide approach outlined in the *Victorian Waterway Management Strategy* (DEPI 2013a).

North central Victoria's waterways are remarkable natural assets. They include two internationally significant and Ramsar listed wetlands - Gunbower Forest and the Kerang Lakes. Our waterways provide important recreational opportunities including fishing, swimming, camping, boating and bushwalking. The health of these waterways underpins many aspects of tourism, jobs and investment in the region.

The purpose of this strategy is to ensure that the future management of our waterways keeps providing these important environmental, social, cultural and economic values. The strategy builds on the North Central *Regional River Health Strategy (2005)*, but has a broader scope, now including the management of floodplains and wetlands as well as rivers.

As floodplains, groundwater systems, wetlands and terminal lakes all form part of river systems, their condition and priority actions for improvement are also recognised in the North Central RWS and subsequent asset management plans.

Eight regional goals were developed to assist in determining the priority waterways to be targeted over the life of the strategy:

- Maintain or improve highly threatened or rare water-dependent species and communities within the North Central Region.
- Maintain or improve ecologically healthy or representative rivers.
- Protect or improve the ecological character of the Gunbower Forest and Kerang Lakes Ramsar sites.
- Maintain or improve wetlands of International, National or State significance as identified in the RCS.
- Maintain or improve waterways within water supply protection areas to support long-term improvement in water quality.
- Maximise environmental outcomes by efficiently managing environmental entitlements in partnership with water holders.
- Work with local urban communities to better understand the values of local waterways.
- Maintain or improve waterways that will provide adaptation under a variable climate.

The priority waterways identified in the Draft North Central Regional Waterway Strategy are presented in

Table 1 and
Figure 1. Part C outlines the proposed actions for the priority waterways.

The Draft North Central RWS is now out for public consultation. Community members are invited to attend one of five public forums or to provide feedback direct to the CMA. For information visit www.nccma.vic.gov.au

Public submissions close on Thursday 10 April, 2014

Submissions can be sent to:
North Central RWS
PO Box 18, Huntly, Vic, 3551

Or email:
info@nccma.vic.gov.au

Table 1: Priorities for the 2014-22 North Central RWS.

Basin	Campaspe	Loddon	Avoca	Avon-Richardson
Priority Streams	Campaspe River, Five Mile Creek, Kangaroo Creek, Coliban River, Little Coliban River	Loddon River, Jim Crow Creek, Sailors Creek, Kangaroo Creek, Tullaroop Creek, Birch's Creek, Box Creek, Pyramid Creek, Serpentine Creek, Little Murray River, Gunbower Creek	Avoca River	Richardson River
Priority Wetlands	-	Frogmore Swamp, Bakers Swamp, Black Swamp, Walkers Swamp, Long Swamp, Middle Swamp, Merin Merin Swamp, Tang Tang Swamp, Thunder Swamp, Richardson's Lagoon, Kerang Lakes (Ramsar), Lake Yando, Cullen Lake, Lake Meran, Leaghur State Park, Johnson Swamp, Little Lake Kelly, Lake Kelly, Lake William, Red Gum Swamp, Lake Lyndger, Lake Leaghur, Lake Elizabeth, Lake Marmal, McDonalds Swamp, Woolshed Swamp, Hird Swamp, Benjeroop State Forest, Lake Tutchewop, Lake Murphy, Great Spectacle, Round Lake, Golf Course Lake, Fosters Swamp, First, Middle, Third Reedy lakes, Little Lake Charm, Racecourse Lake Gunbower Forest (Ramsar), Safe Lagoon, Taylors, Cockatoo, Gum, Heart, unregulated lagoons	First Marsh, Second Marsh, Third Marsh, Lake Bael Bael, Lake Lalbert, Yassom Swamp	York Plains Complex, Wimmera Mallee Pipeline supplied wetlands (Creswick Swamp, Cherrip Swamp, Davis Dam, Corack Lake, Jeffcott Wildlife Reserve, Jesse Swamp, Falla Dam)

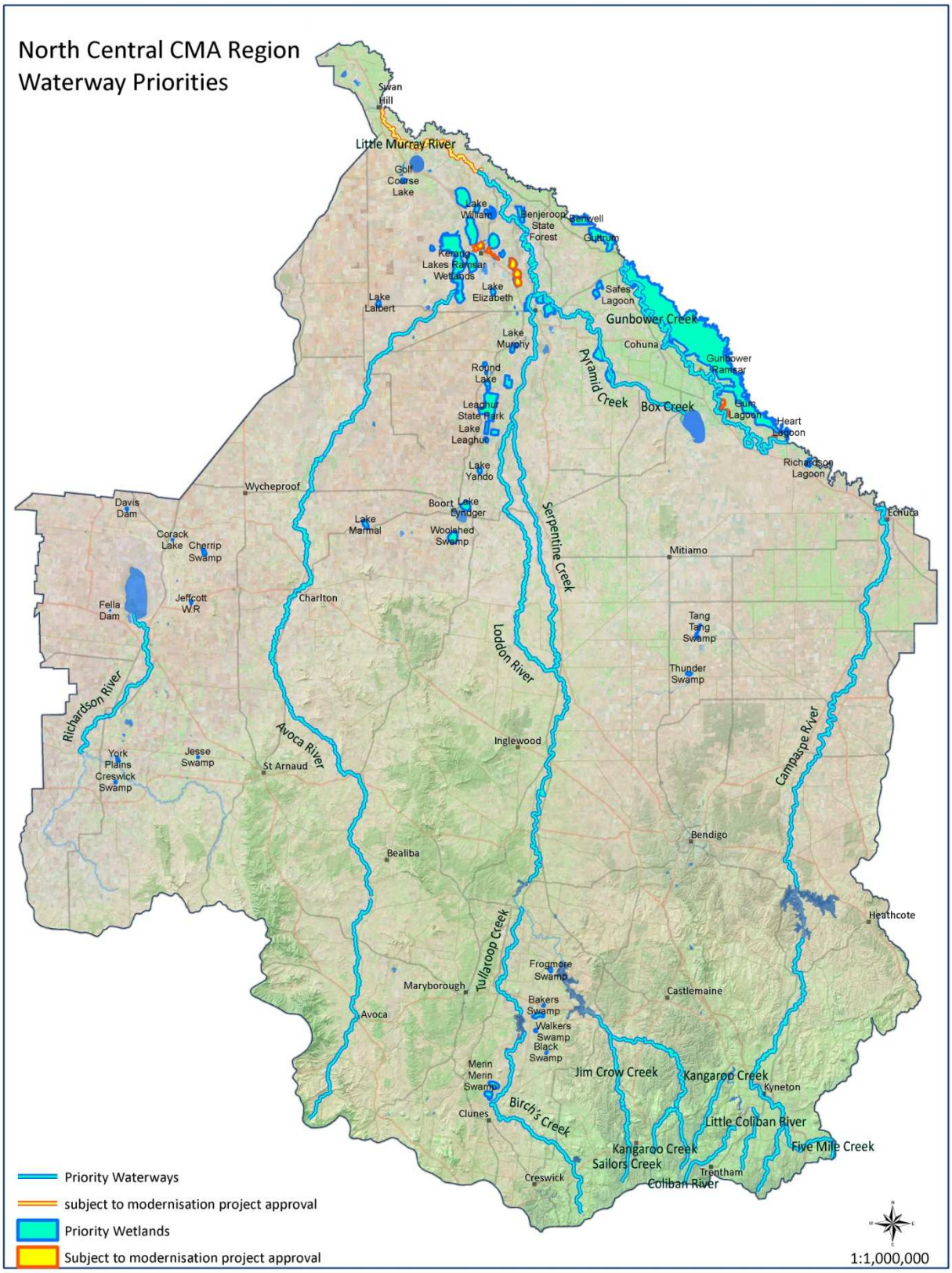


Figure 1: Map of North Regional Waterway Priorities.

PART A – Regional Overview and Strategic Context

1. Purpose and Scope

1.1 Introduction

The 2014-22 North Central Regional Waterway Strategy (RWS) is an integrated strategy for managing and improving the region's waterways (rivers, streams and wetlands). The Strategy sets priorities and outlines a regional works program to guide investment over the next eight years through to 2022. The Strategy will also guide coordination of efforts by landholders, partner organisations and the wider community.

The waterways (rivers and wetlands) of the North Central Region have economic, environmental and social importance. They provide the community with water for drinking, irrigation and industry, are a focal point for recreation and tourism, support unique environmental values and have strong cultural and historic significance.

The regional community highly values the region's waterways and recognises that a coordinated and collaborative approach is required to improve their current condition.

1.2 North Central RWS Objectives

The North Central Regional Waterway Strategy:

- Identifies the region's waterways of high environmental, social and economic values.
- Determines priority waterways.
- Establishes targets and goals for priority waterways.
- Sets out an eight-year action plan that identifies management activities for priority waterways.
- Establishes a monitoring and evaluation program to determine the relative success of implementing the strategy.

1.3 Scope and Policy Context

The 2013 Victorian Waterway Management Strategy (VWMS) provides the framework for government - in partnership with the community - to maintain or improve the condition of rivers, estuaries and wetlands so that they can continue to provide environmental, social, cultural and economic values for all Victorians. The framework is based on regional planning processes and decision-making, within the broader system of integrated catchment management in Victoria (DEPI, 2013a).

The 2013-19 North Central Regional Catchment Strategy (RCS) provides the long-term vision for natural resource management (NRM) within the North Central Region (Figure 2). The RCS sets regional priorities for managing natural assets, and also sets the overall direction for investment and coordination of efforts by landholders, partner organisations and the wider community (North Central CMA, 2013).

The 2013 VWMS and the 2013-19 North Central RCS guide the 2014-22 North Central Regional Waterway Strategy (RWS). The 2014-22 North Central RWS is aligned with a suite of NRM legislation, policies and strategies at federal, state and regional levels (refer Table 3 in Section 3).

The 2014-22 North Central RWS builds upon the previous River Health Strategy developed in 2005 and expands the scope of the former strategy to include floodplains and wetlands as well as rivers. As floodplains, groundwater systems, wetlands and terminal lakes all form part of river systems, their condition and priority actions for improvement are also recognised in the North Central RWS and subsequent asset management plans.

1.4 RWS Consultation

The North Central Regional Catchment Strategy was endorsed in 2013 and involved an extensive consultation process with the regional community about the region's most valued environmental assets including rivers and wetlands. After consultation with the CMA Board and Natural Resource Management Committee (Advisory Committee to the CMA Board) it was agreed that the development of the RWS would build off this extensive consultation process.

Therefore consultation during the development of the Draft RWS has been through the RWS steering Committee, NRMC, CMA Board and key partner agencies. Broader public consultation will be undertaken through the Public Consultation process and will include community meeting through the region.

1.5 North Central Regional Waterway Strategy structure

The North Central Regional Waterway Strategy consists of three major sections:

PART A – Strategic Context and Regional Overview

PART B – Vision, Goals and Guiding Principles

PART C – Regional Work Program

2 Regional Overview

The North Central Region covers approximately three million hectares or 13% of Victoria. Extending from the River Murray in the north, to the Central Highlands in the south; the Mount Camel Range forms the eastern boundary of the region while the internally drained Avon-Richardson Basin forms part of the western border.

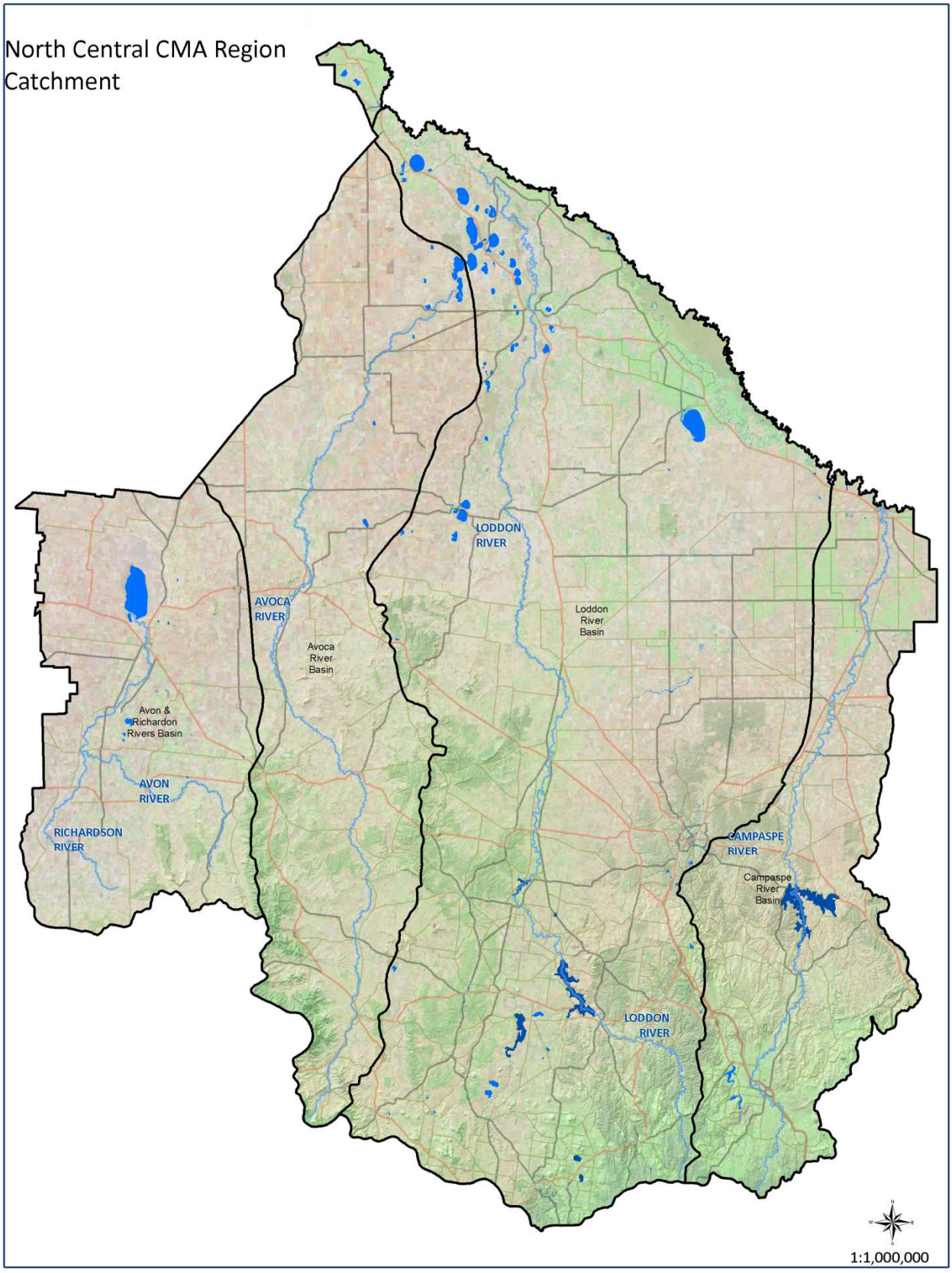


Figure 2: Waterways of the North Central Region.

The North Central Region is part of the Murray-Darling Basin and contains four river basins, or *catchments*, which drain to the north:

- Campaspe Basin 6
- Loddon Basin 7
- Avoca Basin 8
- Wimmera Basin 15

Wimmera Basin 15 is shared by the North Central CMA region (Avon and Richardson rivers) and the Wimmera CMA region (Wimmera River and tributaries). Avoca Basin 8 is shared by the North Central CMA region (Avoca River and part of Lalbert and Tyrell Creeks) and Mallee CMA region (Lake Tyrell and Lake Timboram). The Campaspe and Loddon rivers flow directly into the River Murray. The Avoca River flows into a series of lakes and wetlands (the Avoca Marshes). During flood events, it may flow to the River Murray and via stream channels to a further series of lakes. The Avon-Richardson catchment is internally drained, with most surface water flowing into Lake Buloke.

Waterways (rivers, creeks, floodplains and wetlands) support a diversity of natural flora and fauna and are highly valued by the regional community for aesthetic, recreational and economic values. They are highly important in the movement and cycling of sediment and nutrients through the landscape, and a significant interface between aquatic and terrestrial systems (North Central CMA, 2013).

Although the River Murray between Echuca and Swan Hill lies on the border of the region, and outside the scope of the North Central RWS, the interaction between the region and the River Murray is significant. The River Murray is the single largest source of water in the region for irrigation, while the Loddon, Campaspe and Avoca rivers all contribute water, salt and nutrients to the River Murray as well as the exchange of aquatic species (i.e. migratory fish). The River Murray is a waterway of national importance and is integral to the health of the internationally significant Gunbower Forest and Kerang Lakes wetlands (North Central CMA, 2013).

2.1 Waterway Condition

The condition of waterways in Victoria is periodically assessed using the Index of Stream Condition (ISC) and the Index of Wetland Condition (IWC) and provides the most comprehensive statewide set of information available on waterway condition (DEPI, 2013a).

Stream Condition

The Index of Stream Condition (ISC) provides a measure of condition and assesses sub-indices relating to hydrology, water quality, streamside zone (riparian vegetation), physical form (bank condition and in-stream habitat) and aquatic life (macroinvertebrates). The ISC is categorised into one of five broad condition bands – excellent, good, moderate, poor or very poor. While the condition band is useful in summarising the overall condition of a river reach, it is the details (sub-index and metric scores) that are used to better understand the issues affecting the condition of a reach and are used in river planning and management (DEPI, 2013a).

Recent ISC assessment for the North Central Region identified only 1% of the stream length in good condition, 46% in moderate condition and 30% in poor condition (DEPI, 2013b). This highlights the significant challenge we face in maintaining and enhancing the waterways that we value within the North Central Region.

Wetland Condition

The Index of Wetland Condition (IWC) methodology assesses wetland condition based on the 'biological, physical, and chemical components of the wetland ecosystem and their interactions'. The IWC aims to provide a method to monitor wetland extent and condition over a 10-20 year timeframe, with the benchmark condition considered to be the wetland unmodified by human impact associated with European settlement (DSE, 2005).

For the first time in 2009-10 event-seven of the region's wetlands were assessed with seven wetlands considered to be in excellent condition, 25 in good condition, 38 in moderate condition and seven were in poor condition (North Central CMA, 2013).

The wetlands assessed in this process to date are only a limited sample of all the wetlands within the North Central Region. They were assessed during a very dry period within northern Victoria which likely resulted in low scores for factors such as wetland biota. These, and other wetlands within the region will continue to be assessed during the implementation of the North Central RWS to understand wetland condition during (and after) a wet period.

2.2 Campaspe Catchment

The Campaspe catchment extends from the Great Dividing Range in the south, to the River Murray in the north, and covers a total area of approximately 4,000 square kilometres (km) [approximately 17% of the North Central region]. The catchment is approximately 150 km long and has an average width of approximately 25 km (North Central CMA, 2005).

Rivers and Streams of the Campaspe catchment
The Campaspe River is the major waterway in the catchment flowing 245 km north from its headwaters near Woodend to its confluence with the River Murray at Echuca. The Campaspe River flows through urban, peri-urban and rural townships including Kyneton, Elmore, Rochester and Echuca. The Campaspe's major tributary is the Coliban River which flows from Trentham, through the three Coliban Water storages (Lauriston, Malmsbury and Upper Coliban reservoirs) before reaching Lake Eppalock. Other significant tributaries include the Axe, McIvor, Mount Pleasant, Wild Duck and Pipers creeks.

Since 1836, when explorer Major Thomas Mitchell named the Campaspe River, the landscape has undergone significant change. The cumulative effects of the gold rush, the building of reservoirs and water supply systems, native vegetation clearing, farming systems and urban development are clearly reflected in the current condition of the waterway (North Central CMA, 2005). Results from the 2010 ISC survey (Refer to Figure 3) reveal that only 7% of streams in the Campaspe catchment are in good conditions, 39% are in moderate condition and 54% are in a poor to very poor condition (DEPI, 2013b).

The Lower Campaspe River (below Lake Eppalock) is highly regulated due to the operation of Lake Eppalock, and the Campaspe Weir and Siphon, north of Rochester. Although highly regulated, the Campaspe has recently received significant volumes of environmental entitlements through the Goulburn-Murray Irrigation District Modernisation Project and the implementation of the Murray-Darling Basin Plan. This additional water provides a strong opportunity to meet the environmental flow objectives for the Campaspe and improve the health of the Lower Campaspe over the coming years.

The Campaspe River has high environmental values due to its connection to the Murray River, its iconic River Red Gum communities and native fish population, including Murray Cod and Golden Perch. It also supports a range of social values along its length, including camping, fishing, canoeing/kayaking, swimming, water skiing, bird watching, walking and picnicking.

There are no recognised significant wetlands systems within the Campaspe catchment, although the water storages of Lake Eppalock, Lauriston, Malmsbury and Upper Coliban Reservoirs all support some aquatic values and provide drought refuge.

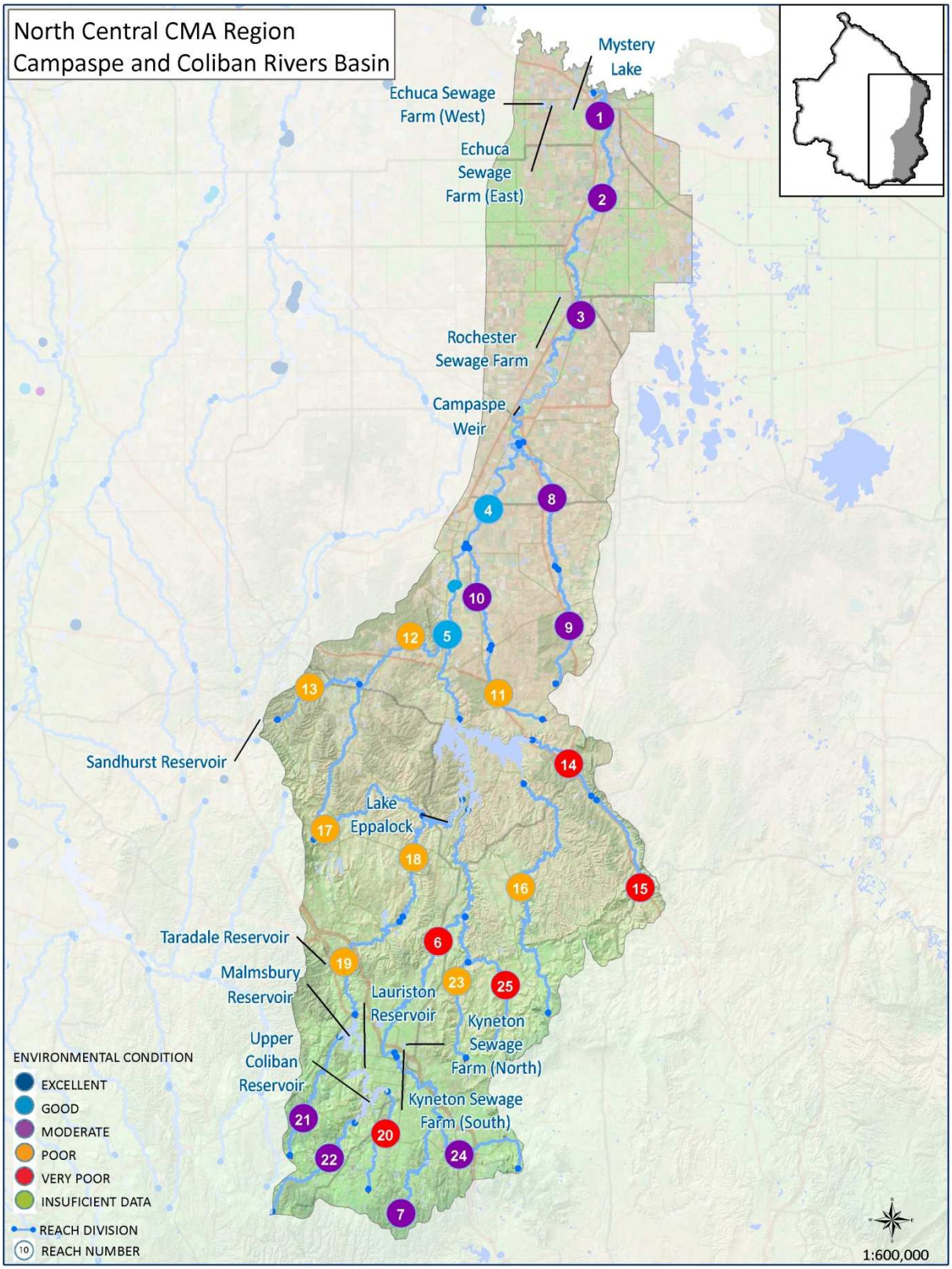


Figure 3: Map of Campaspe catchment waterways

2.3 Loddon catchment

The Loddon catchment is home to two-thirds of the region's population. It covers approximately 1,500,000 ha and extends approximately 310 km from the Great Dividing Range in the south to the River Murray. Mount Alexander is the highest point in the catchment at 741 metres (m), just north of Castlemaine. The northern two-thirds of the catchment are the alluvial plains of the Murray Valley, with granite outcrops at Mount Terrick Terrick, Mount Hope and Pyramid Hill rising some 80-100 m above the plains. Major tributaries include Tullaroop, Birches, Bet Bet, Bullock, Bendigo, Serpentine, Gunbower and Pyramid creeks.

Land-use is highly varied throughout the catchment ranging from vibrant state parks in the south to broad acre dryland and irrigated farming in the north. The major reservoirs in the catchment are Tullaroop Reservoir, Laanecoorie Reservoir and Cairn Curran Reservoir.

Rivers and Streams of the Loddon catchment

The Loddon River headwaters are located near Lyonville in the Wombat Forest and the river flows north through central Victoria for 390 km, through towns including Baringhup, Newbridge, Bridgewater-on-Loddon, Serpentine, Durham Ox and Kerang. The Loddon River enters the River Murray near Benjeroop and also joins Little Murray River via the Fish Point Weir.

Smaller creeks and tributaries of the Loddon River include Tullaroop Creek, Serpentine Creek and Pyramid Creek. The River Murray anabranches of Gunbower Creek and Pyramid Creek flow across the northern floodplain. These creeks are an integral part of the lower Loddon River catchment and support many of the threatened species within the catchment.

Barr Creek is considered one of the saltiest inland waterways in Victoria and plays an important role in salt mitigation in the region. A pump station located along the lower reaches of Barr Creek pumps saline water to the storage basin of Lake Tutchewop to manage flows and salinity levels in the Loddon River and River Murray.

Since European settlement, the cumulative effects of the gold rush, irrigated agriculture and river regulation, urban development and land clearance have fundamentally changed the nature of many of the waterways in the catchment (North Central CMA, 2005). Results from the 2010 ISC survey (Refer to Figure 4) reveal that 41% of waterways in the Loddon catchment are in moderate condition and 55% are in a poor to very poor condition (DEPI, 2013b).

The Loddon River, Tullaroop and Birches Creeks are regulated due to the operation of Tullaroop, Laanecoorie, Cairn Curran, Newlyn Reservoirs and Hepburn Lagoon. Environmental entitlements are held in these storages and are used to meet key environmental objectives for the Birches Creek, Tullaroop Creek, Loddon River and Wetlands located in the lower Loddon catchment.

Wetlands of the Loddon catchment

The Loddon catchment contains many of the North Central Region's wetlands, including the Ramsar listed Gunbower Forest and Kerang Lakes (Refer to Section 2.10). Other important wetland complexes identified in the North Central RCS include the Moolort Plains, Kamarooka, Mid-Loddon and Central Murray Wetlands.

There are a number of threats to the wetlands systems within the Loddon catchment, including altered hydrology, soil disturbance, land forming, habitat fragmentation, salinity, nutrients, invasive plants and animals. These threats can have a significant impact on the condition of the wetlands and the species that they support.

Wetlands within the Loddon catchment that currently receive environmental water, include Lake Boort, Lake Leaghur, Lake Yando, Lake Merin, Little Lake Merin, Lake Murphy, Lake Elizabeth, Hirds Swamp, Jonhsons Swamp and McDonalds Swamp.

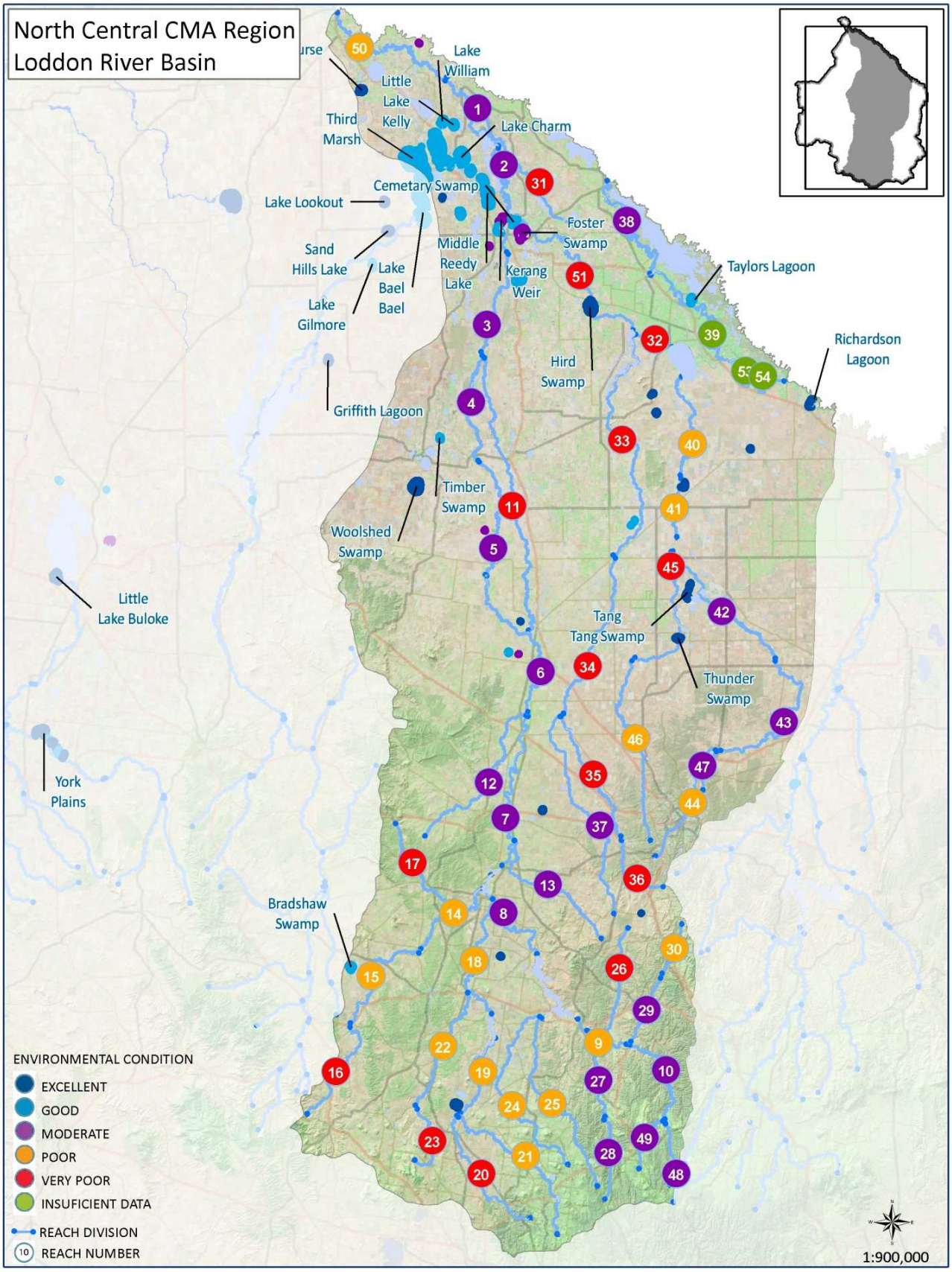


Figure 4: Map of Loddon catchment waterways.

2.4 **Avoca catchment**

The Avoca River catchment covers approximately 1,200,000 ha, though only 690,000 ha lies within the North Central Region. The Avoca catchment extends from the Great Dividing Range near Amphitheatre, to the Avoca Marshes and into the River Murray during flood events. Major townships in the catchment include Avoca, Charlton and Quambatook.

Agricultural activity in the Avoca catchment is based on grazing and cropping. Broadacre grazing is the predominant agricultural land use in the catchment's south and broadacre cropping in the north. Grape production, oil seeds and pulses are important industry sectors in the south of the catchment (North Central CMA, 2005).

The Wimmera Mallee Pipeline Project completed in 2010 - the largest water infrastructure project in Australia - replaced 18,000 km of inefficient earthen channel with 9,159 km of pressurized pipeline and associated structures. The pipeline will save on average 103 billion litres of water a year and provide a continuous water supply to approximately 9,000 farms and 34 townships across the Wimmera and Mallee (GWMW 2013).

Rivers and Streams of the Avoca catchment

The Avoca River rises at the foot of Mt Lonarch, near Amphitheatre. From its headwaters to Charlton, the Avoca River flows within a relatively confined valley, draining Glenlogie, Sugarloaf, Cherry Tree and Strathfillan creeks, which all flow in from the west. Approximately halfway along its length (near Glenloth), the river splits into a series of anabranching channels across a low-angle alluvial plain. Moving downstream, the channel capacity decreases, until the three main channels, namely the Avoca River and western effluent streams of Lalbert and Tyrell creeks, terminate at Lake Bael Bael, Lake Timboran and Lake Tyrell respectively. These latter creeks are ephemeral and are linked only to the main Avoca River across the floodplain during major flood events (North Central CMA, 2005). The Avoca River is listed as a Representative River for the West Victorian dissected uplands, making it one of the most significant waterways in the region.

Early European settlement of the southern half of the catchment was accelerated by the onset of the gold rush, which triggered widespread land clearance and intensive agricultural development. This had a profound effect on erosion and deposition processes in the catchment's waterways (North Central CMA, 2005). Results from the 2010 ISC survey (Refer to Figure 5) reveal that 74% of the streams in the Avoca catchment are in moderate condition, and 24% are regarded as poor (DEPI, 2013b).

Wetlands of the Avoca catchment

There are numerous wetland areas in the Avoca catchment, covering a total area of 175,000 ha. The majority of these areas are located in the northern part of the catchment. The Avoca Marshes, part of the Ramsar-listed Kerang Lakes, are a series lakes and swamps that differ in permanence, depth and salinity. Other wetlands on the plains include Lake Lalbert, Sandhill and Sandhill West lakes, Lake Marmal, Griffiths and Terappee swamps. In the south, Bradshaw Swamp is the largest remaining wetland.

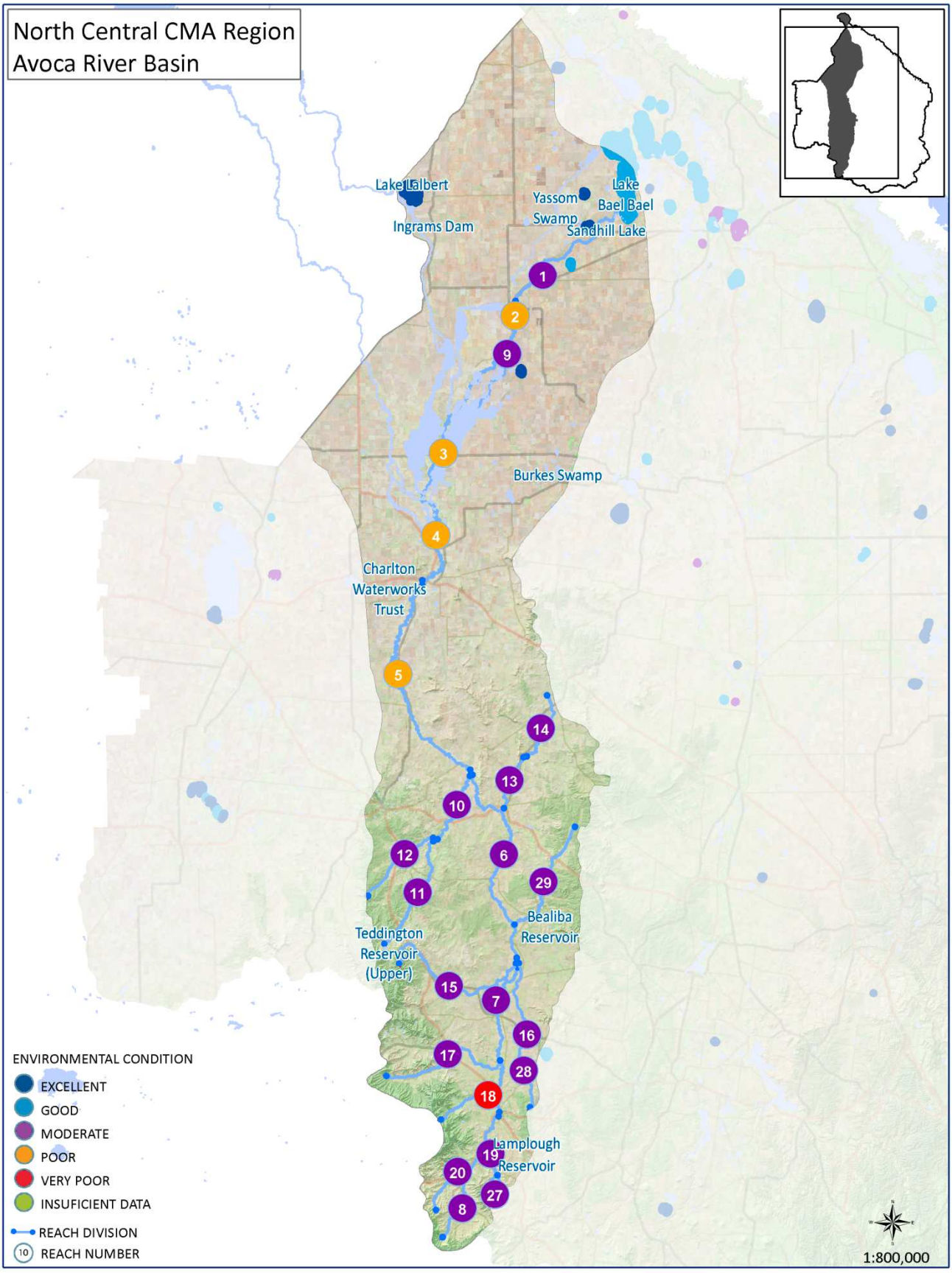


Figure 5: Map of Avoca catchment waterways.

2.5 Avon-Richardson catchment

The Avon-Richardson catchment is a land-locked river system that extends northwards from the Pyrenees foothills southwest of St Arnaud, to Lake Buloke on the margins of the Mallee, and covers a total area of approximately 330,000 ha. The Avon-Richardson catchment lies to the east of the Wimmera basin. The catchment has relatively little river regulation to modify or prevent flood flows.

Rivers and Streams of the Avon-Richardson catchment

The Avon and Richardson rivers are two small land-locked rivers in the Wimmera Basin starting in the Pyrenees. The Avon River originates in the sedimentary hills south of Beazleys Bridge, and the Richardson River flows mainly through the flat clay plains near Callawadda and Marnoo. The two rivers meet at Banyena, where the Richardson River continues flowing northward to the nationally significant Lake Buloke near Donald. The major tributaries flowing into the Avon River are Sandy, Paradise and Reedy creeks. Those flowing into the Richardson River include Wallaloo and Swedes creeks. There are over 100 lakes and wetlands within the Avon-Richardson catchment, including the York Plains, Lake Batyo Catyo, Lake Jil Jil and Lake Cope Cope.

Since Major Thomas Mitchell crossed the Richardson River in 1836, European settlement has left its mark on the catchment's landscape. The impacts of the gold rush, land clearance, farming practices and the water supply system is largely demonstrated by the condition of the waterways (North Central CMA, 2005). Results from the 2010 ISC survey (Refer to Figure 6) reveal that 46% of the streams in the Avon-Richardson catchment are in moderate condition, and 54% regarded as poor (DEPI, 2013b).

Wetlands of the Avon-Richardson catchment

The York Plains is a complex of wetlands along the Avon River which provides important biodiversity in the largely depleted agricultural landscape. York Plains supports large remnant stands of Buloke and River Red Gums, which were the dominant vegetation prior to European settlement but have since become absent from much of the surrounding landscape.

Rising saline groundwater due to past land clearing practices and the removal and destruction of native vegetation through overgrazing, cropping and wood removal threatened the environmental values of these wetlands. The North Central CMA has led extensive riparian restoration work in recent years designed to protect the York Plains wetlands unique ecological character.

Lake Buloke, registered under the National Estate in 1996, comprises wetlands of high significance for maintaining habitat for the conservation of waterbirds, particularly waterfowl and waders. This freshwater lake forms the terminal outlet of the Avon-Richardson River System.

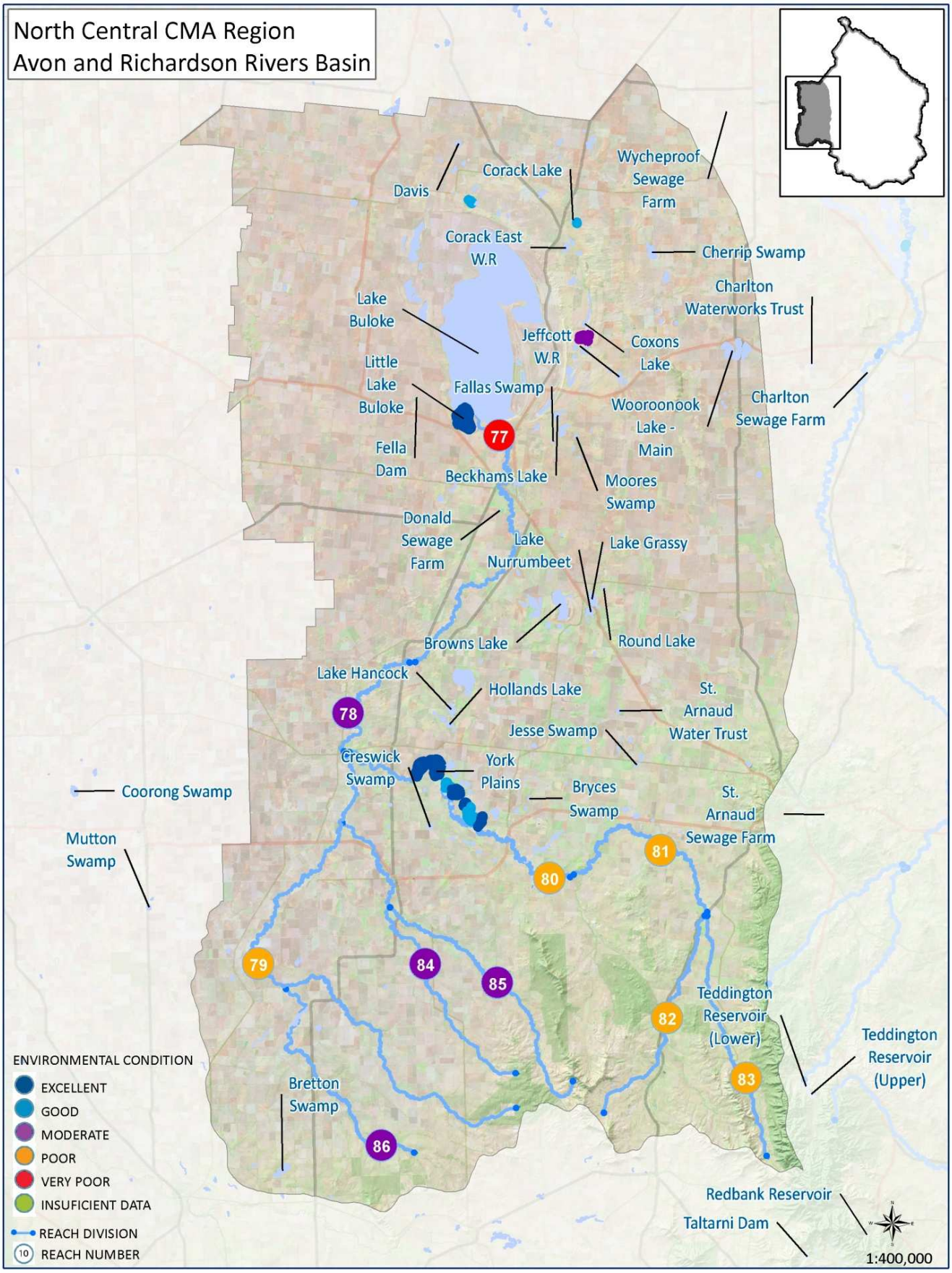


Figure 6: Map of Avon-Richardson catchment waterways.

2.6 Importance of Waterways

People of the North Central Region today retain a strong connection to waterways and most towns have an associated waterway or waterbody that provides aesthetic appeal. Access to water is also the lifeblood of the region and waterways are widely used for recreational pursuits such as boating, swimming and fishing.

The My Victorian Waterway Survey was conducted in 2009, surveying over 7,000 Victorians about community expectations, attitudes and behaviours about waterway management. The survey indicated that Victorians want healthy waterway with 98% of respondents agreeing waterways should be as healthy as possible so they continue to provide for our needs. The survey also indicated most respondents visited waterways for recreational purposes including enjoying the scenery, enjoying native animals, plants and birds, walking, cycling, picnics and fishing (Pisarki and Cary, 2010).

The VWMS highlights the importance of healthy waterways for the economy for Victoria with a 2007 study conservatively estimating Victoria's rivers provide $986 million per year worth of services and benefits to the community (URS, 2007).

Although the waterways of the North Central Region are highly valued for their environmental, social and economic values, many of them remain under threat from a range of factors that have contributed to their poor condition as outlined in Section 2.1. Table 2 provides a summary of the values, threats and impacts to waterways.

Table 2: Waterway Values, Threats and Impacts.

Values	Threats	Impacts
• Native flora and Fauna • Recreation • Water supply for towns, domestic and stock • Water supply for Agriculture and Industry • Tourism • Cultural heritage • Aesthetic • Lifestyle	• Catchment clearing • Poor land management • Grazing and clearing of stream banks • Pest plant and animal invasion • Climate variability • Urban and agricultural development • Inappropriate recreational practices • Removal of structural woody habitat • Waterway regulation and water extraction • In stream barriers for fish passage • Inappropriate levees	• Increased input of contaminants such as sediment, salt or nutrient causing deterioration in in-stream habitat • Increased salinity levels • Changed vegetation structure and species composition • Reduced regeneration of native vegetation • Reduced input of organic matter and structural woody habitat to rivers • Reduction or loss of floodplain linkages • Disrupted longitudinal and lateral linkages to waterways • Changed streambed and channel shape • Changes in flow patterns leading to loss of biological cues for aquatic species, reduced linkages, changes to habitat availability and changed geomorphic processes.

2.7 Aboriginal values and waterways

Throughout North Central Region, the landscape holds the imprint of generations of Aboriginal people that has created the region's rich cultural heritage. European settlement profoundly impacted the land, biodiversity and water and has significantly affected Aboriginal people (North Central CMA, 2013). In recognising the knowledge, culture and perspectives of Aboriginal people today, we acknowledge the transgressions of the past.

Rivers and wetlands are places of significance and importance for Aboriginal people across the North Central Region. These areas are important for sourcing food, health and wellbeing, navigation and boundaries, artistic and cultural expression, ceremony and celebrating rites of passage, sharing of creation stories, establishing alliances and social networks, trading goods, and committing the departed to their final resting places.

There are many registered places of Indigenous cultural heritage held within North Central Region and likely to be many that have not been registered or recognised. Underpinning these material aspects of Aboriginal cultural heritage are intangible places where there may be no physical evidence of past cultural activities. These include places of spiritual or ceremonial significance, places rich in traditional plant or mineral resources, or trade and travel routes.

Traditional Owners maintain rights to speak for their Country and heritage, and uphold responsibilities as the custodians of their culture. North Central CMA acknowledges that the ability of Aboriginal people to fulfill custodial responsibilities and continue traditional practices is inherently linked to the ecological health of rivers and wetlands and the resources they provide.

The *Traditional Owner Settlement Act, 2010* (Vic) provides an out-of-court settlement of native title and delivery of land justice. Currently within the North Central CMA the Dja Dja Wurrung people have recently settled their Native title Claim with the Victorian Government whilst the negotiation involving the Wamba Wamba, Barapa Barapa and Wadi Wadi people continues. Native Title settlements will provide both clarity and new opportunities for building relationships and creating employment, particularly for 'caring for country'.

The North Central RCS outlines principles for engaging with Aboriginal communities. These principles also apply to implementing the North Central RWS:

1. ***Respect and Recognition***:
    - Approach all issues with the understanding that the region's Traditional Owners and Indigenous Victorians have a continuous connection to Country
    - Have a valuable contribution to make in land, water and natural resource management
    - Can fulfil a uniquely integrated role in land, water and resource management practices
2. ***Caring for Country***: Actively seek to develop and support opportunities for the regions Traditional Owners and Indigenous people to connect and care for Country.
3. ***Partnership and Capacity Building:*** Through projects and activities, the North Central CMA and partner organisations will include an Aboriginal consultation component that reflects a meaningful engagement process.

Action:

- The North Central CMA will work with Traditional Owners groups to strongly align the North Central RWS and 'Whole of Country Plans' and continue to explore opportunities to work with TO groups on the Strategy's priority waterways.
- North Central CMA will seek to understand and support Traditional Owner aspirations for water management.

2.8 Community participation in waterway management

The North Central regional community has a long track record of working to protect the region's waterways. Continued community involvement in protecting and enhancing our waterways is critical to meeting the objectives of the North Central RWS. Encouraging participation, providing information and developing skills for the community are important aspects of waterway management and will be an ongoing focus for the North Central CMA.

"Monitoring native fish and all the other little creatures that live within our waterways contributes vital data to organisations like the North Central CMA. I get great satisfaction from knowing that the data I provide is used to help create a better environment."

Rob Loats, NRMC member and Waterwatch volunteer monitor since 1996.

Landcare, Waterwatch and other waterway management projects facilitated by the North Central CMA acknowledge and embrace the opportunity to collaborate with different communities to protect and enhance our environmental assets including waterways. Community partnerships and engagement activities are strongly embedded in the development and implementation of plans, strategies and asset protection programs, as local support is a fundamental component in delivering programs and achieving overall project success.

The North Central RCS outlines a number of community engagement and capacity building principles that will guide the development and implementation of the North Central RWS. These principles include:

- Ownership.
- Valuing local knowledge and skills.
- Integrity and honesty.
- Clear purpose.
- Clarity about roles.
- Concise and effective communication.
- Encourage participation.
- Capability and social learning.
- Building genuine relationships with community and other stakeholders.

The North Central Community Engagement Strategy 2013-15 and the Landcare Support Plan 2014-19 will also guide and encourage active participation of the regional community in waterway management activities to support the implementation of the North Central RWS.

2.9 **Climate**

"*Victoria's liveability is defined by the health and beauty of our natural environment, the quality of our infrastructure and the strength of our economy. Changes in our climate may put each of these assets under pressure if we don't act to protect them.*" Minister for Environment and Climate Change, The Hon Ryan Smith MP, Foreword, Victorian Climate Change Adaption Plan, 2013.

The Victorian Government's Report on Climate Change Science and Greenhouse Gas Emissions in Victoria (March 2012) published existing information on projections for Victoria's future climate with the projected changes including:

- more days over 35°C and higher annual mean temperature
- reduced average rainfall and stream flows
- fewer and heavier rainfall days
- reduced snow cover
- possible sea-level rise and storm surges.

These projections suggest an increased risk of:

- bushfires
- heatwaves
- floods
- drought
- sea level rise and coastal impacts.

There are many actions that can support the region's waterways in adapting and mitigating the impacts effects of climate change and climate variability. These include effective use of the environmental flow entitlements, removing barriers to fish, floodplain connectivity, riparian management, erosion control and protection of drought refuges.

This North Central RWS acknowledges that climate change and climate variability will continue to impact on the health of our waterways and that waterway restoration works as outlined in this Strategy will be the best way to mitigate the impacts of climate change and variability.

2.10 **Geographic Overview**

Water resources

The challenge to provide quality water for central Victoria began in the 1850s when gold was discovered and attracted thousands of hopeful diggers. The region's waterways began to play a crucial role in supplying water to the gold rush communities. Complex water supply networks were designed and installed in the upper catchment areas to meet the water supply needs of gold mining towns that evolved independently of secure water supplies. The Coliban Water Supply System is listed on the Victorian Heritage Register for its European heritage significance.

Surface water

A number of storages were built to service the region's growing development. Coliban Water now manages three major storages on the Coliban River (the Upper Coliban, Lauriston and historic Malmsbury reservoirs). Goulburn-Murray Water manages storages on the Loddon River (Newlyn, Tullaroop, Cairn Curran and Laanecoorie reservoirs and Hepburn Lagoon) and one storage (Lake Eppalock) on the Campaspe River. Today, these storages provide water for domestic, commercial and agricultural uses. Some storages also hold environmental water for release at the optimal time to benefit the river downstream. Irrigation water supplies from the Murray, and Goulburn river systems and stock and domestic supplies from the Wimmera system, supplement the region's surface water resources.

The North Central Region is an integral part of the Murray-Darling Basin. Water resources within the region occur as both groundwater and surface water (including water from the Goulburn system via the Waranga channel). Major reservoirs include Lake Eppalock, Upper Coliban, Lauriston, Malmsbury, Hepburn Lagoon, Newlyn, Cairn Curran, Tullaroop and Laanecoorie.

The Northern Region Sustainable Water Strategy (DSE, 2009) is a key document that aims to identify and understand threats to water availability and quality over the next 50 years. The Northern Region Sustainable Water Strategy is the Victorian Government's long-term water plan to secure water while safeguarding the future of its rivers, aquifers and wetlands across northern Victoria.

The Northern Region Sustainable Water Strategy covers threats to water availability and quality, including the implications of climate change and variability; how regional communities might adjust to reduced water availability; ensuring secure water entitlements for towns, industry and the environment; protecting and where possible, improving the health of rivers, wetlands and aquifers from the impacts of drought, climate change, variability and other risks; and recognising and responding to Indigenous and other cultural and heritage values associated with the region's rivers and catchments (DSE, 2009).

An additional Western Region Sustainable Water Strategy covers the western part of the North Central region.

Groundwater

Groundwater is a significant and valuable resource. Where a groundwater aquifer is highly connected to surface water, a decline in groundwater levels will reduce river flow and may affect both the groundwater and the connected surface water users. Wetlands and other dependent ecosystems, like native vegetation, may also be affected.

Groundwater is used extensively for stock and irrigation purposes and increasingly for town water supplies in the North Central Region. In some towns, such as Trentham in the south of the region, groundwater is used to augment surface water sources, while in others it is the primary potable water source, such as Elmore. Thirteen groundwater systems of different geology and flow path lengths have been identified within the North Central Region. Dependable groundwater supplies for stock and domestic bores are available at depths less than fifty metres in some areas of the North Central Region.

Groundwater use is most extensive in the south of the region for the irrigation of horticultural crops and pastures. Mineral springs are also used to support both the processing and tourist industries. Increasingly, deep lead aquifers in the middle and lower reaches of the Loddon and Campaspe valleys are also employed.

Groundwater management plans have been developed for two of the region's water supply protection areas (WSPAs) – the Lower Campaspe Valley WSPA and the Loddon Highlands WSPA - along with two groundwater management areas (GMAs) - Mid-Loddon GMA, Central Victorian Mineral Springs GMA.

Groundwater Dependant Ecosystems (GDEs) occur where groundwater interacts with environmental assets on the land surface and the asset relies on this interaction for survival for either part or all year. The knowledge regarding GDEs in the region is generally limited and requires further work to identify and develop management approaches to maintaining and enhancing such ecosystems (refer to Section 7).

Land use

Horticultural, dairying and mixed enterprises cover much of the lower Loddon and Campaspe riverine plains. These farms are supported by an extensive irrigation infrastructure and continue to undergo significant and rapid change as part of the irrigation modernisation program.

Dryland agricultural land uses, such as cropping and grazing, cover much of the middle and upper areas. Land use change in the North Central Region is largely being driven by the development of previously undeveloped land through subdivision and rural living zones. This may have significant impacts on catchment and river health.

A major increase in the number of lifestyle properties and urban expansion is obvious in a number of smaller towns, most noticeably along the Calder Highway corridor. Specifically, Bendigo has been identified in the Melbourne 2030 Strategy as an area ear-marked for accelerated development in line with the policy of 'better connected cities'. A 50% population increase over the next 20 years is predicted for Bendigo which in 2012 had a population of 103,722 (City of Greater Bendigo population data, 2013). This development may have a significant impact on both surface and groundwater quality and quantity, as well as the demand on potable supplies and wastewater treatment and reuse.

Floodplains

The catchments of the North Central Region's rivers and streams include extensive floodplain systems. Flooding is a naturally occurring event, and an important component of healthy waterway systems. The inherent functions of floodplains to convey and store floodwater should be recognised and preserved to minimise the deterioration of environmental values and the long-term flood-risk to floodplain production, assets and communities (North Central CMA, 2013).

The region's four catchments include areas of flood-prone land, where flooding has historically caused substantial damage to both the natural and built environment. Ad-hoc works and inappropriate development in the past have significantly impacted on the natural floodplains by changing the flood frequency and flooding patterns, and has caused deterioration in the natural riverine, floodplain and wetland environments. Best practice floodplain management will reduce flood damage, improve the wellbeing of landowners and reduce adverse impacts on the natural environment.

The January 2011 flood event was the largest on record for the majority of river systems in the region inundating an estimated 780,000 ha (25% of the region). Whilst the 2010-11 flood events had devastating impacts on urban and rural communities there have also been significant economic and environmental benefits, including the filling of the region's water storages and wetlands normally disconnected from the floodplain.

Since the January 2011 flood event the North Central CMA has worked with local Councils and the community to develop flood management plans to reduce the future risk of flooding in some of the worst affected communities within the North Central Region.

The Victorian Floodplain Management Strategy (currently in development) will provide statewide direction in relation to floodplain management. Once the state strategy is finalised the Regional Floodplain Management Strategies will be completed.

Population

The North Central Region's population exceeds 220,000 with most people living in the larger urban centres of Bendigo, Swan Hill, Echuca, Daylesford, Kerang, Castlemaine, and Maryborough.

Broader Environmental values

The North Central RCS identified priorities across many environmental assets themes including waterways (rivers and wetlands), biodiversity and soils. The RCS highlights the great diversity of NRM assets across the landscape and recognises the importance of catchment health on all assets in the RCS vision "A community active in protecting and enhancing the integrity of its catchment". In developing and implementing the North Central RWS consideration must always be given to the broader landscape, surrounding environmental assets and catchment.

'Formally recognised' waterway values - Ramsar Sites

Within the North Central Region the significance of the Kerang Wetlands and Gunbower Forest are formally recognised through their listing under the Ramsar Convention on Wetlands. This Convention is an intergovernmental treaty that provides the framework for international cooperation for the conservation and wise use of wetlands - one of the most threatened habitats in the world.

As a Contracting Party to the Ramsar Convention, Australia is required to maintain the ecological character of its Ramsar sites as at the time they were listed through conservation and wise use. The ecological character is defined by the Convention as 'the combination of the ecosystem components, processes and benefits/services that characterise the wetlands at a given point in time'. A change in ecological character is the 'human induced adverse alteration of any ecosystem component, process and or ecosystem benefit/service'.

An Ecological Character Description (ECD) has been completed for the Gunbower Forest Ramsar site and is in preparation for the Kerang Wetlands Ramsar site. This defines limits of acceptable change (LACs) for ecosystem services/benefits (values) and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Ramsar site. It also recommends monitoring needs for the Ramsar site.

Australia has 65 sites listed under the Convention, including 11 sites in Victoria, and two within the North Central Region. Information detailing the description, ecological character and long-term resource condition targets for the region's two Ramsar sites is included in Appendix B.

Social and Cultural values

The North Central Region boasts a dynamic and active community and our waterways support of a diversity of recreational, aesthetic and cultural activities.

The Avon-Richardson River, the Avoca River, and the regionally significant Loddon and Campase rivers, provide drinking water to many towns, support substantial rural and agricultural production and provide for significant recreational uses, including camping, swimming, fishing, boating, canoeing, bush walking, bird watching, picnicking and prospecting.

Major urban centres within the catchment are experiencing significant population growth, forecast to continue at a rate of 1.6% per year until 2030 (City of Greater Bendigo, 2004). As such waterways and waterway managers face the growing challenge to balance urban growth and environmental protection.

Tourism in the region is very popular during summer as people flock to major storages (e.g. Eppalock and Cairn Curran), rivers and lakes to undertake recreational activities.

The region is home to many sites of Indigenous importance. Eleven Indigenous language groups existed in the area prior to European settlement and those groups have left important physical evidence of their historic activities. Where found, this evidence survives as cultural heritage sites or places and can include axe grinding grooves, burial places and scarred trees. Indigenous groups continue to hold a strong affiliation with the region with major cultural heritage sites including Kow Swamp, Lake Boort, Lake Boga, Mt Kooyoora and Mt Franklin. (North Central CMA, 2013)

Economic values

The North Central Region is agriculturally diverse with extensive areas of irrigation across the region concentrated in the north, productive cropping and mixed farming in the west and cropping and grazing country in the mid and upper catchments. Agricultural uses vary from irrigated dairying, mixed farming and horticulture to dryland grazing and cropping. Rural living is an emerging and expanding land use and intensive animal production enterprises are increasing. The gross value of agricultural production within the region was in excess of $2 billion in 2011 (Neil Clark, 2013).

Approximately 13% of the region is public land, a substantial portion of which is reserved for recreation and nature conservation. Commercial forestry operations use public land and are concentrated in the foothill forests and softwood plantations in the south of the region (North Central CMA).

3 Strategic Framework and Context

The North Central Regional Waterway Strategy (RWS) is aligned with a suite of NRM legislation, policies and strategies at federal, state and regional levels. A summary of legislation and policy related to waterway management is presented in Figure 7 and Table 3with more detail provided in Appendix C.

Principally, it is the *Victorian Waterway Management Strategy* (DEPI 2013a) that provides the framework for government, in partnership with the community, to manage waterways so they can support environmental, social, cultural and economic values now and into the future. The VWMS updates the previous *Victorian River Health Strategy* (VRHS) - a significant milestone at the time for river management in Victoria. The 2013 VWMS outlines clear principles for making regional decisions on waterway protection and restoration, identifying regional priorities for management activities and state-wide direction on important management issues affecting river health.

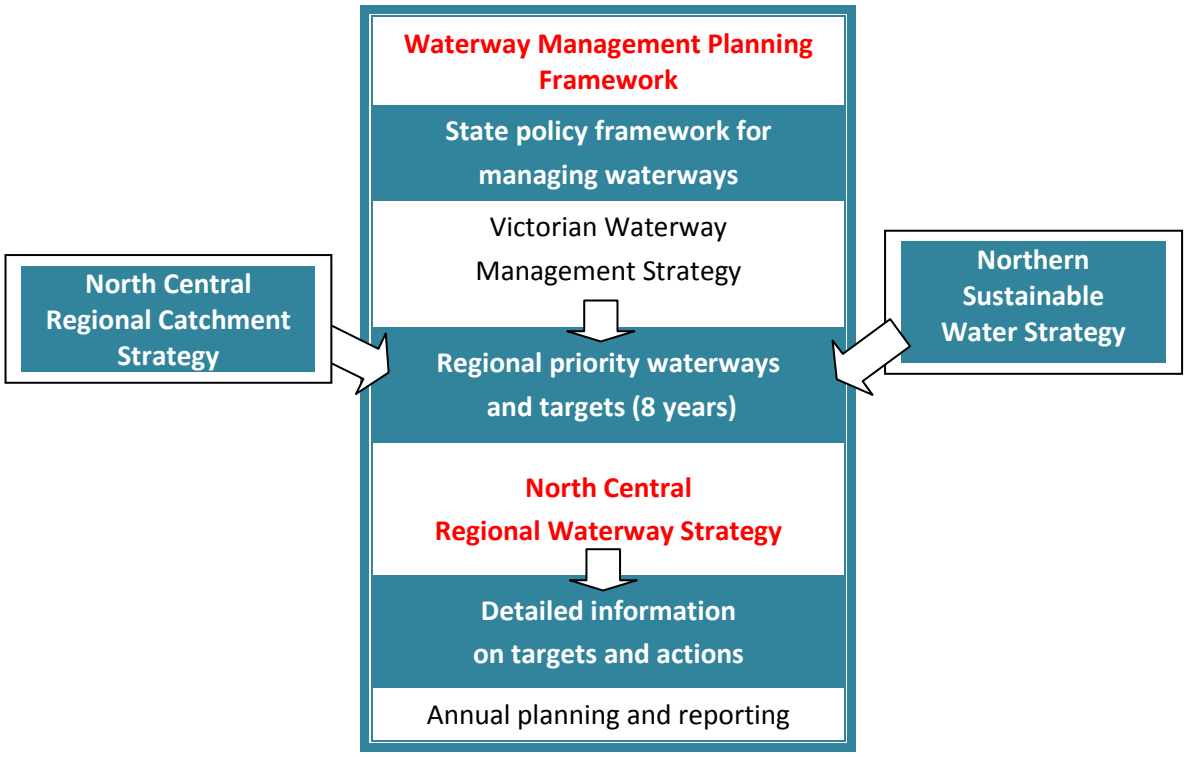


Figure 7: The Integrated Waterway Management Planning Framework (DEPI, 2013a).

Table 3 Waterway management related legislation and policy (AustLII, 2012).

International	*United Nations Declaration of Rights of Indigenous Peoples* 2007 - Recognises and protects Indigenous people's right to maintain and strengthen their spiritual relationship with the land and waters.
	Ramsar Convention (formally, the *Convention on Wetlands of International Importance*) is an international treaty for the conservation and sustainable utilisation of wetlands.
Federal	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984* – Focused on ensuring the preservation and protection for Aboriginal heritage.
	Commonwealth Water Act 2007 – Sets out requirements on how to manage water within the Murray-Darling Basin including developing the Murray-Darling Basin Plan and establishes the Murray-Darling Basin Authority and Commonwealth Environmental Water Holder.
	Environment Protection and Biodiversity Conservation Act 1999 - Provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.
	National Water Initiative (NWI) Under this agreement, governments across Australia have committed to actions to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water.
State	*Catchment and Land Protection Act 1994* – Sets up a framework for the integrated management and protection of catchments including the requirements for CMAs to develop and report on Regional Catchment Strategies.
	Planning and Environment Act 1987-Establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians.
	Water Act 1989 – Outlines the law relating to water in Victoria and provides for integrated management of all elements of the water cycle. The Water Act established the Victorian Environment Water holder and requires waterway mangers to develop regional waterway strategies.
	Flora and Fauna Guarantee Act 1988 – Provides a framework to promote the conservation of Victoria's native flora and fauna.
	Victorian Waterway Management Strategy 2013 - provides the framework for government, in partnership with the community, to manage rivers, estuaries and wetlands so they can support environmental, social, cultural and economic values now and into the future.
	State Environment Protection Policy (Waters of Victoria). It provides a statutory framework for State and local government agencies, businesses and communities to work together to protect and rehabilitate Victoria's surface water environments.
	Traditional Owner Settlement Act 2010 - Provides a system for negotiating or consulting about activities on Crown land where a Traditional Owner Settlement has been reached.
Regional	*2013-19 North Central Regional Catchment Strategy (RCS) s*ets the direction and articulates priorities for the management of natural resources within the North Central Region.
	*2014-22 North Central Waterway Management Strategy (in development) complements the RCS in s*etting the direction and articulating priorities for the management of waterways and wetlands within the North Central Region.
	Loddon Campaspe Irrigation Region Land and Water Management Plan 2011 – Provides an integrated framework for managing land, water and biodiversity within the North Central Region irrigation areas.
	North Central Native Vegetation Plan 2005 – Sets direction and articulates priorities for the management of native vegetation within the North Central Region.
	North Central Dryland Management Plan 2008 – Prioritises investment in NRM projects across the dryland area to achieve the highest value NRM outcomes for the community.
	North Central Floodplain Management Strategy 1999 – Sets the long-term direction for Floodplain Management within the North Central Region.
	North Central CMA Community Engagement Strategy 2013-15 – A strategic framework and action plan for engaging stakeholders and community in catchment management issues and natural resource management programs.
	Sustainable Water Strategies (Northern Region and Western Region) - Sets out long-term plans to secure the water future for Victoria.
	Regional Growth Plans (Loddon Mallee South, Loddon Mallee North, Central Highlands, Wimmera Southern Mallee and Hume regions)

A more detailed summary of relevant legislation and policy is presented in Appendix C – Legislature and policy

3.1 Roles and Responsibilities

The Roles and responsibilities for partners in waterway management are presented in Appendix D. The North Central CMA play a key role in waterway management as outlined in more detail below.

North Central Catchment Management Authority

The North Central CMA was established in 1997 by the Victorian Government under the *Catchment and Land Protection Act 1994.* The North Central CMA is charged with the responsibility of taking a whole-of-catchment approach to natural resource management in the North Central Region.

The primary goal of the North Central CMA is to ensure the protection and restoration of land and water resources, the sustainable development of natural resources-based industries and the conservation of our natural and cultural heritage. Under Part 10 of the *Water Act 1989*, the North Central CMA is the designated responsible manager of waterways, drainage and floodplains.

In terms of waterway management, the North Central CMA's key functions are to:

- develop a Regional Waterway Strategy and associated action plans.
- develop and implement work programs.
- authorise works on waterways and act as a referral body for planning applications, licences to take and use water and construct dams, for water use and other waterway health issues.
- identify regional priorities for environmental watering and facilitating water delivery.
- provide input into water allocation processes.
- develop and co-ordinate regional floodplain management plans.
- manage regional drainage, as appropriate.
- respond to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms.
- undertake community participation and awareness programs.

3.2 Review of the 2005-11 North Central River Health Strategy

Managing waterways in Victoria is achieved within an adaptive management framework. At the core of adaptive management is the ability to learn from previous experience and update management approaches to reflect the knowledge gained during implementation.

A review of the 2005 North Central River Health Strategy (RHS) has provided a sound foundation for the development of the 2014-2022 North Central RWS. The objectives of the RHS review were to:

- Determine the extent to which the planned activities and actions delivering the 2005 RHS were implemented and the extent to which these actions influenced resource condition change.
- Identify ways in which the 2005 RHS was useful, or added value, in NRM project planning and delivery.
- Identify learning's or improvements which could be made to the development process of the 2005 RHS.
- Inform the subsequent development and implementation of the 2014-2022 North Central RWS.

The 2005 RHS review process included a desktop analysis, review of strategy contents, assessment of activities against targets, consultation with CMA staff, key stakeholder interviews and a web based survey.

Key learning's from the RHS review

The review of the 2005 River Health Strategy (RHS) determined that:

- A review of Management Action Targets (MATs) for fencing and revegetation indicated that 35% were met or exceeded, 54% made progress but the target was not met, and no works were completed in 10% of reaches. Targets that were met or exceeded did so by an average of 302%.
- The community engagement approaches used are effective in improving landholder's knowledge and skills in waterway management based on social research undertaken by Charles Sturt University (CSU) on Loddon River.
- Better approaches are needed that provide the broader community with useful knowledge and information that will support local action.
- Targets set in the RHS were unrealistic due to large number of priorities not reflecting realistic funding opportunities, changing investment priorities, more targeted investment approach and basing targets in limited information.
- The RHS did not adapt to changes over the seven years, becoming less relevant in later years.

Key recommendations for the RWS

The following recommendations from the RHS review have been used in developing the 2014-22 North Central RWS:

- Provide clear direction on priorities with linked targets and actions.
- Develop a consistent MERI framework, including SMART Targets.
- Make the document more responsive/adaptive to changing conditions and circumstances.
- Strive for better engagement and more accountability.
- Make information more relevant and accessible by partners and the community.
- Be clear about the level of support that can be offered to the broader community, including managing expectations.
- Explore alternative and innovative information and knowledge exchange. Provide the broader community with localised and useful knowledge to help them plan and implement sound waterway projects in their local areas.

Successes of the 2005 RHS and arising innovations

The review of the 2005 RHS revealed that:

- Significant on-ground works were achieved across the region including:
    - ~ Establishment of over 450 km of waterway fencing.
    - ~ Protection of over 2,700 ha of waterway vegetation.
    - ~ Establishment of over 680 ha of waterway revegetation.
    - ~ Protection of over 1,700 ha of wetland vegetation.
    - ~ Significant pest plant and animal control during waterway and wetland works.
- Environmental flow management over the life of the strategy proved an excellent partnership between agencies. Between 2005 and 2011 the North Central CMA, Goulburn-Murray Water, Victorian Environmental Water holder (VEWH) and Commonwealth Environmental Water Holder (CEWH) played critical roles in planning and delivering environmental flows to meet specific environmental objectives, taking into account the operation constraints and opportunities of managing regulated river systems. The main reasons this partnership was successful were the sharing of an agreed goal, clear roles and responsibilities, good two-way communication and demonstrated commitment to making the partnership work.

- The 2005 RHS highlights the importance of community involvement and capacity building and contains a number of actions and targets set specifically around community involvement. Key projects and programs that have successfully contributed to communicating and engaging the community over the life of the RHS, included:
    - ~ North Central CMA Waterwatch – supporting over 60 volunteer community water quality monitors who collected water samples at over 112 sites across the region; and the successful implementing of school-based programs such as the River Detectives program
    - ~ Landcare Coordination – Providing support to 160 Landcare groups across the region with significant works contributing to enduring landscape change along local waterways
    - ~ Targeted River Health Projects – where communication and engagement plans developed for each project involved the implementation of tailored activities and tools
    - ~ The River Advocates concept - developed as a part of the nine-year Loddon Stressed River project - created a network of like-minded, passionate people along the river who share a connection to the river and who are committed to playing a role in its ongoing management. Fifteen active River Advocates continue to share information about the Loddon River - many through a website blog.

Case Study – Effective Community Engagement on the Loddon River

Many of the community engagement targets set in the RHS focused on improving the river health knowledge of landholders. A study on the Loddon River completed by Charles Sturt University provides confidence that the activities delivered through the RHS have been successful. The study found that:

- The Loddon River health project engaged many more people than most natural resource management programs.
- People involved in the project were more focused on environmental values than non-participants and less concerned about government taking a stronger role in natural resource management.
- Project participants had higher awareness and more knowledge of river health issues, were more confident in recommended practices (e.g. installing off-stream watering points, fencing to manage stock access) and implemented these at much higher levels than non-participants.
- Landholder participants had a strong positive impact on the Loddon River health projects' success.
- Project participants were very satisfied with the support provided by the North Central CMA and DPI staff.

PART B – Vision, Goals and Guiding Principles

4 Strategy Approach

4.1 A vision for waterways of the North Central Region

The long term vision for the 2014-2022 North Central Regional Waterway Strategy (RWS) is:

'Waterways and floodplains will be managed sustainably to protect and enhance their diversity and ecological function while also supporting the regional community's economic, recreational and amenity use'.
Adopted from the North Central Regional Catchment Strategy Waterway and Wetland Theme visions (North Central CMA, 2013a).

This vision will guide the North Central Regional community in implementing the North Central Regional Waterway Strategy over the next eight years. The RWS vision is also complementary to the VWMS and North Central RCS visions (see below).

Vision for Victoria's waterways - "Victoria's rivers, estuaries and wetlands are healthy and well-managed; supporting environmental, social, cultural and economic values that are able to be enjoyed by all communities" (DEPI, 2013)

Vision for the North Central RCS – "A community active in protecting and enhancing the integrity of its catchment"

4.2 Asset based approach

The North Central Region comprises unique and diverse natural environments and biodiversity. Many of the region's most significant environmental assets face a range of threats such as habitat loss and fragmentation, declining water quality, extreme climate variability, invasive plants and animals, and changing land use (North Central CMA, 2013a).

The 2013-19 North Central RCS, the 2013 Victorian Waterway Management Strategy (VWMS), and subsequently the 2014-22 North Central RWS have adopted an asset-based approach which identifies and describes the region's highest priority natural assets, including those of international, national, state and regional significance.

A key challenge for communities across the North Central Region is how to get the best outcomes from the limited resources available. One solution to this challenge is to use an asset-based approach by focusing our efforts on protecting and enhancing environmental assets with the most significant values (ecological, social, cultural and economic), that are under the greatest threat and with high likelihood and feasibility of protection and enhancement (North Central CMA , 2013). The asset-based approach in the North Central RWS has been guided by the VWMS and the Regional Waterway Strategy Guidelines issued by the Department of Environment and Primary Industries (DEPI, 2013c).

An asset-based approach is only successful when there is close collaboration with landholders and communities. There is also a recognition that targeted asset based investment needs to be balanced by investing in a broader program that supports and builds capacity in the broader community.

4.3 Aquatic Values Identification and Risk Assessment (AVIRA)

Aquatic Values Identification and Risk Assessment (AVIRA) is a statewide database for environmental, social and economic values and associated risks to these values. This database sources information from Victoria's key datasets including the Index of Stream Condition and local knowledge and provides a comprehensive understanding of the values and threats for all Victoria's waterways and wetlands.

AVIRA has been a foundational tool in setting priorities for the North Central RWS and has provided valuable information regarding the key values at risk.

4.4 Guiding Principles

Successful implementation of the North Central RWS will require long-term commitment from both the Victorian Government and the North Central Region's communities and will rely on rigorous decision making and investment. The following principles outlined in the VWMS will guide the development and implementation of the North Central RWS:

- **Partnership approach** – waterway management will continue to be a partnership between government, industry and the community.
- **Community involvement** – communities will have the opportunity to be involved in all major phases of waterway management. 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.
- **Appropriate tools** – the full complement of instruments and approaches will be considered to improve waterway condition including; direct Government investment in on-ground works, grant and incentive programs, management agreements and covenants, market-based instruments, information and extension programs and 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.
- **Evidence-based decision-making** – the 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 (DEPI, 2013a).

Regional Waterway Strategies and Management Plans facilitate regional decision-making with community input and use a risk-based approach to identify high value waterways and priority management activities. These strategies and plans will:

- consider environmental, social, cultural and economic values of waterways.
- be holistic and integrate on-ground works with the management and delivery of environmental water management.
- ensure efficient and effective management of the environmental water.
- include maintenance as a vital activity to secure both past and future investment in on-ground works.
- be flexible in response to seasonal climatic variation and plan for the potential impacts of climate change.

4.5 Priority Setting Process

The Department of Environment and Primary Industries (DEPI) 2013 Guidelines and Guidance notes and the 2013-19 North Central RCS have guided the North Central RWS priority setting process. The priority setting process is explained in

Figure 8. A summary of the priority setting process is outlined in Appendix A – Summary of the RWS Priority Setting Process.

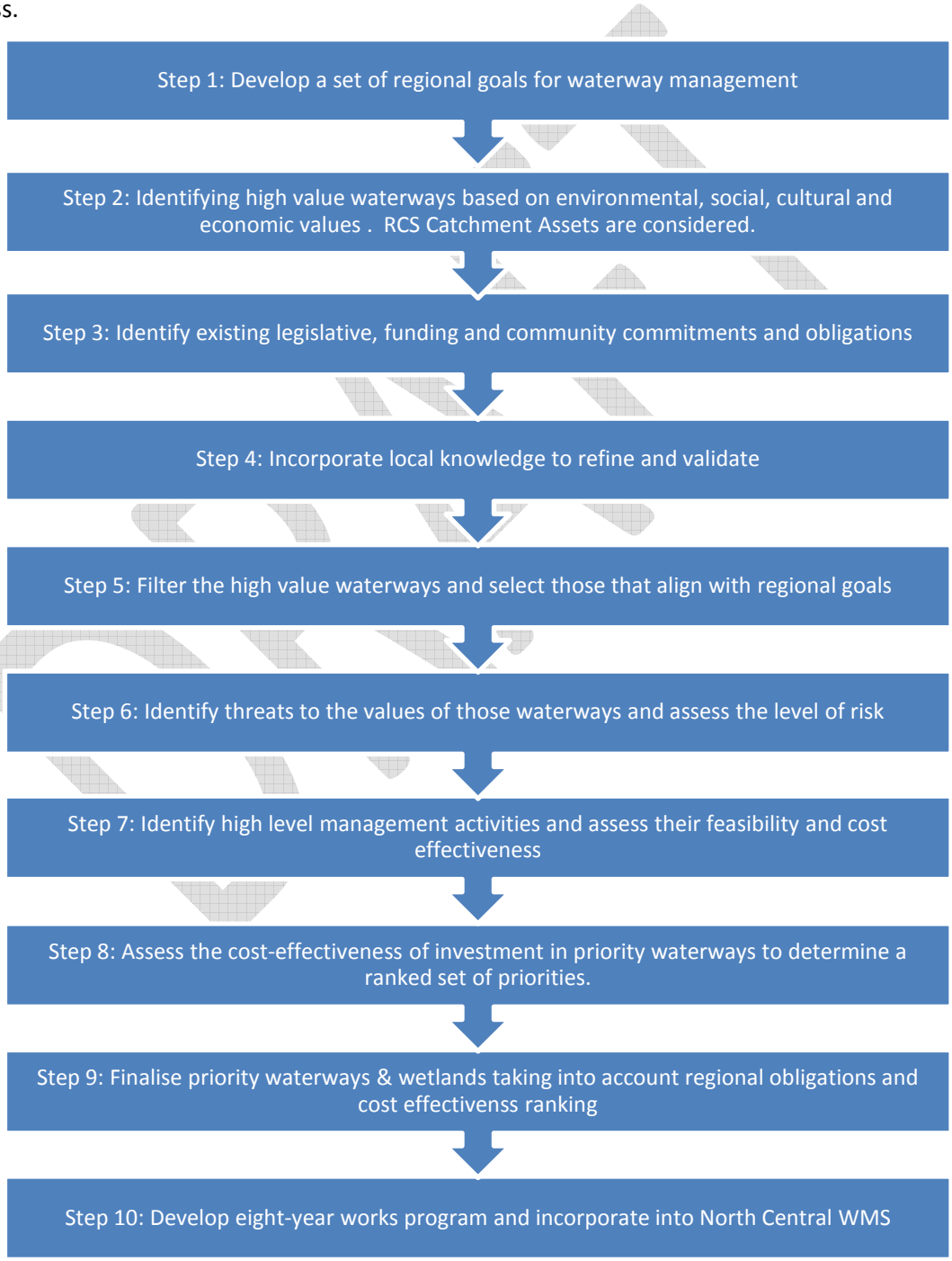


Figure 8:

Table 4 provides some guidance regarding the recommended actions: (Source: DEPI, 2013c)

Table 4: Summary of Recommended Actions.

	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/strengthen community commitment to improving the condition of local waterways • are required to meet statutory or regulatory obligations

5 Regional Waterway Strategy Goals

A number of regional goals have been developed to assist in the priority setting process. The North Central RWS goals reflect the VWMS approach, are consistent with the intent of the 2013-19 RCS, and allow differentiation between assets to assist in prioritisation. The goals for managing waterways in the North Central Region are to:

- Maintain or improve highly threatened or rare water-dependent species and communities within the North Central Region.
- Maintain or improve ecologically healthy or representative rivers.
- Protect or improve the ecological character of the Gunbower Forest and Kerang Lakes Ramsar sites.
- Maintain or improve wetlands of International, National or State significance as identified in the RCS.
- Maintain or improve waterways within water supply protection areas to support long-term improvement in water quality.
- Maximise environmental outcomes by efficiently managing environmental entitlements in partnership with water holders.
- Work with local urban communities to better understand the values of local waterways.
- Maintain or improve waterways that will provide adaptation under a variable climate.

5.1 North Central RWS Priorities

The North Central RWS priority setting process is illustrated in

Figure 8 and is summarized in Appendix A. The priorities for the 2014-22 North Central RWS are listed in Figure 9 and Table 5 with actions for each priority outlined in Section 7. The process, framework and consultation methods used in the development of the regional priorities are available in the discussion paper available at www.nccma.vic.gov.au.

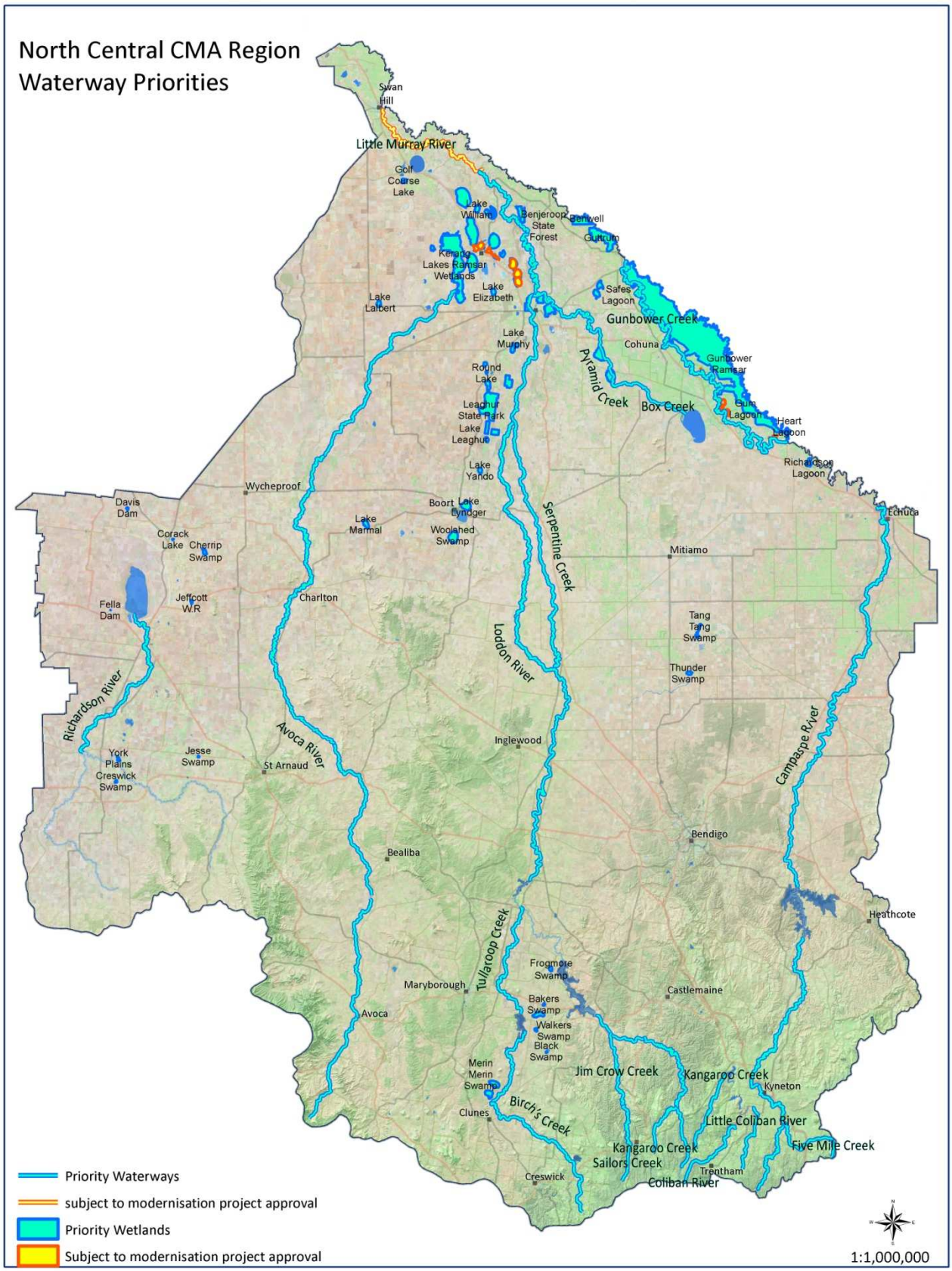


Figure 9: Priorities for the 2014-22 North Central RWS.

Table 5: Priorities for the 2014-22 North Central RWS.

Basin	Campaspe	Loddon	Avoca	Avon-Richardson
Priority Streams	Campaspe River, Five Mile Creek, Kangaroo Creek, Coliban River, Little Coliban River	Loddon River**,** Jim Crow Creek, Sailors Creek, Kangaroo Creek, Tullaroop Creek, Birch's Creek, Box Creek, Pyramid Creek, Serpentine Creek, Little Murray River, Gunbower Creek	Avoca River	Richardson River
Priority Wetlands	-	Frogmore Swamp, Bakers Swamp, Black Swamp, Walkers Swamp, Long Swamp, Middle Swamp, Merin Merin Swamp, Tang Tang Swamp, Thunder Swamp, Richardson's Lagoon, Kerang Lakes (Ramsar), Lake Yando, Cullen Lake, Lake Meran, Leaghur State Park, Johnson Swamp, Little Lake Kelly, Lake Kelly, Lake William, Red Gum Swamp, Lake Lyndger, Lake Leaghur, Lake Elizabeth, Lake Marmal, McDonalds Swamp, Woolshed Swamp, Hird Swamp, Benjeroop State Forest, Lake Tutchewop, Lake Murphy, Great Spectacle, Round Lake, Golf Course Lake, Fosters Swamp, First, Middle, Third Reedy lakes, Little Lake Charm, Racecourse Lake Gunbower Forest (Ramsar), Safe Lagoon, Taylors, Cockatoo, Gum, Heart, unregulated lagoons	First Marsh, Second Marsh, Third Marsh, Lake Bael Bael, Lake Lalbert, Yassom Swamp	York Plains Complex, Wimmera Mallee Pipeline supplied wetlands (Creswick Swamp, Cherrip Swamp, Davis Dam, Corack Lake, Jeffcott Wildlife Reserve, Jesse Swamp, Falla Dam)

6 Management Issues

Implementing the North Central RWS involves meeting a number of challenges and opportunities. Some of these are discussed within this chapter. Guidance is also provided about how to meet these challenges and maximise opportunities over the eight year life of the strategy.

6.1 Environmental Water Management

The efficient and effective management of environmental water is vital to protecting and improving the condition of our region's waterways. Environmental water management has evolved rapidly over the past 10 years with the establishment of the Victorian and Commonwealth environmental water holders and implementation of water management initiatives such as the Murray-Darling Basin Plan.

The guiding principles for environmental water management outlined in the Victorian WMS are:

- Integrated waterway management
- Maximising efficiency and seeking multiple benefits
- Transparent and sound decision-making
- Being prepared for future conditions.

The planning framework for environmental water management decisions is clear and summarised in the VWMS. The North Central RWS identifies priority waterways taking into account environmental water needs. A key component to this planning process is the development of environmental water management plans (EWMPs) for priority waterways identified in the RWS at risk from altered flow regimes.

The North Central CMA has effectively involved key partner organisations and the community in environmental water management planning and decision making through the establishment and use of Environmental Watering Advisory Groups (EWAGs) in the Campaspe, Loddon and more recently the Central Murray Wetlands. These groups have allowed for the effective involvement of a wide range of stakeholders and are an integral component of the ongoing planning process.

There is increasing recognition of the value of waterways and wetlands to Aboriginal people within the Murray Darling Basin and Victoria. The Basin Plan specifies that all watering plans must give regard to the spiritual, cultural needs of Aboriginal people and incorporate them into water planning.

The North Central CMA acknowledges that the health of waterways and wetlands is intrinsically linked to the cultural and spiritual identity of Aboriginal people. The connection between Aboriginal people, waterways and wetlands can be expressed through many ways including the plants used for traditional and contemporary cultural uses such as for food and medicine. Creation stories and song lines passed down over generations are evidence of the invisible spiritual connection Aboriginal people have with waterways and wetlands. Documenting and increasing the awareness of Aboriginal people's connection to waterways and wetlands is a critical step towards developing meaningful cultural objectives that support Traditional Owner aspirations.

Environmental water delivered to wetlands and waterways can often achieve both ecological and cultural benefits. Appropriate water regimes may assist in the preservation and protection of cultural values and facilitate the sharing of cultural knowledge for future generations. North Central CMA recognises that it is important that cultural values and connections be considered in water management planning, in particular environmental water management.

The VWMS clearly outlines how cultural considerations should be included in environmental water management. The VWMS Policy 8.7 states "*In planning for and making discretionary environmental watering decisions, the primary purpose is to maximise environmental benefit. Where consistent with this objective, environmental water managers must also consider whether social and cultural benefits can be achieved*". Policy 8.7 also highlights the need for

waterway managers to engage the regional community, including Traditional Owner (TO) groups, to capture social and cultural values through current waterway and environmental water planning processes.

The North Central CMA, as the waterway manager for the region, is committed to working with the regional community, including Traditional Owners, to ensure environmental outcomes are achieved whilst considering social and cultural outcomes.

Continual improvement in environmental water management will be important throughout the eight year life of the RWS with an emphasis on research to fill critical knowledge gaps and monitoring and reporting to understand the effectiveness of environmental water delivery. Communicating outcomes of the environmental water management program to the community will also be a focus for VEWH and the North Central CMA as waterways manager.

Actions:

The North Central CMA, partner organisations and the community will:

- work to effectively implement the environmental water management framework from engagement, planning, delivery, monitoring and reporting.
- develop environmental watering plans for all key sites by 2018. EWMP priorities will be informed by the North Central RWS and outcomes from the Basin Plan implementation.
- ensure effective engagement by continuing to use Environmental Water Advisory Groups or equivalent in planning and decision making.
- Strive for continual improvement in monitoring approaches ensuring best science is used and that outcomes are communicated to the broader community.
- consult with Aboriginal people in the planning of environmental water management within the Victorian environmental water management framework.
- seek funding to work with Traditional Owners to maintain and revive cultural knowledge and connections to significant waterways and wetlands.

6.2 Native Fish Passage

A key aspect of waterway condition is maintaining connectivity and passage for native fish and improving native fish population viability. Longitudinal connectivity within a river is essential for many fish species such as Murray Cod and Golden Perch to migrate, spawn and recolonise. Within the North Central region there are many barriers to fish movement including weirs, large dams and culvert road crossings etc.

The VWMS highlights a number of State wide priories for improving native fish passage including:

- Campaspe River (Campaspe Syphon & weir)
- Loddon River (various barriers)

In the north the Torrumbarry Irrigation Region is highly interconnected with natural waterway assets such as rivers, wetlands and lakes. A Mid Murray Native Fish Recovery Plan is currently being developed to improve fish populations in a highly regulated irrigation system (See below).

Mid Murray Native Fish Recovery Plan
The Mid Murray Native Fish Recovery Plan aims to optimise outcomes for native fish within the Gunbower Island - lower Loddon River area whilst also meeting the need to provide water for irrigation. The philosophy of the Recovery Plan differs from the more traditional approach of returning the ecosystem to as close to natural conditions as possible by viewing the irrigation system as an ecological asset with high potential value to support self sustaining native fish populations.

The Recovery Plan focuses on delivering on-ground actions at a regional scale by utilising the potential of creeks, wetlands and forests that are connected by the Torrumbarry Irrigation System. For example, although Gunbower

Creek and Box Creek were originally ephemeral today they provide greater ecological value regionally as permanent flowing-water habitats connected to the River Murray and adjacent wetlands. With habitat rehabilitation these streams would become spawning and nursery areas for native fish, as well as migration pathways.
The Recovery Plan uses the latest scientific information on aquatic ecology to provide a conceptual and practical framework of actions that can be integrated or applied to an irrigation system. A comprehensive list of on ground actions is outlined in the Recovery Plan, which focus on three key components of flow management, connectivity (e.g. fish passage) and habitat enhancement.

Through implementation of the Recovery Plan the Gunbower Island - lower Loddon River area has immense potential to support thriving populations of native fish and become a key functioning component of the River Murray ecosystem. The vision of the Recovery Plan is "Greatly increased native fish populations, recovered threatened species, improved natural values, integrated with vibrant and productive irrigation and agriculture."

Action:

- The North Central CMA, in conjunction with agency partners and the community, will seek funding to implement the Lower Loddon Native Fish Recovery Plan.
- The North Central CMA will work with DEPI and water corporations to seek funding to improve fish passage of high priority native fish barriers identified in the RWS.

6.3 Strategic programs - Murray-Darling Basin Plan

The Murray-Darling Basin Plan (Basin Plan) developed under the Australian Government *Water Act 2007* provides a coordinated approach to water use across the Basin's four States and the ACT. The Basin Plan sets legal Sustainable Diversion Limits (SDL) for surface and groundwater from 1 July 2019, establishes Basin wide environmental objectives, environmental watering plans and water quality and salinity management plans.

The Basin Plan allows for environmental works and measures or improvement to river operations to secure environmental outcome equivalent to the SDL, but with less water. The North Central CMA and regional partners are working with DEPI and the MDBA to scope Works and Measures Projects that may be implemented to achieve environmental outcomes with less water.

Action:

- The North Central CMA will continue to work with VEWH, CEWH, DEPI and MDBA in ensuring coordination of Basin Plan implementation, including effective and coordinated use of environmental water within the North Central Region.

6.4 Strategic programs - Irrigation Modernisation

The $2 billion G-MW Connections Project aims to modernise, upgrade and improve the efficiency of the irrigation network in Northern Victoria. The Project will also provide important opportunities and benefits for environmental and urban water users and will ensure the ongoing contribution of irrigated agriculture to our regional, state and national economies.

The G-MW Connections Project is funded by the Victorian Government, Commonwealth Government and Melbourne Water and each investor will receive a defined share of the water savings achieved from improving the efficiency of the channel delivery network. The Commonwealth and Victorian Governments' shares of the water savings will deliver environmental benefits (G-MW, 2014).

The Connections Project involves three key programs, Backbone Channel Upgrades, Strategic Connection Plans and Special projects. Due to its integrated nature many regional waterways are influenced by the irrigation system. The Kerang Lakes, Gunbower Lagoons and Swan Hill Special project all involved significant environmental assets and will require strong collaboration with G-MW. Any changes to the irrigation system will need to take into account opportunities and threats from the Connection Project.

Action:

- The North Central CMA will work with Goulburn-Murray Water to ensure that appropriate environmental outcomes are achieved and that where possible objectives set in the North Central RWS are met.

6.5 Water Storages

Water storages within the North Central region hold significant economic, recreational and environmental value to the community. Although the management of theses storages is vested in water corporations such as Goulburn-Murray Water, Coliban Water and Central Highlands Water, there is a need to consider how actions in the WMS may support the overall management of the storages. G-MW and Coliban Water are currently in the process of developing management plans for their key storages. The CMA through the WMS will work with the relevant water corporations to ensure synergies between the WMS and Storage Management Planning processes.

Action:

- The North Central CMA will work with Water Corporations to align the RWS with Storage Management Plans where required.

6.6 Water Quality

The North Central CMA in conjunction with partner organisation has had a long history in working to improve water quality, in particular through the implementation of Nutrient Management Plans from the late 1990s. Significant progress has been made in improving water quality by reducing wastewater discharge from towns, implementing Local Government Stormwater Management Plans, riparian protection works, and dealing with soil erosion and runoff from agricultural land. A review of the Nutrient Management Plans in 2007 indicated the majority of these plans have been successfully implemented (North Central CMA, 2007).

More recently the asset based and targeted approach to waterway management has led to water quality being considered as part of an integrated approach. The VWMS states that Regional Waterway Strategies will identify priority waterways 'regional hotspots' where environmental, social, cultural or economic values are threatened by poor water quality (DEPI, 2013a). The VWMS also highlights that any water quality actions will need to take into account the scale of the problem and the feasibility of effective action.

Through the North Central RWS priority setting and risk analysis process water quality was identified as a threat to a number of assets. Consultation with water Corporations and consideration of feasibility and scale were used in determining regional hotspots. The Upper Coliban catchment was identified as a regional hotspot for water quality (See below). The North Central CMA will continue to work with regional water corporations, local government, EPA and DEPI in managing water quality issues where they align with RWS priorities and are feasible to deal with.

Water quality reflects the environmental condition of waterways, but can also provide an integrated indicator of the health of whole catchments (VWMS, 2013). The North Central CMA and its regional partners will use water quality monitoring data from the Victorian Water Quality Monitoring Network (VWQMN), Regional Water Monitoring Partnerships and Waterwatch to understand changes to water quality over time.

Upper Coliban Catchment

The Lauriston, Malmsbury and Upper Coliban reservoirs managed by Coliban Water provide the water supply needs for approximately 110,000 people and a wide range of industries and business. Coliban Water has developed a Draft Drinking Water Storages and Land Management Plan that highlights the importance of protecting water quality, identifies risks and outlines various activities to improve water quality within the Upper Coliban catchment.

The Kangaroo Creek and Upper Coliban River flow into the Malmsbury and Upper Coliban Reservoirs respectively. Riparian restoration works have been completed on both the Kangaroo Creek and the Upper Coliban River in recent years minimising the water quality impacts from agricultural runoff. The Kangaroo Creek, Upper Coliban River and Little Coliban River are all priorities in the North Central RWS (See Section 5.1). The North Central CMA will continue to work with Coliban Water to maximise opportunities to improve waterway condition and water quality for the Upper Coliban catchment.

Action:

- The North Central CMA will work in partnership with Coliban Water to improve waterway condition and water quality within the Upper Coliban catchment by ensuring strong linkages between the Regional Waterway Strategy and the Upper Coliban Drinking Water Storages and Land Management Plan.
- The North Central CMA will continue to work with regional water corporations, local government, EPA and DEPI on managing water quality issues throughout the life of the Strategy.

6.7 Waterway in urban areas

Waterways in urban areas are often in poor environmental condition, typically due to impacts from stormwater runoff. Although waterways in urban areas are often highly modified, they provide many important benefits for communities (VWMS, 2013).

Riparian corridors along waterways in particular play an important role in maintaining and improving waterway health. The preservation, rehabilitation and restoration of riparian corridors are essential to achieve the river health objectives in this Strategy. In line with State Planning Policy, vegetated riparian corridors at least 30 m wide on each side of a waterway should be retained in new urban development.

The Office of Living Victoria (OLV) has been created to drive the integration of water and urban planning and the delivery of whole of water cycle management in urban areas. The North Central CMA will work with regional partner organisations and OLV in implementing the Living Victoria Initiative in the North Central region.

Action:

- The North Central CMA will work with regional partners and the community in North Central RWS waterway priorities or urban areas of high community significance. Opportunities to work together will be identified as projects and funding becomes available.

6.8 Recreational fishing

The Department of Environment and Primary Industries is responsible for managing fisheries resources and regulating all game hunting activity in Victoria.

The North Central Region includes many popular recreational fisheries. In 2012, a survey of recreational fishers highlighted that the North Central Region features the second most popular lake or impoundment in Victoria (Lake Eppalock). Other important fisheries in the North Central Region include the Campaspe River, Loddon River, Gunbower Creek, Kerang Lakes, Cairn Curran Reservoir, Upper Coliban Reservoirs, Tullaroop Reservoir, Newlyn Reservoir and Hepburn Lagoon.

A more complete assessment of Victoria's recreational fishing waters can be found in a Guide to Inland Angling Waters of Victoria at:
http://www.depi.vic.gov.au/fishing-and-hunting/fishing-guides/inland-angling-guide

Fisheries Victoria, key partners and the North Central CMA identified the following key strategic priorities for managing inland fishing in Victoria during a 2013 workshop (Refer to Appendix D – North Central Recreational Fisheries Management Priorities):

1. Protect key fisheries assets
2. Advocate for fish habitat recovery works
3. Manage fish stocking
4. Encourage compliance with regulations
5. Improve angler access
6. Develop recreational fishing opportunities.

6.9 Extreme events

The North Central Region is similar to many parts of Victoria and is prone to floods and bushfires. These extreme events can have a significant impact on the health of our waterways. The January 2011 flood event was the largest on record for the majority of river systems in the region inundating an estimated 780,000 ha (25% of the region). Whilst the 2010-11 flood events had devastating impacts on urban and rural communities there have also been significant economic and environmental benefits, including the filling of the region's water storages and wetlands normally disconnected from the floodplain. Major flooding also occurred in the region in 1956, 1974 and 1994.

Floods and bushfires are a natural feature of the environment across Victoria. Changes in catchment and floodplain land use post European settlement have contributed to increased frequency and severity of floods. Possible changes to future climate may increase the intensity of future floods and bushfires. Waterways and their catchments are particularly vulnerable to high intensity large-scale bushfires, particularly if they are followed by flooding. This combination of fire and flooding has the potential to transport large quantities of sediments and nutrients from burnt catchments and have a significant effect on waterway health.

The adverse effects of floods on waterway condition and values are primarily related to accelerated rates of river channel erosion, which can be exacerbated by past clearing of native riparian vegetation. This type of damage includes:

- avulsion (the abandonment of the main river channel in favour of a new course)
- erosion and mobilisation of sediment resulting in:
  - channel widening.
  - infilling of large pools by sediment.
  - loss of vegetation and in-stream habitat.
  - infrastructure damage.
- damage to native riparian vegetation.
- loss of large wood for in-stream habitat.
- loss of or damage to fences protecting riparian vegetation.

Floods can also:

- affect wetlands, primarily by carrying large amounts of sediment and nutrients into them, especially after bushfires.
- accelerate the spread of invasive species.
- cause debris to accumulate above bridges or culverts, threatening their integrity.
- cause waste from sewage treatment facilities to enter waterways.
- kill livestock and destroy various high value crops.

The VWMS outlines the statewide approach to managing extreme events including using the Emergency Management Framework, alignment of Regional waterway and floodplain management strategies and better alignment of bushfire management/

Action

- The North Central CMA will work with partner agencies and the community to better manage extreme events in line with policy outlined in the VWMS, 2013.

6.10 **Invasive species**

Invasive species in waterways and along riparian land are an increasing threat to the health of rivers, estuaries and wetlands in Victoria (VWMS, 2013). The VWMS outlines a framework for managing invasive species in Victorian waterways based on the Biosecurity Strategy for Victoria and Invasive Plants and Animals Policy Framework. A key principle of this approach is to reduce the impact of invasive species on the assets identified in the RWS. Therefore the North Central RWS will use an integrated risk based approach to managing invasive species in implementation.

Action

- The North Central CMA will work with partner agencies and the community to manage invasive species as part of an integrated waterway management approach.

Part C Action Plan

7 Action Plan

The North Central RWS has adopted the 11 program areas (Refer to Figure 9 and Table 7) used in the North Central River Health Strategy 2005. These 11 program areas assist in grouping waterways in a logical way to allow the action plan to be presented in an easy to find format.

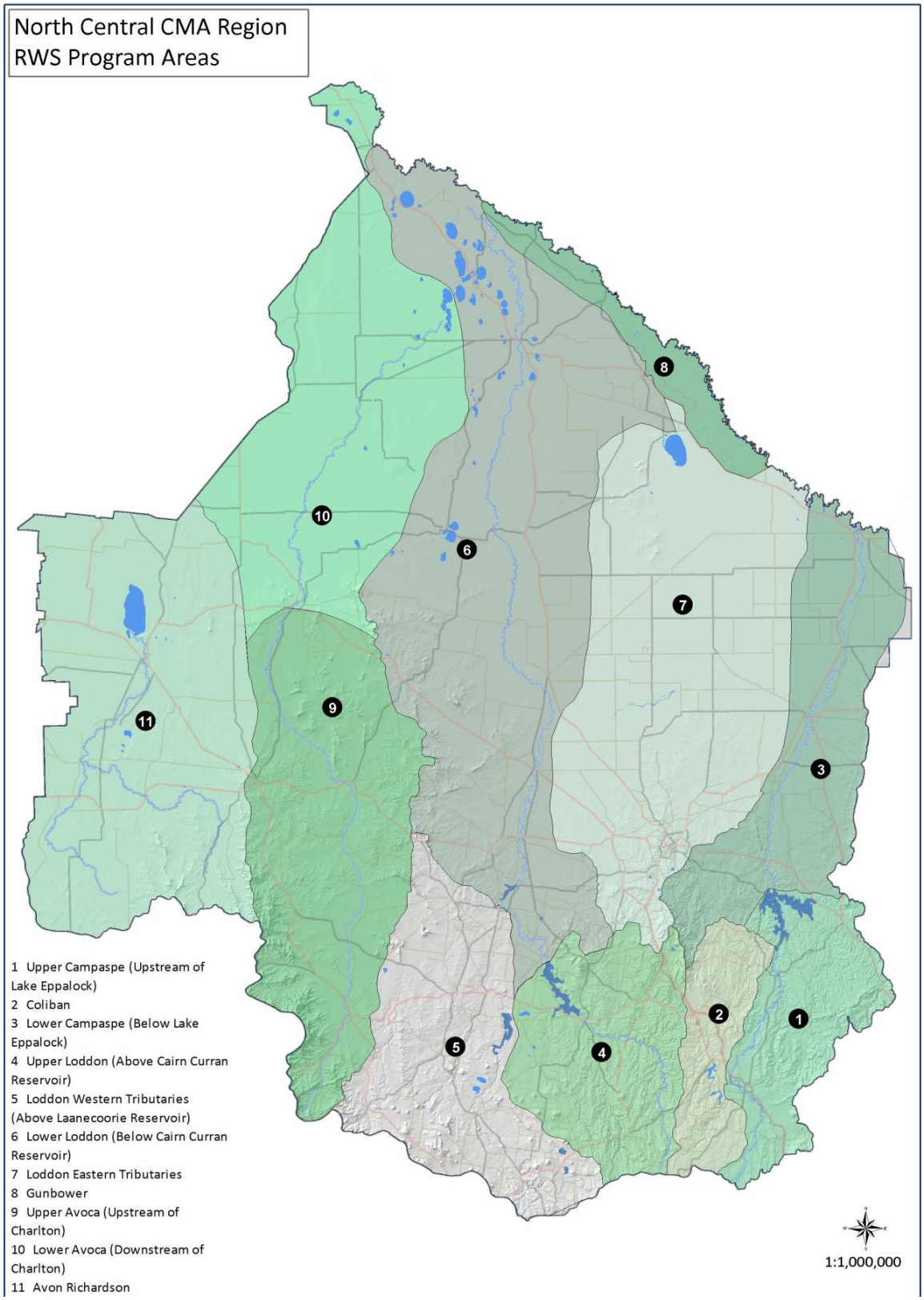


Figure 10 - North Central RWS Program Areas

Table 6: Program Areas.

Catchment	Program Areas
Campaspe (Basin 6)	1. Upper Campaspe (Upstream of Lake Eppalock)
	2. Coliban
	3. Lower Campaspe (Below Lake Eppalock)
Loddon (Basin 7)	4. Upper Loddon (Above Cairn Curran Reservoir)
	5. Loddon Western Tributaries (above Laanecoorie Reservoir)
	6. Loddon Eastern Tributaries
	7. Lower Loddon
	8. Gunbower
Avoca (Basin 8)	9. Upper Avoca (upstream of Charlton)
	10. Lower Avoca (downstream of Charlton)
Wimmera (Basin 15)	11. Avon-Richardson

Program Logic

Program logic is an approach to planning (commonly used in natural resource management) that uses a diagram to demonstrate the rationale for a program and express how change is expected to occur.

The program logic provides the rationale for how the Strategy will contribute to the vision for Victoria's waterways, identified in the VWMS and the North Central Region's vision, identified in the North Central RCS.

Vision for Victoria's waterways - "Victoria's rivers, estuaries and wetlands are healthy and well-managed; supporting environmental, social, cultural and economic values that are able to be enjoyed by all communities" (DEPI, 2013)

Vision for the North Central RCS – "A community active in protecting and enhancing the integrity of its catchment"

The simplified program logic for the North Central RWS is illustrated in Figure 11. It describes how each year, specific management activities (outputs) are delivered by regional agencies in order to achieve particular management outcomes. Over the eight-year planning period, these outputs and outcomes collectively contribute to either maintaining or improving the environmental condition of waterways. In the long-term, this will ensure that Victoria's waterways can continue to support environmental, social, cultural and economic values.

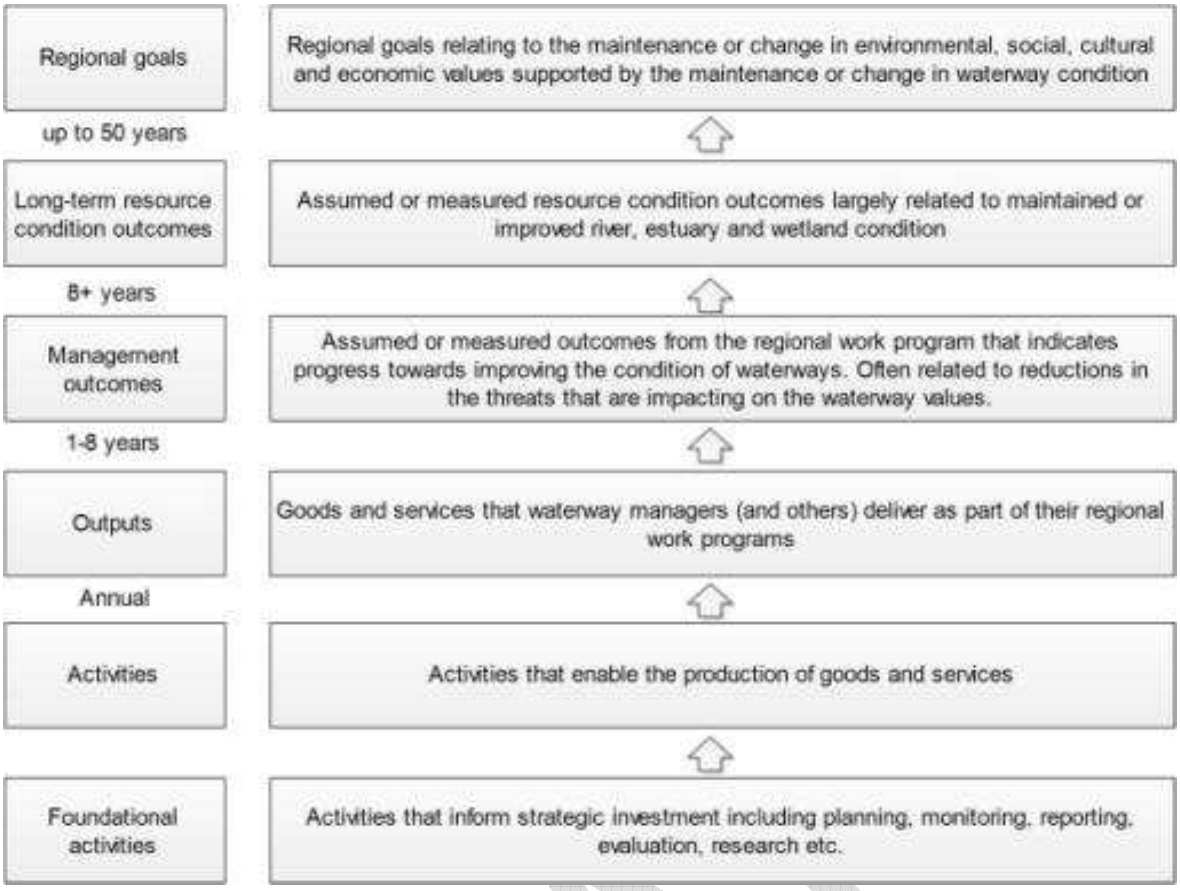


Figure 11: Simplified program logic for the regional Waterway Strategy
(Source: Adapted from DEPI, 2013)

The highest level of the program logic (regional goals) is aligned with the vision for Victoria's waterways and the vision for the region. The following sections outline the North Central RWS eight year action plan presented in each Basin and Program area.

7.1 Campaspe Basin

The Campaspe Basin extends from the Great Dividing Range in the south to the River Murray in the north, and covers a total of 4,000 square kilometers. The catchment is approximately 150km long and 25km long. The Campaspe River itself is approximately 225km in total length. The Coliban River is the major tributary that joins the Campaspe River at Lake Eppalock. Other significant tributaries include the Axe, McIvor, Mt Pleasant, Wild Duck and Pipers creeks. In order to present the priority reaches, their actions, targets and costs, the Campaspe catchment is divided into three Program Areas.

A major focus for the RWS for the next eight years in the Campaspe Basin involves implementing the Caring for Campaspe Project, planning and delivery of environmental water and working with Coliban Water to improve water quality and waterway condition in the Upper Coliban catchment.

7.2 Upper Campaspe Program Area

The Upper Campaspe Program Area covers the southeast portion of the Campaspe River basin and includes the towns of Redesdale, Heathcote, Tooborac, Kyneton and Woodend (Figure 12). This area includes the Campaspe River (Reaches 6 and 7) from its forested headwaters in the Great Dividing Range to Lake Eppalock. The river receives flows from Five Mile Creek (Reach 24) and Pipers Creek (Reach 23). McIvor Creek (Reaches 14 and 15) and Wild Duck Creek (Reach 16) flow directly into Lake Eppalock. The location andpriority waterways are shown in Figure 12

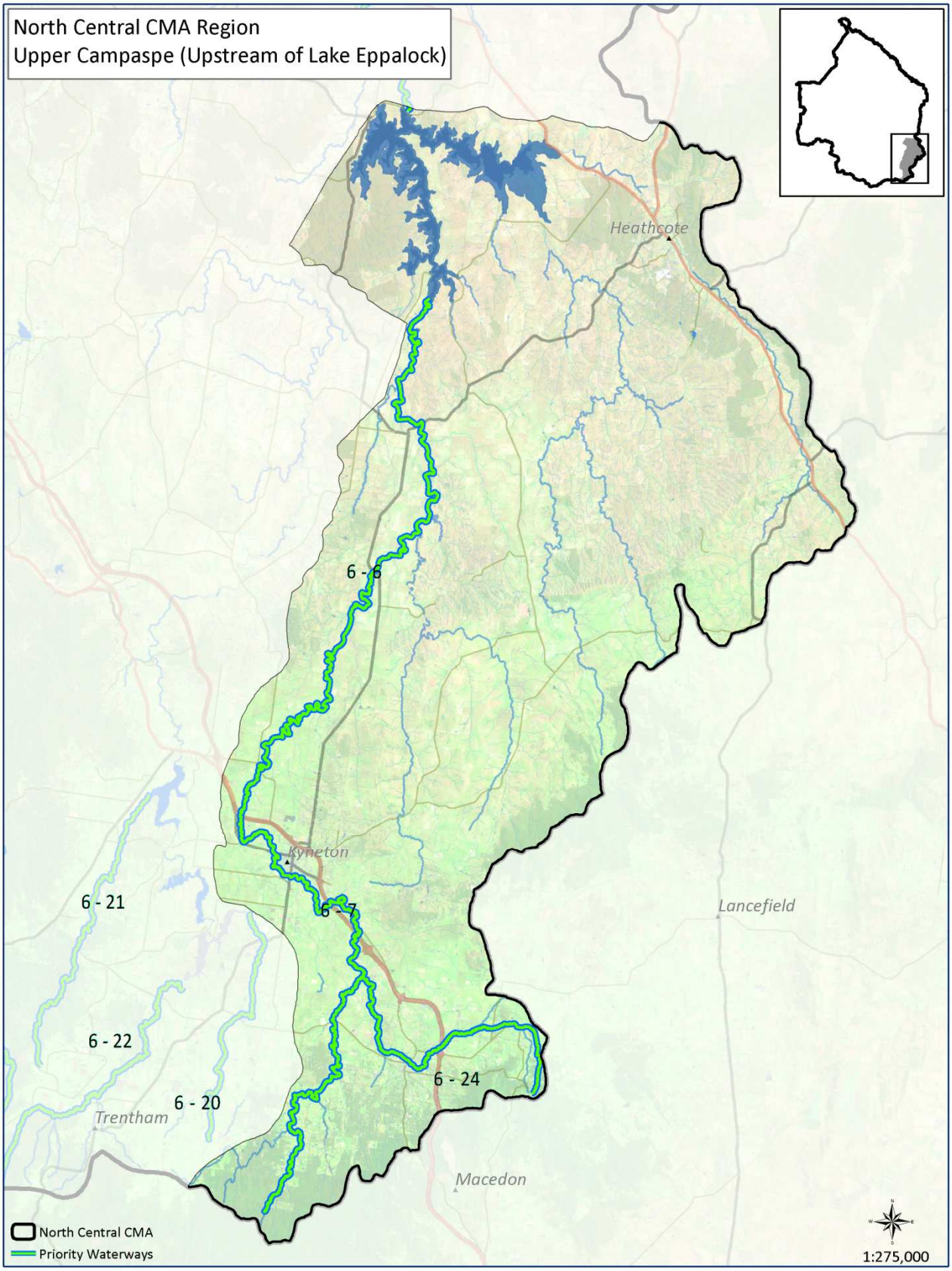


Figure 12: Upper Campaspe Program Area.

The priorities outlined in the North Central RWS for the Upper Campaspe Program Area are the Campaspe River and Five Mile Creek.

Table 7: Upper Campaspe Program Area Action Plan.

Program Area : 1		**Upper Campaspe**			
Basin	6- Campaspe	**Waterway**	Campaspe River	**Reach/es**	6, 7
Long-term Resource Condition		1. Improve the condition of the Campaspe River Reach 6 & 7 from very poor and moderate to good (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Campaspe River Reach 6 & 7 by 2021 with a measured increase of one point in the streamside zone sub-index of the ISC. 3. Removal of willows along the Upper Campaspe River by 2030.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Improve vegetation structure and diversity)	1.1.1	Construction of riparian fences	104 (km)	**CMA**, Landholders
		1.1.2	Provision of off-stream watering points	100	**CMA**, Landholders
1.2	Removal of willows to improve in-stream habitat and bank stability	1.2.1	Willow removal works	30 (km)	**CMA**, Landholders
1.3	Improve vegetation structure and diversity through indigenous vegetation establishment along frontages	1.3.1	Establish native indigenous vegetation	120 (ha)	**CMA**, Landholders
1.4	Increased landholder skills and awareness in riparian management practices	1.4.1	Establish Management Agreements with landholders participating in river health incentives	100 Management Agreements	**CMA**, Landholders
		1.4.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.4.3	Work with Local Landcare groups to support project implementation		CMA, landcare groups
1.5	Strengthen traditional owner involvement in regional waterway management	1.5.1	Promote cultural awareness of values	2 (events)	**CMA,** Indigenous representatives
		1.5.2	Cultural heritage mapping along river	1 no.	**CMA,** Indigenous representatives
			Estimated cost of activities for the Campaspe River		**$ 4,468,750**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.3 Coliban Program Area

The Coliban Program Area covers the southwest portion of the Campaspe catchment and includes the towns of Taradale, Malmsbury, Lauriston, Tylden and Trentham. Waterways within the area include the Coliban River (Reach 22) from its forested headwaters to the Upper Coliban Reservoir and the continuation of the Coliban River (Reaches 18 and 19) downstream of Malmsbury Reservoir to Lake Eppalock. The Little Coliban River (Reach 20) flows directly into the Upper Coliban Reservoir. Kangaroo Creek (Reach 21) descends the western forested hills and flows into the Lauriston Reservoir. The confluence of Myrtle Creek (Reach 17) and the Coliban River occurs just upstream of Lake Eppalock. The location of priority waterways is shown in Figure 13.

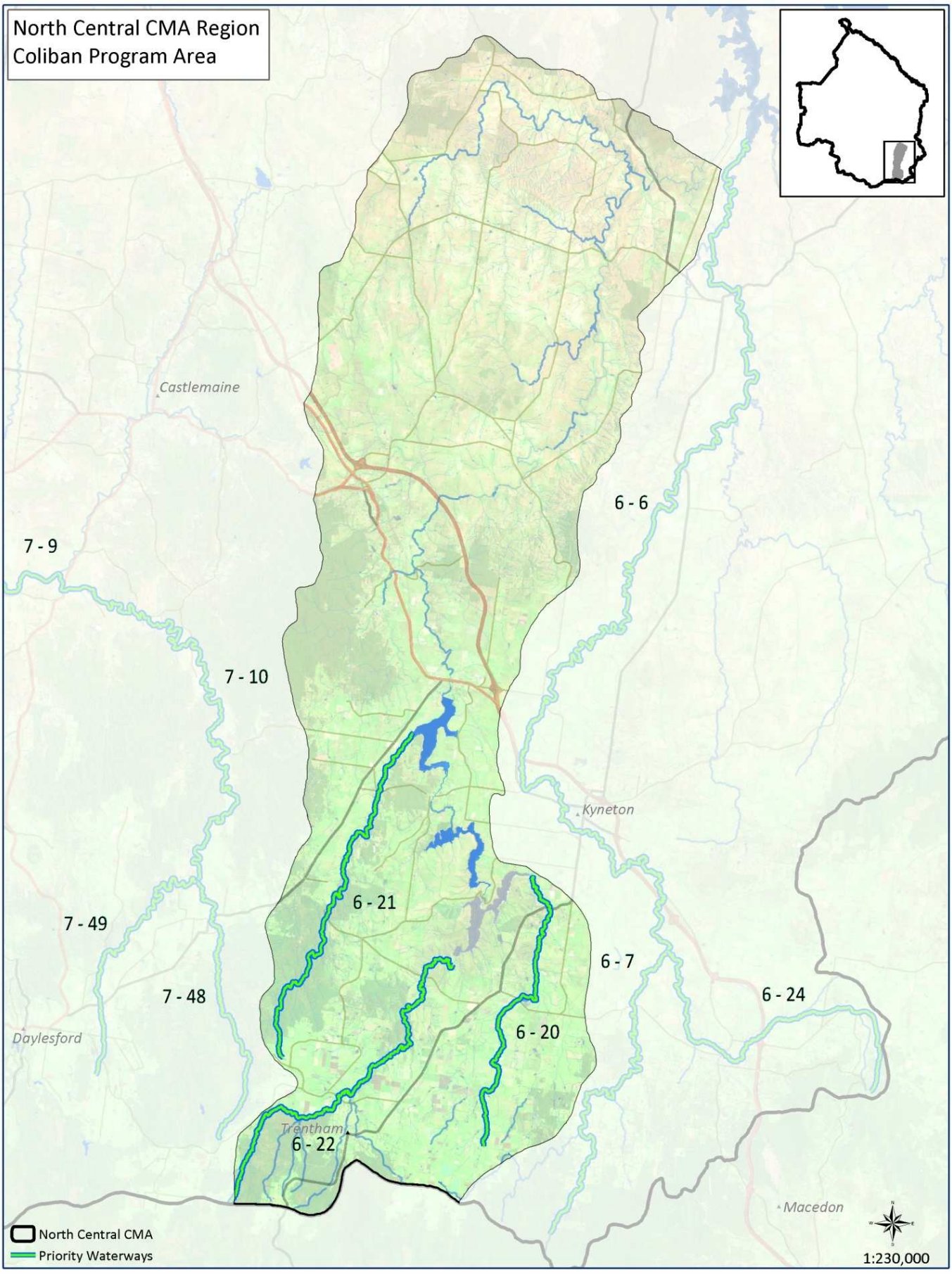


Figure 13: Coliban Program Area

A significant works program has recently been complemented by the North Central CMA within the upper Coliban catchment from 2008-2011 targeting the Kangaroo Creek (Reach 21) and Coliban River (Reach 22). Ongoing monitoring of these areas will be required to ensure the maximum benefits from the previous works programs are realised.

The Lauriston, Malmsbury and Upper Coliban reservoirs managed by Coliban Water provide the water supply needs for approximately 110,000 people and a wide range of industries and business. The North Central CMA and Coliban Water will continue to work together to improve water quality and waterway condition with a focus on the Upper Coliban (upstream of the Coliban Water Storages. Environmental flow management will continue in Reaches 18 and 19 of the Coliban River below Malmsbury. Table 8 presents the priorities for the Upper Coliban Program area.

Table 8: Upper Coliban Program Area Action Plan

Program Area : 2		**Coliban**			
Basin	6- Campaspe	**Waterway**	Kangaroo Creek, Coliban River and Little Coliban River	**Reach/es**	18, 19, 21, 22, 20
Long-term Resource Condition		1. Improve the condition of Kangaroo Creek and Coliban River (Reach 22) from moderate to good (based on Index of Stream Condition) by 2050. 2. Work with Coliban Water to improve water quality in the Upper Coliban Catchment by 2021. 3. The delivery of environmental flows are maximised contributing to increased hydrology and aquatic life ISC scores for Coliban River Reaches 18 & 19 by 2021.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Improve the altered water regime threat score	1.1.1	Deliver environmental water in line with the Seasonal Watering Plan for Reach 18 & 19 Coliban River	As per seasonal watering plan	**CMA,** Coliban Water, VEWH
1.2	Improve planning for environmental water management	1.2.1	Update the flow study	1 no.	**CMA,** Coliban Water, VEWH
		1.2.2	VEFMAP monitoring of channel form, water quality and fish populations	*	**CMA**, VEWH
1.3	Maintain or improve water quality	1.3.1	Engagement with local community in application of Waterway Best Practice Management with a focus on reducing impacts on water quality	-	**CMA**, Coliban Water, landowners
1.4	Install fencing for species control (livestock access) along waterway frontages	1.4.1	Construction of riparian fences (4 km Kangaroo Creek and 24 km Coliban River Reach 22)	26 (km)	**CMA**, Landholders
1.5	Weed control for species control (woody weeds) along frontages	1.5.1	Maintain woody weed control	13 (ha)	**CMA**, Landholders
1.6	Removal of willows to improve in-stream habitat and bank stability	1.6.1	Willow removal works	2 (km)	**CMA**, Landholders
1.7	Maintain vegetation structure and diversity through indigenous vegetation establishment along frontages	1.7.1	Maintain native indigenous vegetation	64 (ha)	**CMA**, Landholders
1.8	Increased landholder skills and awareness in riparian management practices	1.8.1	Establish Management Agreements with landholders participating in river health incentives	50 Management Agreements	**CMA**, Landholders
		1.8.2	Coordinate/attend community engagement events	5 (events)	**CMA**
		1.8.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.9	Increased understanding of community values in Coliban River	1.9.1	Constraints study to identify community values by 2015	1 no.	**CMA**
			Estimated cost of activities for the Kangaroo Creek, Coliban River and Little Coliban River	**$1,298,125**	

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

* Costs associated with VEFMAP monitoring are not included

7.4 **Lower Campaspe Program Area**

The Lower Campaspe (below Lake Eppalock) Program Area covers the northern portion of the Campaspe River basin from Lake Eppalock to the River Murray. The area includes the towns of Axedale, Elmore, Rochester and Echuca along the Campaspe River as well as Mandurang, Axe Creek, Strathfieldsaye and Toolleen. The area includes the Campaspe River (Reaches 1 to 5) and its major tributaries. Forest Creek (Reaches 10 and 11) and Mount Pleasant Creek (Reaches 8 and 9) enter from the east and Axe Creek (Reach 12), which is fed by Sheepwash Creek (Reach 13), enters from the southwest. The location of priority waterways is shown in Figure 14. The North Central RWS major focus in the Lower Campaspe program areas will be on the Campaspe River. Working with the community in protecting riparian vegetation and effectively managing the significant environmental water entitlements will be important for the long-term health of the river. The Action Plan for the Lower Campaspe Program is presented in Table 9.

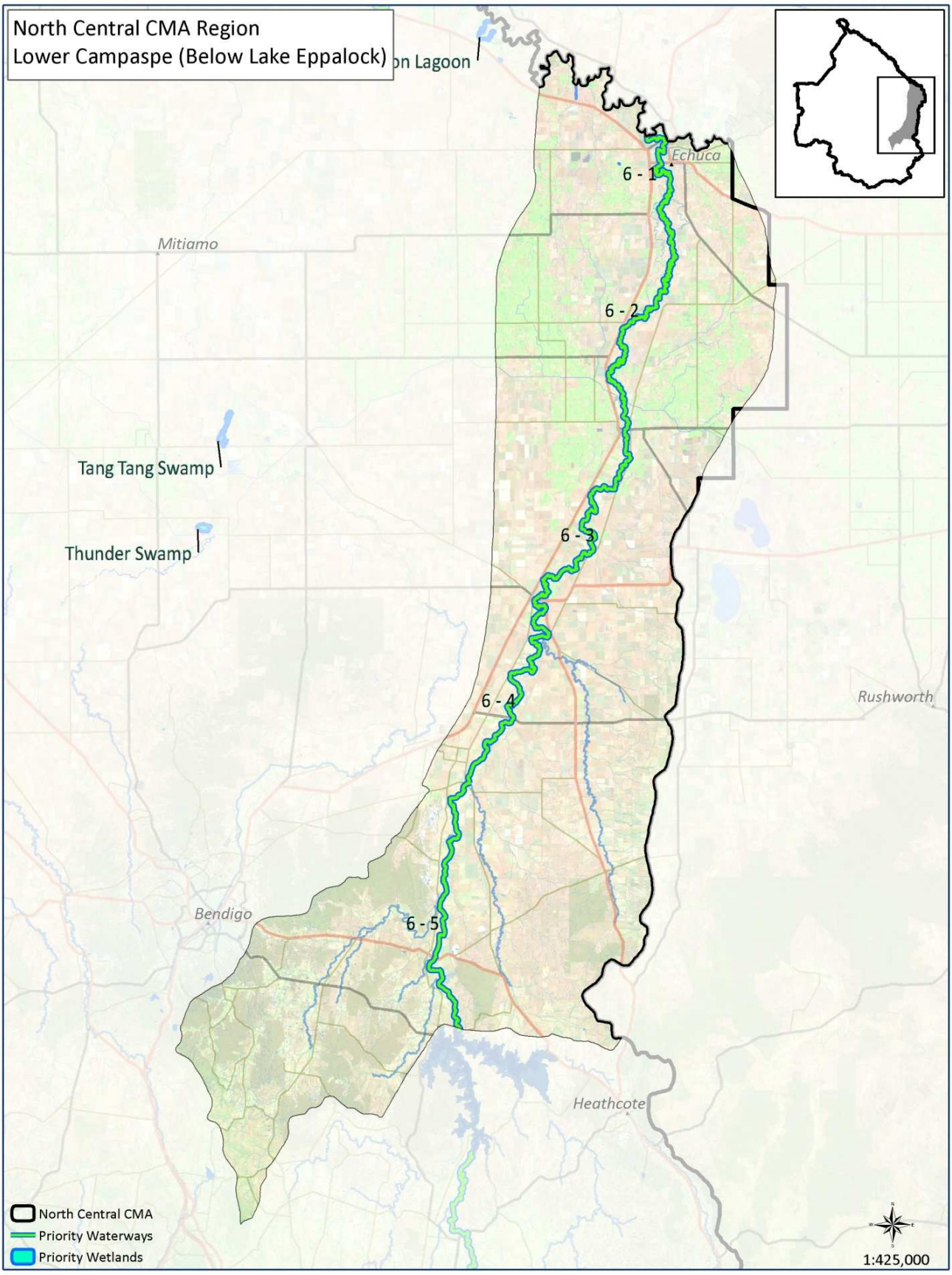


Figure 14 - Lower Campaspe Program Area

Table 9 - Lower Campaspe Program Area Actions

Program Area : 3		Lower Campaspe			
Basin	6- Campaspe	**Waterway**	Campaspe River	**Reach/es**	1, 2, 3, 4, 5
Long-term Resource Condition		1. Improve the condition of the Lower Campaspe River from moderate to good (based on the Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Lower Campaspe River by 2021 with a measured increase of one point in the streamside zone sub-index of the ISC. 3. The delivery of environmental flows are maximised contributing to increased hydrology and aquatic life ISC scores by 2021.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Increase habitat available by modifying existing fish barriers	1.1.1	Modify fish barriers (Echuca and Barnadown stream gauges) and allow fish passage along the Campaspe River	59 (km), 2 barriers	**CMA**, G-MW
		1.1.2	Investigate options to improve fish passage for the Campaspe syphon and Camapspe Weir	1 no.	**CMA**, G-MW
1.2	Improve the altered water regime threat score	1.2.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA,** G-MW, VEWH, CEWH
1.3	Improve planning for environmental water management	1.3.1	Update the flow study	1 no.	**CMA,** G-MW, VEWH, CEWH
		1.3.2	VEFMAP monitoring of channel form, water quality and fish populations	*	**CMA**, VEWH
1.4	Install fencing for species control (livestock access) along 50% of waterway frontages (both banks) along the Campaspe River	1.4.1	Construction of riparian fences	108 (km)	**CMA**, Landholders
		1.4.2	Provision of offstream watering points	100 no.	**CMA**, Landholders
1.5	Improve vegetation structure and diversity through indigenous vegetation establishment along one quarter of frontages along the Campaspe River	1.5.1	Establish native indigenous vegetation	139 (ha)	**CMA**, Landholders
1.6	Increased landholder skills and awareness in riparian management practices	1.6.1	Establish Management Agreements with landholders participating in river health incentives	100 Management Agreements	**CMA**, Landholders
		1.6.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.6.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.7	Maintain or improve populations of threatened squirrel gliders in Rochester area	1.7.1	Support local Landcare Groups / community in seeking funding to fence and enhance squirrel glider habitat.	-	CMA, Landcare groups
1.8	Improve access for angler and canoeists along the river	1.8.1	Seek Recreational Fishing Grant funding in conjunction with local angling groups to construct of fishing/canoe platforms at Rochester and Axedale.	-	**CMA**, Angling clubs
1.9	Improve monitoring of fish populations through partnerships with angling clubs	1.9.1	Support targeted monitoring using citizen science (angling club records, angular diary program).	-	**CMA**, Angling clubs
		1.9.2	Promote recreational fisher awareness of, and participation in, Regional Waterway Strategy actions through regional consultation forums, angular club meetings and public media.	10 (events)	**CMA**, Angling clubs
1.10	Strengthen traditional owner involvement in regional waterway management	1.10.1	Promote cultural awareness of values	2 (events)	**CMA,** Indigenous representatives
		1.10.2	Cultural heritage mapping along river	1 no.	**CMA,** Indigenous representatives
			Estimated cost of activities for the Campaspe River		**$5,299,688**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

* Costs associated with VEFMAP monitoring are not included

7.5 Loddon Basin

The Loddon River catchment covers 1,531,998 hectares or about 6.8% of the area of Victoria. The Loddon River rises on the Great Dividing Range near Trentham and flows for some 430km to the River Murray. Major tributaries include Tullaroop, Bet Bet, Bullock, Bendigo and Pyramid creeks.

A significant waterway management program was complemented on the Loddon River through the Loddon Stressed River Project and Upper Loddon and Campaspe Projects. The Loddon catchment also has an extensive floodplain in its lower reaches compromising many significant wetlands including the Ramsar listed Kerang Lakes and Gunbower Forest.

The Loddon Basin program area action plan has been separated into five program areas with priorities and actions outlined in the following sections.

7.6 Upper Loddon Program Area

The Upper Loddon (above Cairn Curran) Program Area includes the southeast portion of the Loddon River basin. Major towns include Castlemaine, Maldon, Daylesford and Creswick. The area includes the main stem of the Loddon River (reaches 9 and 10) from its forested headwaters to Cairn Curran Reservoir. Barkers Creek (Reach 30) feeds into Campbells Creek (Reach 29), which enters the river south of Castlemaine. Muckleford Creek (Reach 26) also enters the Loddon River from the north. Prior to entering Cairn Curran Reservoir, the river receives flows from the southern tributaries of Jim Crow Creek (Reach 27), which is fed by Sailors Creek (Reach 28). Joyces Creek (Reach 25) flows directly into the reservoir, of which Middle Creek (Reach 24) is a major tributary. The location of priority waterways is shown in Figure 15.

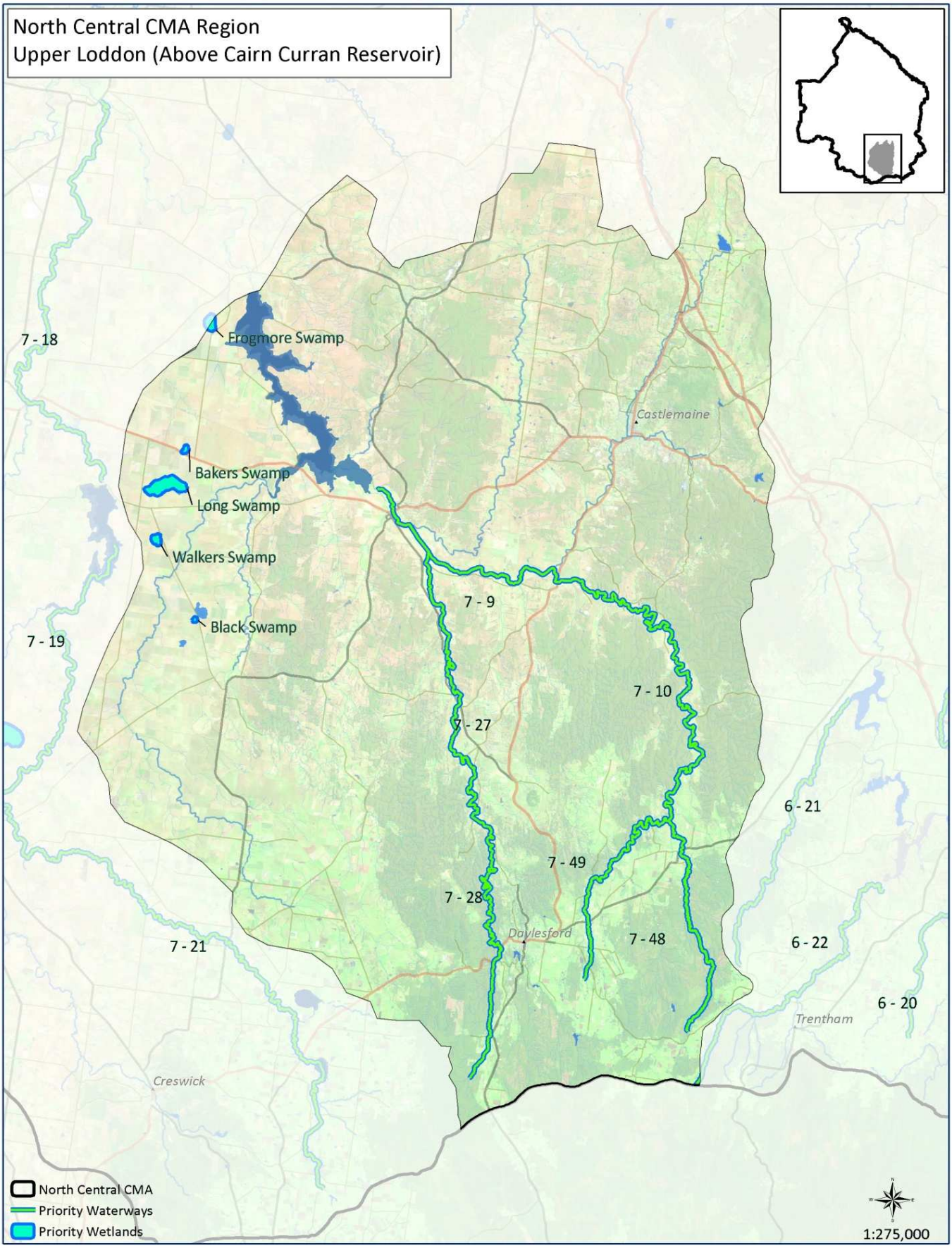


Figure 15: Upper Loddon Program Area

Significant works have been completed in the Upper Loddon on the Loddon River, Sailors and Jim Crow Creeks under the previous River Health Strategy. The focus for the Upper Loddon over the life of the North Central RWS will be on ensuring maximum benefit from previous waterway management works. A maintenance program will be implemented targeting these previous works to ensure works and agreements are achieving their intended outcomes (Refer to Table 10).

Table 10: Upper Loddon Program Area Actions

Program Area : 4		**Upper Loddon**			
Basin	Loddon	**Waterway**	Loddon River, Jim Crow Creek, Sailors Creek and Kangaroo Creek	**Reach/es**	48, 10, 9, 27, 28, 49
Long-term Resource Condition		1. Improve the condition of the waterways from moderate to good (based on Index of Stream Condition) by 2050. 2. Implement a maintenance program ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Removal of willows to improve in-stream habitat and bank stability	1.1.1	Willow removal works (Loddon River, Sailors Creek, Kangaroo Creek)	5 (km)	**CMA**, Landholders
1.2	Undertake woody weed control along riparian frontage	1.1.2	WoNS Control- Gorse, Blackberry and Broom (Loddon River, Jim Crow Creek, Sailors Creek, Kangaroo Creek)	18 (ha)	**CMA**, Landholders and Landcare groups
1.3	Increased landholder skills and awareness in riparian management practices	1.3.1	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Loddon River, Jim Crow Creek, Sailors Creek and Kangaroo Creek		**$276,563**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.7 Loddon Western Tributaries Program Area

The Loddon Western Tributaries (above Laanecoorie) Program Area covers the southwest portion of the Loddon Basin. Maryborough, Creswick, Clunes, Lexton and Carisbrook are the major towns in the area. The Tullaroop Creek (Reach 18 & 19) above and below Tullaroop Reservoir is formed at the confluence of Creswick Creek (Reach 20) and Birch Creek (Reach 21). McCallum Creek (Reach 22) enters Tullaroop Creek between the two reservoirs. Beckworth Creek (Reach 23) is a tributary of McCallum Creek. Bet Bet Creek (Reaches 14, 15 and 16) is the other major waterway of the area, of which Burnt Creek (Reach 17) is a tributary. Bet Bet Creek also flows directly into Laanecoorie Reservoir. The location of priority waterways is shown in Figure 16. The focus for the Loddon Western Tributaries program area over the life of the RWS will be on the Tullaroop and Birches Creek, Middle and Merin Merin Swamps (Refer to Table 12 below).

Figure 16 - Loddon Western Tributaries Program Area

Table 11 - Loddon Western Tributaries Program Area Actions

Program Area : 5		**Loddon Western Tributaries**			
Basin	Loddon	**Waterway**	Tullaroop Creek	**Reach/es**	18, 19
Long-term Resource Condition		1. Improve the condition of Tullaroop Creek Reach 18 & 19 from poor to moderate (based on Index of Stream Condition) by 2050. 2. Improvement of one in the ISC streamside zone subindex along the Tullaroop Creek by 2025.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along riparian frontage	1.1.1	Construction of riparian fences	25 (km)	**CMA**, Landholders
		1.1.2	Off stream Watering	3 no.	**CMA**
1.2	Improve the altered water regime threat score	1.2.1	Deliver environmental water in line with the Seasonal Watering Plan	1 no.	**CMA**, G-MW, VEWH
1.3	Improve planning for environmental water management	1.3.1	Update the flow study	1 no.	**CMA** , G-MW, VEWH
		1.3.2	Finalise and Implement the Loddon Environmental Water Management Plan	1 no.	**CMA** , G-MW, VEWH
1.4	Undertake surveys into presence of River Blackfish populations	1.4.1	Electrofishing surveys and report	1 no.	**CMA**
1.5	Weed control for species control (woody weeds) along one quarter of frontages	1.5.1	Weed spraying to reduce competition for natural regeneration	10 (ha)	**CMA**, Landholders
1.6	Improve vegetation structure and diversity through indigenous vegetation establishment along one quarter of frontages	1.6.1	Establish native indigenous vegetation	20 (ha)	**CMA**, Landholders
1.7	Increased landholder skills and awareness in riparian management practices	1.7.1	Coordinate/attend community engagement events	3 (events)	**CMA**, Landholders
		1.7.2	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Tullaroop Creek		**$ 439,844**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 5		Loddon Western Tributaries			
Basin	Loddon	**Waterway**	Birches Creek	**Reach/es**	21
Long-term Resource Condition		1. Improve the condition of Birches Creek (Reach 21) from poor to good (based on Index of Stream Condition) by 2050. 2. Improvement of one in the ISC streamside zone subindex along Birches Creek by 2021. 3. Maintain and enhance Blackfish populations within Birches Creek by 2022.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along riparian frontage	1.1.1	Construction of riparian fences	48 (km)	**CMA**, Landholders
		1.1.2	Off stream Watering	40 no.	**CMA**, Landholders
1.2	Weed control for species control (woody weeds) along one quarter of frontages	1.2.1	Weed spraying for natural regeneration or revegetation	60 (ha)	**CMA**, Landholders
		1.2.2	Willow Control	20 (km)	**CMA**
1.3	Improve vegetation structure and diversity through indigenous vegetation establishment along one quarter of frontages	1.3.1	Establish native indigenous vegetation	40 (ha)	**CMA**, Landholders
1.4	Increased landholder skills and awareness in riparian management practices	1.4.1	Establish Management Agreements with landholders participating in river health incentives	50 Management Agreements	**CMA**, Landholders
		1.4.2	Coordinate/attend community engagement events	10 (events)	**CMA**, Landholders
		1.4.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.5	Maintain and enhance River Blackfish and Mountain Galaxias populations and in stream habitat	1.5.1	Undertake monitoring program to assess fish population and habitat conditions	1 no.	**CMA**
		1.5.2	Habitat improvement works	1 no.	**CMA**
1.6	Improve the altered water regime threat score	1.6.1	Deliver environmental water in line with the Seasonal Watering Plan	1 no.	**CMA**, G-MW, VEWH
1.7	Improve planning for environmental water management	1.7.1	Review flow study and assess groundwater contribution by 2015	1 no.	**CMA**, G-MW, VEWH
		1.7.2	Finalise and implement the Bullarook Environmental Water Management Plan by 2015	1 no.	**CMA**, G-MW, VEWH
			Estimated cost of activities for the Birches Creek		**$ 2,047,156**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 5		Loddon Western Tributaries			
Basin	Loddon	**Waterway**	Middle Swamp, Merin Merin Swamp		
Long-term Resource Condition		1. Wetlands to be in 'good' condition as measured by Index of Wetland Condition (IWC) assessments by 2025			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along riparian frontage at Middle and Merin Merin Swamp	1.1.1	Construction of riparian fencing	8 (km)	**CMA**, PV
		1.1.2	Establish Management Agreements with landholders participating in river health incentives	4 Management Agreements	**CMA**, Landholders
1.2	Improve vegetation structure and diversity through indigenous vegetation establishment at Middle & Merin Merin Swamps	1.2.1	Establish native indigenous vegetation	20 (ha)	**CMA,** PV
		1.2.2	Weed control undertaken to complement natural regeneration	20 (ha)	**CMA** , PV
1.3	Conduct IWC assessments on all wetlands to inform baseline condition	1.3.1	Undertake IWC assessments	2 no.	**CMA**
			Estimated cost of activities for the Loddon Western Tributaries		**$281,250**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.8 **Loddon Eastern Tributaries Program Area**

The Loddon Eastern Tributaries Program Area extends 100km north from south of Bendigo to Kow Swamp and Macorna North near the River Murray. Bendigo is the major town in the area. Other towns include Huntly, Goornong, Raywood, Mitiamo, Marong, Pyramid Hill, Macorna and East Loddon. The area includes Bendigo Creek (Reaches 40 to 44), which flows from Bendigo to Kow Swamp, and its major tributaries of Back Creek (Reach 47) and Myers Creek (Reaches 45 and 46). The area also includes Bullock Creek (Reaches 34 to 36), which is fed by Spring Creek (Reach 37) in the south. The location of priority waterways is shown in Figure 17.

The Loddon Eastern tributaries include Kow Swamp, a major storage managed by Goulburn-Murray Water and a number of wetlands particularly along the Bendigo Creek floodplain, including Tang Tang Swamp, Thunder Swamp, Winghee Swamp and Govetts Swamp. The focus for the Loddon Eastern Tributaries over the life of the RWS will be on the Tang Tang and Thunder Swamps. (Refer to Figure 17 and Table 12 below).

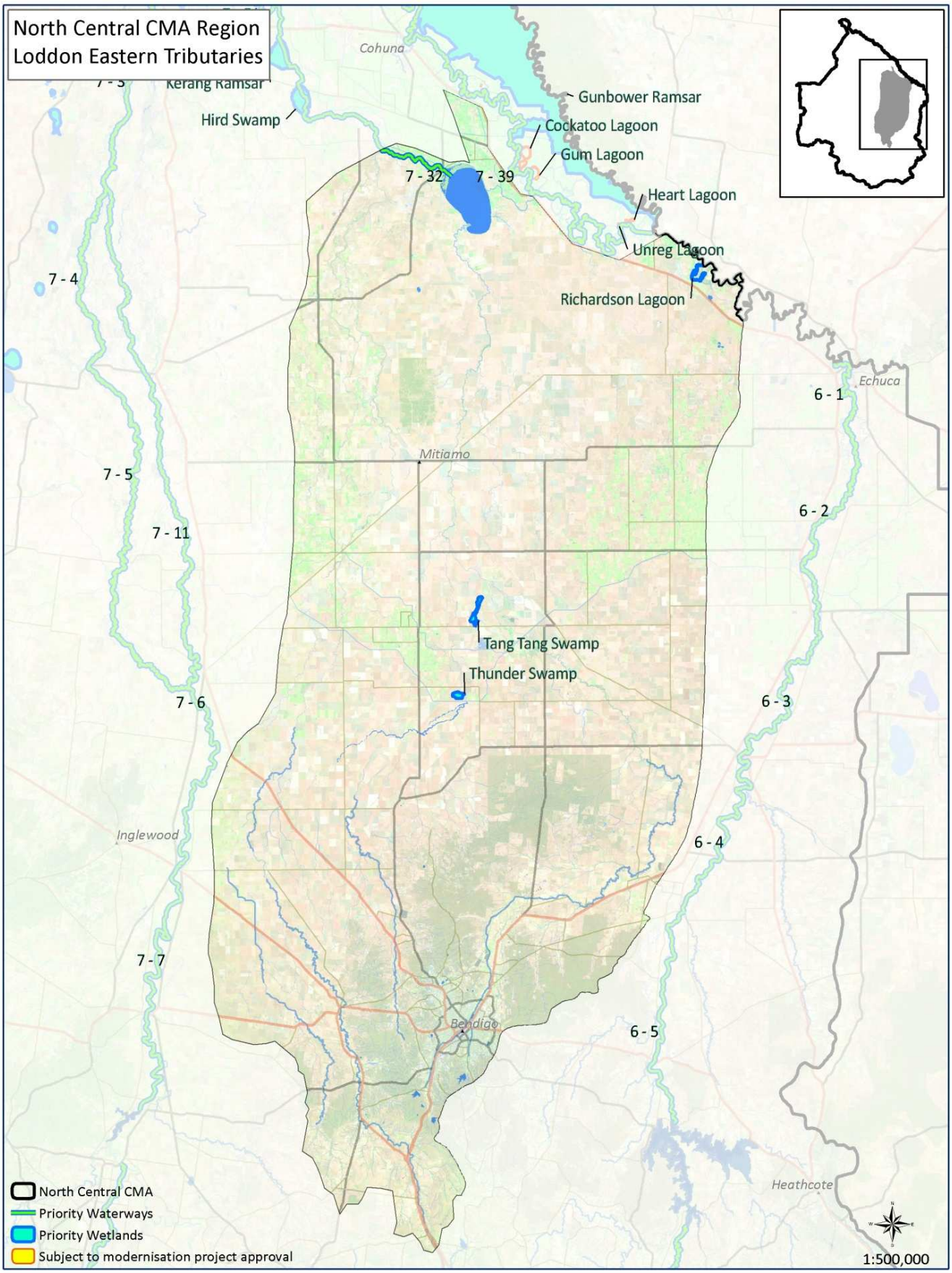


Figure 17 - Loddon Eastern Tributaries Program Area

Table 12 - Lower Eastern Tributaries Program Area Actions

Program Area : 6		**Loddon Eastern Tributaries**			
Basin	Loddon	**Waterway**	Loddon	**Wetlands**	Tang Tang Swamp, Thunder Swamp
Long-term Resource Condition		1. Maintain and improve the condition of the Kamarooka wetlands by 2050 as measured by Index of Wetland Condition 2. Improve the condition of waterbird habitat and maintain the diversity of habitats			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access)	1.1.1	Construction of riparian fencing	5 (km)	**PV,** CMA, landowners
		1.1.2	Establish Management Agreements with landholders participating in river health incentives	1 Management Agreement	**PV,** CMA, landowners
1.2	Maintain and improve vegetation	1.2.1	Undertake annual weed control	8 no.	**PV,** CMA, landowners
		1.2.2	Undertake annual rabbit control	8 no.	**PV,** CMA, landowners
1.3	Reduce predator population to maintain bird breeding population	1.3.1	Undertake fox control	2 no.	**PV,** CMA, landowners
1.4	Conduct IWC assessments on all wetlands to inform baseline condition	1.4.1	Undertake IWC assessments	2 no.	**CMA**
1.5	Improved planning for environmental water management	1.5.1	Develop an Environmental Water Management Plan	2 no.	**CMA**, Water Corporation, VEWH
1.6	Improve the changed water regime threat score	1.6.1	Deliver environmental water in line with the Seasonal Watering Plan	1 no.	**CMA**, Water Corporation, VEWH
		1.6.2	Investigate and confirm the feasibility of works to improve the delivery of environmental water into Tang Tang swamp by 2018	1 no.	**CMA**, Water Corporation, VEWH
			Estimated cost of activities for the Loddon Eastern Tributaries		**$ 753,125**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.9 Lower Loddon Program Area

The Lower Loddon Program Area extends from the township of Baringhup in the south to Swan Hill in the north. It includes the Loddon River between Cairn Curran Reservoir and Laanecoorie Reservoir as well as its continuation north across the floodplain through Bridgewater, Fernihurst and Kerang to the River Murray (Reaches 1 to 8). The area also includes the tributaries of Bradford Creek (Reach 13) and Bullabul Creek (Reach 12), the Serpentine Creek anabranch (Reach 11) and Barr Creek (Reach 31), Pyramid Creek (Reach 33), Box Creek (Reach 32) and Little Murray River (Reach 50). The location and 2010 ISC condition of these waterways are shown in Figure 18.

The Lower Loddon also comprises extensive wetland systems across the lower Loddon floodplain. These wetlands systems include the Ramsar listed Kerang lakes and other significant wetlands complexes such Mid Loddon and Central Murray identified in the North Central RCS.

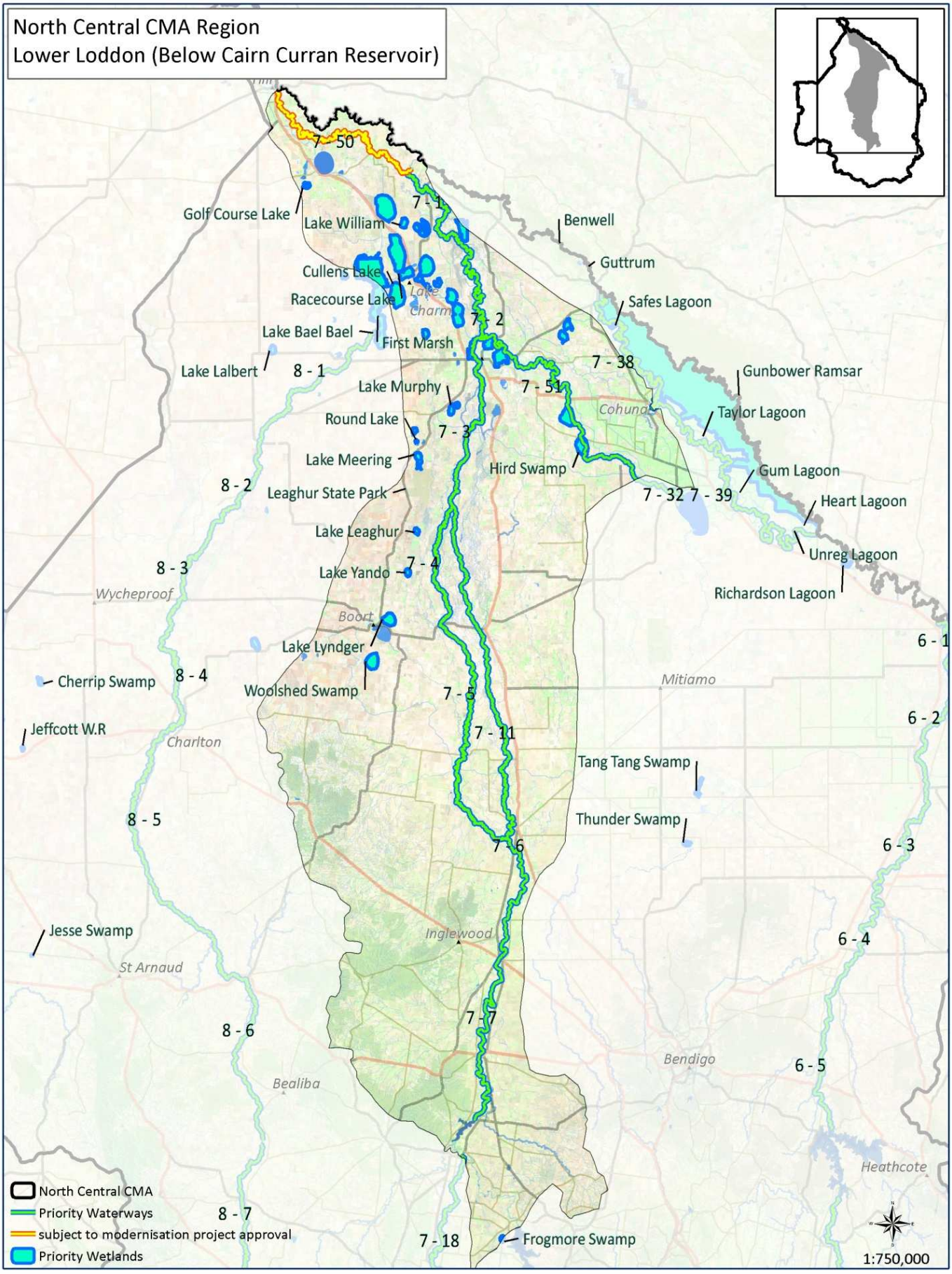


Figure 18: Lower Loddon Program Area

Significant works have been completed on the Loddon River through the implementation of the Loddon Stressed River Project (2003-12) under the previous River Health Strategy and will form part of the maintenance program for the region. The focus for the Lower Loddon in the North Central RWS will be on managing environmental watering to rivers and wetlands, implementation of the Mid Murray Native Fish Recovery Plan and collaborating with successful G-MW connections projects to ensure maximum environmental outcomes and the protection of some of our key wetlands systems (Refer to Table 13 below).

Table 13 - Lower Loddon Program Area Actions

Program Area : 6		**Lower Loddon**			
Basin	Loddon	**Waterway**	Kerang Ramsar Wetlands		
Long-term Resource Condition		1) Maintain and enhance the ecological character of the Ramsar wetlands as measured by the Ecological Character Description.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Support the development of a co-ordinating Ramsar wetlands management committee comprising all relevant stakeholders	1.1.1	Support the development of a committee to ensure coordination and implementation of a Ramsar Management Plan	1	**DEPI**, CMA, G-MW, Parks Victoria, Gannawarra Shire
1.2	Support the committee to develop a Kerang Ramsar Wetlands Management Plan	1.2.1	Management Plan developed by 2018	1	**DEPI**, CMA, G-MW, Parks Victoria, Gannawarra Shire
1.3	Environmental water delivery to Hird Swamp Lake Cullen, Johnson Swamp	1.3.1	Environmental water delivered as per Environmental watering plans and seasonal water plans	As per seasonal watering plan	**CMA**, GMW, VEWH
1.4	Support the G-MW connection Project Kerang Lakes By-Pass Investigations *	1.4.1	Support G-MW Connection Program Special Project implementation if required	Subject to approval	**DEPI**, CMA, G-MW, Parks Victoria
			Estimated cost of activities for the Lower Loddon	**$ -**	

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS. Costs associated with managing the Kerang Lakes have not been included in the RWS and will be confirmed in developing the Management Plan.

* Connections Project will only proceed if approved through State and Federal Government approval processes.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Loddon River and Serpentine Creek	**Reach/es**	1,2,3,4,5,6,7,11
Long-term Resource Condition		1. Improvement of the condition of the riparian zone of the Lower Loddon River and Serpentine Creek by 2021 with a measured increase by one in the ISC streamside zone sub index 2. The delivery of environmental flows are maximised contributing to increased hydrology and aquatic life ISC scores by 2021. 3. Implement a maintenance program to ensure on-going effectiveness of works.			

Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Improve the altered water regime threat score	1.1.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA**, G-MW, VEWH
1.2	Improve planning for environmental water management	1.2.1	Undertake a flows study for Serpentine Creek by 2015	1 no.	**CMA**, G-MW, VEWH
		1.2.2	Finalise and implement the Loddon Environmental Water Management Plan by 2015	1 no.	**CMA**, G-MW, VEWH
1.3	Improve vegetation structure and diversity	1.3.1	Monitor effectiveness of existing Riparian Management Agreements	At least 10% sites reviewed	**CMA** & Landholders
1.4	Increase habitat available by modifying existing fish barriers	1.4.1	Modify fish barrier (The Chute) and allow fish passage along the Loddon River	1 barrier	**CMA**, G-MW
		1.4.2	Investigate options to improve fish passage in upstream barriers	1 no.	**CMA**, G-MW
1.5	Increased landholder skills and awareness in riparian management practices	1.5.1	Coordinate/attend community engagement events	10 (events)	**CMA**, Landholders
		1.5.2	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Lower Loddon	**$ 3,612,500**	

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Box Creek and Pyramid Creek	**Reach/es**	32, 51
Long-term Resource Condition		1. Improve the condition of Box Creek from poor to moderate (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of Box Creek with a measured increase of two points in the streamside zone sub-index of the ISC. 3. The delivery of environmental flows are maximised contributing to increased hydrology and aquatic life ISC scores. 4. Implement a maintenance program to ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Implementation of the Mid Murray Native Fish Recovery Plan	1.1.1	Modify fish barriers (Taylors Creek Weir and Spittle's Regulator) and allow fish passage through Box Creek, Loddon River and Gunbower Creek.	2 barriers	**CMA**, G-MW
		1.1.2	Habitat improvement works	1 no.	**CMA**, G-MW
		1.1.3	Baseline and repeat survey and monitoring to assess effectiveness of habitat improvement works	2 no.	**CMA**, G-MW
1.2	Improve the altered water regime threat score	1.2.1	Deliver environmental water in line with the Seasonal Watering Plan	1 no.	**CMA**, G-MW, VEWH
1.3	Improve planning for environmental water management	1.3.1	Undertake a flows study for Box/Pyramid Creek by 2015	1 no.	**CMA**, G-MW, VEWH
1.4	Install fencing for species control (livestock access) along 100% of waterway frontages (both banks)	1.4.1	Construction of riparian fences	5 (km)	**CMA**, Landholders
		1.4.2	Provision of offstream watering points	10 no.	**CMA**, Landholders
1.5	Improve vegetation structure and diversity through indigenous vegetation establishment along frontages	1.5.1	Establish native indigenous vegetation	20 (ha)	**CMA**, Landholders
1.6	Increased landholder skills and awareness in riparian management practices	1.6.1	Establish Management Agreements with landholders participating in river health incentives	10 Management Agreements	**CMA**, Landholders
		1.6.2	Coordinate/attend community engagement events	10 (events)	**CMA**, Landholders
		1.6.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.7	Improve monitoring of fish populations through partnerships with angling clubs	1.7.1	Support targeted monitoring using citizen science (angling club records, angular diary program).	-	**CMA**, Angling clubs
		1.7.2	Promote recreational fisher awareness of, and participation in, Regional Waterway Strategy actions through regional consultation forums, angular club meetings and public media.	10 (events)	**CMA**, Angling clubs
			Estimated cost of activities for the Box Creek and Pyramid Creek		**$ 2,048,438**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area 7		Lower Loddon			
Basin	Loddon	**Waterway**	Little Murray River	**Reach/es**	50
Long-term Resource Condition		1. Improve the condition of the Little Murray River from poor to good (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Little Murray River with a measured increase of two points in the streamside zone sub-index of the ISC. *Please note objectives for Little Murray Weir are subject to the Swan Hill G-MW Connections Project being implemented.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Implement the Swan Hill Connections Project - Subject to approval	1.1.1	CMA will work with G-MW to implement Little Murray River restoration works associated with mitigation actions - Subject to Project Approval*	Subject to Swan Hill Connections Project approval	G-MW, CMA
1.2	Develop a Little Murray River Environmental Management Plan (EMP) considering whole of river and complimenting works implemented through Connections project.	1.2.1	Implement complimentary works to achieve benefits for entire Little Murray River	1 no.	G-MW, CMA, Landholders
1.3	Implement Little Murray River Complimentary Works *Please note this would only proceed in Swan Hill Connections Project is approved and mitigation works are implemented.	1.3.1	Complimentary actions will targeted entire Little Murray River both u/s and d/s of Little Murray Weir s.	Refer to EMP. Subject to Swan Hill Connections Project approval	G-MW, CMA, Landholders
1.4	Improve the altered water regime threat score	1.4.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA,** G-MW, VEWH, CEWH
1.5	Improve planning for environmental water management	1.5.1	Develop an Environmental Flow study	1 no.	**CMA,** G-MW, VEWH, CEWH
1.6	Install fencing for species control (livestock access) along 50% of waterway frontages (both banks) along the Campaspe River	1.6.1	Construction of riparian fences	70 (km)	**CMA**, Landholders
		1.6.2	Provision of offstream watering points	40 no.	**CMA**, Landholders
1.7	Improve vegetation structure and diversity through indigenous vegetation establishment along one quarter of frontages along the Little Murray River	1.7.1	Establish native indigenous vegetation	250 (ha)	**CMA**, Landholders
		1.7.2.	Undertake Weed Control	150 (ha)	**CMA**, Landholders
1.8	Improve in stream habitat	1.8.1	Replace Large Woody Debris	4 sites	
1.9	Increased landholder skills and awareness in riparian management practices	1.9.1	Establish Management Agreements with landholders participating in river health incentives	50 Management Agreements	**CMA**, Landholders
		1.9.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.9.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.10	Improve access for angler and canoeists along the river	1.10.1	Seek Recreational Fishing Grant funding in conjunction with local angling groups to construct of fishing/canoe platforms	-	**CMA**, Angling clubs
1.11	Improve monitoring of fish populations through partnerships with angling clubs	1.11.1	Support targeted monitoring using citizen science (angling club records, angular diary program).	-	**CMA**, Angling clubs
		1.11.2	Promote recreational fisher awareness of, and participation in, Regional Waterway Strategy actions through regional consultation forums, angular club meetings and public media.	10 (events)	**CMA**, Angling clubs
			Estimated cost of activities for the Little Murray	**$4,050,000**	

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Mid Loddon Wetlands (Lake Yando, Little Lake Meran, Lake Meran, Leaghur State park, Lake Lyndger, Lake Leaghur, Woolshed Swamp, Great Spectacle)		
Long-term Resource Condition		1. Maintain and improve the condition of the Mid Loddon wetlands by 2050 as measured by Index of Wetland Condition 2. To increase the species richness of wetland-dependant bird species across the Boort Wetlands to 30 by 2020 and the number of individuals to an average of 1000 - as measured by monthly counts during a wet phase.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake annual weed control	Annual	**PV,** CMA, landowners
		1.1.2	Undertake annual rabbit control	Annual	**PV,** CMA, landowners
		1.1.3	Establish management agreements with landowners participating in weed and pest animal control works	4 Management Agreements	**CMA**, Landholders
1.2	Reduce predator population to maintain bird breeding population	1.2.1	Undertake fox control	Annual	**PV,** CMA, landowners
1.3	Conduct IWC assessments on all wetlands to inform baseline condition	1.3.1	Undertake IWC assessments	8 no.	**CMA,** PV
1.4	Improve the changed water regime score	1.4.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA,** G-MW, VEWH, PV, DEPI
1.5	Improved planning for environmental water management	1.5.1	Assessment of environmental values and watering constraints for Little Lake Meran, Leaghur State Park, Lake Lyndger, Woolshed and Great Spectacle Swamp	5 no.	**CMA,** G-MW, VEWH, PV
		1.5.2	Develop Environmental Water Management Plans (including undertaking investigations to fill information gaps).	4 no.	**CMA,** G-MW, VEWH, PV
1.6	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.6.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA,** G-MW, VEWH, DEPI
			Estimated cost of activities for the Mid Loddon Wetlands		**$ 2,312,156**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Red Gum Swamp and McDonald Swamp		
Long-term Resource Condition		1. Improvement and maintenance of extent and condition of riparian vegetation at Red Gum Swamp and McDonald Swamp by 2050 as measured by IWC. 2. Provision of a water regime that supports a diversity of flora and fauna typical of a shallow freshwater marsh, in particular providing key waterbird habitat including a mix of associated grasses and sedges, open water and mudflats.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake weed control around wetland	annual	**PV,** CMA, landowners
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake fox control	annual	**PV,** CMA, landowners
1.3	Conduct IWC assessments to inform baseline condition	1.3.1	Undertake IWC assessments	2 no.	**PV,** CMA, landowners
1.4	Improved planning for environmental water management	1.4.1	Infrastructure connection feasibility, bathymetry and environmental assessment for Red Gum and McDonald Swamp by 2018	2 no.	**CMA**, VEWH, GMW, PVI
		1.4.2	Develop Environmental Water Management Plan by 2018	2 no.	**CMA**, VEWH, GMW, PV
1.5	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.5.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA,** VEWH, PV, DEPI
1.6	Investigate feasibility of installing carp screens to reduce threat to aquatic vegetation	1.6.1	Undertake investigation	1 no.	**CMA**
		1.6.2	Upgrade culvert structure on Red Gum Swamp	1 no.	**CMA**, GMW
1.7	Improve the water regime threat score	1.7.1	Deliver Environmental Water in line with seasonal watering plan (Subject to Infrastructure construction)	1 no.	**CMA**, VEWH, GMW
			Estimated cost of activities for Red Gum Swamp and McDonald Swamp		**$ 559,375**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Lake Elizabeth		
Long-term Resource Condition		1. Improvement and maintenance of extent and condition of riparian vegetation (specifically Black Box) at Lake Elizabeth by 2050 as measured by IWC. 2. To provide an appropriate water regime that maintains Lake Elizabeth as a permanent, saline wetland whilst providing habitat for reintroduction of the critically endangered Murray Hardyhead through maintenance of appropriate water quality and the provision of Saline Aquatic Meadow (EVC 842) vegetation			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake annual weed control	annual	**PV,** CMA
		1.1.2	Undertake annual rabbit control	annual	**PV,** CMA
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake annual fox control	annual	**PV,** CMA
1.3	Conduct IWC assessments to inform baseline condition	1.3.1	Undertake IWC assessments	1 no.	**CMA**
1.4	Improve delivery flow paths for environmental water at Lake Elizabeth	1.4.1	Upgrade culvert structure	1 no.	**CMA**, GMW
1.6	Murray Hardyhead translocation into Lake Elizabeth	1.6.1	Undertake fish and macroinvertebrate surveys to inform Murray Hardyhead translocation feasibility	1 no.	**DEPI ,** CMA, PV
		1.6.2	Translocate Murray Hardy Head to Lake Elizabeth	Subject to feasibility	**DEPI ,** CMA, PV
1.7	Improved planning for environmental water management	1.7.1	Bathymetry survey and updates to water balance model	1 no.	**CMA**
		1.7.2	Develop Environmental Water Management Plan by 2015	1 no.	**CMA**, VEWH, GMW, DEPI
1.8	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.8.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA,** G-MW, VEWH, PV, DEPI
1.9	Maintain a breeding population of Endangered Murray Hardyhead in Round Lake	1.9.1	Undertake annual fish surveys to monitor population	8 no.	**CMA**, DEPI
		1.9.2	Monthly WQ monitoring	8 no.	**CMA**, DEPI
1.10	Improve the water regime threat score	1.10.1	Deliver Environmental Water in line with seasonal watering plan	1 no.	**CMA**, VEWH, GMW
			Estimated cost of activities for the Lake Elizabeth		**$ 814,000**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Benjeroop Wildlife Reserve		
Long-term Resource Condition		1. Improvement and maintenance of extent and condition of riparian vegetation at Benjeroop State Forest by 2050 as measured by IWC.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake weed control	annual	**PV,** CMA
		1.1.2	Undertake rabbit control	annual	**PV,** CMA
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake fox control	annual	**PV,** CMA
1.3	Conduct IWC assessments to inform baseline condition	1.3.1	Undertake IWC assessments	1 no.	**CMA**
1.4	Improved planning for environmental water management	1.4.1	Develop Environmental Water Management Plan by 2018	1 no.	**CMA**, VEWH, GMW, PV
1.5	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.5.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA**, VEWH, PV, DEPI
1.6	Improve the water regime threat score	1.6.1	Deliver Environmental Water in line with seasonal watering plan	1 no.	**CMA**, VEWH, GMW
			Estimated cost of activities for the Benjeroop State Forest		**$ 862,188**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Lake Murphy		
Long-term Resource Condition		1. To provide a water regime that supports a diversity of waterbirds, flora and fauna typical of a deep freshwater marsh.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake annual weed control	annual	**PV,** CMA
		1.1.2	Undertake annual rabbit control	annual	**PV,** CMA
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake annual fox control	annual	**PV,** CMA
1.3	Conduct IWC assessments to inform baseline condition	1.3.1	Undertake IWC assessments	1 no.	**CMA**
1.4	Improve delivery flow paths for environmental water at Lake Murphy	1.4.1	Investigation into leaking outfall structure	1 no.	**CMA**, GMW
1.5	Investigate feasibility of installing carp screens to reduce threat to aquatic vegetation	1.5.1	Undertake investigation	1 no.	CMA
1.6	Improved planning for environmental water management	1.6.1	Assess environmental values and water requirements by 2018	1 no.	**CMA,** VEWH, PV, DEPI
		1.6.2	Develop Environmental Water Management Plan by 2018	1 no.	**CMA**, VEWH, GMW, PV
1.7	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.7.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA**, VEWH, PV, DEPI
1.8	Improve the water regime threat score	1.8.1	Deliver Environmental Water in line with seasonal watering plan	1 no.	**CMA**, VEWH, GMW
			Estimated cost of activities for the Lake Murphy		**$ 430,938**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Round Lake, Golfcourse Lake, Woorinen North Lake, Lake Wandella		
Long-term Resource Condition		1. Maintain the populations of endangered Murray Hardyhead through appropriate environmental water regime			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake annual weed control	8 no.	CMA, PV
		1.1.2	Undertake annual rabbit control	8 no.	CMA, PV
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake annual fox control	8 no.	CMA, PV
1.3	Maintain a breeding population of Endangered Murray Hardyhead in Round Lake	1.3.1	Undertake bi-annual fish surveys to monitor population	4 no.	**DEPI** , CMA
		1.3.2	Monthly WQ monitoring	8 no.	**DEPI** , CMA
		1.3.3	Investigate feasibility of translocating Murray Hardyhead into Golf Course Lake, Woorinen North Lake and Lake Wandella	1 no.	**DEPI** , CMA
1.4	Improved planning for environmental water management	1.4.1	Develop Environmental Water Management Plan by 2018	1 no.	**CMA**, VEWH, GMW, PV, DEPI
1.5	Improve the water regime threat score	1.5.1	Deliver Environmental Water in line with seasonal watering plan	1 no.	**CMA**, VEWH, DEPI, PV, DEPI
1.6	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.6.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA**, VEWH, DEPI, PV
			Estimated cost of activities for the Round Lake and Golfcourse Lake		**$ 673,125**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 7		Lower Loddon			
Basin	Loddon	**Waterway**	Loddon	**Wetlands**	Richardsons Lagoon
Long-term Resource Condition		1. Provision of an appropriate water regime that targets the maintenance of varying habitats to support a range of fauna species and habitat functions including waterbird resting, nesting and feeding.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and improve vegetation	1.1.1	Undertake weed control around wetlands	annual	**PV,** CMA
		1.1.2	Undertake rabbit control	annual	**PV,** CMA
1.2	Reduce pest predator population to maintain bird breeding population	1.2.1	Undertake fox control	annual	**PV,** CMA
1.3	Install fencing for species control (livestock access) along riparian frontage at Richardsons Lagoon	1.3.1	Construction of riparian fencing		**CMA,** PV
1.4	Improve vegetation structure and diversity through indigenous vegetation establishment	1.4.1	Establish native vegetation		**CMA,** PV
1.5	Conduct IWC assessments to inform baseline condition	1.5.1	Undertake IWC assessments	1 no.	**CMA**
1.6	Improve the water regime threat score	1.6.1	Deliver Environmental Water in line with seasonal watering plan	1 no.	**CMA**, VEWH
1.7	Improve monitoring and reporting to demonstrate outcomes from environmental watering	1.7.1	Waterbird monitoring to assess success of water delivery regime	8 no.	**CMA**
1.8	Investigate feasibility of installing carp screens to reduce threat to aquatic vegetation	1.8.1	Undertake investigation	1 no.	**CMA**
			Estimated cost of activities for the Richardsons Lagoon		**$ 526,250**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.10 **Gunbower Program Area**

The Gunbower Program Area focuses on Gunbower Creek (Reaches 38 and 39), Gunbower Forest and the Guttrum and Benwell State Forest. The area includes the towns of Gunbower, Cohuna and Koondrook. A major focus of the RWS will be the continued planning and implementation of the Living Murray and Basin plan programs relating to Gunbower Forest. This will be supported by continued integrated works program for Gunbower Creek. Investigations will also continue to determine the feasibility of construction of works and measures to more efficiently deliver environmental water to the Guttrum and Benwell Forests. The location of priority waterways is shown in Figure 19 and Table 14 below.

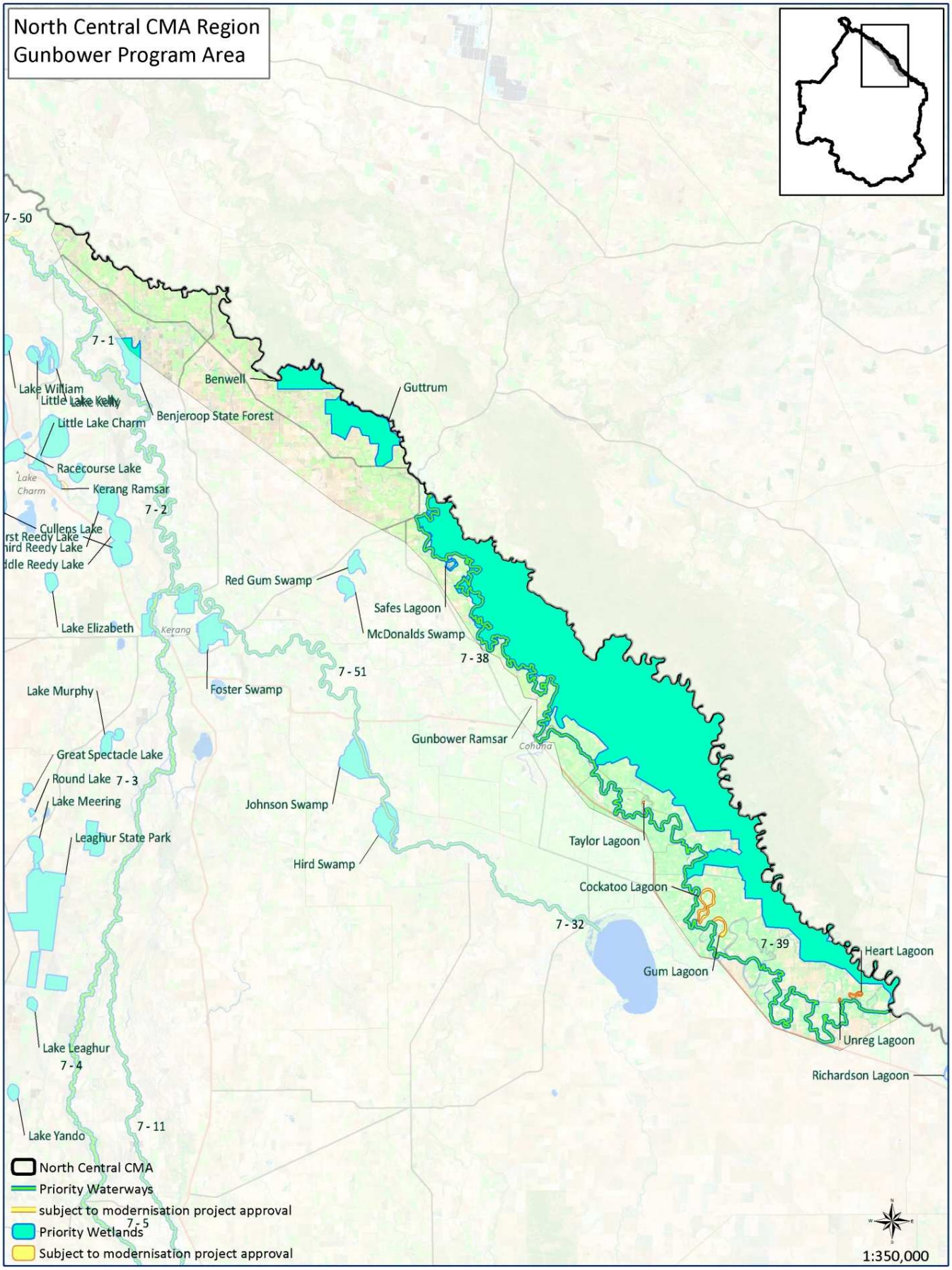


Figure 19 - Gunbower Program Area

Table 14 - Gunbower Program Area Actions

Program Area : 8		Gunbower			
Basin	Loddon	**Waterway**	Gunbower Creek	**Reach/es**	38,39
Long-term Resource Condition		1. Improve the condition of the Gunbower Creek from moderate to good (based on Index of Stream Condition) by 2050. 2. Improve the condition of the Gunbower Creek by 2021 with a measured increase of two points in the streamside zone sub-index of the ISC. 3. Implement a maintenance program to ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Implementation of the Mid Murray Native Fish Recovery Plan	1.1.1	Modify fish barriers (National Channel Offtake, Koondrook Weir, Cohuna Weir) and allow fish passage through Gunbower Creek, Box Creek and Loddon River	3 barriers *	**CMA**, G-MW
		1.1.2	Screening of irrigation off-takes to reduce fish movement into irrigation channels	*	**CMA**, G-MW
1.2	Improve the altered water regime threat score	1.2.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA**, G-MW, VEWH
1.3	Improve planning for environmental water management	1.3.1	Update the flow study for Gunbower Creek by 2015	1 no.	CMA, G-MW, VEWH, DEPI, PV
		1.3.2	Finalise and implement the Gunbower Environmental Water Management Plan by 2015	1 no.	**CMA**, G-MW, VEWH, DEPI, PV
1.4	Install fencing for species control (livestock access) along 100% of waterway frontages (both banks)	1.4.1	Construction of riparian fences	120 (km)	**CMA**, Landholders
		1.4.2	Provision of offstream watering points	40 no.	
1.5	Removal of willows to improve in-stream habitat and bank stability	1.5.1	Willow Control	32 (km)	**CMA**, Landholders
1.6	Improve vegetation structure and diversity	1.6.1	Woody weed control	32 (ha)	**CMA**, Landholders
		1.6.2	Establish native indigenous vegetation	80 (ha)	**CMA**, Landholders
1.7	Increased landholder skills and awareness in riparian management practices	1.7.1	Establish Management Agreements with landholders participating in river health incentives	40 Management Agreements	**CMA**, Landholders
		1.7.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.7.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
1.8	Improve monitoring of fish populations through partnerships with angling clubs	1.8.1	Support targeted monitoring using citizen science (angling club records, angular diary program).	-	**CMA**, Angling clubs
		1.8.2	Promote recreational fisher awareness of, and participation in, Regional Waterway Strategy actions through regional consultation forums, angular club meetings and public media.	10 (events)	**CMA**, Angling clubs
			Estimated cost of activities for the Gunbower Creek		**$ 5,239,063**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

* Costs associated with the implementation of the Mid Murray Fish Recovery Plan still to be determined

Program Area : 8		Gunbower			
Basin	Loddon	**Waterway**	Gunbower Forest Ramsar		
Long-term Resource Condition		1. 80% of permanent, semi-permanent and temporary wetlands in healthy condition as demonstrated by a sustainable intact floristic assemblage by 2025. 2. 30% of River Red Gum forest in healthy condition by 2025 as demonstrated by a sustainable intact floristic assemblage and tree canopy cover greater than 60%. 3. Successful breeding of thousands of colonial waterbirds at least 3 years in 10 by 2030. 4. A 10% population increase in native fish species currently known to be present by 2025. 5. Presence of 2 native fish species currently considered as locally extinct by 2025.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Improve the altered water regime	1.1.1	Deliver environmental water in line with the Seasonal Watering Plan, the Ecological Watering Guide and other requirements	As per seasonal watering plan	CMA, G-MW, MDBA, VEWH, CEWH, DEPI, PV
		1.1.2	Construction of a package of works to enable delivery of water to Gunbower National Park	*	CMA, G-MW, SEWPAC, MDBA, VEWH, CEWH, DEPI, PV
1.2	Improve and maintain wetland and understory vegetation structure and diversity	1.2.1	Pest Plant control	8 no.	CMA, SEWPAC, DEPI, PV
1.3	Improve and maintain threatened native fauna species (e.g. Murray Cod, Southern Pygmy Perch, Broad Shell Turtle)	1.3.1	Investigate feasibility of Implementation a re-introduction program as required	1 no.	CMA, G-MW, SEWPAC, MDBA, VEWH, CEWH, DEPI, PV
		1.3.2	Pest Animal control (e.g. Foxes)	8 no.	CMA, SEWPAC, DEPI, PV
1.4	Monitor our progress towards achieving the ecological objectives of the Gunbower Forest	1.4.1	Implement Condition and Intervention Monitoring Programs	2	CMA, G-MW, SEWPAC, MDBA, VEWH, CEWH, DEPI, PV
			Estimated cost of activities for the Gunbower Forest Ramsar		**$ 1,718,750**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

* This program is funded under The Living Murray Program and the Sustainable Diversion Limits Works and Measures Programs and has not been costed as part of this RWS.

Program Area : 8		Gunbower			
Basin	Loddon	**Waterway**	Guttrum-Benwell State Forest		
Long-term Resource Condition		1. Restore the original ecological characteristics (waterbird breeding and habitat, extensive reedy vegetation, forest diversity and productivity, temporary habitat for large bodied fish) of Guttrum and Benwell forests and maintain them in a sustainable way			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Improve the altered water regime	1.1.1	Construction of a package of works to enable delivery of water	*	CMA, G-MW, MDBA, VEWH, CEWH, DEPI, PV
		1.1.1	Deliver environmental water in line with the Seasonal Watering Plan (Subject to successful completion of Action 1.1.1 above)	1	CMA, G-MW, SEWPAC, MDBA, VEWH, CEWH, DEPI, PV
			Estimated cost of activities for the Guttrum-Benwell State Forest		**$ -**

* Subject to funding under Sustainable Diversion Limits Works and Measures Programs, Costs have not been included as part of this RWS.

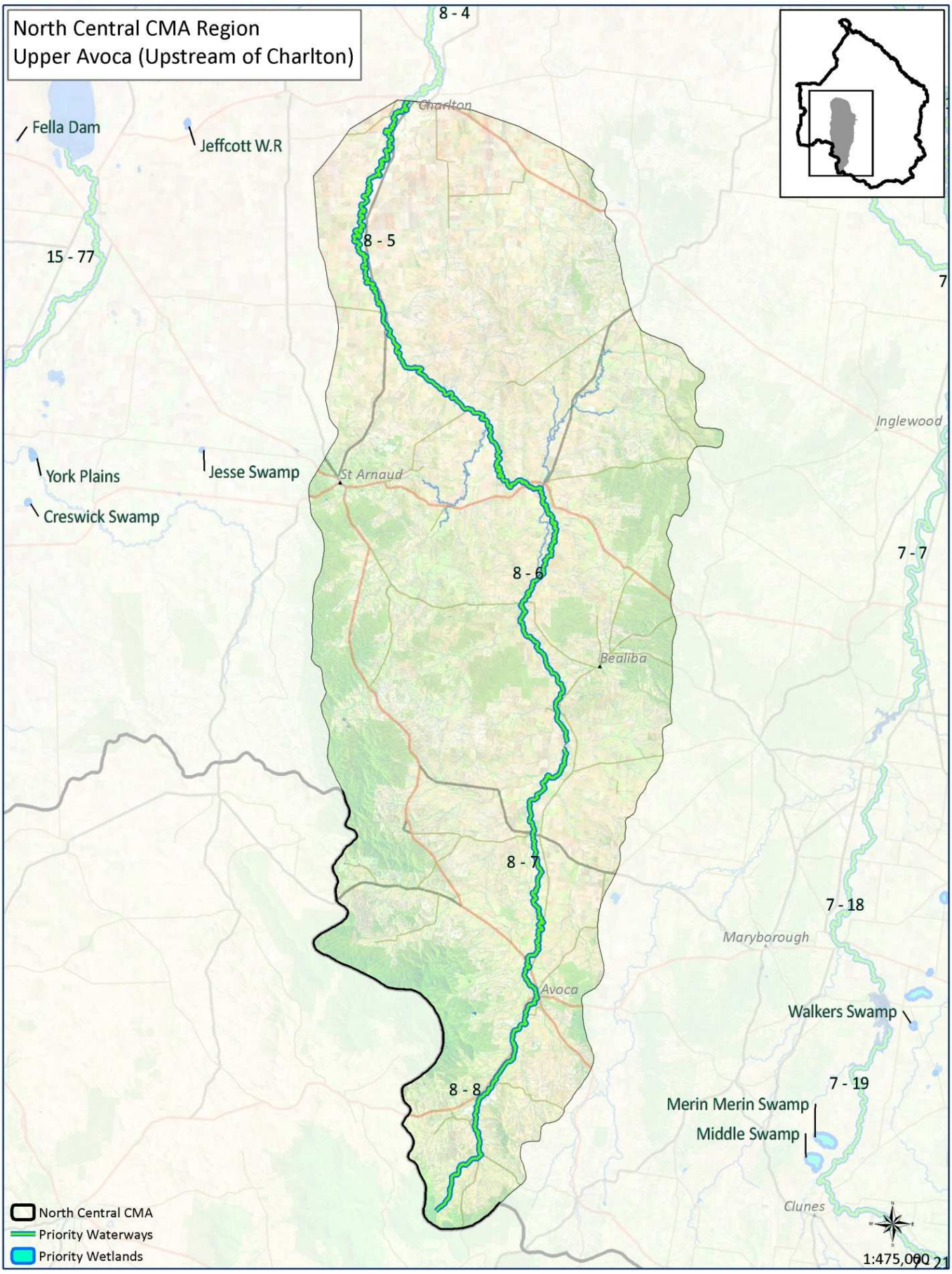
7.11 **Avoca Basin**

The Avoca River drains Victoria's fifth largest catchment, the Avoca Basin, which occupies an area of 1.2 million hectares. The North Central CMA is responsible for 690,000ha of the basin, the rest of which falls within the adjacent Mallee CMA region. Major tributaries entering the Avoca River include Glenlogie, Number Two, Cherry Tree, Fentons and Campbells creeks. The Avoca Basin is also home to one of the region's most significant wetland system, the Avoca Marshes, part of the Kerang Lakes Ramsar Site.

7.12 **Upper Avoca Program Area**

The Upper Avoca Program Area includes the southern portion of the Avoca River catchment, extending about 250km north from the Great Dividing Range near Amphitheatre to Charlton. The area includes the townships of St Arnaud, Logan, Emu, Bealiba and Natte Yallock. The area includes the main stem of the Avoca River (Reaches 5, 6, 7 and 8) to the township of Charlton and ten of its major tributaries. Upstream of Avoca, Glenlogie Creek (reach 20) enters near Ampitheatre followed by Rutherford Creek (Reach 19). Downstream of Avoca, Number Two Creek (18), Mountain Creek (Reach 17) and Cherry Tree Creek (Reach 15) enter from the west and Homebush Creek (Reach 16) flows from the east. Fentons Creek (Reaches 13 and 14) enters the Avoca River at Logan, while Strathfillan Creek (Reach 11) is fed by Middle Creek (Reach 12) and meets the river downstream of Logan.

A major focus of the North Central RWS in the Upper Avoca will be the Avoca River and will build on the recent works completed in Reach 7. The location of priority waterways is shown in



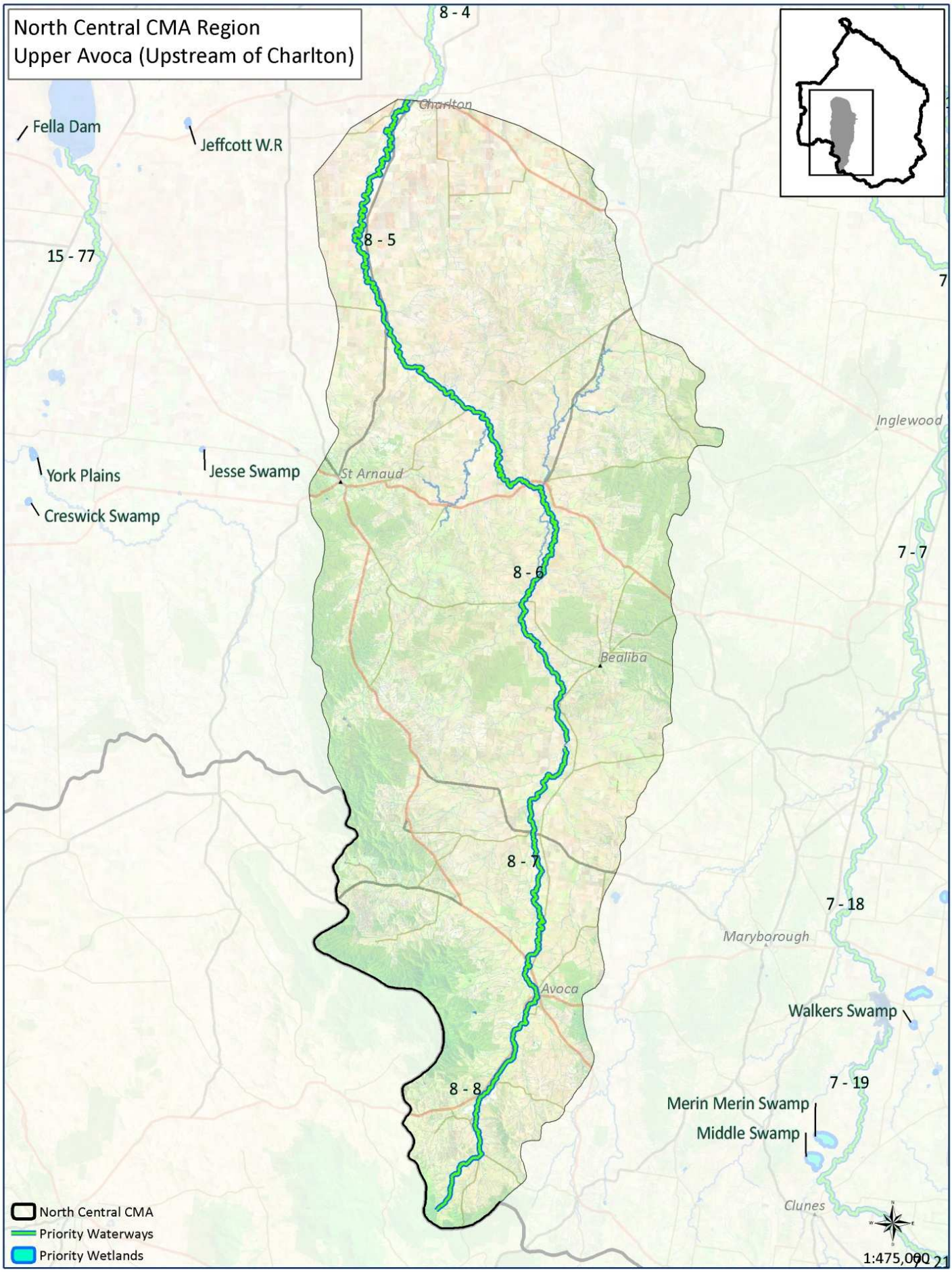


Figure 20 and Table 15.

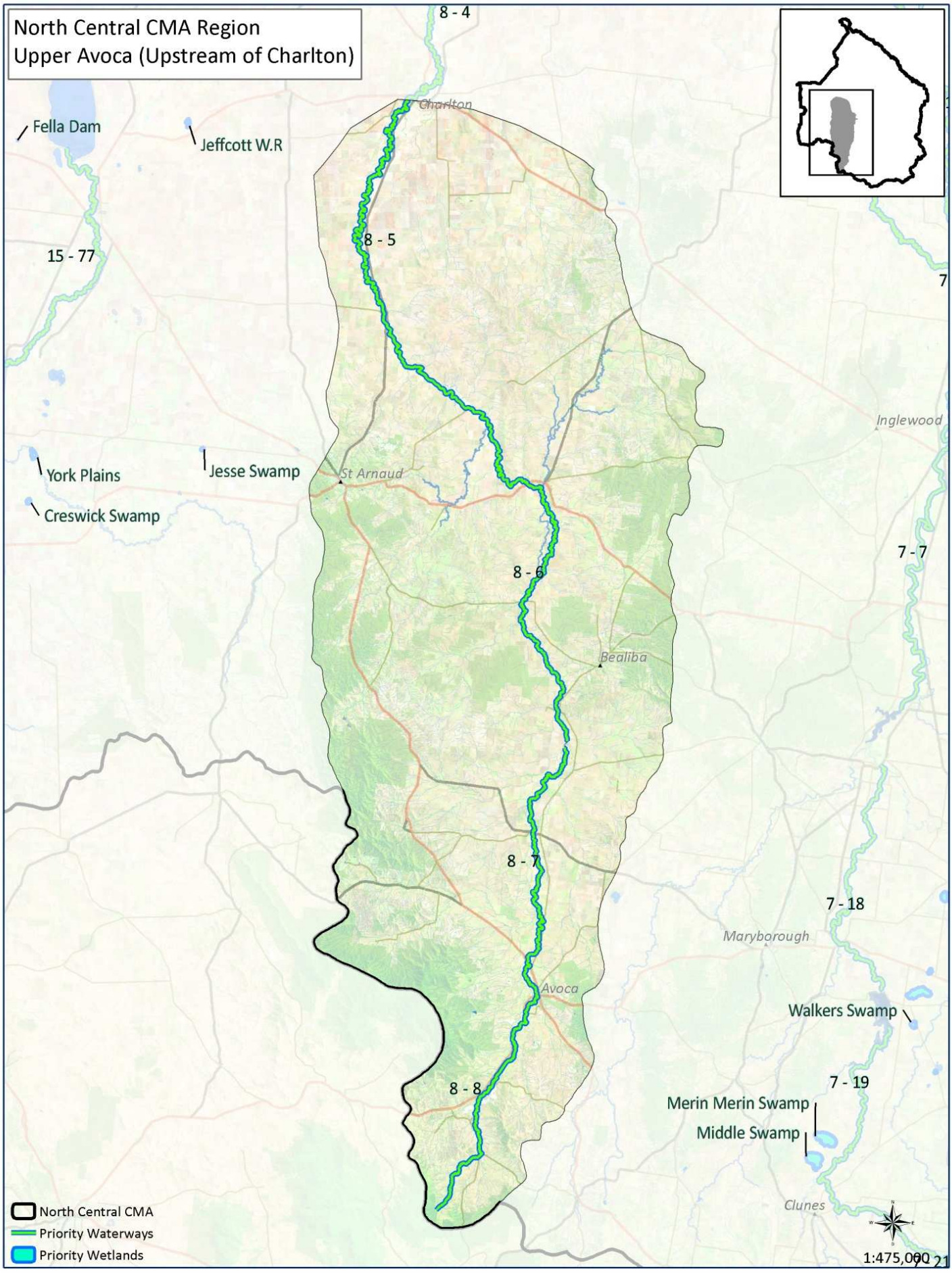


Figure 20 - Upper Avoca Program Area

Table 15 - Upper Avoca Program Area Actions

Program Area : 9		Upper Avoca			
Basin	Avoca	**Waterway**	Avoca River	**Reach/es**	5,6,7,8
Long-term Resource Condition		1. Improve the condition of the Upper Avoca River from moderate to good (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Upper Avoca River by 2021 with a measured increase of one point in the streamside zone sub-index of the ISC. 3. Implement a maintenance program to ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along waterway frontages (both banks)	1.1.1	Construction of riparian fences	150 (km)	**CMA**, Landholders
		1.1.2	Provision of offstream watering points	80 no.	**CMA**, Landholders
1.2	Improve vegetation structure and diversity through weed control and indigenous vegetation establishment along frontages	1.2.1	Woody weed control	10 (ha)	**CMA**, Landholders
		1.2.2	Establish native indigenous vegetation	160 (ha)	**CMA**, Landholders
1.3	Increased landholder skills and awareness in riparian management practices	1.3.1	Establish Management Agreements with landholders participating in river health incentives	80 Management Agreements	**CMA**, Landholders
		1.3.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.3.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Upper Avoca		**$ 3,943,750**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.13 **Lower Avoca Program Area**

The Lower Avoca Program Area encompasses the northern portion of the Avoca River catchment downstream of Charlton to the Avoca Marshes. This area includes the townships of Charlton and Quambatook along the Avoca River as well as Wycheproof, Lalbert and Lake Meran. It includes the main stem of the Avoca River (Reaches 1, 2, 3 and 4), the Mosquito Creek anabranch (Reach 9) and the Avoca Marshes.

A major focus of the North Central RWS in the Lower Avoca program area will be implementation of waterway management activities on the Avoca River and maintaining the current condition of the Avoca Marshes. The location of priority waterways is shown in Figure 21 and Table 16.

Figure 21 - Lower Avoca Program Area

Table 16 - Lower Avoca Program Area Actions

Program Area : 10		Lower Avoca			
Basin	Avoca	**Waterway**	Avoca River	**Reach/es**	1,2,3,4
Long-term Resource Condition		1. Improve the condition of the Lower Avoca River from poor to moderate (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Lower Avoca River by 2021 with a measured increase of one point in the streamside zone sub-index of the ISC. 3. Implement a maintenance program to ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along waterway frontages (both banks)	1.1.1	Construction of riparian fences	138 (km)	**CMA**, Landholders
1.2	Improve vegetation structure and diversity through weed control and indigenous vegetation establishment along frontages	1.2.1	Woody weed control	40 (ha)	**CMA**, Landholders
		1.2.2	Establish native indigenous vegetation	40 (ha)	**CMA**, Landholders
1.3	Improve management of flows between Avoca River and Mosquito Creek	1.3.1	Replacement of Mosquito Sills on the Lower Avoca River by 2015	1 no.	**CMA**, Landholders
1.4	Increased landholder skills and awareness in riparian management practices	1.4.1	Establish Management Agreements with landholders participating in river health incentives	100 Management Agreements	**CMA**, Landholders
		1.4.2	Coordinate/attend community engagement events	20 (events)	**CMA**, Landholders
		1.4.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Lower Avoca		**$ 3,024,275**

Program Area : 10		Lower Avoca			
Basin	Avoca	**Waterway**	First Marsh, Second Marsh, Third Marsh, Lake Bael Bael, Lake Lalbert, Yassom Swamp		
Long-term Resource Condition		1. To maintain or improve the ecological condition of the Avoca Marshes by 2050 as measured by the Index of Wetland Condition. 2. To increase the extent of River Red Gum dominated EVCs by 10% on the bed/fringes of Second and Third marsh through establishing regeneration by 2025.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Maintain and Improve the condition of grassland and grassy woodlands in the Avoca Marshes	1.1.1	Construction of fences to enable grazing regime management	20 (km)	**CMA**, Landholders
		1.1.2	Annual pest plant and animal control program	annual	**PV,** CMA, Landholders
		1.1.3	Establish management agreements with landowners participating in pest plant and animal control works	Management Agreements	**PV,** CMA, Landholders
1.2	Conduct IWC assessments on all wetlands to inform baseline condition	1.2.1	Undertake IWC assessments	8 no.	**CMA**
			Estimated cost of activities for the Lower Avoca		**$1,262,500**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

7.14 **Avon Richardson Basin**

The Avon-Richardson catchment lies in the west of the North Central region of Victoria and covers approximately 330,000 ha. The Avon and Richardson rivers join at Banyena and flow north to Lake Buloke. Major tributaries include Sandy, Wallaloo and Andersons creeks. The Avon-Richardson is home to the York Plains wetland complex and the nationally recognised Lake Buloke.

7.15 **Avon-Richardson Program Area**

The Avon-Richardson Program Area extends from the Pyrenees foothills southwest of St Arnaud to Lake Buloke, north of Donald. Other towns in the area include Marnoo and Watchem. The major waterways of the area include the intermittently flowing Avon River (Reaches 46, 47 and 48) and Richardson River (Reaches 43, 44 and 45). These rivers meet at Banyena with the Richardson River continuing northward to Lake Buloke. Sandy Creek (Reach 49) is the major tributary of the Avon River, while Wallaloo Creek (Reach 50), Andersons Creek (Reach 51) and Richardson (or Dog Trap) Creek (Reach 52) feed into the Richardson River.

A major focus of the North Central RWS in the Avon-Richardson Program Area will be implementing waterway management activities on the Lower Richardson River and managing environmental water to Wimmera Mallee Pipeline wetlands. The location of priority waterways is shown in Figure 22 and Table 17.

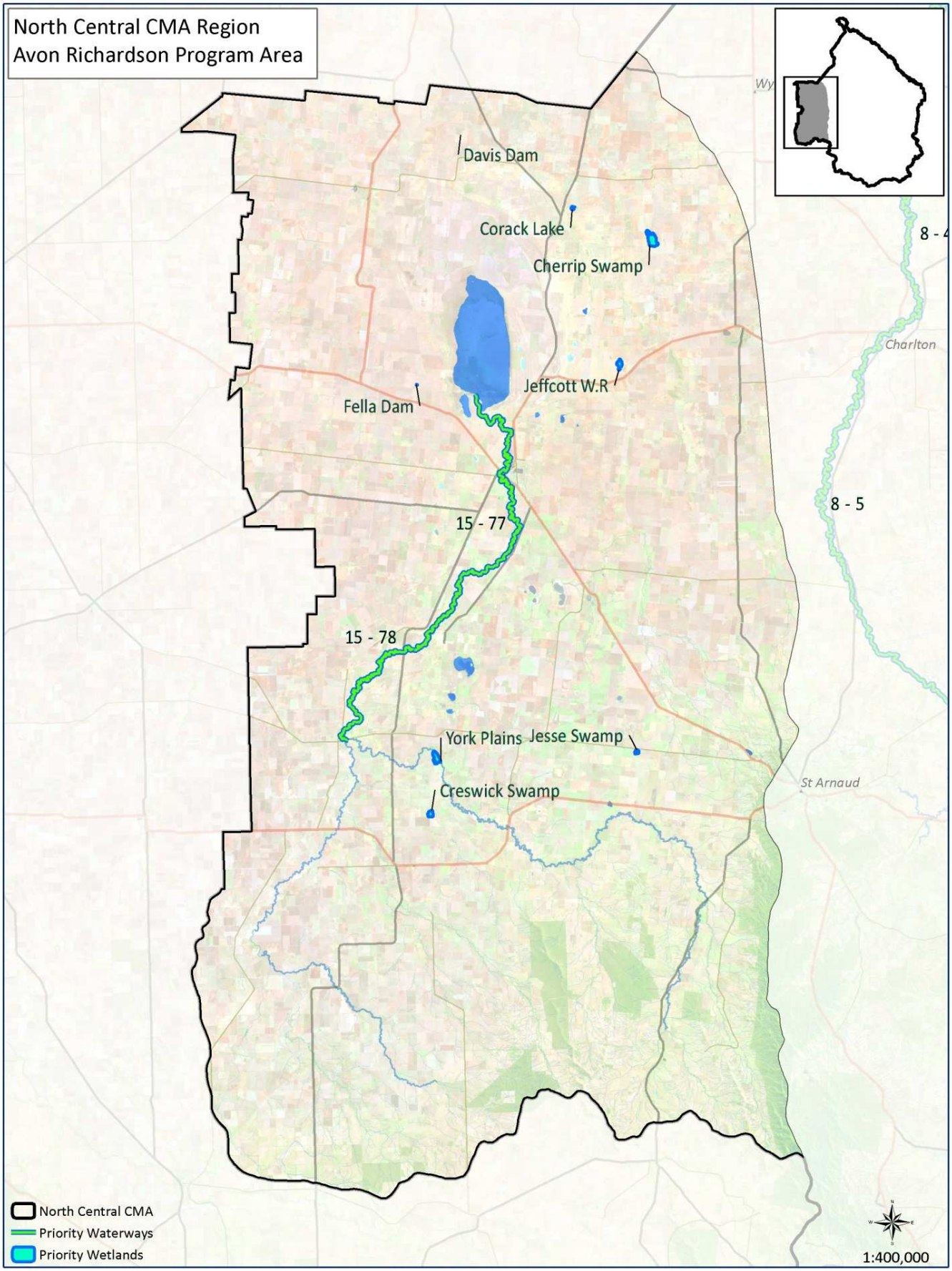


Figure 22 - Avon-Richardson Program Area

Table 17 - Avon-Richardson Program Area Actions

Program Area : 11		Avon-Richardson			
Basin	Wimmera	**Waterway**	York Plains, Wimmera Mallee Pipeline supplied wetlands (Creswick Swamp, Cherrip Swamp, Davis Dam, Corack Lake, Jeffcott Wildlife Reserve, Jesse Swamp, Falla Dam)		
Long-term Resource Condition		1. To improve the condition of the York Plains and Wimmera Mallee Pipeline supplied wetlands by 2050 as measured by Index of Wetland Condition			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access)	1.1.1	Construction of riparian fencing		**CMA,** landowners
		1.1.1	Provision of offstream watering systems		**CMA,** landowners
1.2	Maintain and improve vegetation	1.2.2	Undertake weed control around wetlands		**CMA,** landowners
		1.2.2	Undertake rabbit control	8 no.	**CMA,** landowners
1.3	Reduce predator population to maintain bird breeding population	1.3.1	Undertake fox control	8 no.	**CMA,** landowners
1.4	Annual waterbird monitoring to assess success of water delivery regime	1.5.1	Conduct annual surveys		**CMA**
1.5	Conduct IWC assessments on all wetlands to inform baseline condition	1.5.1	Undertake IWC assessments	3 no.	**CMA**
1.6	Improved planning for environmental water management	1.6.1	Develop an Environmental Water Management Plan for the Wimmera Mallee Pipeline supplied wetlands	1 no.	**CMA**, VEWH, GWMW
1.7	Improve the changed water regime score	1.7.1	Deliver environmental water in line with the Seasonal Watering Plan	As per seasonal watering plan	**CMA**, VEWH, GWMW
1.8	Increased landholder skills and awareness in wetland management practices	1.8.1	Establish Management Agreements with landholders participating in wetland management	Management Agreements	**CMA**, Landholders
			Estimated cost of activities for the Avon-Richardson		**$ 103,125**

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

Program Area : 11		Avon-Richardson			
Basin	Wimmera	**Waterway**	Richardson River	**Reach/es**	77,78
Long-term Resource Condition		1. Improve the condition of the Richardson River from very poor to moderate (based on Index of Stream Condition) by 2050. 2. Improve the condition of the riparian zone of the Richardson River by 2021 with a measured increase of one point in the streamside zone sub-index of the ISC. 3. Maintain and improve fish populations in Rich Avon Weir pool. 4. Implement a maintenance program to ensure on-going effectiveness of works.			
Management Outcome Targets		**Management Activity/Output**		**Quantity**	**Lead agency/ Partners**
1.1	Install fencing for species control (livestock access) along waterway frontages (both banks)	1.1.1	Construction of riparian fences	46 (km)	**CMA**, Landholders
1.2	Weed control for species control (woody weeds) along frontages	1.2.1	Establish woody weed control	20 (ha)	**CMA**, Landholders
1.3	Improve vegetation structure and diversity through indigenous vegetation establishment along frontages	1.3.1	Establish native indigenous vegetation	20 (ha)	**CMA**, Landholders
1.4	Improve planning for environmental water management	1.4.1	Participate in bulk entitlement, licensing and management rule review process.	1 no.	**CMA**, VEWH, GWMW
		1.4.2	Construct a fence to exclude stock from Rich Avon weir pool	2 (km)	**CMA**, Landholders
		1.4.3	Scoping study to improve stream flow management in the Avon-Richardson River.	1 no.	**CMA**
1.5	Increased landholder skills and awareness in riparian management practices	1.5.1	Establish Management Agreements with landholders participating in river health incentives	40 Management Agreements	**CMA**, Landholders
		1.5.2	Coordinate/attend community engagement events	10 (events)	**CMA**, Landholders
		1.5.3	Work with Local Landcare groups to support the implementation and maintenance of projects	4 (events)	**CMA**, Landcare groups
			Estimated cost of activities for the Richardson River	**$ 1,104,000**	

Please Note: All actions outlined in the RWS are subject to available funding. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

8 Implementation

The North Central RWS sets out the actions required to achieve our vision "*'Waterways and floodplains will be managed sustainably to protect and enhance their diversity and ecological function while also supporting the regional community's uses'*.

The North Central RCS (NCCMA 2013) and the VWMS (DEPI, 2013) both recognise the need for strong and collaborative partnerships. The successful implementation of the North Central RWS will require governments and the community working together.

The North Central RCS articulates a number of principles that are required for successful implementation of the RCS and relies on a strong collaborative approach between government and the community. The North Central RCS will:

1. **Support the community** - through community engagement and capacity building and recognising the extensive community driven environmental protection through existing networks including Landcare.
2. **Encourage Strong Government collaboration** – Collaboration is critical for success implementation of RCS and sub strategies such as the RWS.
3. **Integration** – Integration of information, issues and actions will need to be considered if an effective outcome for the regions assets is to be achieved.
4. **Seek funding to implement** – The RCS and underlying Strategies such as the RWS will require significant investment from government and the community and all funding opportunities will be explored.
5. **Measuring the success of the RCS** – An effective Monitoring, Evaluation, Reporting and Improvement framework will assist in measuring the effectiveness of the strategy.

These principles outlined in the North Central RCS will also be applied to the Implementation of the North Central RWS.

This chapter highlights key implementation issues and activities that will be required to successfully implementation the North Central RWS including resourcing, maintenance and partnerships.

8.1 Resourcing the Strategy

The North Central RWS provides clear direction regarding the priorities for waterway management over the next eight years. The successful implementation of the North Central RWS will be influenced by available funding and strong community and partner agency support. The North Central CMA will work with Partner agencies and the community to seek investment to implement the North Central RWS.

8.2 Maintenance

Significant waterway management works have occurred through the previous implementation of the River Health Strategy and will continue in the implementation of the North Central RWS.

Implementing a maintenance program will ensure implemented works are effective and contribute to achieving the long-term targets set for our waterways.

Management agreements are put in place when waterway management works are negotiated between the North Central CMA and landholders. These management agreements set out the initial works to be completed and generally articulate the ongoing requirements of the landholder in relation to maintenance, including weed control, grazing and fence maintenance. A successful outcome relies on the management agreement being implemented appropriately. An effective maintenance program should therefore focus on supporting landholders to implement their program over the long-term.

Principles of maintenance program:

- Continued landholder engagement, skills development and capacity building are the main focus of the RWS maintenance program.
- Previous riparian and structural works should be regularly inspected and maintained to ensure their ongoing effectiveness.
- Current best management practices will be utilised.

The North Central CMA estimates that an effective maintenance program will cost approximately $400,000 per year. This investment will help to ensure that previous waterway works are achieving their intended outcomes.

Action:

- The North Central CMA continues to seek funding to implement an effective maintenance program across the North Central Region.

8.3 **Partnerships**

Ongoing strong partnerships between the North Central CMA, regional partners and the community will also be critical for the successful implementation of the North Central RWS. The VWMS outlines the key roles and responsibilities and institutional arrangements at both State and regional levels in relation to waterway management. The North Central RCS and the VWMS both highlight the importance of strong partnerships in implementation.

Action:

- The North Central CMA, partner organizations and the community will continue to work together to achieve the outcomes articulated in the North Central RWS.

9 Monitoring, Evaluation, Reporting and Improvement

9.1 Introduction

Effectively managing rivers and wetlands requires all responsible agencies to have access to reliable information on which to base management decisions. Additionally, adaptive management at the regional level requires both regular review and learning from previous experience. This allows the responsible agencies to alter management approaches based on knowledge gained during implementation.

Figure 23 is a representation of the Victorian Waterway Management Strategy's eight year adaptive management cycle. The cycle includes (DEPI, 2013a):

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

Community participation and research and innovation occur across all parts of the program. This knowledge and information is crucial for ensuring effective adaptive management and informing associated monitoring, evaluation and reporting processes.

Figure 23: The eight-year adaptive management cycle of the Victorian Waterway Management Program and regional Waterway Strategies (Source: DEPI, 2013)

A detailed monitoring, evaluation, reporting and improvement (MERI) plan has been developed for the North Central RWS to support adaptive management from planning to strategy completion. It is expected that projects delivering against the RWS will complete and utilise a similar approach.

The MERI plan:

- presents the program logic underpinning the RWS.
- clarifies the assumptions associated with the program logic and identifies strategies to manage potential risks.
- identifies the key questions for evaluation and establishes processes to monitor progress within the framework of internal and statewide monitoring programs.
- clarifies the communication and reporting needs and identifies the processes required to support these needs.
- enables lessons learned from monitoring and evaluation to be gathered and inform improvement.

The MERI plan will be reviewed on an annual basis to ensure it remains current and relevant to informing adaptive management.

9.2 Monitoring

Monitoring is the collection of information to show change in the state or trend of the biophysical, social or economic assets relevant to the activity or RWS. Monitoring activities are targeted to inform evaluation and reporting on RWS implementation. Monitoring activities include collecting information relating to foundational influences and externalities that impact on RWS implementation. Foundational influences include factors such as climatic variability, drought, flood, bushfire and potential impacts of climate change; and externalities include factors such as land use change, population growth, government support, economic conditions, community expectations and landholder attitudes.

Where appropriate, projects delivering against the RWS will align monitoring activities with both North Central CMA standards and the statewide monitoring processes coordinated through the Victorian Waterway Management Program.

9.3 Evaluation

Evaluation is the deliberate collection and analysis of data and information to allow improvement, reporting and development of projects/programs before, during and after their implementation. The asking of key evaluation questions is a key step in the adaptive management cycle (Figure 23). These questions provide the basis for designing and implementing a MERI plan for the RWS.

Evaluating the RWS involves assessing the extent to which the outcomes have been achieved at each level of the program logic underpinning the RWS. It also addresses the assumptions in the program logic and provides direction and improved knowledge for subsequent planning cycles.

The evaluation questions developed for the RWS address the following five categories (DSE, 2012b):

1. Impact - changes to resource condition, management activities or institutions
2. Appropriateness - addressing the needs of beneficiaries and against best practice
3. Effectiveness - achievement of desired management outputs and resource condition objectives

4. Efficiency - value or return from investment
5. Legacy - after the activity/program ends.

The scale and frequency of evaluation will vary throughout the life of the RWS, and will include an annual review cycle along with more detailed reviews in the third and final years of the RWS.
Where appropriate, projects delivering against the RWS will develop evaluation questions and undertake evaluation at similar periods to that described below.

Annual review [undertaken by North Central CMA (for the RWS) and project delivery agencies (for projects)]

- Progress towards planned activities, outputs and budgets
- New knowledge and information
- Changes to planned activities and outputs, based on above

Year four evaluation (2018) [undertaken by North Central CMA (for the RWS) and project delivery agencies (for projects)]

- Progress towards planned activities, outputs and budgets
- Where possible progress towards management outcomes
- New knowledge and information

Final evaluation (2022) [*undertaken by a party external to North Central CMA]

- Assessment of progress and/or achievements against the RWS targets
- Capturing of knowledge (lessons learnt, new data or approaches) gained during implementation of the RWS, from all partners
- Review of changes to the RWS, from 2016 evaluation and review (and the information these changes were based on)

9.4 **Reporting**

Reporting involves communicating about the RWS and related project activities, learning's, finances and information for the purposes of:

- Communicating outcomes, challenges and learning's.
- Demonstrating performance, accountability and transparency of management actions.
- Informing adaptive and integrated management.

This may be any facet of the project, from the design, delivery, monitoring, outcomes, lessons or improvements. Audiences will include, but are not limited to:

- the project team.
- current and potential participants.
- the organisation (Board, Natural Resource Management Committee (NRMC), the Executive team and non-project staff).
- the regional community.
- funders.

Reporting should capture the entire story of a strategy/project and should have:

- **A start**: pre project: e.g. description of asset, its baseline condition, threats, its importance (environmentally, economically and socially)

- **A middle**: what was delivered, and
- **An end**: what biophysical, social, and economic changes did the project/strategy achieve compared to the baseline. What was the percentage of the total asset impacted, at the regional, state-wide or national scale?

Public reporting against the RWS's outcome targets will occur, at a minimum, following the final review. The North Central CMA will also support reporting of management outcome targets for the Victorian Waterway Management Strategy in 2016 and 2020. Reviews undertaken in the fourth and final years of the RWS will inform these reports.

The Victorian Waterway Management Program leads resource condition reporting. This involves the collection, analysis and reporting of information on the condition of Victoria's waterways every eight years, subject to available funding (DEPI, 2013a). This reporting, combined with regional knowledge, provides the collective data to assess the condition of waterways over the long-term.

The MERI plan for the 2014-22 North Central RWS identifies the key stakeholders who should be kept informed on the RWS's progress or would benefit from Strategy information. It also identifies what they need to know and how it will be communicated. Projects delivering against the RWS will report in a similar manner.

9.5 Knowledge Gaps and Research

Critical knowledge gaps were identified whilst developing the program logic and evaluation questions for the RWS. The MERI plan for the RWS identifies these key knowledge gaps along with strategies for addressing them - including collating existing information or proposing areas for further research programs. To align with the Victorian Waterway Management Program the 2014-22 North Central RWS will support research:

- Providing 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.
- Targeting 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) (DEPI, 2013a).

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 making predictions and testing 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 (e.g. riparian revegetation) (DEPI, 2013a).

9.6 Adaptive Management

Effective adaptive management requires an active culture of reflection (i.e. review and evaluation); communication of learning's within the project team and processes for incorporating learning into planning and management. It also involves implementing activities designed to test best practices and assumptions at an ecosystem level, where the full complexity of situations is recognised and there is a strong emphasis on social learning through the involvement of many stakeholders and specialists.

The MERI plan for the 2014-22 North Central RWS provides a framework for regular reflection and review of trends towards achieving targets. Projects delivering against the RWS are expected to embed similar opportunities. Based on information gleaned from either formal or informal review, appropriate changes will be made to delivery. The changes made will be clearly documented, along with the evidence on which the decision for change was based. Adaptive management will take place at a number of scales - project delivery, project design and strategy design.

9.7 **RWS Review**

As described in Section 9.3 the 2014-22 North Central RWS will be evaluated in 2018 and 2022. This aligns with the Victorian Waterway Management Strategy review phase. These evaluations will inform reviews of management activities, outputs and outcomes. Any changes to the RWS will be clearly documented, as will the evidence on which the changes are based.

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Appendix A – Summary of the RWS Priority Setting Process

1. **North Central RWS Priority Setting**

Step 1: Regional Goals

The goals for waterways management in the North Central region are as follows:

- Maintain or improve highly threatened or rare water dependant species and communities within the North Central CMA
- Maintain or improve ecologically healthy or representative rivers
- Protect or improve the ecological character of the Gunbower Forest and Kerang Lakes Ramsar sites
- Maintain or improve wetlands of National or State significance as identified in the RCS
- Maintain or improve waterways within water supply protection areas to support long-term improvement in water quality
- Maximise environmental outcomes by efficiently managing environmental entitlements in partnership with water holders
- Work with local communities to better understand the values of local waterways particularly where there is a high social value (including urban communities).
- Maintain or improve waterways that will provide adaptation under a variable climate

Step 2: High Value Riverss and Wetlands

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

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

For waterway assets in AVIRA, these characteristics can be assessed using specific scoring rules as detailed in Appendix 1. The results from this approach are:

- 112 / 112 Riverss are high value
- 67 / 67 wetlands are high value (please note that 24 of these sites are within Gunbower Forest).

The data in AVIRA for wetlands only covers a limited set of wetlands for the region. It is recognised that most wetlands will have some value, therefore all wetlands are assumed to be high value (further consideration of available information will be required prior to completion of the RWS.)

The North Central CMA recently completed the North Central RCS that provides clear direction regarding priority catchment assets. The information developed as part of the RCS has also been considered in identifying high value Rivers and wetlands.

In identifying high value Rivers and wetlands we recognise that there are a large number of assets in the region requiring prioritisation to develop an achievable eight year works program for the RWS (see Steps 3 - 10).

Step 3: Existing Obligations and Commitments

There are a number of legislative, funding and community obligations and commitments that need to be recognised and used in conjunction with the risk assessment and priority setting process.

Some of these existing obligations and commitments include but are not limited to:

- Protection of the Gunbower Forest and Kerang Lakes Ramsar sites, including:
    - Flooding Enhancement of Gunbower Forest
    - Kerang Lakes CFOC project
- Delivery of environmental water to key river and wetlands:
    - Campaspe, Coliban and Loddon rivers, and Birch's and Gunbower creeks.
    - Numerous wetlands within the region including Wimmera Mallee pipeline wetlands and Central Murray wetlands.
- Goulburn-Murray Water (G-MW) Modernisation projects focused on improving environmental assets within the region.
    - Swan Hill Modernisation Project – Little Murray River
    - Gunbower Lagoons Modernisation Project
    - Kerang Lakes By-pass Project
- Current long-term projects already funded
    - Caring for Campaspe
    - CFoC funding including Protecting and enhancing priority wetlands and Kerang Lakes and Gunbower Projects

Step 4: Incorporate local knowledge to refine and validate assets considered

The RWS Steering Committee and internal CMA working groups for rivers and wetlands were consulted to ensure the priority setting process utilised the most up-to-date and accurate information. Consultation with CMA, regional DEPI and Parks Victoria staff was undertaken to ensure local knowledge was incorporated into the priority setting process wherever possible.

Wetland information used in AVIRA relied on Index of Wetland Condition (IWC) data. There are a limited number of wetlands within the North Central region where IWC data was available, so information was taken from other sources including past regional wetland planning processes, existing monitoring and local knowledge.

This process identified the following assets as part of the prioritisation process:

- Six additional river reaches
- 50 additional wetlands

Please note: Given the lack of data for some wetlands, there are likely to be additional wetlands that may need to be added to this list. Please let Rohan Hogan from the CMA know if there are other wetlands that should be considered.

Step 5: Filter high values waterways that align with Regional Goals

This step involved identifying which of the high values waterways triggered one or more of the regional goals. A set of rules were developed linking the regional goals to specific values within AVIRA. Appendix A1 outlines the waterways that have triggered one or more of the regional goals.

In summary:

- 65 / 112 River reaches triggered at least one goal
- 67 / 67 wetlands triggered at least one goal

The regional goal to 'Maintain or improve waterways within water supply protection areas to support long-term improvement in water quality' was only triggered by 35 of the 65 reaches. Therefore an amendment was made to the priority setting process by only considering water supply protection areas that are at a scale where it is feasible to deal with water quality issues. This refinement meant that large catchments, such as above Lake Eppalock or Cairn Curran Reservoir were considered infeasible to deal with water quality issues. However, water supply protection areas such as the Upper Coliban system were included as it was considered more feasible to deal with water quality issues due to the relatively smaller scale and complexity of issues.

Therefore large water supply protection areas were assumed not to trigger the water supply protection goal reducing the total from 65 to 43 river reaches.

It should be noted that goals 7 and 8 have no associated values within AVIRA and therefore have not been used in Step 5. High social values including urban communities will consider as part of the overall action planning stage of the project and be determined with support from the Steering Committee and the Natural Resources Management Committee (community advisory committee to the North central CMA Board).

Step 6: Identify Threats to Values

Within AVIRA, a risk assessment is undertaken for each waterway resulting in 836 risk level assessments, e.g.38 values are assessed against 22 threats for each river reach. To assist with ranking priority waterways, the focus of the risk assessment was further refined to only consider those risks to specific values linked to the regional goals.

All river reaches and wetlands identified in the above process undertook the risk assessment (subject to data availability).

Step 7: Identify high level management activities and assess feasibility

For each identified risk, a 'first cut' of the technical feasibility (rated high, medium, low) of reducing each threat was determined. Social and/or economic factors were assessed during the development of the works program.

Calculating a Priority Waterway Score

To calculate the score for a priority waterway, raw scores were calculated for each risk/feasibility combination as follows:

raw score = risk level x feasibility

where: risk to asset = 5–very high, 4-high, 3-moderate, 2-low, 1-very low
feasibility of reducing the threat = 3–high, 2–medium, 1–low

All raw scores for a waterway were then added and the total divided by the number of raw scores calculated. This produced a Priority Waterway Score (ranging from 0 and 15) where 15 indicates an activity with a very high risk to the asset associated with a very high feasibility management activity.

Step 8: Assess the cost effectiveness of investments

Information present below was extracted from Waterway Benefit: Cost Scoring Tool – Use Manual version 4)

The WBCS Tool supports further assessment of waterway assets in a way that integrates information about value, threat and technical feasibility from AVIRA, with a more complete set of information that can be then used to compare the relative cost-effectiveness and ranking of projects to protect these assets.

It is designed to enable a rapid assessment of a large number of assets, for example by an expert group, with sufficient knowledge of both the assets under consideration and a general grasp of the

factors required to determine a Waterway Benefit: Cost Score calculated according to the following equation:

$$BCS = \frac{V \times W \times A \times (1-R) \times DF \text{ (based on time lag)}}{C + PV(M)}$$

The variables that feed into the Waterway Benefit: Cost Score are:

V = value of the asset
W = priority waterway score, effectively a surrogate for the impact of works, assuming the required works are fully implemented
A = multiplier for adoption, based on the attractiveness of works by private citizens (if required)
R = all risks, that is the likelihood that the project could fail due to factors such as socio-political, administrative constraints or failure of partner cooperation
DFB = discount factor function for benefits, which depends on L
L = lag until benefits occur (years)
C = short-term cost of project
PV = present value function
M = annual cost of maintaining outcomes from the project in the longer term.

The first steps utilize information from AVIRA. Specifically, V is informed by the asset values compiled in AVIRA and W is the impact of works from the Priority Waterway Score (PWS) calculated from the assessment of risk level and feasibility (See Guidance Note #6). Additional information needed to calculate the WBCS consists of A, R, the time lag to benefits L, C and M.

The priority waterway score (W) is calculated by multiplying the level of risk to the asset value by the technical feasibility of addressing that risk. In performing this calculation it is important to ensure that all other variables are consistent with the project fully dealing with the risk to the asset value.
The WBCS Tool also incorporates a consideration of uncertainty through an assessment of the information quality used to estimate variables and identification of the major knowledge gaps.

Process
Workshops involving internal CMA working groups for streams and wetlands provided information to assist the WBCS Tool process. The information used for this process has been documented in Appendix 3.

The WBCS is a way of comparing the relative benefits of streams and wetlands and will be used to assist in guiding priority setting Step 9.

Step 9: Finalise priority waterways
Taking into account all the information provided in Steps 1 – 8, a list of indicative priorities was developed. Refer to Appendix 4 for more detail on indicative priorities.

Step 10: Develop eight Year works program
Decisions regarding how many priorities and the total cost of the eight year works program are to be made in consultation with RWS Steering Committee, NRMC, Board and DEPI.

Secondary priorities will also be identified subject to future investment opportunities.

In setting the eight year works program the following will be considered:

- Total cost of eight year works program (to be determined in discussion with DEPI, Board, NRMC and CMA Steering Committee)
- Current and past investment
- Existing obligations

- Indicative priorities from Step 9
- Feasible and cost effective actions.

Table A1: Waterways and Regional Goals

Reach No.	Name	Maintain and improve waterways of high community value	Maintain or improve waterways within water supply protection areas to support long term improvement in water quality	Maintain or improve the resilience of known populations of threatened fish species.	Maintain or improve the resilience of known populations of threatened bird species.	Maintain or improve the resilience of known populations of other significant waterway dependent species.	Protect all environmental values of near ecologically healthy rivers.	Protect all environmental values of representative rivers.	Maximise environmental outcomes by efficiently managing environmental entitlements in partnership with waterholders	Priority Waterway	Number of Goals met
6~21	Kangaroo Creek		x				x			x	2
7~52	Loddon River			x						x	1
8~2	Avoca River							x		x	1
8~3	Avoca River							x		x	1
7~32	Box Creek			x						x	1
6~22	Coliban River		x				x			x	2
8~5	Avoca River							x		x	1
7~50	Little Murray River	x	x	x	x					x	4
8~1	Avoca River	x				x		x		x	3
7~4	Loddon River								x	x	1
7~1	Loddon River								x	x	1
8~4	Avoca River	x						x		x	2
7~6	Loddon River	x							x	x	2
6~4	Campaspe River	x	x	x					x	x	4
6~3	Campaspe River	x							x	x	2
7~21	Birch Creek					x				x	1
6~2	Campaspe River	x	x						x	x	3
7~39	Gunbower Creek	x	x		x					x	3
6~19	Coliban River			x						x	1
7~12	Bullabul Creek					x				x	1
7~38	Gunbower Creek	x			x					x	2
6~20	Little Coliban River		x							x	1
7~48	Loddon River	x								x	1
6~5	Campaspe River		x	x					x	x	3
7~51	Pyramid Creek			x	x	x				x	3
15~78	Richardson River					x				x	1
7~44	Bendigo Creek				x					x	1
7~30	Barkers Creek	x								x	1
8~7	Avoca River	x						x		x	2
7~7	Loddon River	x	x	x					x	x	4

7~33	Bullock Creek				x					x	1
15~77	Richardson River			x		x				x	2
6~12	Axe Creek							x		x	1
6~16	Wild Duck Creek					x				x	1
6~1	Campaspe River	x		x					x	x	3
7~8	Loddon River	x		x					x	x	3
7~10	Loddon River	x					x			x	2
8~8	Avoca River							x		x	1
7~2	Loddon River	x		x					x	x	3
7~28	Sailors Creek	x					x			x	2
7~20	Creswick Creek					x				x	1
6~6	Campaspe River	x					x			x	2
8~6	Avoca River							x		x	1
15~79	Richardson River										0
15~80	Avon River										0
15~81	Avon River										0
15~82	Avon River										0
15~83	Sandy Creek										0
15~84	Wallaloo Creek										0
15~85	Andersons Creek										0
15~86	Dog Trap Creek										0
6~10	Forest Creek										0
6~11	Forest Creek										0
6~13	Sheepwash Creek										0
6~14	McIvor Creek										0
6~15	McIvor Creek										0
6~17	Myrtle Creek										0
6~18	Coliban River										0
6~23	Pipers Creek										0
6~24	Five Mile Creek										0
6~25	Jews Harp Creek										0
6~7	Campaspe River										0
6~8	Mount Pleasant Creek										0
6~9	Mount Pleasant Creek										0
7~11	Serpentine Creek										0
7~13	Bradford Creek										0
7~14	Bet Bet Creek										0
7~15	Bet Bet Creek										0
7~16	Bet Bet Creek										0
7~17	Burnt Creek										0

7~18	Tullaroop Creek										0
7~19	Tullaroop Creek										0
7~22	McCallum Creek										0
7~23	McCallum Creek										0
7~24	Middle Creek										0
7~25	Joyces Creek										0
7~26	Muckleford Creek										0
7~27	Jim Crow Creek										0
7~29	Campbells Creek										0
7~3	Loddon River										0
7~31	Barr Creek										0
7~34	Bullock Creek										0
7~35	Bullock Creek										0
7~36	Bullock Creek										0
7~37	Spring Creek										0
7~40	Bendigo Creek										0
7~41	Bendigo Creek										0
7~42	Bendigo Creek										0
7~43	Bendigo Creek										0
7~45	Myers Creek										0
7~46	Myers Creek										0
7~47	Back Creek										0
7~49	Kangaroo Creek										0
7~5	Loddon River										0
7~53	Gunbower Creek										0
7~54	Gunbower Creek										0
7~9	Loddon River										0
8~10	Campbell Creek										0
8~11	Campbell Creek										0
8~12	St Arnaud Creek										0
8~13	Fentons Creek										0
8~14	Fentons Creek										0
8~15	Cherry Tree Creek										0
8~16	Homebush Creek										0
8~17	Middle Creek										0
8~18	Number Two Creek										0
8~19	Rutherford Creek										0
8~20	Glenlogie Creek										0
8~27	Greenhill Creek										0
8~28											0

8~29	Cochranes Creek										0
8~9	Mosquito Creek										0

Summary of Overall Priorities for the RWS

River and Creeks

		High Value Waterway	Existing Obligation			Regional Goal Triggered	Local Knowledge	Feasible and Cost Effective	Subject to Modernis-ation	Priority Waterway	Inclusion in 8 Year Works Program
			Legislative	Funding	CMA Commitment to Community						
7~49	Loddon River	✓				✓		✓		✓	✓
7~49	Kangaroo Creek	✓				□	✓	✓		✓	✓
6~21	Kangaroo Creek	✓				✓		✓		✓	✓
7~38	Gunbower Creek	✓	✓	✓	✓	✓		✓	✓	✓	✓
8~03	Avoca River	✓				✓		✓		✓	✓
7~04	Loddon River	✓	✓			✓		✓		✓	✓
6~01	Campaspe River	✓	✓	✓	✓	✓		✓		✓	✓
6~22	Coliban River	✓				✓		✓		✓	✓
8~07	Avoca River	✓				✓		✓		✓	✓
8~02	Avoca River	✓				✓		✓		✓	✓
7~01	Loddon River	✓	✓			✓		✓		✓	✓
15~77	Richardson River	✓				✓		✓		✓	✓
8~01	Avoca River	✓				✓		✓		✓	✓
7~5	Loddon River	✓	✓			✓		✓		✓	✓
7~9	Loddon River	✓				✓		✓		✓	✓
15~78	Richardson River	✓				✓		✓		✓	✓
7~28	Sailors Creek	✓				✓		✓		✓	✓
7~06	Loddon River	✓	✓			✓		✓		✓	✓
7~02	Loddon River	✓	✓			✓		✓		✓	✓
7~07	Loddon River	✓	✓			✓		✓		✓	✓
7~18	Tullaroop Creek	✓	✓				✓	✓		✓	✓
6~04	Campaspe River	✓	✓	✓	✓	✓		✓		✓	✓
6~06	Campaspe River	✓	✓	✓	✓	✓		✓		✓	✓
7~27	Jin Crow Creek	✓					✓	✓		✓	✓
6~05	Campaspe River	✓	✓	✓	✓	✓		✓		✓	✓
8~04	Avoca River	✓				✓		✓		✓	✓
7~08	Loddon River	✓	✓			✓		✓		✓	✓
7~3	Loddon River	✓	✓			□	✓	✓		✓	✓
6~24	Five Mile Creek	✓				□	✓	✓		✓	✓
7~19	Tullaroop Creek	✓	✓			□	✓	✓		✓	✓
6~02	Campaspe River	✓	✓	✓	✓	✓		✓		✓	✓
6~03	Campaspe River	✓	✓			✓		✓		✓	✓
7~11	Serpentine Creek	✓	✓			□	✓	✓		✓	✓
8~06	Avoca River	✓				✓		✓		✓	✓
6~20	Little Coliban River	✓				✓		✓		✓	✓
7~39	Gunbower Creek	✓	✓	✓	✓	✓		✓		✓	✓
7~32	Box Creek	✓				✓		✓		✓	✓
7~10	Loddon River	✓				✓		✓		✓	✓
6~18	Coliban River	✓	✓			□	✓	✓		✓	✓

7~21	Birch's Creek	✓	✓			✓		✓		✓	✓
6~7	Campaspe River	✓		✓	✓	✓		✓		✓	✓
8~05	Avoca River	✓				✓				✓	✓
8~08	Avoca River	✓				✓					✓
7~50	Little Murray River	✓							✓	✓	✓
6~19	Coliban River	✓	✓			✓					✓
7~51	Pyramid Creek	✓				✓					✓
6~23	Pipers Creek	✓									No
6~16	Pohlman Creek/ Wild Duck Creek	✓									No
7~33	Bullock Creek	✓									No
6~12	Axe Creek	✓									No
7~12	Bullabul Creek	✓									No
7~20	Creswick Creek	✓									No
7~30	Barkers Creek	✓									No
7~44	Bendigo Creek	✓									No
15~79	Richardson River	✓									No
15~80	Avon River	✓									No
15~81	Avon River	✓									No
15~82	Avon River	✓									No
15~83	Sandy Creek	✓									No
15~84	Wallaloo Creek	✓									No
15~85	Andersons Creek	✓									No
15~86	Dog Trap Creek	✓									No
6~10	Forest Creek	✓									No
6~11	Forest Creek	✓									No
6~13	Sheepwash Creek	✓									No
6~14	McIvor Creek	✓									No
6~15	McIvor Creek	✓									No
6~17	Myrtle Creek	✓									No
6~25	Jews Harp Creek	✓									No
6~8	Mount Pleasant Creek	✓									No
6~9	Mount Pleasant Creek	✓									No
7~13	Bradford Creek	✓									No
7~14	Bet Bet Creek	✓									No
7~15	Bet Bet Creek	✓									No
7~16	Bet Bet Creek	✓									No
7~17	Burnt Creek	✓									No
7~22	McCallum Creek	✓									No
7~23	McCallum Creek	✓									No
7~24	Middle Creek	✓									No
7~25	Joyces Creek	✓									No
7~26	Muckleford Creek	✓									No
7~29	Campbells Creek	✓									No
7~31	Barr Creek	✓									No
7~34	Bullock Creek	✓									No

7~35	Bullock Creek	✓									No
7~36	Bullock Creek	✓									No
7~37	Spring Creek	✓									No
7~40	Bendigo Creek	✓									No
7~41	Bendigo Creek	✓									No
7~42	Bendigo Creek	✓									No
7~43	Bendigo Creek	✓									No
7~45	Myers Creek	✓									No
7~46	Myers Creek	✓									No
7~47	Back Creek	✓									No
7~53	Gunbower Creek	✓									No
7~54	Gunbower Creek	✓									No
8~10	Campbell Creek	✓									No
8~11	Campbell Creek	✓									No
8~12	St Arnaud Creek	✓									No
8~13	Fentons Creek	✓									No
8~14	Fentons Creek	✓									No
8~15	Cherry Tree Creek	✓									No
8~16	Homebush Creek	✓									No
8~17	Middle Creek	✓									No
8~18	Number Two Creek	✓									No
8~19	Rutherford Creek	✓									No
8~20	Glenlogie Creek	✓									No
8~27	Greenhill Creek	✓									No
8~28	Unnamed Creek	✓									No
8~29	Cochranes Creek	✓									No
8~9	Mosquito Creek	✓									No

Summary of Overall Priorities for the RWS

Wetlands

	High Value Waterway (Limited Data, assumed al high value)	Existing Obligation			Regional Goal Triggered (Limited AVIRA Data)	Local Knowledge	Feasible and Cost Effective	Subject to Modernisation	Priority Waterway	Inclusion in 8 Year Works Program
		Legislative	Funding	CMA Commitment to Community						
Frogmore Swamp	✓					✓	✓		✓	✓
First Marsh (Avoca)	✓	✓	✓		✓		✓		✓	✓
Third Marsh (Avoca)	✓	✓	✓		✓		✓		✓	✓
Bakers Swamp - Moolort	✓						✓		✓	✓
Safe Lagoon	✓						✓		✓	✓

Lake Yando	✓					✓	✓		✓	✓
Cullens Lake	✓	✓	✓			✓	✓		✓	✓
Second Marsh (Avoca)	✓	✓	✓		✓		✓		✓	✓
Lake Bael Bael	✓	✓	✓		✓		✓		✓	✓
Lake Meering (Merin)	✓					✓	✓		✓	✓
Middle Swamp near Clunes	✓				✓		✓		✓	✓
Merin Merin Swamp	✓					✓	✓		✓	✓
Black Swamp - Moolort	✓						✓		✓	✓
Walker's Swamp - Moolort	✓						✓		✓	✓
Leaghur State Park	✓						✓		✓	✓
Lake Lalbert	✓				□		✓		✓	✓
Johnson Swamp	✓	✓	✓		□		✓		✓	✓
Little Lake Kelly	✓	✓			✓		✓		✓	✓
Lake William	✓	✓			✓	□	✓		✓	✓
Lake Kelly	✓	✓			□		✓		✓	✓
Red Gum Swamp	✓				□		✓		✓	✓
York Plains	✓		✓	✓	□	✓	✓		✓	✓
Lake Lyndger	✓				□	✓	✓		✓	✓
Lake Leaghur	✓				□	✓	✓		✓	✓
Lake Elizabeth	✓			✓	✓		✓		✓	✓
Lake Marmal	✓				□	✓	✓		✓	✓
Richardson s Lagoon	✓	✓		✓	□		✓		✓	✓
McDonalds Swamp	✓	✓		✓	□	✓	✓		✓	✓
Woolshed Swamp	✓				✓		✓		✓	✓
Hird Swamp	✓	✓		✓	✓		✓		✓	✓
Benjeroop State Forest	✓				□		✓		✓	✓
Tang Tang Swamp	✓				✓		✓		✓	✓
Lake Tutchewop	✓	✓			□	✓	✓		✓	✓
Yassom Swamp	✓				□	✓	✓		✓	✓
Lake Murphy	✓	✓			□	✓	✓		✓	✓
Great Spectacle	✓				□		✓		✓	✓
Golf Course Lake	✓				□	✓	✓		✓	✓
Fosters Swamp	✓				✓		✓		✓	✓
Middle Reedy Lake	✓	✓		✓	□		✓		✓	✓
Thunder	✓				✓		✓		✓	✓

Swamp										
Round Lake	✓	✓			□				✓	✓
Little Lake Meering	✓				□	✓				No
Sandhill Lake	✓				□	✓				No
Long Swamp	✓			✓	□	✓			✓	✓
Taylors Lagoon	✓				□			✓		No
Lake Boort	✓	✓		✓	□	✓			✓	✓
Tragowel Swamp	✓				✓					No
Gunbower Forest	✓	✓	✓	✓	✓				✓	✓
Turner / Phyland Lagoon	✓				□			✓		No
Cockatoo Lagoon	✓				□			✓		No
Gum Lagoon	✓				□			✓		No
Bell's Swamp	✓				□					No
Stephenson Swamp	✓	✓			✓				✓	TBC
Benwell / Guttrum State Forest	✓		✓		□	✓			✓	TBC
Lake Lookout	✓				□	✓				No
Black Swamp/ Town Swamp	✓				✓				✓	TBC
Cope Cope Lakes	✓				□					No
Heart Lagoon	✓				□			✓	✓	TBC
Cemetery Swamp	✓	✓			✓				✓	TBC
Brandy Lake/Lake Wandella?	✓				□	✓				No
Unregulated Lagoon	✓				□			✓	✓	TBC
Bunguluke wetlands	✓				□					No
Splatts Lagoon	✓				□					No
Longmore Lagoon	✓				□					No
Upper Gunbower Lagoon	✓				□					No
Lake Charm	✓	✓			□				✓	TBC
Heppell Lagoon	✓				□					No
Lake Buloke	✓					✓				No
Middle Reedy Lake	✓					□		✓	✓	TBC
Reedy Lake	✓					□		✓	✓	TBC
Third Lake	✓					□		✓	✓	TBC
Racecourse Lake	✓					□		✓	✓	TBC
Kangaroo Lake	✓					□				No
Lake Charm	✓					□				No
Lake Boga	✓					□				No

Kow Swamp	✓					□				No
Creswick Swamp	✓					✓				No
Hollands Lake	✓					✓				No
Lake Hancock	✓					✓				No
Lake Batyo Catyo	✓				✓	□				No
Wooroonook Lake - Main	✓					✓				No
Woorinen Central Lake	✓					✓				No
Bradshaw Swamp	✓				✓	□				No
Saligari Swamp	✓					✓				No
Lignum Swamp	✓					✓				No
Bartlett Swamp North	✓					✓				No
Little Lake Boort	✓					✓				No
Griffith Lagoon	✓				✓	□				No
Little Lake Charm	✓	✓				✓			✓	TBC
Two Mile Swamp	✓					✓				No
Dry Lake	✓					✓				No
Round Lake	✓					✓				No
Long Lake	✓					✓				No
Lake Mannaor	✓					✓				No
Govetts Swamp	✓					✓				No
Dartagook Forest	✓					□				No
Spectacle	✓					□				No

Appendix B – Ramsar Site Values and Actions

B.1 Gunbower Forest

The Gunbower Forest Ramsar Site, which was listed as a Ramsar site in 1999, is part of the second largest Red Gum forest in Victoria, and is subject to periodic inundation from the Murray River when it supports large numbers of breeding waterfowl.

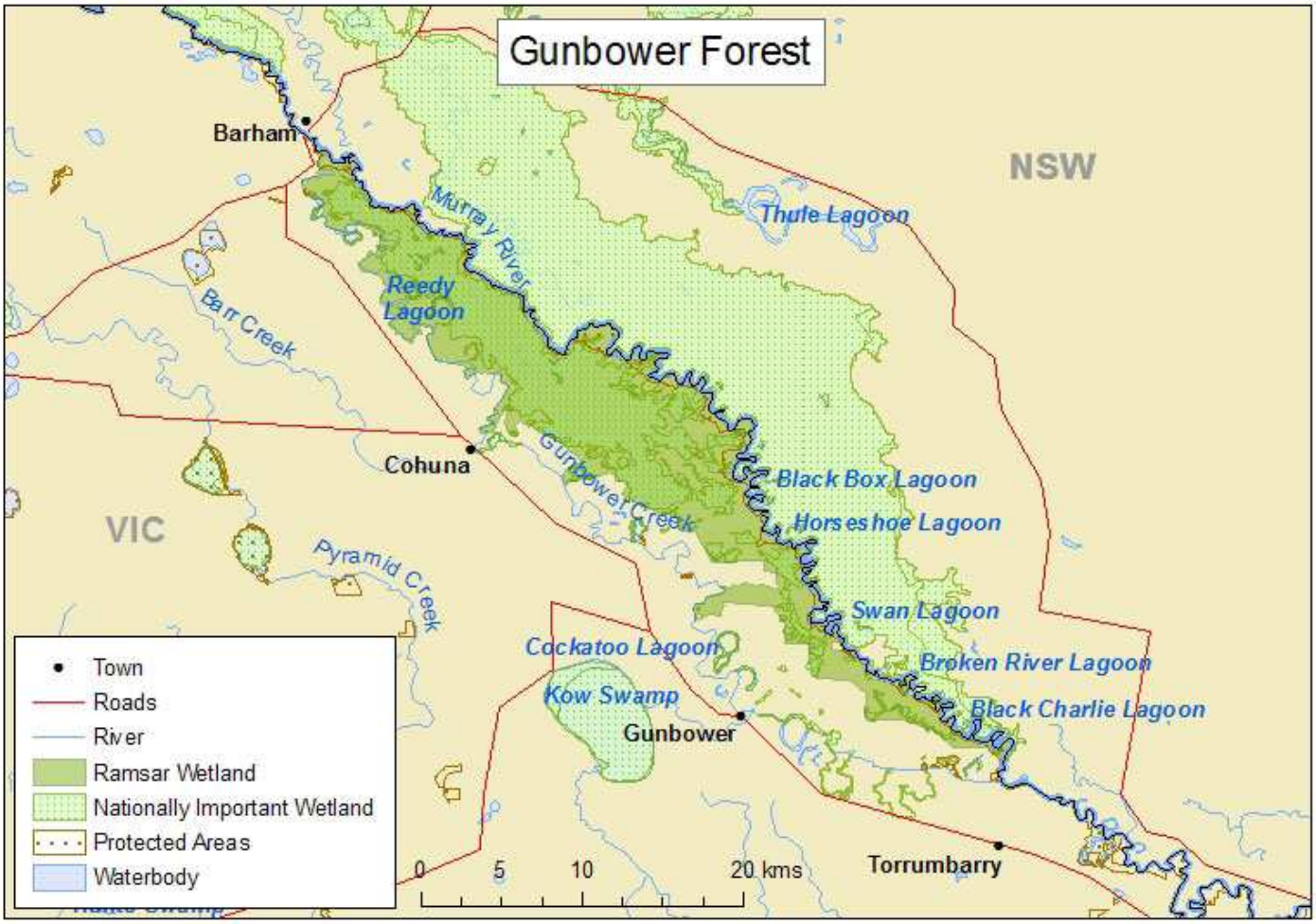


Figure B1 – Gunbower Forest Ramsar Site

Gunbower Forest is one of a series of river red gum forests on the Murray River floodplain in northern Victoria. Together with the adjoining Koondrook-Perricoota component of the NSW Central Murray Forests Ramsar site, Gunbower Forest comprises the second largest river red gum forest in Australia. It is also an Icon Site in the Living Murray program. The River Red Gums (Eucalyptus *camaldulensis*) rely on regular flooding in late winter or early spring to survive.

River Red Gum inhabits the low-lying, more frequently flooded areas of Gunbower Forest. Infrequently flooded areas support woodlands dominated by Black Box (*Eucalyptus largiflorens)* while Grey Box *(Eucalyptus macrocarpa)* is found in areas not subject to inundation. River Red Gum has understoreys of Wallaby grasses, Kangaroo grasses, River Swamp Wallaby grasses, and Warrego summer grass. Black Box and Grey Box are associated with terrestrial grasses and shrubs for their understoreys.

The Ramsar site supports several species of waterbirds, including the only breeding colony of Intermediate Egret in Victoria. Other waterbird species that breed in Gunbower Forest are the Australian White Ibis, Nankeen Night Heron, Eastern Great Egret and Cormorant species.

Several species of fish are recorded in the Ramsar wetland including Golden Perch, Murray Cod and Silver Perch.

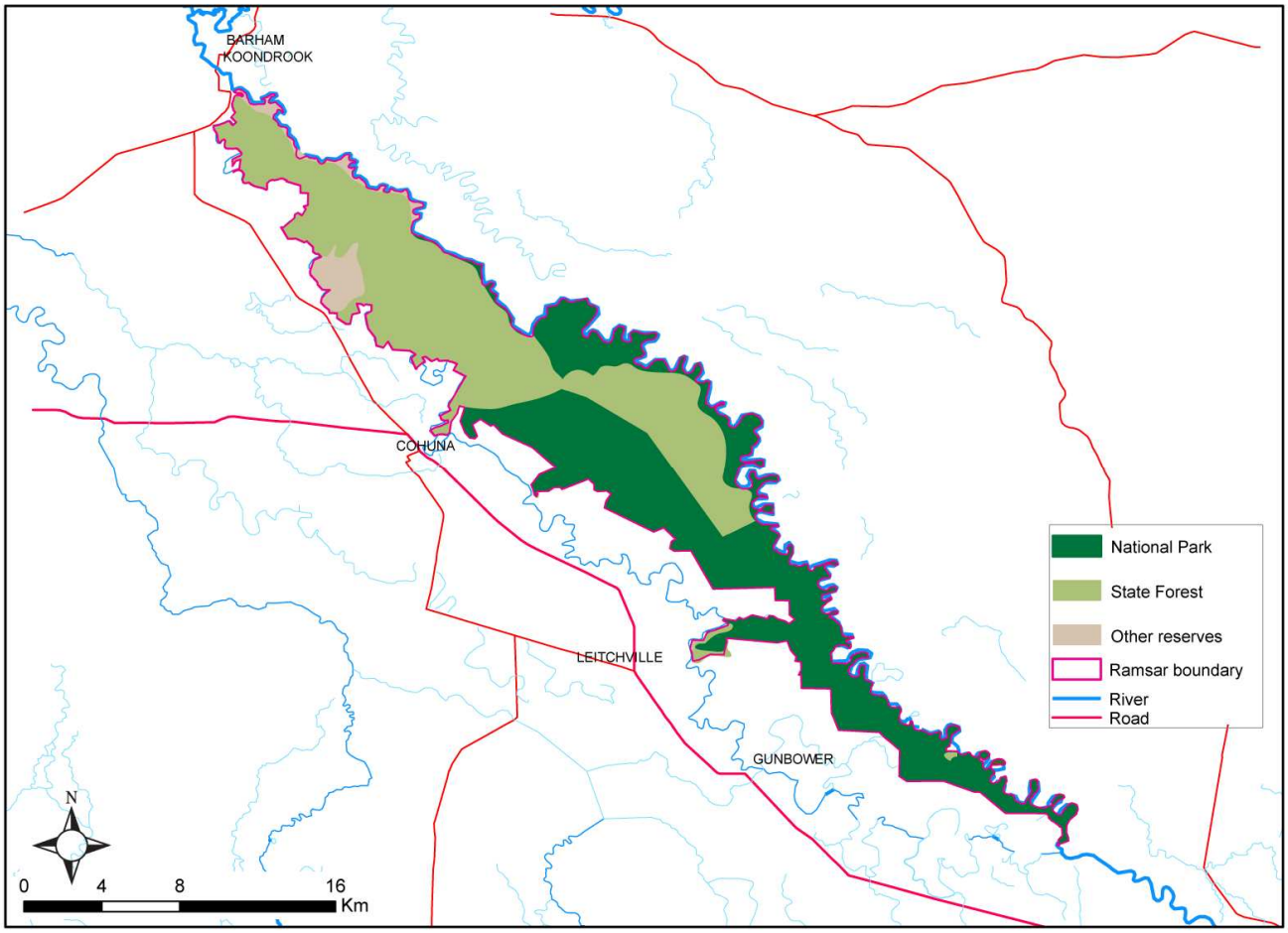
Gunbower Forest is an important Indigenous cultural heritage area, featuring shell deposits, mounds, scar trees, burial sites, heaths and sacred sites. The Ramsar site is currently subject to multiple land uses including timber harvesting, firewood collection, and conservation. Recreational pursuits include fishing, four wheel driving, camping, bushwalking, and bird watching.

Table B2 outlines they key characterises of the Gunbower Forest Ramsar site and figure B2 indicates the land tenure of the site.

Table B2: Site details for the Gunbower Forest Ramsar site

Wetland	Area (Ha)	Ramsar wetland type	Land tenure	Land Manager
Gunbower Forest	**19,931 hectares**	**Freshwater, tree-dominated wetlands; includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils**	**National Park State Forest**	**Parks Victoria, DEPI**

Figure B2: Current Land Management within the Gunbower Forest Ramsar site



Source: Hale, J. and Butcher, R., 2011, Ecological Character Description for the Gunbower Forest Ramsar Site. Report to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), Canberra.

The ecological character description for the site (Hale and Butcher, 2011) identifies a number of ecosystem services and benefits (values) and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Ramsar site. Table 20 provides the current status of the critical value, component or process against the LAC.

Table B3: Ecosystem Services, Benefits, Components and Processes which are Critical to the Ecological Character of the Gunbower Forest Ramsar Site

Ecosystem service/benefit	Benchmark Description	Current Status		
		Does not exceed LAC	Exceeds LAC	No Data/No LAC set
Critical services				
Diversity of wetland types	The site supports the part of the second largest remaining river red gum forest and provides a mosaic of vegetated wetland habitats.	X[1]		
Physical habitat	Gunbower Forest provides habitat for feeding and breeding of wetland birds.	X[1]		
Threatened species	The Ramsar site supports at least five species listed as threatened under the EPBC Act and/or the IUCN Red List: • Australasian bittern (*Botaurus poiciloptilus*) • Murray cod (*Maccullochella peelii peelii*) • Silver perch (*Bidyanus bidyanus*) • Swamp wallaby grass (*Amphibromus fluitans*) • Winged peppercress (*Lepidium monoplocoides*)			X[2]
Ecological connectivity	The site provides important migratory routes between riverine, wetland and floodplain habitats for fish spawning and recruitment.			X[1]
Organic carbon cycling	As part of a major floodplain system, the site is important for the cycling of nutrients, particularly carbon both on the floodplain and as a source of organic carbon to receiving waterways.			X[1]
Critical components and processes				
Hydrology	• Inundation of the site is driven largely by flows within the Murray River and major tributaries. • The hydrology of the site is highly regulated and seasonality of low and moderate flow is determined largely by irrigation needs. • Large scale floods that inundate the forest are generally the result of catchment scale rainfall events.		X[3]	

	• Groundwater sources are secondary with the site being termed a "flushing zone" losing groundwater to the river following inundation.			
Vegetation	• The two critical wetland vegetation categories are floodplain forests and floodplain marshes. • Approximately 80 percent of the site is covered in inundation dependent forest and woodland (river red gum and black box), which has a combined extent of over 16 000 hectares. • River red gum forest is the dominant vegetation community, comprising 65 percent of the site. • Seventy-five species of native aquatic / wetland plant species recorded in floodplain marshes. • Species richness and cover of plants in floodplain marshes is highly variable temporally and spatially. • The site is important for the threatened swamp wallaby grass (*Amphibromus fluitans*) and winged peppercress (*Lepidium monoplocoides*).	X		
Fish	• Data deficient. • Twelve native species of fish have been recorded from within the site, including two threatened species: Murray cod (*Maccullochella peelii peelii*) and silver perch (*Bidyanus bidyanus*). • Results from surveys indicate that abundance varies considerably and that invasive species generally comprise 16 – 36 percent of the total abundance and up to nine percent of biomass of large bodied fish.	X		
Wetland birds	• Sixty-six species of wetland bird have been recorded from the site. This includes nine species listed under international migratory agreements and the internationally threatened Australasian bittern (*Botaurus poiciloptilus*). • Maximum counts recorded during the 1974 floods comprise approximately 6000 individuals. A large proportion of the wetland birds recorded within the site have been observed breeding.			X

- Hale, J. and Butcher, R., 2011, Ecological Character Description for the Gunbower Forest Ramsar Site. Report to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), Canberra.
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- Butcher, R., Brooks, S., Cottingham, P., Hale, J., and Watkins, D. (2011). Ramsar Rolling Review: phase 2 pilot testing. Submitted to Australian Government Department of Sustainability, Environment, Water, Populations and Communities

[1] Changes in character related to services are assessed against LAC for related components and processes. There is no evidence that these services have significantly changed at the site.

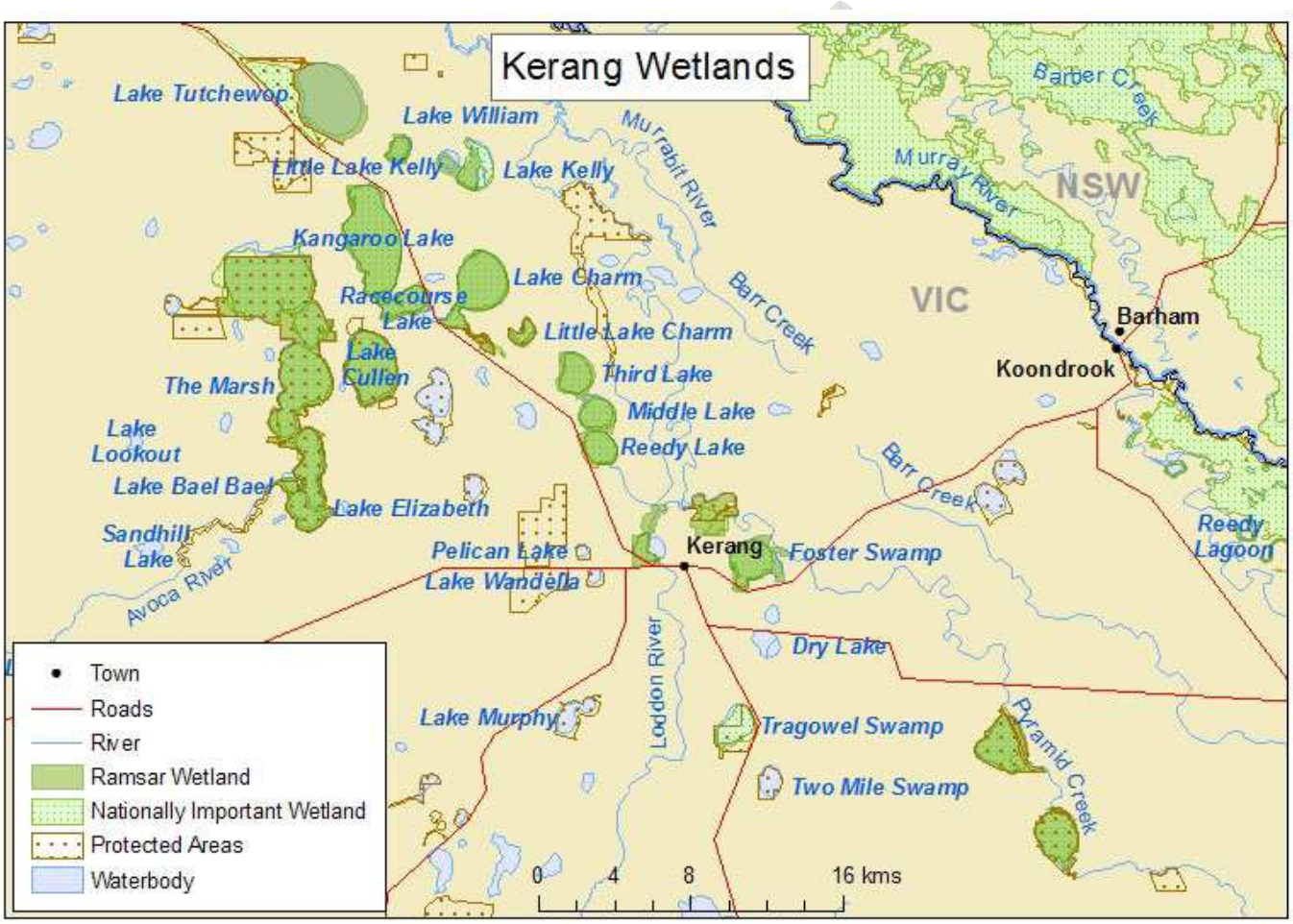
[2] Threatened fish and plants species are known to still occur within the site, there is insufficient data to assess against the LAC for the Australasian bittern.

[3] There is evidence that the hydrology of the site has changed in recent years and the LAC for small and medium flood frequencies and duration has been exceeded. However, whether this is a result of sustained change or the effects of the recent (2000 to 2010) drought is unknown. It is likely due to a combination of a number of factors that include water resource development, climate change and shorter term climatic cycles.

B.2 Kerang Wetlands

The Kerang wetlands are a system of lakes and swamps which differ widely in permanence, depth, salinity and amounts of aquatic vegetation. The wetlands are very important waterbird habitats. They support large populations of some common endemic Australian species and they also provide habitat for migratory species listed under the Japan-Australia and the China-Australia Migratory Birds Agreements.

Figure B3- Kerang Ramsar Wetlands Map



The individual shallow swamps and lakes of this system range in salinity from freshwater marshes to highly saline lakes. Permanent wetlands are the dominant type within the area. This is due to a constantly available water supply – irrigation quality water in the supply lakes and drainage water in the saline lakes and evaporation basins.

Water depths vary from very shallow, i.e. less than 1 metre, to in excess of 8 metres. Kangaroo Lake is the deepest lake at 8.4 metres.

Table B4 outlines they key characterises and land tenure of the Kerang Ramsar sites

Table B4: Site details for the Kerang Ramsar sites

Management Unit	Wetland	Area (Ha)	Ramsar wetland type	Land tenure	Land Manager
Unregulated	Avoca Marshes	**3,395**	Permanent open freshwater Deep freshwater marsh	Natural Features Reserve – Wildlife Reserve	Parks Victoria
	Cemetery Swamp	**89**	Shallow freshwater Marsh	Natural Features Reserve – Wildlife Reserve	Parks Victoria
				Timber Reserve	DEPI
				Municipal Purposes Reserve	Gannawarra Shire
	Stevensons Swamp	**80**	Semi permanent saline	Natural Features Reserve – Wildlife Reserve	Parks Victoria
Regulated, Drainage Supply	Lake Kelly Little Lake Kelly	**192** **88**	Permanent saline	Salinity Disposal Reserve	Goulburn-Murray Water
	Lake William	**71**	Permanent saline	Salinity Disposal Reserve	Goulburn-Murray Water
	Lake Tutchewop	**842**	Permanent saline	Salinity Disposal Reserve	Goulburn-Murray Water
	Fosters Swamp	**259**	Semi-permanent saline	Sewage Purposes Reserve	Lower Murray Water
Regulated, Fresh Supply, Irrigation	Lake Charm Little Lake Charm Reedy Lakes	**520** **113** **598**	Permanent open freshwater	Water Supply Reserve	Goulburn-Murray Water
	Kangaroo Lake Racecourse Lake	**984** **235**	Permanent open freshwater	Water Supply Reserve	Goulburn-Murray Water
Regulated, Fresh Supply, Non-irrigation	Back and Town Swamps	**130**	Shallow freshwater marsh	Public land vested in Water Authority	Goulburn-Murray Water
	Lake Cullen	**632**	Permanent saline	Natural Features Reserve – Wildlife Reserve	Parks Victoria
	Johnson Swamp	**411**	Deep freshwater marsh	Natural Features Reserve – Wildlife Reserve	Parks Victoria
	Hird Swamp	**344**	Deep freshwater marsh	Natural Features Reserve – Wildlife Reserve	Parks Victoria

The ecological character description for the site (Hale and Butcher, 2011) identifies a number of ecosystem services and benefits (values) and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Ramsar site. Table B4 provides the current status of the critical value, component or process against the LAC.

Table B5- Ecosystem Services, Benefits, Components and Processes which are Critical to the Ecological Character of the Kerang Wetlands Ramsar Site

Critical component, process or service	Benchmark Description	Current Status[1]		
		Does not exceed LAC	Exceeds LAC	No Data/No LAC set
Hydrology (percentage full, depth/volume, frequency of inundation)	The Ramsar site has been influenced by the Torrumbarry Irrigation System since its establishment in 1923. This is approximately six decades prior to the listing of the site. Four types of hydrological grouping occur at the site including irrigation/regulated wetlands maintained as permanent open water (for storage), terminal/regulated drainage wetlands managed as salt disposal basins (evaporation basins to reduce salt discharge into the Murray), regulated fresh supply, non-irrigation wetlands reserved to protect natural features and natural/unregulated freshwater wetlands that are influenced by flows from the Avoca River.	X		
Salinity	The Ramsar site exhibits a full range of salinities from very fresh to hypersaline, including deep permanent freshwater lakes with salinities typically less than 500 EC, wetlands that range between 4000 EC to 50 000 EC and hypersaline salt disposal basins.		X	
Waterbirds – internationally/nationally listed waterbirds	The site supports a high diversity and abundance of waterbird species including 37 species listed under international bilateral agreements for migratory bird species (Bonn, JAMBA, CAMBA or ROKAMBA).			X
Waterbirds – colonially breeding/nesting waterbirds (ibis, darters, cormorants,	Twenty-eight waterbird species have been recorded breeding in the wetlands since			X

spoonbills)	1980. Up to 13 species were recorded breeding each year between 1987 and 1993 (Clunie 2010). Colonial waterbird breeding has been recorded at Reedy Lake, Middle Lake, Avoca Marshes and Hird Swamp. The Ramsar site regularly supports over 20 000 waterbirds (on 10 occasions between 1979 and 2003). Large aggregations of particular species have occurred at Middle Lake, Hird and Johnson Swamps, Lake Cullen and Lake Tutchewop. The species include: straw-necked ibis (*Threskiornis spinicollis*), sacred (Australian white) ibis			

[1] A large number of knowledge gaps were identified in the ECD for Kerang Lakes which hampered the setting of LAC (Kellogg, Brown and Root, 2011). There is some indication that salinity at a number of sites, most notably Tutchewop Lakes, as well as alterations to hydrological regimes. However, the ECD states that:

"Although changes have occurred at individual wetlands within the Ramsar site, the ecological character of the Ramsar site as a whole has been maintained since listing."

Resource Condition Target:

"Maintain or improve the ecological character of the Gunbower Forests and Kerang Wetlands"

Appendix C – Legislature and policy

C.1 Key Victorian legislation and policy

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

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

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

The *Planning and Environment Act 1987* establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians. North Central CMA has statutory obligations regarding referrals and advice about *Water Act 1989* matters relating to planning permits under sections 55 and 52 of the *Planning and Environment Act 1987*, primarily providing advice or approval to development authority's (predominantly councils) on planning permits and subdivisions (and to a much lesser extent, building permits).

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the key Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The FFG provides for the preparation of a Flora and Fauna Guarantee Strategy. This strategy was launched as Victoria's Biodiversity Strategy.

The *Catchment and Land Protection Act 1994* establishes Regional Catchment Strategies (RCSs) as the primary framework for integrated management of land, water and biodiversity in each of the ten catchment management authority (CMA) regions of Victoria. The North Central CMA is responsible for preparing the North Central RCS and coordinating and monitoring its implementation. The current 2013-19 North Central RCS is the overarching strategy, under which there are a range of sub-strategies and action plans for the North Central Region. The long-term objectives and priorities for action in the North Central RCS that relate to waterways will be implemented through this North Central RWS.

Regional planning processes for waterway management were established in 2002 under the Victorian River Health Strategy (VRHS) and implemented through the ten regional River Health Strategies (RRHSs). Community input and participation in these regional planning processes was a critical element to ensure that regional planning reflected the community values of waterways in each region. The RRHSs identified high value rivers and priority management actions to be undertaken over a six-year period. These RRHSs were the cornerstone of the regional planning framework for waterways (supported in some areas by regional wetland strategies), but have now passed their intended lifespan. The development of this North Central RWS is a statutory requirement under the *Water Act 1989* and replaces the RRHS.

Water resource planning in Victoria is addressed through 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.

C.2 Key Federal legislation and policy

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

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

The Living Murray Initiative is one of Australia's most significant river restoration programs. It aims to achieve a healthy working Murray River system for the benefit of all Australians. This includes returning water to the environment. The Living Murray has recovered almost 500 gigalitres of water to help improve the health of six icon sites. The Living Murray program was established in 2002 in response to evidence showing the declining health of the Murray River system. It is a partnership of the NSW, Victorian, South Australian, ACT and Australian governments, coordinated by the MDBA.

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the Act as matters of national environmental significance.

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

C.3 International Agreements

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

The Convention on Wetlands of International Importance (the Ramsar Convention) provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. The Convention encourages member countries to nominate sites containing representative, rare or unique wetlands, or that are important for conserving biological diversity, to the List of Wetlands of International Importance (Ramsar sites). Ramsar sites are a matter of national environmental significance under the *Environment Protection and Biodiversity Act 1999* (Cth).

C.4 Waterways with International, National or State Agreements

A number of waterways in Victoria are recognised as being of international, national or state significance. Managing these waterways will be consistent with any obligations outlined in relevant state, national and international legislation, policy and agreements. For example, as a contracting party to the Ramsar Convention, Australia is required to meet a number of obligations including the maintenance of the ecological character of its Ramsar sites through conservation and wise use.

An ecological character description has been completed for the Gunbower Ramsar sites and is in preparation for the Kerang Ramsar sites. This defines limits of acceptable change (LACs) for ecosystem services/benefits (values) and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Ramsar site. It also recommends monitoring needs for the Ramsar site.

C. 5 Role and responsibilities for partners

Table C1: Partners and their roles and responsibilities in waterway management.

	Partners	Roles and responsibilities/links with waterways
State Government Agencies and statutory bodies	Department of Environment and Primary Industries	The Department of Environment and Primary Industries (DEPI) is the lead agency for waterway management. It is responsible for the development of waterway policy, co-ordination of regional delivery and prioritisation of Government investment in waterways. DEPI is also responsible for other aspects of natural resource management relevant to waterways, including: • ensuring the sustainable management of Victoria's water resources • overseeing the catchment planning framework to promote integrated catchment management throughout Victoria • managing biodiversity • managing public land, including waterways on public land and bushfire management on public land • delivering sustainability and environment services at the regional level, including some services that relate to waterway management. • managing fisheries and recreational fishing in waterways to optimise economic and social value while ensuring the sustainability of resources • investing in and delivering farming programs on private land where waterways occur • overseeing the management of biosecurity, including aquatic invasive species
	Environment Protection Authority Victoria	The EPA Victoria is an independent body responsible for the protection and improvement of Victoria's environment by establishing environmental standards, regulating and working with organisations to meet these standards. Their roles and responsibilities include; • identifying the beneficial uses of water environments and the level of environmental quality needed to protect them through the State Environmental Protection Policy (SEPP, Waters of Victoria) • setting statutory standards for acceptable water quality and indicators of water quality • investigating water quality incidents classified as 'pollution' • using mandatory and regulatory mechanisms, such as licensing and other discretionary tools, to assist in achieving water quality objectives • acting in partnership with DEPI and regional bodies to monitor water quality and waterway health, and enabling problem solving approaches and independent audits of impacts on the environment and the protection of beneficial uses
	Parks Victoria	Parks Victoria manages parks and conservation reserves in which many waterways are located, including national, State, wilderness, metropolitan and regional parks, marine national parks and sanctuaries and conservation and natural features reserves. Parks Victoria creates, manages and maintains visitor sites and manages a range of assets, including visitor facilities and access points, piers and jetties, sporting facilities and navigation aids, many of which are associated with waterways.
	Victorian Environmental Water Holder	The Victorian Environmental Water Holder is appointed under the *Water Act 1989* to manage Victoria's environmental water entitlements. The Victorian Environmental Water Holder works with the waterway managers, Commonwealth Environmental Water Holder, Murray–Darling Basin Authority. Storage operators and land managers to ensure environmental water entitlements are used to achieve the best environmental outcomes.
National/other state authorities	Murray–Darling Basin Authority	The Murray–Darling Basin Authority was established under the federal *Water Act 2007* as an independent, expertise based statutory agency. The primary roles of the Authority 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

	Partners	Roles and responsibilities/links with waterways
		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, Coliban Water, Central Highlands Water, Lower Murray Water	Water corporations in Victoria are established under the *Water Act 1989* and provide a range of water services to customers within their service areas. Water corporations provide a combination of irrigation services, domestic and stock services, bulk water supply services and urban water and wastewater services in the North Central Regional. Their links with the North Central RWS include; • broader catchment health and improved water quality links to water supply • water reform, operational role in environmental water management.
Local Government	The North Central Region contains all or part of 12 Local Government areas: Mt Alexander Shire, Macedon Ranges Shire, Campaspe Shire, Gannawarra Shire, City of Greater Bendigo, Rural City of Swan Hill, Hepburn Shire, Central Goldfields Shire, Loddon Shire, Buloke Shire, Mitchell Shire, Pyrenees Shire, Northern Grampians Shire	Councils are involved in the management of waterways in Victoria through their role as responsible planning authorities, managers of stormwater drainage and on-site domestic wastewater systems, users of integrated water systems, land managers, emergency management bodies, and supporters of community groups. Specifically with regard to waterways, local government has the following roles and responsibilities: • incorporating waterway restoration and catchment management objectives, priorities and actions into statutory planning processes • undertaking floodplain management and flood warning in accordance with the Victoria Flood Management Strategy • developing and implementing urban stormwater plans • managing on-site domestic wastewater systems • managing adjoining waterways under Committees of Management • managing rural drainage schemes where appropriate
Traditional Owners	Traditional Owner Boards/Councils	Traditional Owners with recognised native title rights or formal agreements with the State are important in land and water management. Joint management co-operative management agreements can involve establishment of majority Traditional Owner boards or councils that prepare management plans and/or provide advice about the management of specific areas.
Community	Landholders	Landholders are vital to the successful implementation of this strategy, as most works are on privately owned land or affect areas that require private co-operation, and their land management practices have a vital role in catchment health. Under the *Catchment and Land Protection Act 1994* landholders are required to; • protect water resources • avoid causing or contributing to land degradation which causes or may cause damage to land of another owner • conserve soil • eradicate regionally prohibited weeds and prevent the growth and spread of regionally controlled weeds • prevent the spread of, and as far as possible eradicate, established pest animals.
	Individuals	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, 'Friends of' groups) participate in regional planning, priority setting and the implementation of regional works programs, participate in monitoring waterways condition and undertake projects in priority areas.
	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.

Appendix D – North Central Recreational Fisheries Management Priorities

Acknowledgements

Workshop attendees: Rob Loats (VRFish), Ron Lewis (Native Fish Australia), Greg Hellsten (The Council of Victorian Fly Fishing Clubs, Midlands and North Central Angling Association, Bendigo and District Flyfishers Inc.), Les Gilsenan and Tom Reid (Rochester and District Angling Club), Rob Tankaskovic (Bendigo Legion Angling Club), Michael Schiell (Central Victorian Lure Casters Super Series), Rohan Hogan and Tess Grieves (North Central Catchment Management Authority), Renae Ayres (Arthur Rylah Institute, Fish Habitat Network), Brian Mottram and Taylor Hunt (Fisheries Victoria).

Workshop apologies: Australian Trout Foundation, Futurefish Foundation, Roger Miles, Greg Brodie, Gary Hodges and Wally Cubin.

Background

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

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

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

Key recreational fisheries in the North Central Catchment

The NCCMA region includes many popular recreational fisheries. In 2012, a survey of recreational fishers highlighted that the North Central Catchment features the second most popular lake or impoundment in Victoria - Lake Eppalock. Other important fisheries in the NCCMA region include Campaspe River, Loddon River, Gunbower Creek, Kerang Lakes, Cairn Curran Reservoir, Upper Coliban Reservoir, Tullaroop Reservoir, Newlines Reservoir and Hepburn Lagoon.

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

Strategic Priorities

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

1. **Protect key fisheries assets**
2. **Advocate for fish habitat recovery works**
3. Manage fish stocking
4. Encourage compliance with regulations
5. Improve angler access
6. Develop recreational fishing opportunities

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

Fishery management priorities

On 18 October 2013, Fisheries Victoria and the NCCMA convened a workshop with key recreational fishing representatives to identify key fisheries management priorities for the region. The ideas and proposals from this forum were reviewed by Fisheries Victoria against project feasibility criteria and are captured as fishery management priorities (Table 1). The outcomes of this workshop builds on past fishery management planning processes, in particular the 2002 Bendigo Region Fishery Management Plan.

Table 1: North Central Fishery Management Priorities

No.	Fishery management priorities
1	Support the reintroduction of structural woody habitat and riparian habitat as per river reaches specified in the NCCMA Regional Water Strategy (e.g. Campaspe River, Pyramid Creek, Little Murray River, Gunbower Creek, Loddon River etc.).
2	Establish aquatic habitat hotspots, including improving riparian habitat and fishing access (e.g. Arsons Reserve, Campaspe River near boundary between Campaspe and Bendigo shires).
3	Investigate the use of submerged structural fish habitat in impoundments (e.g. Kerang Lakes, Greens Lake) to improve the survival, growth and reproduction of stocked fish.
4	Promote recreational fisher awareness of, and participation in, Regional Waterway Strategy actions managed by the NCCMA through regional consultation forums, angling club meetings and public media.
5	Support the establishment of a fish way at Koon rook weir to allow fish passage and connectivity between Murray River and Gunbower Creek.
6	Support targeted monitoring using citizen science (angling club records, angler diary program etc.) in line with NCCMA Regional Water Strategy actions.
7	Support the implementation of the Mid-Murray Floodplain Reconnection Project – Fish way connectivity, environmental flows and installation of woody habitat in the Torrumbarry Irrigation Area.
8	Better understand and adopt environmental flows that enhance native fish populations in the Loddon and Campaspe river systems.
9	Investigate the extent of fish migration into irrigation channels (Boort Channel off take, number 3 channel at Cohuna) and where practical, the feasibility of limiting or preventing this migration.