Mallee Waterway Strategy 2014-22

Mallee Catchment Management Authority

The 2014-22 Mallee Waterway Strategy (MWS) is a key planning document for the region that sets priorities for the future management of our rivers, creeks and wetlands.

You can download a copy of the Strategy from the Mallee Catchment Management Authority (CMA) website at **www.malleecma.vic.gov.au**, or contact us to request a printed copy to be sent to you:

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Acknowledgements

The Mallee CMA acknowledges Aboriginal Traditional Owners past and present 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.

The Mallee CMA acknowledges the contribution of regional stakeholders to the development of this Strategy; including representatives from the Department of Environment and Primary Industries (DEPI), Parks Victoria (PV), Local Government, Water Corporations, community and industry based groups, and the Indigenous community.

The Mallee CMA acknowledges the Victorian State Government as the funding body for the production of this Strategy.

Images front cover: Murray River at Colignan; Scarred tree at Mulcra Island; Kangaroos at Ducksfoot Lagoon.
Photos: Mallee CMA.

Mallee Waterway Strategy 2014-22

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mallee catchment management authority

State Government Victoria

Preface

Mallee waterways (rivers, creeks, lakes, wetlands) are valued for a variety of environmental, social, cultural and economic reasons. They provide us with the basic natural resource of water and many of our regional industries depend on them. The social and recreational opportunities our waterways offer are enjoyed by people living both within and outside of the region and many residents, especially our Indigenous community, have deep social, cultural and historical connections to them. Waterways are also essential to the region's natural environment, supporting an abundance of biodiversity and providing diverse ecosystems that deliver vital services such as carbon storage and nutrient cycling.

By providing a single regional planning document for the management of these important assets, this Mallee Waterway Strategy will support and focus the coordinated effort of our land managers, government agencies and wider community over the next eight years; while building on past achievements and recognising future challenges.

An extensive consultation process was undertaken in developing the Mallee Waterway Strategy, with stakeholder input integral to the identification of waterways which are a priority for management over the life of the Strategy; and the development of work programs to guide investment and the region's efforts in protecting and enhancing these waterways. I wish to thank everyone who provided comment, attended workshops and meetings, and made individual submissions throughout this process.

All sectors of our community including individual land managers, industry and community based groups, and government agencies and authorities are fundamental to the success of this Strategy. It will only be through sustained and collaborative efforts that our aspirations for the region's waterways can be realised.

The Mallee has a proud history of identifying and addressing key natural resource management issues through practical solutions and effective partnerships. This capacity continues to be a vital resource for the region, and one which I believe can be further enhanced through the implementation of this Mallee Waterway Strategy.

Sharyon Peart

Mallee CMA Board Chair

October 2014

Our Vision

The Mallee Waterway Strategy has adopted the visions of the Victorian Waterway Management Strategy (VWMS) and the Mallee Regional Catchment Strategy (RCS) to reflect the region's long term (50 year) aspirations for our waterways and their management.

'Mallee rivers and wetlands are valued, healthy and well managed; supporting environmental, social, cultural and economic values that are able to be enjoyed by all communities' (adapted from VWMS 2013 Vision); and

'Informed and active communities balancing the use of resources to generate wealth with the protection and enhancement of our natural and cultural landscapes' (2013-19 Mallee RCS Vision)

Linkages to the Mallee RCS are further strengthened through the application of its 20 year objective for Mallee Waterway assets.

Waterways - To protect and enhance the environmental condition of Mallee waterways, their associated riparian ecosystems and in turn the social, cultural, economic and environmental services they provide to the community.

Incorporation of the RCS's 20 year objectives for Culture and Heritage and Community Capacity assets recognises the significant contribution that delivery of the MWS will make to these targets.

Culture and Heritage - To protect the extent and condition of cultural heritage (Indigenous and non-Indigenous) sites across all Mallee land tenures.

Community Capacity for Natural Resource Management - To increase community capacity for, awareness of, and participation in efforts to protect the Mallee's natural, cultural and productive landscapes.

A set of long term (20 year) goals are also established by the MWS to further define strategic directions for waterway management and help guide priorities for action planning. These goals detail our aspirations for both the environmental condition of Mallee waterways and the Culture and Heritage and Community Capacity outcomes associated with waterway management:

- To maintain or improve habitat within waterways and on surrounding riparian land;
- To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based);
- To restore appropriate water regimes and improve connectivity;
- To protect the extent and condition of Cultural Heritage (Indigenous and non-Indigenous) sites associated with waterways; and
- To increase community capacity for, awareness of, and participation in waterway management.

Contents

Section 1

Introducing the Strategy

About the Strategy

The Mallee Waterway Strategy (MWS) provides a single, regional planning document for the management of our waterways (rivers, creeks, lakes, wetlands) and surrounding riparian land over the next eight years (2014-22).

Developed in partnership with regional stakeholders, the MWS supports and focuses the coordinated effort of our land managers, government agencies and the wider community; while building on past achievements and recognising future challenges.

Purpose and Scope of the MWS

The MWS is prepared under the provisions of the *Water Act 1989* (s.190) which requires that the Mallee Catchment Management Authority (CMA) (as one of Victoria's 10 waterway managers) develop a 'regional waterway strategy' for the purposes of performing its functions under s.189(1) of the Act. These regional waterway strategies are the centre-piece of an integrated waterway management framework for rivers, estuaries[1] and wetlands (see Figure 1.1).

Within this context the MWS will deliver against:

- State-wide strategic directions for waterway management, as detailed by the 2013 Victorian Waterway Management Strategy (VWMS)[2];
- Regional objectives and priorities for the management of our natural, cultural and productive landscapes (particularly those that relate to waterways), as detailed by the 2013-19 Mallee Regional Catchment Strategy (Mallee RCS)[3]; and
- Regional water allocation and water recovery targets, as detailed in the Northern and Western Sustainable Water Strategies (SWSs)[4].

To achieve this, the MWS:

- Sets regional goals for waterway management that align with the Mallee RCSs broader objectives;
- Identifies high value waterways and, from these, determines a subset which are a priority for management over the eight year planning period;
- Details strategic work programs for priority waterways (including the Hattah-Kulkyne Lakes Ramsar Site) to guide investment over the eight year period;
- Identifies the roles and responsibilities of regional stakeholders in the implementation of these work programs; and
- Establishes principles to guide the implementation of a seasonally adaptive approach to annual delivery processes.

In some instances, the MWS is also supported by site and/or issue based plans (e.g. environmental water management) that provide more detailed information on specific targets and management activities (see Figure 1.1).

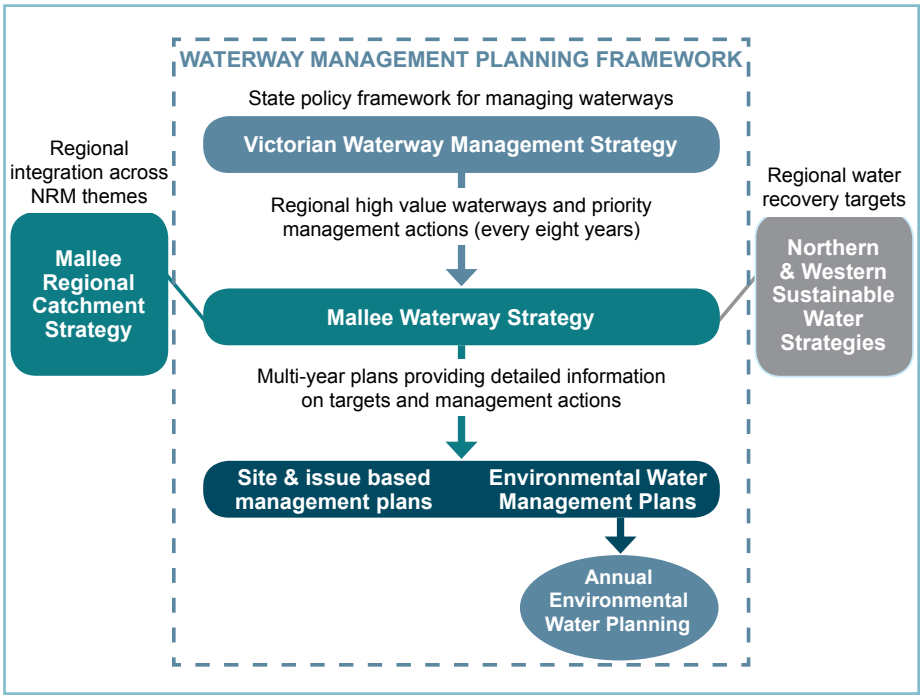


Figure 1.1: Integrated Waterway Management Planning Framework.

History of the MWS

This 2014-22 MWS replaces the Mallee River Health Strategy (MRHS) as the primary planning document for regional waterway management, and builds on its scope by incorporating the management of the region's wetlands as well as rivers.

The MRHS was prepared as a requirement of the State Government in response to the Victorian River Health Strategy (VRHS), and was ministerially endorsed in 2006.

A 2013 review of the MRHS, together with its mid-term review 'Addendum', determined that the majority of five year Management Action Targets (MATs) set for the region's priority waterways were either achieved or over achieved. Collectively, this delivered:

- Targeted implementation of significant on ground work programs; including:
  - 52 waterways with improved environmental flows for the enhancement of priority habitat;

[1]No estuaries occur within the Mallee region.

[2]The VWMS framework is based on regional planning processes and decision making, within the broader system of integrated catchment management in Victoria.

[3]The 2013-19 Mallee RCS is the primary integrated planning framework for land, water and biodiversity management in the region.

[4]SWSs set out a long term regional plan to secure water for local growth, while maintaining the balance of the area's water system and safeguarding the future of its waterways and groundwater.

- 336 km of riparian frontage fenced to reduce the impact of stock;
- 113 km of river (5,050 ha of floodplain) with riparian pest plant and animal control;
- 65 disused/abandoned pump sites removed and the restoration of 200 poorly maintained sites;
- 721 km of river (9,350 ha of floodplain) with improved recreation management through track rationalisation, rubbish removal, and signage; and
- 78 Cultural Heritage sites protected through fencing and erosion control works.

- Comprehensive community engagement and capacity building programs to enhance awareness of, and participation in, waterway management; including:
  - Delivery of the Mallee Waterwatch Program to both community and school groups;
  - Utilisation of 36 demonstration sites to encourage the adoption of best riparian management practice; and
  - Targeted communication and education programs and/or materials to raise awareness of river health related issues.
- Significant improvements in regional data sets for better understanding of asset condition; threat incidence, severity and impact; and the effectiveness of proposed interventions; and
- The establishment and ongoing delivery of improved monitoring programs to evaluate the impact of regional delivery on threat mitigation and/or asset condition.

While this 2014-22 MWS builds on the outputs and outcomes achieved under the MRHS, it has also incorporated the lessons learnt from the development, implementation and review of the preceding Strategy; specifically in regards to:

- **Engagement** - facilitating a high level of stakeholder understanding and ownership of the Strategy's purpose, priorities and management activities provides a strong foundation for future implementation. Providing opportunities for all key stakeholders to have input into the MWS should be a key consideration in the development phase;
- **Partnerships** - collaborative arrangements between government, community, land owners and industry stakeholders have been a positive and rewarding feature of regional waterway management to date. The Strategy should continue to provide specific strategic support and encouragement for such arrangements;
- **Knowledge** - the Strategy should continue to be based on the best available information in order to provide confidence in investment and interventions;
- **Feasibility** - the long, medium and short term targets detailed within the Strategy need to balance the region's ambitions for improved waterways with what is financially, physically and socially possible;
- **Accountability** - the Strategy should outline clear reporting mechanisms for evaluating and communicating the region's progress against long, medium and short term targets; and
- **Flexibility** - the Strategy should be sufficiently flexible and adaptable throughout its delivery timeframe to respond to changing conditions and circumstances.

View from the regulator at Lower Potterwalkagee Creek. Photo: Mallee CMA.

Development of the Strategy

The development of this MWS has primarily been informed by three key means: state and federal legislation, policies and strategies; regional strategies and action plans; and the Mallee community.

Strategic Framework

The MWS sits within a complex regulatory and policy framework that informs its development and which in turn gives it purpose and effect. By considering the relevant components of this framework in the identification of regional goals, priorities and targets; the MWS provides a key mechanism for translating international, federal and state objectives into regional outcomes.

Key regional planning documents have also been integrated into the MWS development process to capture existing commitments which are based on comprehensive stakeholder input.

Figure 1.2 provides examples of the key federal, state and regional legislation, policies, strategies and plans which have informed the development of this MWS (see Appendix 1A for further detail).

Community Engagement

The success of this MWS is dependent on meaningful and ongoing engagement with all stakeholders. Capturing the values, knowledge and aspirations of the region's individuals, groups and organisations throughout the MWS development phase was a fundamental component of this process.

Figure 1.3 provides an overview of the consultation framework employed in the development of the MWS. Key engagement activities conducted under this framework included media articles,

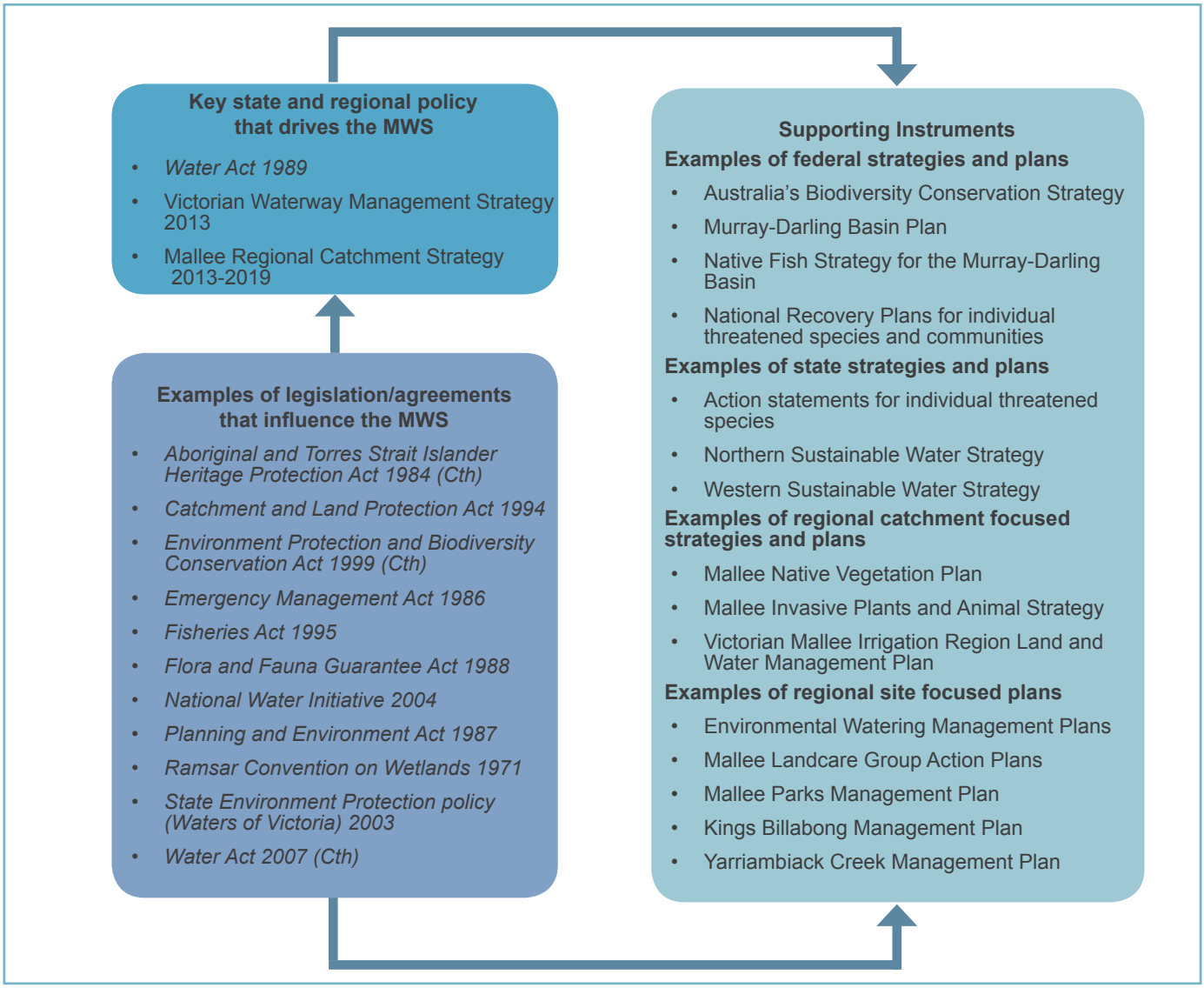


Figure 1.2: Examples of federal, state and regional legislation, policies, strategies and plans which have informed the development of the MWS.

workshops, surveys, email updates, field trips, and general promotions at regional (e.g. field days) and local (e.g. site visits) events. Further detail on activities delivered and the stakeholders engaged is provided in Appendix 1B.

Through participation in these activities a broad cross section of the Mallee community provided valuable input into:

- The identification of regional and local scale documentation to assist in identifying existing commitments and priorities;
- The identification of environmental, social, cultural and economic values associated with our waterways;
- The development of long term goals for the condition of our waterways to support these values;
- The identification of threats to our waterway values and the priority management actions required to address those threats;
- The development of Waterway Management Units to support a whole of system/multiple asset scale approach to planning and delivery;
- The identification of key challenges and opportunities for managing our waterways.

A draft of the MWS was released for public comment in May 2014, with opportunities to provide feedback widely promoted. Comments were received on the draft at targeted workshops and through written submissions and personal communications (e.g. telephone calls).

This final MWS has taken account of the comments and feedback received throughout the consultation period.

Regional stakeholders will also be engaged throughout the MWS's implementation and review phases. This ongoing consultation will utilise established partnership/engagement mechanisms as outlined in Figure 1.3.

Community based committees played a key role in developing the MWS. Photo: Mallee CMA.

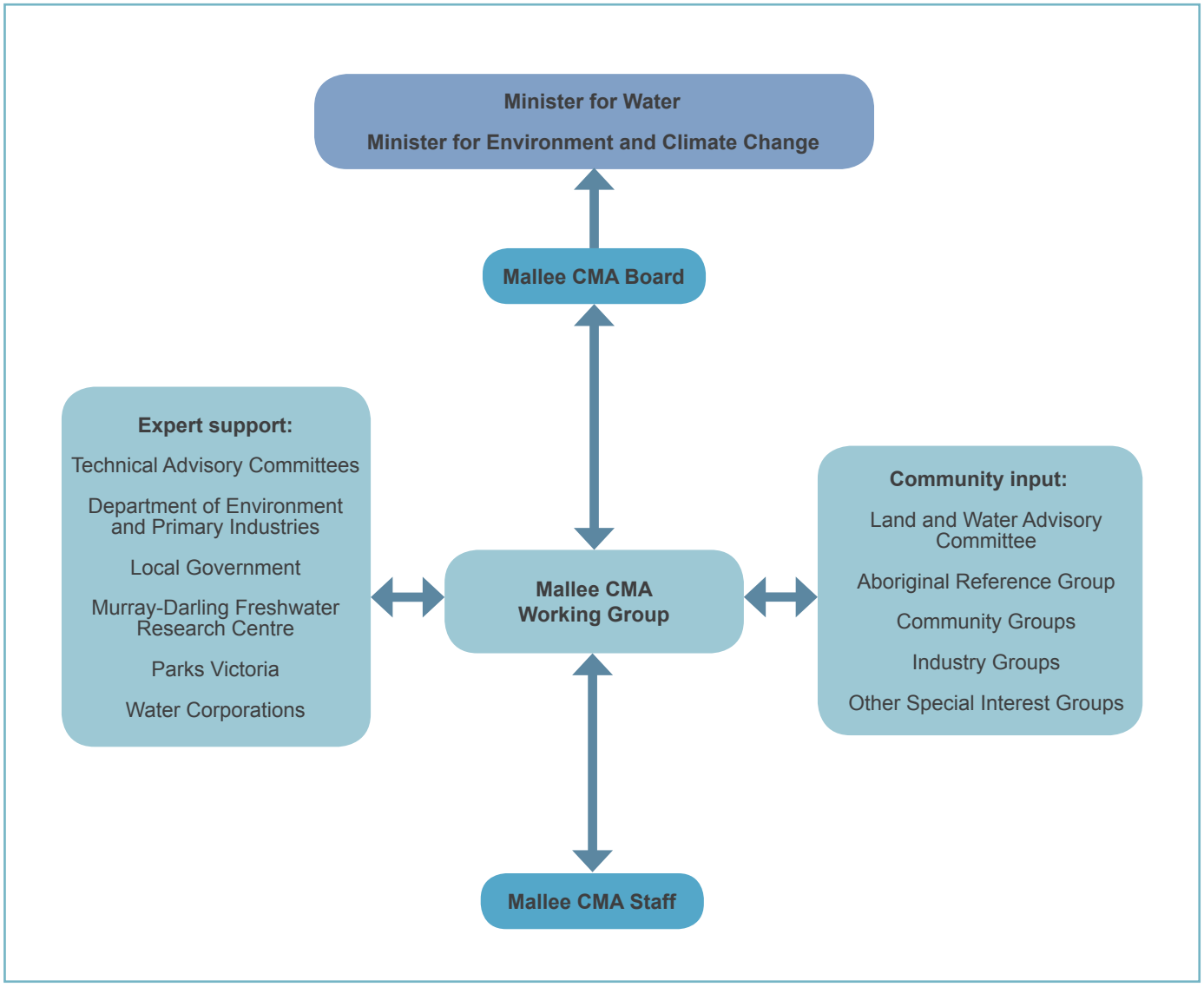


Figure 1.3: Consultation framework employed in the development of the MWS.

Section 2

Mallee Waterways

Waterway Assets

Mallee waterways include our rivers, creeks, lakes, wetlands, and surrounding riparian land.

These assets represent a defining feature of our landscape and are fundamental to the region's environmental, social and economic future.

Rivers

The Mallee contains some 1,600 km of river assets which can be divided into three distinct groups according to the river basin in which they are located; the Mallee, Avoca or Wimmera Basin[1].

The Mallee Basin contains the Murray River which forms the northern boundary of the region, as well as the boundary between Victoria and New South Wales (NSW). While the main river channel lies in NSW, Victoria is responsible for the management of its southern floodplain from the 1881 winter level water mark, which within the Mallee represents some 731 km of Murray River frontage.

There is also 555 km of Murray River anabranches and tributaries within the Mallee Basin, the main systems being Lindsay River and Wallpolla Creek in the north-west of the region.

Tyrrell and Lalbert Creeks are intermittent creeks that flow north-west from the Avoca River, within the Avoca Basin. Flow in the Avoca River must exceed 5,000 ML/month at Charlton for these two creeks to commence flowing (SKM 2002a), which occurs every two or three years on average.

The section of Tyrrell Creek that occurs within the Mallee extends from Dumosa in the south to Lake Tyrrell in the north, a distance of approximately 90 km. Lalbert Creek flows some 67 km within the Mallee, from just west of Lake Lalbert to Lake Timboram.

The Avoca Basin also includes a small section of the Murray River (27 km), and one of its anabranches, Parnee Malloo Creek.

Relatively small sections of two north flowing intermittent streams of the Wimmera River system occur within the Mallee region; 67 km of Outlet Creek and 43 km of Yarriambiack Creek.

Outlet Creek is generally dry, filled by overflowing floodwaters from Lake Albacutya (located in the Wimmera CMA region). Studies suggest the wetting cycle of Lake Albacutya has been reduced from

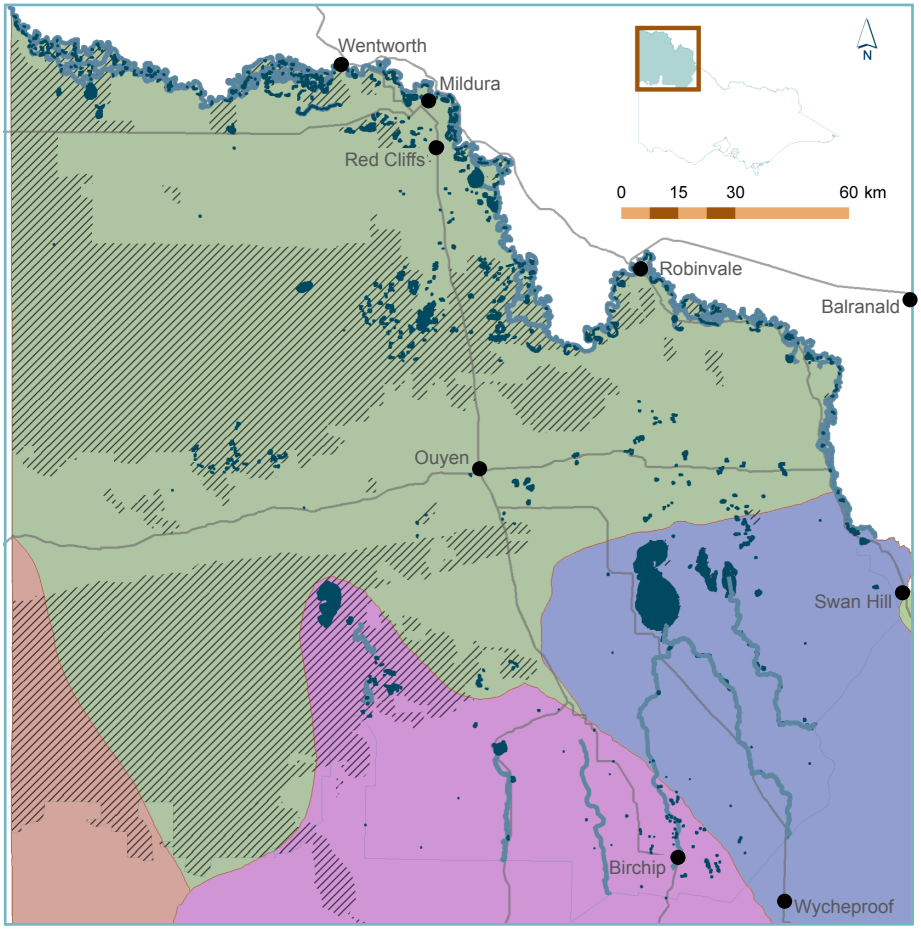


Figure 2.1: Mallee Waterways and Basin in which they occur.

[1]The Mallee also contains a portion of the Millicent Coast Basin, however there are no waterways contained within this basin in the Mallee CMA region.

What is a river?
The definition of a river encompasses rivers, streams and their tributaries and includes the water, the channel and the surrounding riparian land.

What is a wetland?
Wetlands are still-water environments, usually where water collects in depressions in the landscape. This definition includes lakes and swamps. Some wetlands are dependent on groundwater for their existence; others depend on surface water run-off or large floods from adjacent rivers. Some wetlands naturally have water in them all the time, while most wetlands in the Mallee are naturally ephemeral, meaning they dry out for short or long periods of time.

What is riparian land?
Riparian land is the area of land that adjoins, regularly influences or is influenced by, the river or wetland. It includes the regularly wetted floodplain and soil and can vary in width from a narrow strip to a wide corridor.

one in 20 years under natural conditions, to one in 100 years under regulated conditions (SKM, 2002b).

Yarriambiack Creek flows from the Wimmera River to Lake Corrong and Lake Lascelles, east of Hopetoun. Apart from small amounts of local run-off, flows in the creek are largely dependent on run-off upstream in the Wimmera River catchment and water supplied through the Wimmera Mallee Pipeline.

Within the Mallee, Dunmunkle Creek represents two separate waterways that occur within two river basins: the Wimmera and the Avoca. A 48 km southern section commencing in the Wimmera catchment and flowing north towards Lascelles; and a 73 km northern section commencing as a broad shallow area south of Birchip in the Avoca Basin. This section flows north-west then north-east through Green Lake, before joining Tyrrell Creek and entering Lake Tyrrell. Flows in both sections are dependent on local or upstream run-off in their respective river catchments.

Wetlands

There are some 900 wetlands in the Mallee, occupying almost 50,000 ha. Mallee wetlands are diverse and include: riverine wetlands, natural saline wetlands fed by groundwater, shallow depressions in the south of the region filled by local catchment run-off, and artificially maintained wetlands such as the Cardross Lakes and Koorlong Basins.

Some 84% of our wetland area occurs on public land, with the remaining located on freehold land historically used primarily for either dryland farming or irrigated horticulture. Government support (e.g. incentive programs) over recent years has seen an increasing number of these wetlands on private land being managed for conservation.

Semi-permanent saline wetlands are the most prevalent wetland type in the Mallee. These wetlands have increased in both number and area since European settlement due to altered hydrological regimes, clearing of native vegetation, changes in surrounding land use, and the use of natural wetlands and low-lying areas for salinity management.

Wetlands associated with the Murray River or its anabranches are primarily seasonal, intermittent or ephemeral wetlands that fill when the Murray River floods, although under natural or pre-regulation conditions some would have been inundated more or less permanently. Most riverine wetlands are freshwater meadows, marshes and permanent open freshwater wetlands, characterised by trees such as River Red Gum and Black Box. Only a few saline wetlands occur along the Murray River, primarily the result of secondary salinisation caused by disposal of saline irrigation drainage water or intrusion of saline groundwater.

Wetlands in the centre and south-east of the region are mostly saline systems (salinas and boinkas) that are typically associated with fault line influences and natural groundwater discharge sites. These wetlands are generally semi-permanent and are characterised by salt tolerant flora. Large terminal saline wetlands such as Lake Tyrrell and LakeTimboram are significant features of the region.

In the south-west of the region, wetlands are generally freshwater marshes restricted to the Outlet Creek system within Wyperfeld National Park; although a few saline wetlands do occur north of Outlet Creek.

The far south contains almost a quarter of the Mallee's most depleted wetland type, freshwater meadows. Historically these ephemeral wetlands would have been inundated by local catchment run-off, however the hydrology of this area has been significantly altered through the historical development of the area for agriculture.

Cowanna Billabong, Merbein. Photo: Mallee CMA.

Wallpolla Wetland. Photo: Mallee CMA.

Waterway Values

Mallee waterways are valued for many environmental, social, cultural and economic reasons.

They provide us with the basic natural resource of water and many of our regional industries depend on them. The social and recreational opportunities they offer are enjoyed by people living both within and outside of the region and many residents, especially our Indigenous community, have deep social, cultural and historical connections to them.

Our waterways are also important to the region's natural environment, supporting an abundance of biodiversity and providing diverse ecosystems that deliver vital services such as carbon storage, nutrient cycling and water purification.

Environmental Value

The environmental services provided by the region's rivers, creeks, wetlands and riparian lands are as broad and diverse as the systems that provide them. Key examples include:

- the provision of water for the benefit of in-channel and floodplain ecosystems;
- the provision of specialised habitat, including refugia and connectivity opportunities within largely cleared landscapes;
- the transport of nutrients, carbon, salts and silts through the landscape; and
- the replenishment of connected groundwater systems to support associated groundwater dependent ecosystems.

The Mallee supports a diverse and unique range of flora and fauna, with many species associated with the region's waterways and adjoining riparian land. A number of species have been listed as threatened at a federal level (under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)), and at a state level (under the *Flora and Fauna Guarantee Act 1988* (FFG Act) or Victorian Rare or Threatened Species (VROTS)). (See Table 2.1).

Examples of species which depend upon habitat provided by our waterways for their ongoing conservation include the EPBC listed Growling Grass Frog, Murray Cod, Murray Hardyhead, Regent Parrot, Winged Peppercress and Ridged Water-milfoil; and the FFG listed Carpet Python, Silver Perch, Broad-shelled Turtle, Swamp Sheoak and Hoary Scurf-pea.

A full list of endangered and vulnerable waterway dependent species found in the Mallee is provided in Appendix 2A.

Kayaking at Hattah Lakes. Photo: Danielle Southton.

Environmental, social, cultural and economic values associated with Mallee waterways include:

- Ecosystem services, such as aquatic habitat, connectivity of landscapes, nutrient recycling and water purification;
- Extensive indigenous cultural sites dating back thousands of years and more recent historic sites relating to European settlement;
- Water supplies for irrigation, industrial, stock and domestic use; and
- A rich and diverse landscape for tourism and recreation.

The habitat which supports these species is defined by the prevailing native vegetation community at any location. In Victoria, these communities are classified into Ecological Vegetation Classes (EVCs). There are around 300 different EVCs in Victoria and 50 in the Mallee, several of which are primarily associated with the region's waterways (e.g. Grassy Riverine Forest, Riverine Chenopod Woodland, Lignum Swampy Woodland).

Many of the vegetation communities that once dominated the Mallee landscape are now highly fragmented as a result of land clearing; with most of the region's remaining indigenous vegetation occurring within large blocks of public land. This includes extensive areas of waterway related habitat that is integral to the survival of many native plant and animal species.

Within the region's agricultural landscapes, habitat supported by the southern creeks and their associated wetland systems provides important connectivity and refugia opportunities for our native species.

Economic Value

Mallee waterways play a major role in sustaining the economy of the region through irrigated agriculture and tourism; as well as being a primary source of reticulated water for regional industries, dryland farming businesses and communities.

Irrigation in the Mallee extends adjacent to the Murray River from Nyah to the South Australian border and encompasses private diverters and the pumped irrigation districts of Mildura, Merbein, Red Cliffs, Robinvale and Nyah. The region is recognised nationally and internationally for its horticultural produce and is a key part of the nation's food bowl, producing almost 100% of Victoria's dried vine fruits, 70% of Victoria's table grapes, 30% of Australia's wine grapes, and significant proportions of the nation's almonds, citrus, avocados, olives, and vegetable crops, supplying both domestic and export markets. Collectively these industries play a major role in sustaining the economy of the region, with the gross value of production for irrigated crops in 2011-12 being $570 million (Australian Bureau of Statistics, 2011-12).

Our wetlands also support the region's economy with several (e.g. Kings Billibong and Lake Cullulleraine) providing water for irrigation, stock and domestic water supply and others such as Psyche Lagoon, the Wargan Basins and Lakes Hawthorn and Ranfurly, providing an important role in regional salt interception and irrigation drainage disposal. Flood mitigation services (i.e. storing floodwater and releasing it slowly back into waterways) provided by wetlands further enhance the economic value we derive from them.

It is estimated that some $216 million is generated from tourism in the region annually (Australian Bureau of Statistics, 2011-12); a significant proportion of which is associated with the recreational and aesthetic opportunities afforded by the region's waterways. For example Hattah Lakes and the National Park in which they are located attract some 70,000 visitors a year, contributing over $10.7 million to the region's economy. The water filtration, flood control, water storage and habitat services afforded by these wetlands are calculated to provide a further $3.8 million, making the total economic value of Hattah Lakes over $14.5 million (O'Conner, 2010).

Social Value

The aesthetic value and recreational opportunities (e.g. fishing, boating, swimming, hunting, bird watching, camping and bush walking) provided by our waterways is of considerable social value to the region and beyond.

The ephemeral creek systems of the southern Mallee provides aesthetic value to the visual landscape; while terminal lakes and deeper holes within the systems can provide recreational opportunities such as swimming and boating when water is present from floods or supplied by the Wimmera Mallee Pipeline.

Outside the region, there are inestimable intrinsic values that the Murray River and the iconography of the Murray Darling Basin impart to the broader Australian population, such as: informing the national character, history and heritage; environmental significance; recreational use; and the basin's importance as Australia's food bowl.

Cultural Value

The Mallee has been occupied for thousands of generations by Indigenous people with human activity dated as far back as 23,400 years ago. The region's rich and diverse Indigenous heritage has been formed through the historical and spiritual significance of sites associated with this habitation, together with the strong connection Traditional Owners continue to have with the Mallee's natural landscapes.

Given the semi-arid climate of the region, ready access to more permanent water has been a major determinant of human habitation, and as such the highest density of identified Indigenous Cultural Heritage sites are located around or close to areas of freshwater sources.

The Murray River and its associated waterways were important habitation areas for multiple Aboriginal groups, containing many places of spiritual significance. The high number of Indigenous Cultural Heritage sites throughout the Murray floodplain is unique in Victoria, for both concentration and diversity. They include large numbers of burial, middens and hunting sites.

In the south, waterways were focal points for the region's Traditional Owners, with many lakes being the site for large gatherings of several social clan groups that afforded trade and cultural exchanges.

Waterways also play a large role in the region's more recent non-Indigenous heritage due to the historical infrastructure (e.g. buildings, irrigation and river navigation structures) they often contain. These places provide links to early industries and settlements and play a key part in the region's identity.

Table 2.1: Number of threatened species and communities at each level of listing which have been recorded within Mallee waterways and surrounding riparian land (source: Victorian Biodiversity Atlas 2014).

	National (EPBC Act)	State (FFG Act)	State (VROTS)
Flora	2	31	210
Fauna	7	48	87
Flora Communities	4	4	-
Fauna Communities	-	2	-

Formally Recognised Waterways

Many of the region's waterways have been recognised as nationally and internationally important for the environmental, social, cultural and economic values they provide.

Provisions in place for the protection of these waterways range from international conventions and partnerships, to statutory protection under state and federal legislation, and special listings in reports and policy documents by state and federal agencies.

Ramsar Sites

The Ramsar Convention on Wetlands is an inter-governmental treaty that provides the framework for international cooperation for the conservation of wetlands, one of the most threatened habitats in the world.

There is one Ramsar Site in the Mallee region - the Hattah-Kulkyne Lakes - and as a contracting party to the Ramsar Convention, Australia is required to maintain its ecological character through conservation and wise use.

Ecological character is defined by the Ramsar Convention as "the combination of the ecosystem components, processes and benefits/services that characterise the wetlands at a given point in time". A change in ecological character is the "human induced adverse alteration of the ecosystem component, process and/or ecosystem benefit/service".

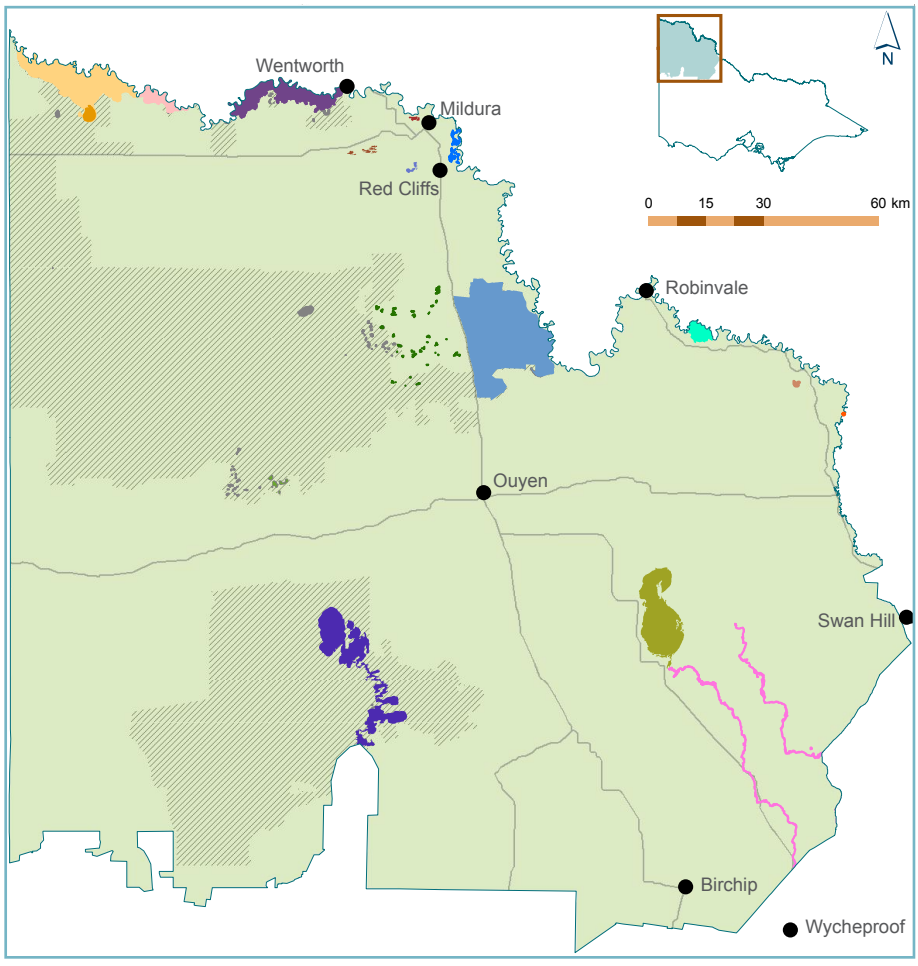
The 955 ha Hattah-Kulkyne Lakes Ramsar Site is a system of 12 shallow temporary lakes which occur on public land (i.e. Hattah-Kulkyne National Park) managed by Parks Victoria.

Some 17 individual sites within the region have been formally recognised as containing waterways which are of national and international importance.

A further 64% of the region's wetlands and 55% of reaches have been recognised as important at the State level through legislated protection of the parks, reserves and forests in which they occur.

All Mallee waterways with formally recognised significance will be identified as 'high value' in the regional priority setting process (Section 3) and key threats to their environmental condition will be addressed as part of the regional work program (Section 4).

Associated management activities will be developed and implemented to align with and support existing management plans and/or legislation.



Legend

- Major Towns
- Mallee CMA Boundary
- A1 and A2 Public Land

Waterway	Ramsar	Living Murray	DIWA	Heritage rivers	A1 Public Land
Belsar Island			X		
Tyrrell Creek & Lalbert Creek Floodplains			X		
Cardross Lakes			X		
Hattah Lakes	X	X	X		X
Heywoods Lake			X		
Kings Billabong Wetlands			X		
Lake Ranfurly			X		
Lake Tyrrell			X		
Lake Wallawalla			X		X
Lindsay Island		X	X		X
Mulcra Island		X			X
Major Mitchell Lagoon			X		
Pink Lakes			X		X
Raak Plain			X		X
Wallpolla Island		X	X		X
Wargan Basins			X		
Wimmera River (Outlet Creek & Wirrengren Plains Section)			X	X	X
Other Public Land Waterways					X

Figure 2.2: Formally recognised waterways in the Mallee.

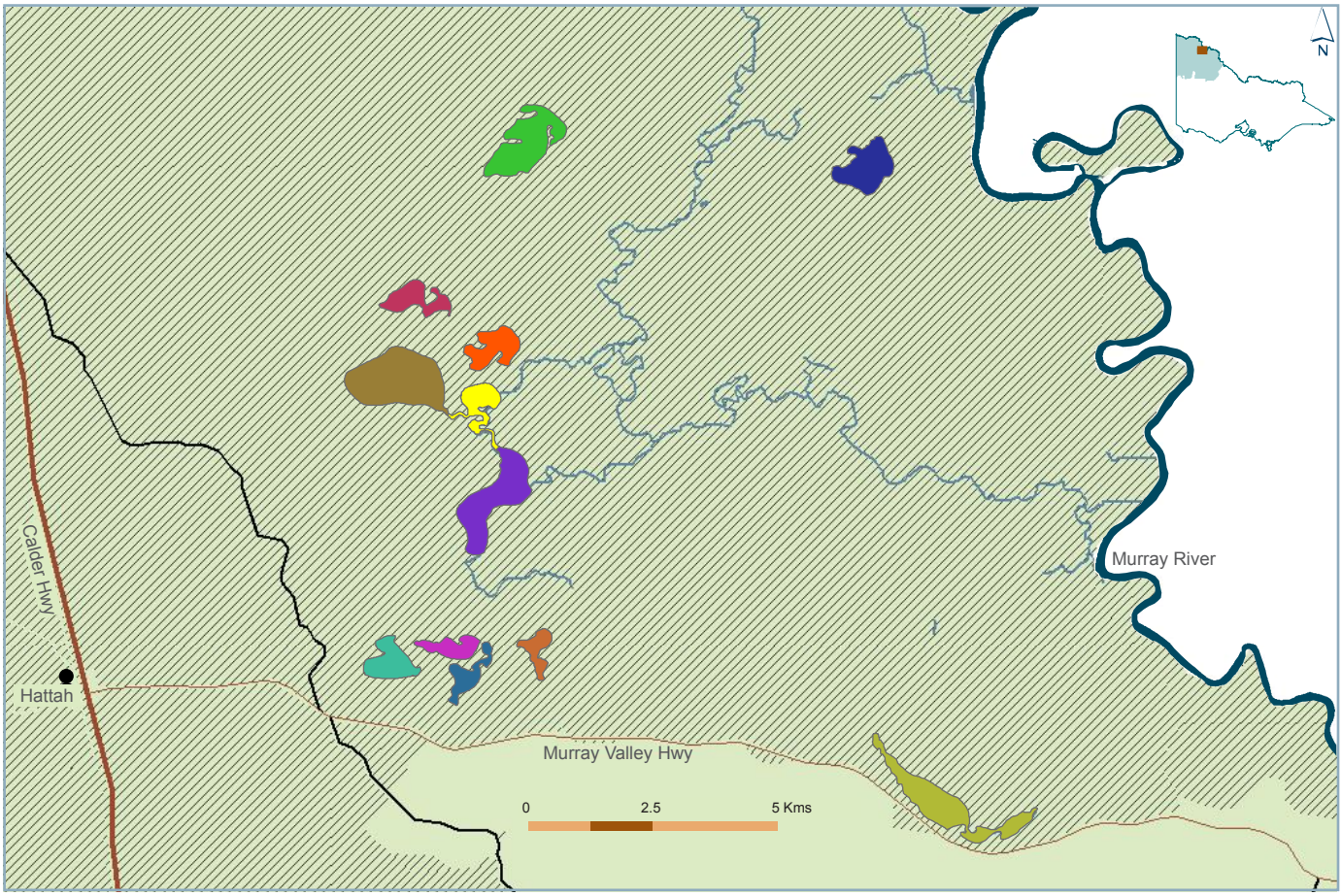


Figure 2.3: Hattah-Kulkyne Lakes Ramsar Site.

Characterised by a River Red Gum and Black Box landscape, the lakes are located on the Murray River floodplain between Ouyen and Mildura, 480 kms north-west of Melbourne (see Figure 2.3).

When the Ramsar Site was listed in 1982, the lakes included two Ramsar wetland types. In addition, a small section of Chalka Creek was classed as 'intermittent creeks'. A more detailed analysis of natural conditions was undertaken in 2007 (Ecological Associates), which classified the lakes into three wetland types (see Table 2.2).

Significant environmental values relating to wetland representativeness, threatened species, regional biodiversity, breeding waterbirds and habitat and connectivity for breeding fish contribute to the Site meeting five of the nine Ramsar Convention criteria for listing wetlands of international importance. These are described in more detail in Appendix 2B.

An ecological character description (ECD) prepared for the Hattah-Kulkyne Lakes defines limits of acceptable change (LACs) for ecosystem services and physical, chemical and biological ecosystem components and processes that are considered critical to the ecological character of the Site (see

Table 2.2: Area and wetland type for lakes in the Hattah-Kulkyne Lakes Ramsar Site.

Wetland	Surface Area (hectares)	Ramsar Wetland Type at Listing (1982)	Wetland Type (Ecological Associates, 2007)
Arawak	40	P	SPW
Bitterang	73	P	PTW
Brockie	28	P	SPW
Bulla	40	P	SPW
Cantala	101	P	PTW
Hattah	61	O	SPW
Konardin	121	P	PTW
Kramen	124	P	E
Lockie	141	P	PTW
Mournpall	195	O	SPW
Yelwell	81	P	PTW
Yerang	65	P	PTW

P = seasonal/intermittent freshwater lakes over eight hectares; O = permanent freshwater lakes over eight hectares; SPW = semi-permanent wetlands (dry approximately 1 year in 4); PTW = persistent temporary wetlands (dry events occur less than 13% of the time); E = episodic (inundated only rarely).

Appendix 2C). Key threats to the Site's ecological character and ongoing monitoring requirements are also detailed (see Appendices 2D and 2E).

Living Murray Icon Sites

The Living Murray (TLM) Initiative, led by the Murray-Darling Basin Authority, focuses on improving the environment at six 'icon sites' chosen for their high ecological value and cultural significance to Indigenous people and the wider community. Two of these icon sites are located within the Mallee region; the Lindsay, Wallpolla and Mulcra Island components of the Chowilla Floodplain; and the Hattah Lakes. The Murray River Channel itself is also an Icon site and although it is technically within New South Wales, the channel is affected by management decisions in the Mallee.

The Chowilla Floodplain and Lindsay-Wallpolla Islands icon site comprises one of the most significant floodplain ecosystems in semi-arid Australia and contains the largest remaining area of natural River Red Gum forest in the lower Murray. It is typified by complex anabranch systems, including streams, billabongs, backwaters, and swamps. A high diversity of both terrestrial and aquatic habitats support populations of rare, endangered and nationally threatened species and contain heritage protected sites of cultural significance.

The component of this site which is located in the Victorian Mallee (Lindsay-Wallpolla and Mulcra Islands) covers almost 20,000 ha (see Figure 2.2).

The Hattah Lakes were selected as an icon site because of their extent, condition, diversity and habitat value, as well as their social and cultural importance. The icon site comprises the entire wetland complex (some 20 lakes ranging in size from <10 ha to 200 ha) and the adjoining floodplain, which is defined by the 1956 flood (the largest on record). Collectively this covers some 13,000 ha (see Figure 2.2).

Directory of Important Wetlands

The Directory of Important Wetlands-Australia (DIWA) identifies important wetlands in Australia, while providing a substantial knowledge base of their variety and associated characteristics (e.g. dependent flora and fauna species).

To be considered nationally important, the Directory requires that a wetland meets at least one of six nationally agreed criteria. The criteria cover: biogeographic representativeness; important ecological or hydrological functions; provision of animal habitat during times of vulnerability or adverse conditions; support for more than 1% of the national population of any taxa; support for threatened taxa or communities; and historical or cultural significance.

The Directory currently identifies 16 sites within the Mallee that have been assessed as meeting at least one of these criteria, and are therefore classified as nationally important (see Figure 2.2).

Lake Little Hattah. Photo: Mallee CMA.

Heritage Rivers

In 1991, Victoria reviewed the values of all its rivers and put in place a system of Heritage Rivers. Eighteen river reaches were designated as Heritage Rivers and 26 Natural Catchment Areas were identified. These rivers and catchments are protected under the *Heritage Rivers Act 1992* which requires their preservation as part of our heritage.

Included within this heritage classification is the Wimmera River from Polkemmet Bridge to Wirrengren Plain. While occurring primarily within the Wimmera CMA region, a section north of Lake Albacutya (i.e. latter 67 km of Outlet Creek and Wirrengren Plain) is located within the Mallee.

Parks and Reserves

Much of the native vegetation remaining in the Mallee has been reserved in large parks such as Murray-Sunset, Big Desert, Wyperfeld and Hattah-Kulkyne National Parks; extensive tracts of riverine and dryland state forests; and over 500 small reserves scattered throughout the agricultural area. Collectively these areas protect some 84% of the area of wetlands in the region and 80% of rivers.

The management of these waterways primarily involves managing threats (e.g. invasive species, bushfire) within the park, reserve or forest, as guided by legislation (e.g. *National Parks Act 1975, Crown Land (Reserves) Act 1978, Forests Act 1958, Land Act 1958*) and associated park and forest management plans.

Parks Victoria currently undertakes planning and objective setting for environmental management across this network using the Levels of Protection framework to prioritise all parks and reserves into six discrete Park Groups. The highest priorities are parks and reserves in Park Groups A1 and A2, which within the Mallee encompasses Hattah-Kulkyne National Park, Murray-Sunset National Park and Wyperfeld National Park.

Collectively these priority management areas contain some 462 km of river reaches and 31,860 ha of wetlands, representing 64% of total wetland area and 50% of rivers (see Figure 2.2).

Waterway Threats

Mallee waterways continue to be threatened by a range of pressures which can directly impact on their environmental condition; and therefore on their capacity to provide the environmental, social, cultural and economic services we value.

Major threats to our waterways are those that impact on one or more of their environmental attributes. Attributes can be broadly categorised into four key indicators of environmental condition: habitat, water quality, water regime and connectivity. A summary of threats to the condition of these key indicators in the Mallee is provided below.

Altered Water Regimes

In the Mallee, the trend of land use change from mixed dryland cropping/ grazing enterprises to more intensive horticultural production, in addition to population growth, has led to greater demand for water over time.

Flow modification of the Murray River system has occurred to meet the needs of navigation, irrigation and urban water use. River regulation modifications include less variable in-channel flows, a reduction in the frequency and duration of small and medium floods, weirs which raise water levels immediately upstream and redirection of flows into some anabranches to supply irrigators. This has altered the wetting and drying phases of many wetlands and ephemeral anabranches, by either permanently inundating the area, or by restricting flows. These changes can ultimately have a significant impact on important riparian habitat and associated vegetation communities (e.g. River Red Gum, Black Box), fish populations, algae, nutrient cycling, water quality, channel/wetland shape and form etc.

The Avoca system, containing Lalbert and Tyrrell Creeks, is one of the least regulated rivers in Victoria. The construction of levees to restrict flooding of adjacent land and other management activities such as clearing, cultivation, and the widespread application of gypsum have however changed run-off patterns across the landscape. Additionally, the construction of catchment dams in the upper Avoca catchment has reduced inflows into the Avoca River.

The Wimmera River is heavily regulated and its two distributaries occurring in the Mallee, Yarriambiack and Outlet Creeks together with their associated wetlands, are largely influenced by headwater storages.

In terms of the region's off stream wetlands, their natural run-off patterns have been affected by land clearing, cultivation, and the widespread application of gypsum. Prior to pipelines being established, most of these wetlands were fed by a domestic channel system and functioned primarily as water storages.

Land and Water Salinisation

Groundwater relationships vary along the length of the Murray River. In some areas groundwater discharges into the Murray, substantially increasing salt levels, while in other areas the Murray discharges to the groundwater. Groundwater recharge typically increases during floods; while during low flows, increased drainage of aquifers back to the River occurs.

Salinity effects at Psyche Lagoon. Photo: Mallee CMA.

Key threats to the environmental condition of Mallee waterways include:

- Altered water regimes - caused by water over extraction, increased interception and reduced run-off;
- Habitat degradation - caused by inappropriate land management practices, invasive species, and recreational pressures;
- Poor water quality - caused by inappropriate land management practices, rising saline groundwater and invasive species; and
- Reduced connectivity - caused by barriers such as weirs and levees, and water over extraction.

To ensure that our waterways can continue to provide the environmental, economic, social and cultural services we value, it is essential that these threats are addressed in an integrated and targeted manner.

Saline groundwater has risen across the Mallee as a result of widespread clearing of vegetation for agriculture. Once watertables rise to within about two metres of the soil surface, groundwater is drawn up by capillary action, leading to salt accumulation and salt scalds. These changes to soil chemistry can pose a significant threat to the ecology of waterways and their associated riparian habitat.

Irrigation and weirs can change saline groundwater flow patterns, increasing salt inputs to the floodplain and associated waterways. River salinities can increase even during high rivers and particularly on flood recessions when accumulated salt drains to the river.

Invasive Plants and Animals

The introduction and dispersal of invasive weed species has changed the composition and character of many riverine landscapes in the Mallee. Environmental weeds compete with indigenous plants for resources and can change the composition of floristic communities, reduce the quality and extent of native vegetation, and reduce the diversity and availability of fauna habitat. They can also impact on the use of popular recreational areas, affecting aesthetic values and limiting access.

In some instances, weed proliferation may impact on water quality as a result of nutrient pulses caused by rapid shedding of leaves (e.g. willows) and an ability to spread rapidly can result in physical interruptions to water flow, causing changes in water course behaviour.

Significant terrestrial weeds impacting on riparian habitat within the region include African Boxthorn, Bridal Creeper, Dodder, Noogoora Burr, Olive, Spiny Rush, and Willows.

While there is limited regional information available on the occurrence, distribution and impact of aquatic weeds, Leafy Elodea is a key species, with others such as Arrowhead and Cabomba considered to be emerging threats to our waterways.

Invasive animals cause major damage to native vegetation and can create significant soil disturbance. They also prey on indigenous fauna found within riparian areas, including mammals, reptiles and birds. Rabbits, foxes, feral cats, feral pigs, and feral goats are considered the primary threats to the condition of the region's riparian habitat.

Within waterways, European Carp have become a major threat to the ecology of the Murray River, its tributaries, and associated wetlands. Carp can impact waterways by undermining banks, destroying aquatic vegetation, and increasing turbidity which affects water quality. Carp, together with other key invasive fish species (e.g. Eastern Gambusia, Redfin) also compete with native fish for food and habitat, and may prey on eggs and juveniles.

Land Use Change

The change of land management or use practices from either a steady state or from accepted best management can have both direct and indirect impacts on our waterways.

Clearing vegetation around waterways and within their catchments has significantly changed the amount, quality and flow pattern of run-off entering many of the region's waterways. Run-off from highly modified catchments is likely to contain high levels of sediment and nutrients, pollutants, and seeds of exotic plants. Widespread vegetation clearing, as has occurred throughout the dryland areas of the Mallee, can also lead to increased salinity (see Land and Water Salinisation).

Grazing pressures resulting from the presence of livestock within riparian areas can lead to soil erosion and compaction, increased bank erosion, introduction of weed species, and increased run-off of sediments and nutrients to the waterway. Compaction and selective grazing can also degrade vegetation, decrease regeneration, and cause a loss of habitat for native fauna species.

Drainage of water from irrigation into low lying areas of frontage, the River, or the adjoining floodplain has led to rising water tables and salinity, waterlogging, and increased nutrients to waterways. This can result in increased risk of algal blooms, the decline or even death of native vegetation, and can impact the amenity of the affected site. Poor structural condition of drains may also result in erosion, increasing sediment loads to the River and to wetlands.

Stormwater drainage systems are designed to transport water run-off from urban areas directly to wetland or river systems. Many pollutants can be transferred through stormwater, such as chemical pollutants, heavy metals, sediments, nutrients, salts and litter; causing a decline in local and downstream water quality.

Inadequate planning for, and management of, existing pump sites (water diversion infrastructure) can impact on both the environmental and aesthetic value of river frontages. Decreased bank stability from poorly located sites and soil and water contamination through the inappropriate storage of fuel can be a direct result of this. Proliferation of access tracks to the site for pump maintenance can lead to soil erosion, compaction, and reduction in water quality. Disposal of filter backflush water releases a slug of nutrients into the River, and may also be an erosion risk.

Recreational Pressures

Many Mallee waterways are popular recreational destinations for the local community and visitors alike, making recreational use an important social value of these waterways. The environmental impacts of this use also make it a key threat. Historically, the impacts of recreation have included littering, track proliferation, fishing pressures, fallen wood depletion, soil compaction and erosion. As population and visitation increase so do the potential impacts of these threats.

Poorly designed and maintained pump sites impact on our waterways. Photo: Mallee CMA.

Waterway Condition

Ongoing assessments of our waterways are essential if we are to understand (and manage) long term changes in condition at the regional scale.

The condition of waterways in the Mallee is periodically assessed as part of the Department of Environment and Primary Industries (DEPI) state-wide Index of Stream Condition (ISC) and Index of Wetland Condition (IWC). These two monitoring programs collect detailed information on key aspects of river/ wetland health to provide an overall measure of the environmental condition of a waterway or section of waterway.

River Condition

The Index of Stream Condition is a state-wide measure of river and stream condition according to five sub-indices: hydrology; physical form; streamside zone; water quality; and aquatic life[1], comprised of 23 different metrics which are combined to characterise each sub-index (see Figure 2.4).

The ISC evaluates sections of a river known as 'reaches'. Reaches are identified on the basis of similar water regime regime, vegetation and landscape characteristics. They vary in length from 1.7 to 84.8 km.

Assessments of river condition using the ISC were first conducted in 1999 and again in 2004 and 2010. In general, this monitoring has identified that no major changes have occurred to the condition of the region's rivers over this timeframe. Therefore while no general improvement was detected, overall deterioration in stream condition appeared to have been controlled (DEPI, 2013c)[2].

This is an encouraging result, given that the data collected in the third assessment period coincided with the end of the severe Millennium drought in south-eastern Australia. It is assumed that the targeted threat mitigation actions undertaken in the region over this period played an important role in minimising the impact of the drought, and that they should assist with future improvements in condition under favorable climatic conditions.

The third (2010) ISC assessed 73 individual reaches in the region, representing 1,450 km of rivers. Data was available for at least two of the five sub-indices at each reach. See Appendix 2F for a full list of reaches and individual indices/condition scores).

Water Quality - Eight reaches were monitored to assess water quality in the Mallee, six of these were located on the Murray River and one each on Lindsay River (reach 71) and Toupnein Creek (reach 76). Water quality results ranged from good to moderate. All sites assessed had high levels of turbidity and phosphorus (DEPI, 2013c).

Hydrology - Flow stress scores were assessed at 18 reaches along the Murray River in the region. Hydrology scores for all other reaches in the Mallee Basin were extrapolated from these scores. All reaches (with the exception of reach 24, Yarriambiack Creek, in the Wimmera

[1] No data was available for aquatic life in the Mallee region.

[2] ISC scores cannot be directly compared across the three monitoring timeframes as different methodologies were employed for each assessment.

Periodic assessments on the condition of Mallee waterways are conducted as part of the state-wide Index of Stream Condition (ISC) and Index of Wetland Condition (IWC) monitoring programs.

Results from the most recent ISC assessment conducted in 2010 determined that 7% of reaches are in moderate condition and the remaining 93% are in poor or very poor condition.

Baseline IWC monitoring conducted in 2009/10 reported 53% of wetlands as being in good or excellent condition, 42% in moderate condition, and 5% in poor or very poor condition.

Ongoing application of these monitoring programs will provide the region with a sound basis on which to make management decisions and assess long term condition change.

Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
Hydrology refers to the amount of water that is within the river channel at a particular point in time at a particular location. A minimum of 15 years of monthly flow data is used.	Physical form takes into account the river bank condition as well as instream habitat (logs or 'snags') and major barriers to fish migration such as dams and artificial weirs.	Streamside zone measures characteristics of the woody vegetation within 40 metres of the river's edge.	Water quality is the quality of water in the river.	Aquatic life is based on the number and type of aquatic macroinvertebrates found within the river.
• Low flows • High flows • Zero flows • Seasonality • Variability	• Bank condition • Artificial barriers • Instream woody habitat	• Width • Fragmentation • Overhang • Cover of trees and shrubs • Structure • Large trees • Weeds	• Total Phosphorus • Turbidity • Salinity (EC) • pH	• AUSRIVAS • SIGNAL • EPT • Number of families

Figure 2.4: The 2010 Index Stream Condition Sub-indices and Metrics (source: DEPI, 2013c).

Basin) had extremely modified flow regimes (DEPI, 2013c).

All reaches experienced significant summer and winter stress, with all reaches experiencing higher stress in winter. This is attributed to irrigation supply systems operating in the large tributaries upstream of the Mallee catchment, notably the Loddon, Campaspe, Goulburn and Broken Rivers, where flows are harvested in winter and released in summer to meet agricultural demands. Furthermore, a significant proportion of summer irrigation releases are diverted to large channels and irrigation districts before the flow reaches Swan Hill. This accounts for reduced flows at the end of the high flow season and increased flows during low flow periods in summer.

Drought also had a significant impact in the Mallee region. All sites had higher levels of flow stress during the drought compared with flow stress before the drought.

Streamside Zone - Streamside vegetation was assessed at 73 reaches across the region. Of these, only one reach (reach 2 on the Murray River at Burra) was in excellent condition. The majority (59% or 43 reaches) were in good condition and the remainder were either in moderate (34% or 25 reaches) or poor (6% or four reaches) condition.

Sixty-five reaches were assessed in the Mallee Basin, where the condition of streamside vegetation ranged from excellent to poor. Thirty-eight reaches (58%) were in good condition, 22 reaches (34%) were in moderate condition and four reaches (6%) were in poor condition. The low scores were attributed predominantly to narrow, fragmented streamside vegetation, while the moderate and good scores reflected diverse streamside vegetation and the absence of Willows. Six reaches in the Avoca catchment and two reaches in the Wimmera catchment were assessed with scores being either moderate or good.

Physical Form - The physical condition of 73 reaches was assessed with the majority (67% or 49 reaches) in moderate condition. The remainder ranged from poor (eight reaches or 11%) to good (12 reaches or 16%) and excellent (four reaches or 6%).

Of the 73 reaches assessed, 64 were located in the Mallee Basin. Three-quarters (72% or 46 reaches) of the basin's reaches were in moderate condition and only two reaches, reach 1 on the Murray River near Piangil and reach 46 on Powell Creek, were in excellent condition. Six reaches (9%) were classified as poor, the worst being reaches 57 and 69 on Sandy Creek and Lindsay River respectively - both scored poorly for all parameters. Notably, with the exception of reaches 46 (Powell Creek), 47 (Carpul Creek) and 81 (Boy Creek), all of the reaches assessed in the Mallee Basin were affected by downstream fish barriers. Of the six reaches assessed in the Avoca Basin, two were in excellent condition (Tyrrell Creek, reach 24 and Parnee Malloo Creek, reach 26), two were in good condition (Lalbert Creek, reach 22 and Murray River, reach 25) and two in moderate condition (Lalbert Creek, reach 21 and Tyrrell Creek, reach 23).

Overall Condition - To determine their overall condition, each river reach assessed is given an overall ISC score of between 0-50. This score is then categorised into one of five broad condition bands - excellent, good, moderate, poor or very poor - based on change from its reference (i.e. undisturbed or unmodified form) condition. Figure 2.5 shows the ISC condition scores for each reach assessed in the Mallee, Avoca and Wimmera Basins.

Overall, only 4% of stream length in the Mallee Basin was in moderate condition. Most of stream length was in poor condition (64%) or very poor condition (32%). Of the six reaches in the Avoca Basin assessed, four had insufficient data to determine condition, one reach was in moderate condition (Parnee Malloo, reach 26), and the other was in poor condition (Murray River, reach 25). In the Wimmera Basin, one reach (Outlet Creek, reach 91) had insufficient data to determine condition and the other reach was in very poor condition (Yarriambiack Creek, reach 24).

Kings Billabong. Photo: Mallee CMA.

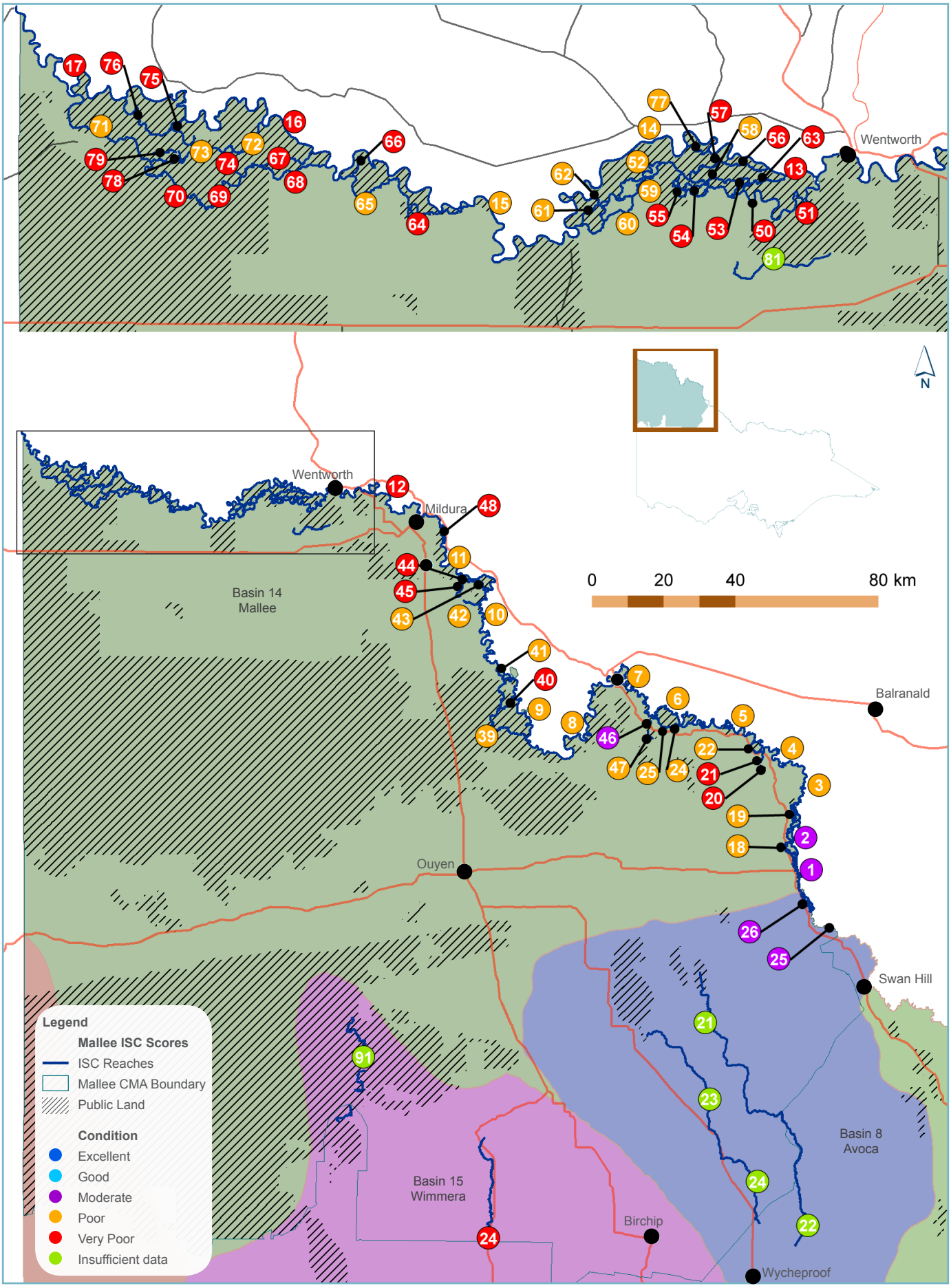


Figure 2.5: Environmental condition of Mallee reaches as measured by 2010 Index of Stream Condition (ISC).

Wetland Condition

The Index of Wetland Condition is a state-wide measure of wetland condition according to six sub-indices: wetland catchment, physical form, hydrology, water properties, soils and biota. These comprise 16 different measures which are combined to characterise each sub index (see Figure 2.6).

Assessments of wetland condition were first conducted between spring 2009 and autumn 2010 following a period of extended drought. Monitoring was conducted on 79 wetlands assessed as having a high conservation value and which were considered to be a priority for management.

Future wetland condition assessments are scheduled to be undertaken at eight-year intervals to provide comparative condition data and a basis for evaluations on the long term impacts of MWS implementation.

Using the benchmark of 'unmodified by human impact associated with European settlement', over half (53%) of the wetlands assessed were in good or excellent condition overall, 42% were in moderate condition, and only 5% were in poor or very poor condition. Figure 2.7 shows the IWC condition scores for each wetland assessed in the Mallee, Avoca and Wimmera Basins.

While the number of high-value wetlands in good condition is somewhat surprising given that the assessment coincided with the end of the 2002-2010 Millennium drought, there was more variation evident in condition for each of the sub-indices, as detailed in Table 2.3.

A full list of wetlands and individual sub-index condition scores is provided in Appendix 2G.

Table 2.3: Condition category distribution of IWC assessed wetlands.

IWC Sub-Index	Condition Category			Total No. Wetlands Assessed
	Very Poor - Poor %	Moderate %	Good - Excellent %	
Wetland Catchment	8	8	84	79
Physical Form	0	4	96	79
Hydrology	89	5	6	79
Water Properties	4	4	92	79
Soils	1	1	98	79
Biota	50	23	27	78
Total IWC	**5**	**42**	**53**	**78**

Wetland monitoring. Photo: Mallee CMA.

Wetland Catchment	Physical Form	Hydrology	Water Properties	Soils	Biota
Measures adjacent land use characteristics and the wetland buffer	Takes into account the area and form of the wetland	Refers to the wetlands frequency, duration and seasonality of inundation	Refers to the nutrient and salinity status of the wetland	Soil physical properties (structure, texture, consistency and profile)	Measures the quality of wetland vegetation
• Land use intensity classes • Buffer width • Buffer perimeter	• Change in area • Change in form (bathymetry)	• Change in water regime	• Activities leading to nutrient enrichment • Evidence of a change in salinity	• Soil disturbance	• Critical life forms • Presence of weeds • Indicators of altered processes • Vegetation structure and health

Figure 2.6: Index of Wetland Condition sub-indices and measures (source: DEPI, 2005).

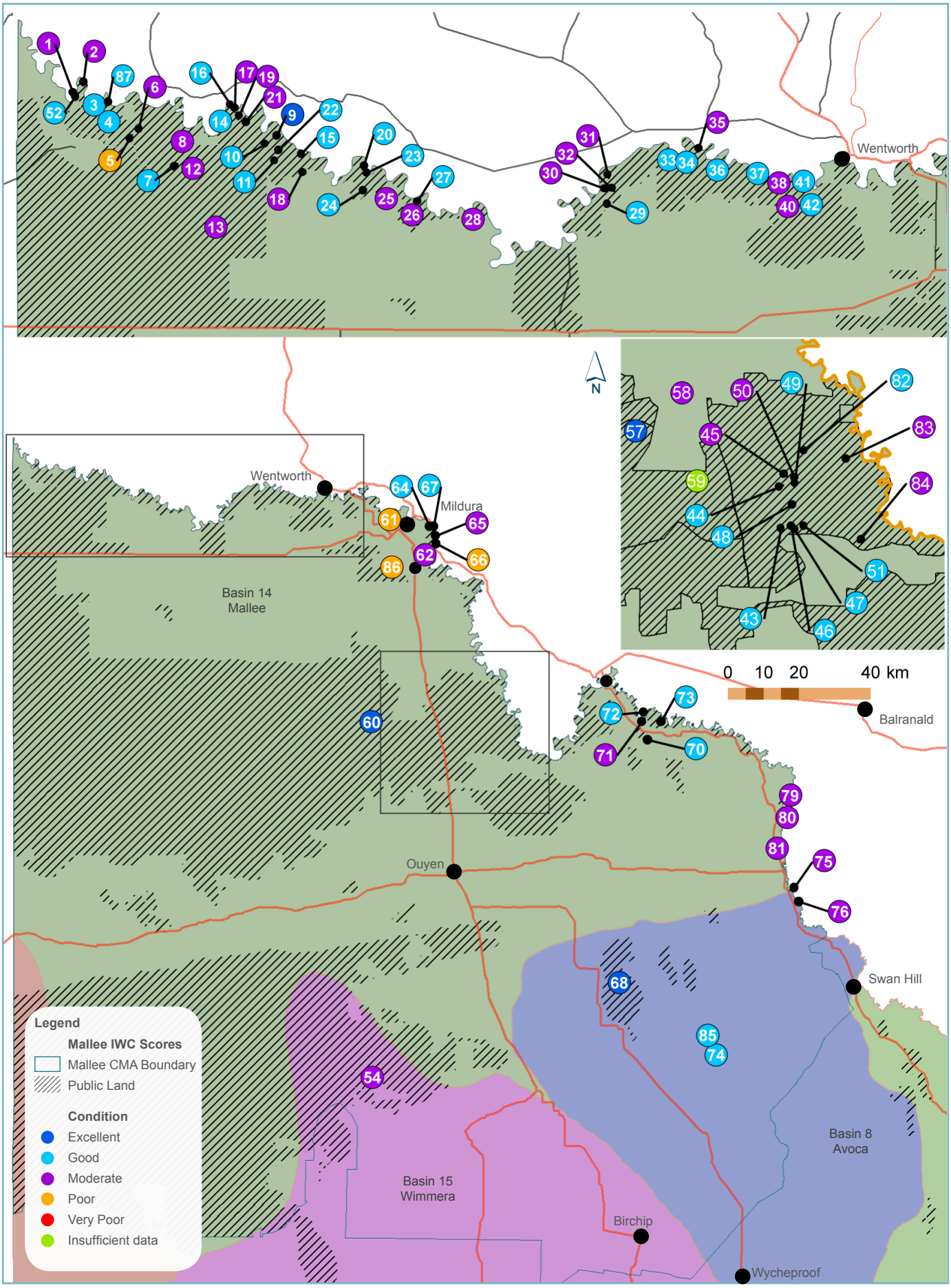


Figure 2.7: Environmental condition of Mallee Wetlands as measured by 2009/10 Index of Wetland Condition (IWC).

Future Challenges

The Mallee faces a number of challenges that may threaten both the effectiveness of our management activities and the long term resilience of our waterway assets. Collectively, these represent key drivers which have the potential to significantly influence the long and medium term outcomes achieved through this MWS.

Climate Variability

The variability of our climate and extreme weather events both present significant risks to waterway management in the Mallee. Recent examples include:

- The 'Millennium Drought' which had severe impacts on the region between 2002 and 2010; and
- The La Nina rains of the 2010-11 summer that followed the drought, causing significant flooding events and widespread damage.

Other weather extremes common to our region include heavy frosts, hail, heat-waves and high winds.

All have the potential to either directly impact on the region's management activities, or impact indirectly by generating events such as fire or flood.

It is important therefore that we have the flexibility to revise and adjust our management priorities when such events occur to incorporate responses that can benefit both our waterways and our communities.

Climate Change

A changing climate has been identified as a critical issue facing the Mallee, with our future climate projected to be hotter and drier than it is today. It is estimated that by 2030 the average annual temperature will be around 1^0C warmer, with the greatest increases expected in summer. The number of hot days (days over 30^0C) are also expected to increase. (DSE, 2008)

Reductions in the total average rainfall of around 4% are expected, with the greatest reductions occurring in spring (7%). Increases in potential evaporation and reductions in relative humidity are expected to contribute to drier conditions (DSE, 2008).

These decreases in rainfall and higher evaporation rates will mean less soil moisture and consequently less water for waterways. Demand for water may also increase as a result of warmer temperatures and urban population growth. Our need to use water more efficiently will therefore be even greater.

Based on calculations for elsewhere in the Murray-Darling Basin, decreases in the amount of water available for irrigation from the lower Murray may decrease by up to 20% by 2030. Lower flows and higher temperatures may also reduce water quality within the catchment and create more favourable conditions for potentially harmful algal blooms.

Changed climate conditions are likely to exacerbate the negative impacts of existing threats such as reduced connectivity, degraded habitats and invasive flora and fauna, and as such have significant negative impacts on the condition of waterways and the environmental, social, cultural and economic values they provide.

Despite the significance of climate change as a risk to Mallee waterways, in the context of the WMS, our capacity to directly influence the nature and potential consequences of that risk is limited.

We do however have the opportunity to plan for these expected changes by identifying and implementing adaptation options that minimise the loss of values.

Improving knowledge to generate greater capacity for the region to respond to pressures arising from climate change would further support such outcomes.

Changing Demographics

Small rural communities in the Mallee continue to experience population decline and increasingly older age profiles. This reflects the continuing trend for young people to leave rural areas and relocate to larger population centres (e.g. Mildura) to access a greater availability of employment, education, and training opportunities.

In some areas, these population changes also coincide with a decline in key industries and the withdrawal of services, both public (e.g. schools and hospitals) and private (e.g. banking and retail), making living in these areas less desirable and further impacting on the wellbeing and sustainability of the remaining community.

The growth of our urban areas at the expense of our rural population presents a great challenge in sourcing the necessary co-investment of time and resources from a diminishing (and ageing) population of rural landholders and community-based groups.

There is a risk that there will be insufficient people on the ground in large parts of our region to help implement the interventions that will maintain or improve our waterway assets and the values that they provide.

Within this context it is essential that the capacity of our communities is recognised and that adequate support mechanisms are established where necessary.

Opportunities for innovative and more efficient delivery mechanisms should also be encouraged.

Key challenges which have the potential to significantly influence the outcomes achieved through this MWS include:

- Climate variability and extreme weather events such as drought and flood;
- Identifying and implementing adaptation options in response to a changing climate; and
- Supporting stakeholders in small rural communities which are experiencing population decline and increasingly older age profiles.

Section 3

Delivery Framework

Applying a Strategic Approach

The Mallee Waterway Strategy (MWS) establishes and applies a high level logic framework to set the region's long term aspirations and strategic directions for waterway management, and guide priorities for action planning.

The region's vision, management objectives and goals are core components of this framework (see Table 3.1), with guiding principles and defined roles and responsibilities for regional stakeholders providing further direction to our management approach[1].

Vision

The MWS has adopted the 50 year visions of the Victorian Waterway Management Strategy (VWMS) and the Mallee Regional Catchment Strategy (RCS) to reflect the region's long term aspirations for our waterways and their management.

This approach will ensure that linkages to these overarching documents are maintained throughout the development, implementation and review phases of the MWS.

[1]Lower level components of the MWS logic framework (i.e. resource condition, outcome and output targets) are detailed under 'Setting Targets' in Section 3.

The MWS is therefore based upon the vision of:

Mallee rivers and wetlands are valued, healthy and well managed; supporting environmental, social, cultural and economic values that are able to be enjoyed by all communities (adapted from VWMS 2013 Vision); and

Informed and active communities balancing the use of resources to generate wealth with the protection and enhancement of our natural and cultural landscapes (2013-19 Mallee RCS Vision).

Management Objectives

Linkages to the Mallee RCS are further strengthened through the application of its 20 year objective for Mallee waterway assets. Specifically:

To protect and enhance the environmental condition of Mallee waterways, their associated riparian ecosystems and in turn, the social, cultural, economic and environmental values they provide to the community (adapted from 2013-19 Mallee RCS objectives for River and Wetland assets).

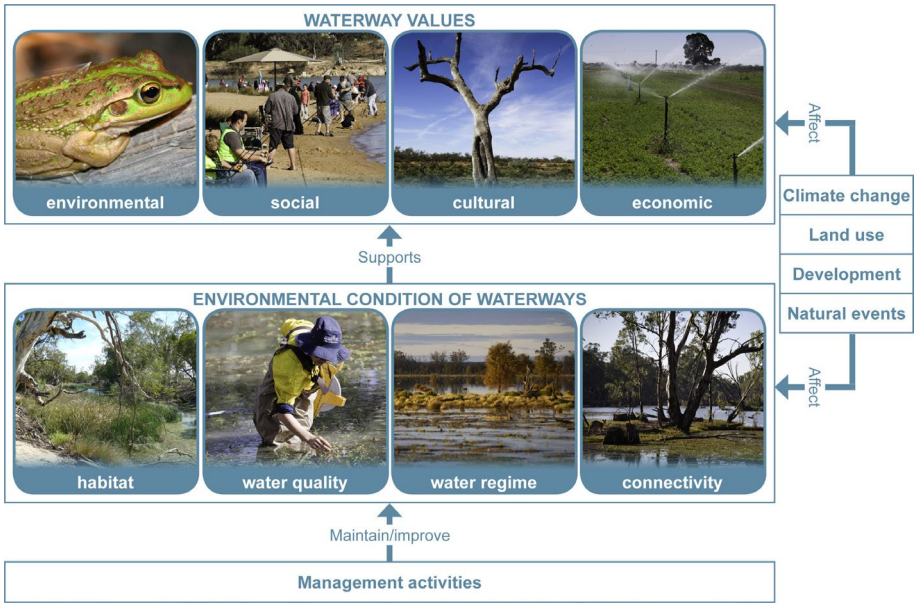


Figure 3.1: The drivers of environmental condition that support the values of Mallee waterways (adapted from 2013 VMWS).

This long term objective for the management of regional waterways is based on the principle that many of the values provided by Mallee waterways rely largely on the environmental condition of those waterways. It also links to the VWMS management objective '*to maintain or improve the environmental condition of waterways to support environmental, social, cultural and economic values*'.

As such, management should be directed at maintaining or improving the key drivers of environmental condition (i.e. habitat, water quality, water regime and connectivity) that support the multiple values of waterways (see Figure 3.1).

It is also recognised that while the primary function of this MWS is to facilitate the management of regional waterways, its delivery will also contribute significantly to the region's Culture and Heritage and Community Capacity assets.

Mallee RCS 20 year objectives for each of these asset classes have been incorporated into the MWS logic framework to reflect these interactions and to support their strategic management for complementary outcomes. Specifically:

To protect the extent and condition of Cultural Heritage (Indigenous and non-Indigenous Sites (2013-19 Mallee RCS objective for Culture and Heritage assets); and

To increase community capacity for, awareness of, and participation in efforts to protect the Mallee's natural, cultural and productive landscapes (2013-19 Mallee RCS objective for Community Capacity assets).

Goals

To support its vision and management objectives, the MWS has established a set of long term (20 year) regional goals which further define strategic directions for waterway management and help guide priorities for action planning.

As detailed above, a key feature of the MWS's approach is that management

efforts be directed at the key drivers of environmental condition to ultimately support the environmental, social, cultural, economic values that waterways provide (see Figure 3.1).

Within this context three regional goals were developed to directly align with the individual factors determining the environmental condition of Mallee waterways (i.e. habitat, water quality, water regime and connectivity).

These goals are:

- To maintain or improve habitat within waterways and on surrounding riparian land;
- To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based); and
- To restore appropriate water regimes and improve connectivity.

A further two goals were developed to direct the region's management efforts where Culture and Heritage and Community Capacity form complementary outcomes of MWS delivery.

These goals are:

- To protect the extent and condition of Cultural Heritage (Indigenous and non-Indigenous) sites associated with waterways; and
- To increase community capacity for, awareness of and participation in waterway management.

Guiding Principles

In addition to the goals detailed above, the following principles have been applied to guide delivery of the MWS[1].

Partnership approach - waterway management will continue to be a partnership between government, industry and the community.

Community involvement - communities will have the opportunity to be involved in waterway management and this participation can help foster increased stewardship.

Traditional Owners - the skills, knowledge and perspectives of Indigenous people will be incorporated into waterway management.

[1] Adapted from Victorian Waterway Management Strategy (2013).

Integrated catchment management - management of waterways will occur within a broader framework of integrated catchment management. Management will recognise the importance of waterways as a connection between catchments, groundwater, and the strong influence of land use and catchment condition on waterway condition.

Appropriate Tools - the full complement of instruments and approaches will be considered to improve waterway condition including: direct government investment in ongoing works; grants 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 effective and efficient long term improvements in waterway condition and the greatest community gain.

Evidence based decision making - best available knowledge will underpin decision making, policy and waterway management programs. However decisions should not be avoided solely due to a lack of scientific certainty.

Adaptive management - policy and programs are part of a broader framework of adaptive management (supported by effective monitoring, reporting, evaluation and research) to ensure continuous improvement.

Regional 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 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; and
- Be flexible in response to seasonal climatic variation and plan for the potential impacts of climate change.

Roles and Responsibilities

Successful delivery of the MWS will require the support of regional stakeholders; that is, all of the groups, organisations, communities and individuals who play a role in managing our waterway assets.

The Mallee waterway management partnership model is complex, reflecting the diversity of landscapes in which it operates. Co-ordination of effort will be based on broad agreement among the region's stakeholders regarding their roles in managing our waterways. This will support the delivery of planned management activities detailed within this MWS across multiple jurisdictions and scales.

An overview of the main roles and responsibilities of key stakeholders in managing Mallee waterways is provided in Appendix 3A.

Table 3.1: Regional components, context and approach of MWS logic framework.

Component	Context	Approach
Vision (50 year)	Long term statement of our aspirations for the region's waterway assets.	State-wide (VWMS) and regional (RCS) visions adopted to support linkages.
Management Objectives (20 year)	Sets long term direction for where we want to be and what we want to achieve.	RCS objectives for the region's River, Wetland, Culture and Heritage, and Community Capacity assets adopted to support linkages.
Goals (20 year)	Defines strategic directions for waterway management and helps guide priorities for action planning.	Aligned with individual determinants of waterway's environmental condition, and with complementary Culture and Heritage and Community Capacity management.

Setting Priorities

Applying a framework for targeting the delivery of management activities detailed in this MWS will ensure that available resources are applied effectively and efficiently.

A key challenge for the region is how to get the best outcomes from the finite resources available for the management of our waterways. One solution is to apply an asset based approach which focuses our efforts on maintaining or improving waterway assets that:

- Have the highest environmental, social, cultural and economic values;
- Are under the greatest threat; and
- Can be managed using interventions which have a high likelihood and feasibility of success within acceptable timeframes.

Application of this asset based approach through the MWS prioritisation framework will facilitate targeted planning and implementation processes to deliver greatest environmental, social, cultural and economic returns on our efforts.

Comprehensive consultation has been undertaken throughout the prioritisation process to ensure that the expectations and knowledge of our regional stakeholders have been captured.

Figure 3.2 provides a summary of the key steps undertaken in applying the MWS prioritisation framework.

Information and Data Collection

The regional priority setting process relies on information about values, threats and risks. It is essential that this information is collected in a consistent way and, where possible is based on data collected through on-ground monitoring activities. The state-wide Aquatic Value Identification and Risk Assessment (AVIRA) database has been utilised by the MWS as the primary data source on which its prioritisation processes are based.

AVIRA contains value and threat information for selected sections of rivers (reaches) and wetland assets. The database sources information from a combination of key data sets (e.g. Index of Stream Condition) and local knowledge.

Considerable regional effort has been made to ensure that the data within AVIRA is both comprehensive, current and accurate. This has included extensive consultation to capture the knowledge of our partners, regional stakeholders and the broader community.

Table 3.2: AVIRA value categories and primary information/data sources.

Value Type	Value Categories	Information/Data Sources
Environmental	• Formally recognised significance • Representativeness • Rare or threatened species/ communities • Naturalness • Landscape features	• Index of Stream and Wetland Condition • Published reports • State/regional databases and associated spatial layers • Local knowledge
Social	• Activity • Place • People	• Published reports • State/regional databases and associated spatial layers • Local knowledge
Cultural	• Heritage (Indigenous and Post-European)	• State/regional databases and associated spatial layers. • Local knowledge
Economic	• Water • Power generation • Other resources	• Published reports • State/regional databases and associated spatial layers • Local knowledge

Table 3.2 provides an overview of the categories applied in AVIRA to determine a waterway's environmental, social, cultural and economic values. A full list of the quantitative measures applied to each of these categories to allow for the calculation of value scores ranging from 5 (very high value) to 1 (very low value) is provided in Appendix 3B.

Threats detailed in AVIRA are grouped into the following categories:

- Altered water regimes;
- Altered physical form;
- Poor water quality;
- Degraded habitats;
- Invasive flora and fauna; and
- Reduced connectivity.

A complete list of the quantitative measures applied to each of these categories to allow for the calculation of threat severity scores ranging from 5 (very high threat) to 1 (very low threat) is provided in Appendix 3C.

AVIRA also incorporates a standardised risk assessment framework that provides an automated assessment of the level of risk to all values present within a waterway. This assessment is based on evidence of associations between values and threats, including a level of confidence in each of those associations.

Using this framework, a suggested category of management response for each value/threat combination (e.g. reduce the threat, protect the value, fill data gaps) is generated.

High Value Waterways

The MWS identifies waterways as being of high value if they have one or more of the following characteristics[1]:

- Formally recognised significance;
- Presence of highly threatened or rare species/communities;
- High naturalness values (e.g. aquatic invertebrate communities, riparian vegetation) or special waterway values (e.g. drought refuge, important bird habitat);

[1]As detailed in Victorian Waterway Management Strategy (2013).

- High social values, cultural or economic values (e.g. recreational fishing, Aboriginal cultural heritage, urban water source).

The value of the region's individual waterways was determined using the measures detailed in Appendix 3B. Of the 282 individual waterway assets assessed, 100% were identified as being of high value. (See Appendix 3D).

Priority Waterways

In order to further refine the number of waterways on which we focus our efforts over the next eight years, only those high value waterways which align with at least one of the region's long term (20 year) environmental goals are considered in the subsequent phases of the prioritisation process. The criteria applied to determine alignment with these goals is detailed in Appendix 3E .

Application of this filter identified 216 (76%) of the region's 282 high value waterways as aligning with regional goals (see Appendix 3E).

Further assessment of these waterways was then undertaken to determine:

- Threats to the individual values of each waterway;
- The level of risk to these values[1]; and
- The technical feasibility of addressing key threats[2].

Based on these assessments, all 216 waterways were found to be a priority for future management on the basis that they had at least one value x threat interaction where: the risk level was assessed as high; the recommended treatment was to 'Reduce Threat Level; and there was a high feasibility of achieving this.

Waterways were then ranked in order of priority and a category of high, medium or low priority was assigned to provide work program planning with a secondary level of classification (see Figure 3.3 and Appendix 3E).

It is important to note that the priority waterways and their associated categories developed through this process relate to a waterway's ranking in regard to future management activities being undertaken to reduce threats to their values. It is not an indication of the importance of each waterway.

[1]Risk assessment scores were generated by the AVIRA database (with 5= very high risk level and 1= very low).

[2]Assessments on the technical feasibility of reducing the impacts of key threats to those values linked with the region's goals were undertaken using local expertise to calculate a feasibility score (where 3= high feasibility and 1= low)

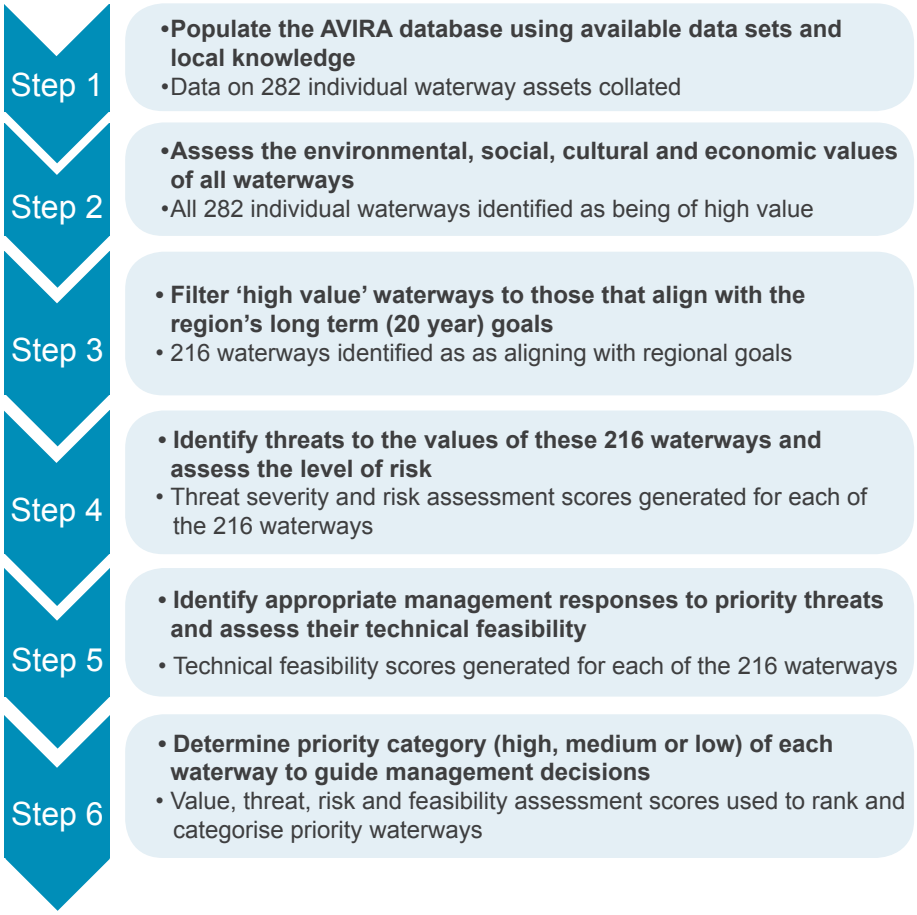


Figure 3.2: Process applied to identify waterways which are a priority for future management.

Lindsay River. Photo: MalleeCMA.

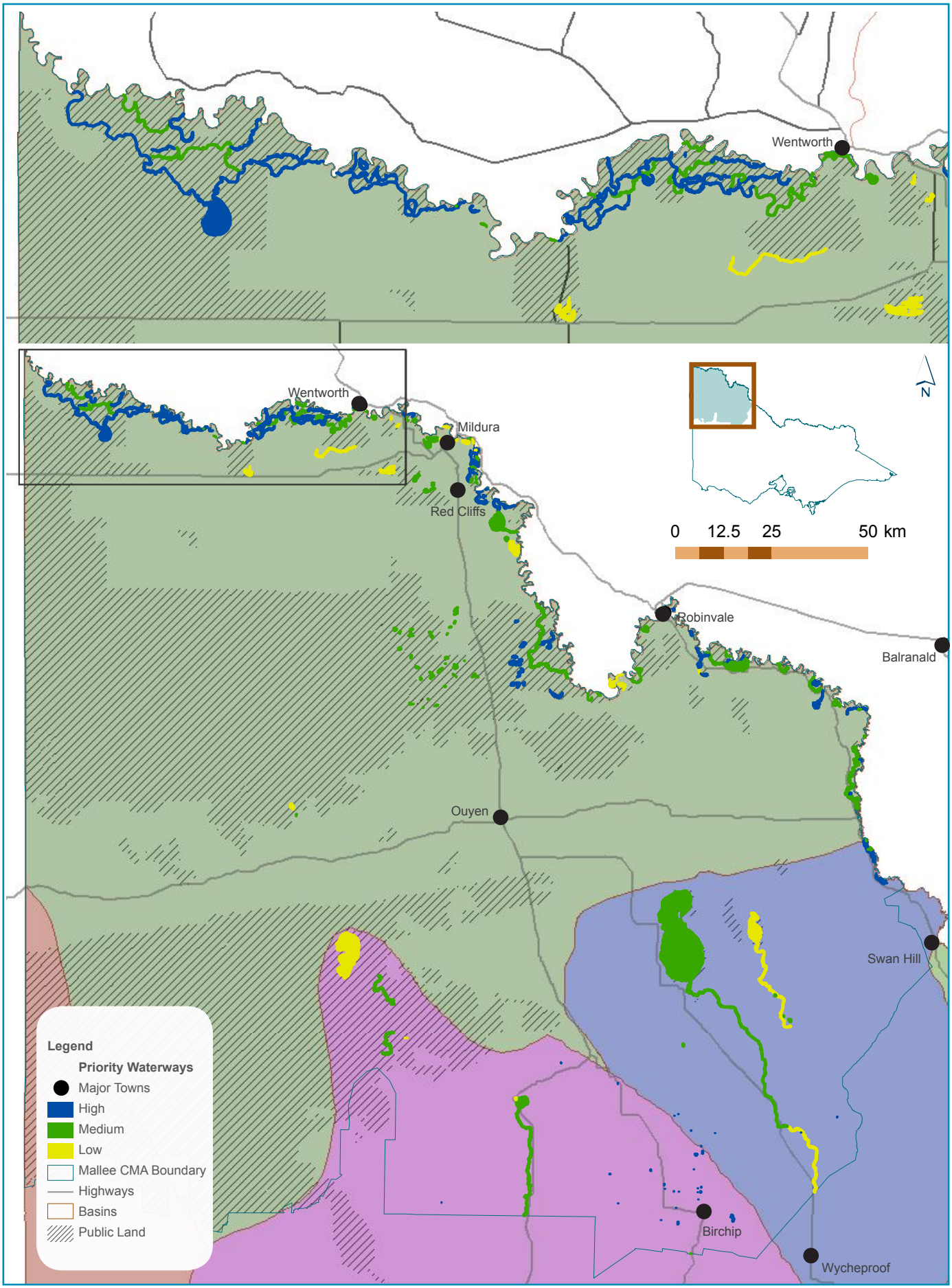


Figure 3.3: Mallee priority waterways.

Scale of Management

Through application of the MWS prioritisation process, 216 waterways have been identified as a priority for future management. Rather than developing stand-alone targets and work plans for each of these individual assets, they have instead been grouped into planning units (termed Waterway Management Units (WMUs)) which recognise their interconnectedness and the commonality of threats impacting on their values.

Under this framework, each of the region's wetlands and reaches has been grouped into 23 WMUs (see Figure 3.4). Of these, 22 are represented by discrete geographic locations and one encompasses the region's dispersed wetlands assets with four sub-classifications according to type (i.e. freshwater, saline natural, saline irrigation drainage, artificial and sewerage).

Development of these WMUs was informed by a combination of spatial analyses, expert workshops and local knowledge.

They also broadly align with the landscapes (Catchment Assets) identified by the 2013-19 Mallee RCS as priorities for management; enhancing linkages to this overarching strategic document.

The integrated planning and implementation framework facilitated by these WMUs will allow for strategic planning outcomes and landscape scale/ whole of system benefits to be achieved, while applying an asset based approach (i.e. targeting effort to highest priority waterways).

Table 3.3 provides an overview of the scale at which different components of the MWS delivery framework are being undertaken.

Table 3.3: Scales applied by the MWS Delivery Framework.

Component	Scale(s)
Setting long term aspirations and strategic directions	Whole of Region
Setting Priorities	Individual Waterways
Setting Targets	Waterway Management Units*
Setting Regional Work Plans	Waterway Management Units

*Targets are also able to be applied at individual waterway and whole of region scales for evaluation purposes

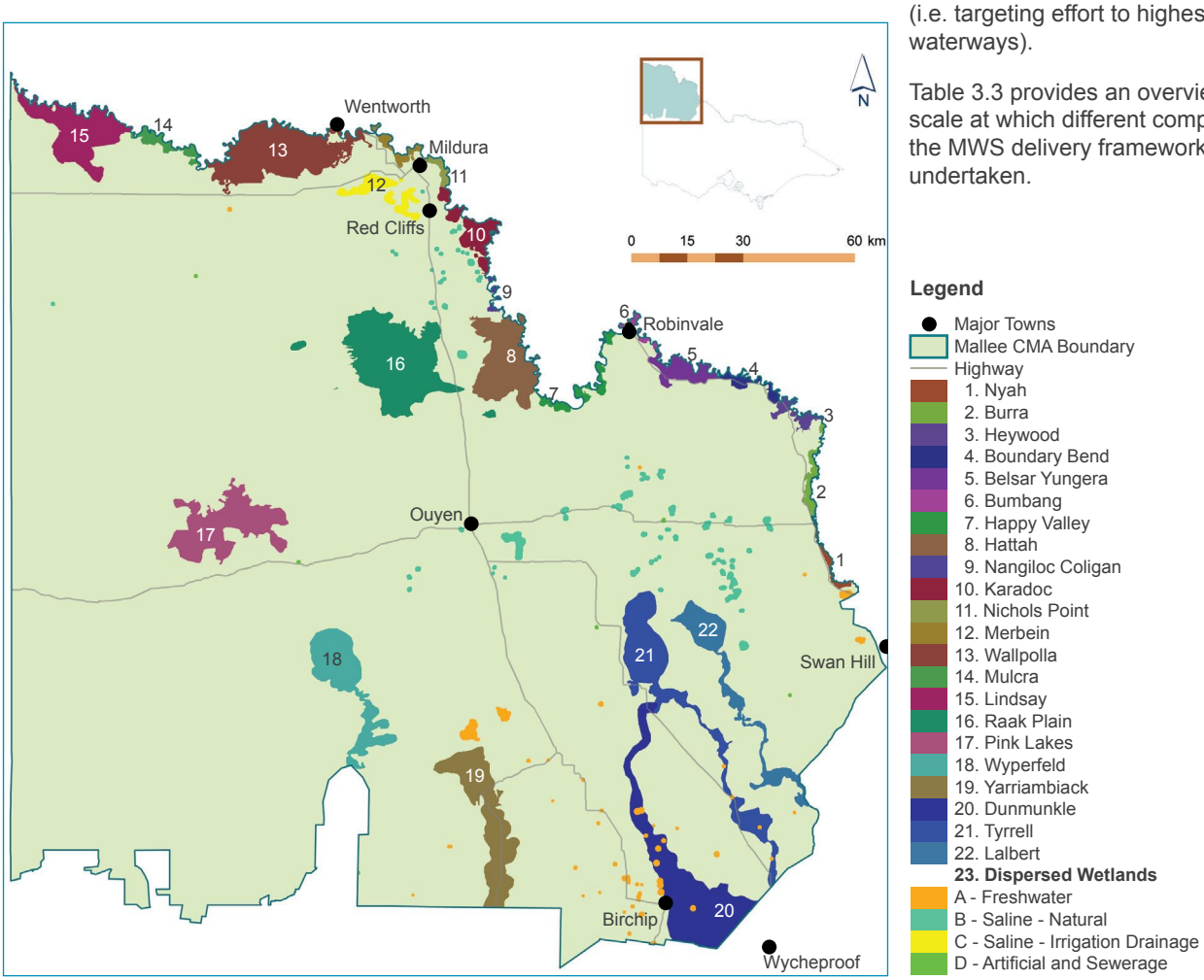


Figure 3.4: Waterway Management Units.

Setting Targets

While the MWS identifies long term (20 year) goals and management objectives for the region's waterways, determining if they have been achieved is outside the scope of this Strategy's delivery timeframe. As such, it is necessary to establish a set of targets which can provide quantitative measures of the region's progress towards these longer term aspirations over the MWS's eight year planning, delivery and review cycle.

These targets have been developed at three levels to align with both State[1] and regional logic frameworks:

- Long term Resource Condition Targets (8+ years);
- Medium term Management Outcome Targets (1 - 8 years); and
- Short term Output Targets (1 - 8 years).

Table 3.4 provides an overview of how each target level is applied by the MWS.

Developing and Measuring Targets

Targets for each level (long, medium and short term) have been set at the Waterway Management Unit (WMU) scale using baseline information/data which was identified as being:

- Available for all of the region's priority waterway assets;
- From a reliable and repeatable source; and
- Able to be amalgamated up from the individual asset scale for WMU and whole of region applications.

This baseline data, from which progress against targets will also be measured

[1]DEPI MER Framework

Table 3.4: Application of long, medium and short term targets.

Level	Definition	Context	Baseline/Change Data Source	Indicators
Long term resource condition targets (8+ years)	Desired impact of planned outputs in the long term; may not be measurable within MWS timeframe.	Change in measures of environmental condition	2010-2022 ISC sub-indices scores	Rivers: • Hydrology • Physical Form • Streamside Zone • Water Quality • Aquatic Life
			2009/10-2022 IWC sub-indices scores	Wetlands: • Wetland Catchment • Hydrology • Water Properties • Soils • Biota • Physical Form
		Change in measures of Cultural Heritage values	2014-22 AAV and DPCD data sets	• Number of sites on registers
		Change in measures of community capacity condition	2014-22 Mallee CMA Community Capacity Monitoring data sets	• Human Capital • Social Capital • Physical Capital • Financial Capital • Natural Capital
Management outcome targets (1 - 8 years)	Desired impact of planned outputs at completion of MWS delivery.	Change in measures of environmental, social and cultural value.	2014-22 AVIRA value ratings	• Rare or threatened species/ communities • Naturalness • Activity • Place • People
		Change in measures of threat severity	2014-22 AVIRA threat ratings	• Altered water regimes • Altered physical form • Poor water quality • Degraded habitat • Invasive flora and fauna • Reduced connectivity
Management output targets (1 - 8 years)	Anticipated quantity of management activity required to achieve management outcomes and resource condition targets.	Measured result of implementing annual work programs	2014-22 MCMA output records (tabular and spatial)	• Units (i.e. ha, km, no.) • Spatial object (i.e. polygon, point, line)

(see Table 3.4), has been collated at appropriate scales (i.e. individual asset, WMU, whole of region) and will be documented within the detailed Monitoring, Evaluation, Reporting and Improvement (MERI) Plan being developed as a supporting document to this MWS.

While it is anticipated that quantitative data from which to determine change from these baselines over the MWS delivery period will be available for all targets; logic models will be applied to describe any output → outcome → condition relationships for which 'real data' is not available.

The individual long, medium and short term targets developed for each WMU are detailed within the Regional Work Plans provided in Section 4. They have also been combined into whole of region targets to further support MWS evaluation processes (see Figure 3.6).

The region's limited knowledge on the quantity of management activity required to achieve desired changes in both threat severity and asset condition/ values means that in many instances the output targets set by the MWS have been estimated according to:

- Conceptual and logic models which describe known and assumed relationships between outputs, outcomes and condition targets (see Figure 3.5)[1]; and
- The levels of activity that could be expected to be implemented over an eight year timeframe within indicative investment levels.

[1] Technical reports applying conceptual models to predict the success of various management interventions on various threats were referenced throughout the RWP development process (e.g. GHD, 2012; Morris and Papas, 2012).

Recreational Fisheries Management Priorities

Through state-wide planning processes associated with regional waterway strategies, the Water and Fisheries Victoria divisions of the Department of Environment and Primary Industries (DEPI) identified that to improve habitat outcomes on the ground, there was mutual benefit in Fisheries Victoria (FV) and recreational fishers working with CMAs to identify and collaborate on habitat related projects that lead to better fishing outcomes.

To progress this outcome in the Mallee, a workshop was convened by Fisheries Victoria and the Mallee CMA with representatives from the region's key recreational fishing groups and relevant agencies.

The ideas and proposals identified at this forum were then reviewed by Fisheries Victoria against project feasibility criteria and captured as fishery management priorities (see Table 3.5).

Where possible these priorities have been incorporated into the MWSs Regional Work Plans as planned management activities (see Section 4).

A summary report from the workshop is provided as Appendix 3F.

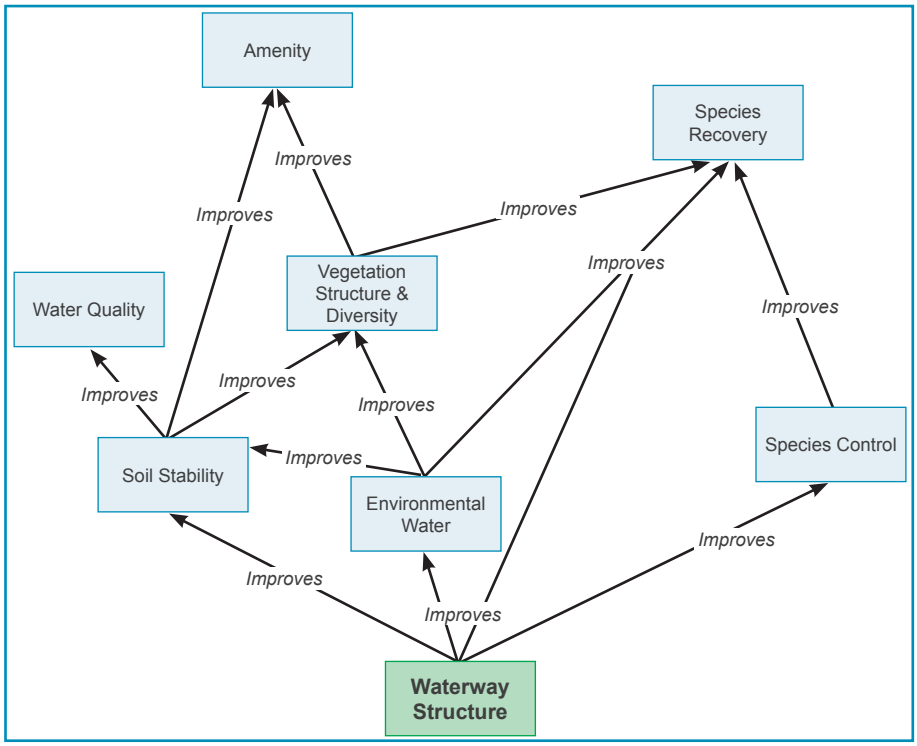


Figure 3.5: Example of a logic model used to guide the identification of appropriate outputs and associated targets (source: DEPI Output Data Standard, 2013).

Table 3.5: Mallee fishery management priorities.

No.	Fishery Management Priorities
1	Develop a pilot database of fisher catch records in the Mallee CMA region as a cost effective and community engaging method for monitoring and reporting of fish populations and fisheries.
2	Work with Mallee CMA to enhance native fish breeding and survival in wetlands adjacent to Margooya Lagoon (Robinvale).
3	Enhance recreational fishing by altering water regimes, improving water quality and increasing in-stream habitat in Lake Lascelles and other waters supported by the Wimmera-Mallee pipeline.
4	Investigate opportunities to enhance native fish populations in the Hattah Lakes system e.g. broodstock translocation, fish stocking, habitat enhancement etc.
5	Investigate populations status of Murray Crayfish in the Mallee CMA region (in consultation with NSW Fisheries).
6	Improve ways to engage representative and local recreational fishers for input in Mallee CMA project planning, implementation and monitoring.
7	Support efforts to incorporate a responsible fishing message in community education programs (e.g. FV education trailer, Waterwatch, Landcare, Culturally and Linguistically Diverse (CALD) products etc.)
8	Investigate the adequacy of current measures to protect spawning fish immediately below barriers and fishways in the Mallee CMA region.

Monitoring, Evaluation, Reporting and Improvement

A critical component of any strategic instrument such as this MWS is the capacity for adaptive management. That is, can it be flexible in the face of new information, unexpected outcomes and the uncertainty that is inherent to natural resource management? A monitoring, evaluation, reporting and improvement (MERI) framework is one way to provide that flexibility.

This framework is a simple mechanism that can be used to incorporate the principles of MERI into the delivery of the MWS. It will provide the capacity to understand and record the successes (or otherwise) and knowledge gained from MWS implementation.

The primary intention of the framework is that it will form the basis for adequately reviewing and reporting on the MWS at key points throughout its implementation period.

A secondary intention is that it aligns with and supports associated MERI processes being delivered under the 2013-19 Mallee Regional Catchment Strategy (RCS) and the 2013 Victorian Waterway Management Strategy (VWMS).

A detailed MERI Plan will be developed as a supporting document to the MWS to allow for the annual review of MERI activities and facilitate continuous improvement and adaptive management processes. An overview of the key components to be incorporated into this Plan is provided below.

Program Logic

Key to any MERI framework is consideration of the anticipated cause and effect relationships between planned actions and expected outcomes. The Program Logic for this MWS visualises the expected hierarchy of outcomes that indicate progress towards our vision, objectives and goals; documenting the region's understanding of how delivery of the MWS will impact on our waterways and their management over time (see Figure 3.6).

The MWS logic is informed by a suite of knowledge, science and experience drawn from a regional evidence base and the application of assumptions to produce a theory of change. Examples of some key assumptions applied in the development of the Program Logic include that:

- The region's strategic management intentions over the life of the MWS are the right mechanisms that have sufficient scope and scale to contribute meaningfully to our 20 year objectives and goals;
- There will be sufficient resources available to the region over the life of the MWS to implement its strategic management intentions with sufficient scope and scale to contribute meaningfully to our 20 year objectives and goals;
- There is sufficient information or access to information over the life of the MWS to evaluate the impact of implementation on resource condition; and
- The relationships between planned actions and expected outcomes are based on a 'typical year'. Adaptation in response to events such as drought, flood or fire may be required over the life of the MWS to account for changed conditions and/or risks.

Waterwatch volunteer monitoring at Sandilong Creek. Photo: Mallee CMA.

Monitoring

Monitoring activities will collect information to inform evaluation and reporting on the implementation of the MWS. This will include monitoring of:

- The level of expenditure against regional priorities;
- The type, area and location of waterway management activities/ outputs implemented in the region;
- The short term impacts of delivery (e.g. threat abatement at point of investment); and
- The long term impacts of delivery (e.g. waterway condition change at the whole of region and WMU scales).

All monitoring will be undertaken in line with the broader Mallee RCS framework and will be consistent with state-wide processes coordinated through the Victorian Waterway Management Program.

Information on foundational influences (e.g. drought, flood, bush fire) and externalities (e.g. land use change, market conditions, community expectations) that impact on implementation of the MWS will also be collected where appropriate.

Evaluation and Reporting

Delivery of the MWS will be evaluated and reported at key intervals: annually; at four years (mid-point of implementation); and eight years (end-point of implementation). Regional stakeholders will participate in these evaluations as part of already established partnership/ engagement mechanisms (e.g. Technical and Community Advisory Committees).

The primary intention of undertaking ***annual reviews*** of the MWS is to:

- Assess progress towards planned management activities and outputs;
- Identify any short term delivery outcomes (e.g. threat reduction at point of investment); and
- Consider any new knowledge/ information that may influence future implementation.

The results of these annual reviews will be reported as part of the Mallee CMA's obligations under the *Catchment and Land Protection Act 1994* (CaLP Act); which requires that CMAs report annually on the condition and management of land and water resources on behalf of the region. Annual project reports developed to meet specific investor requirements (e.g. financial, spatial, tabular data) will provide further detail and context.

These reviews will also support reporting of management outcome targets for the Victorian Waterway Management Strategy in 2016 and 2018.

A ***mid-term review*** of the MWS will be undertaken in year four (2018) to:

- Assess progress towards planned management activities and outputs;
- Identify any short term delivery outcomes (e.g. threat reduction at point of investment);
- Review progress against management outcome targets where possible; and
- Consider any new knowledge/ information that may require the MWS to be updated.

Mid-term review findings will be published by the Mallee CMA as a stand-alone report.

The ***final review*** of the MWS will be undertaken through an independent process on completion of the implementation phase (2022) to:

- Capture all knowledge gained through implementation;
- Assess achievements and progress against MWS targets; and
- Provide a clear evidence base for changing regional programs and management approaches in the future.

A report detailing the outcomes of this final review will be produced by the Mallee CMA and promoted to all stakeholders. Findings will also be incorporated into associated reviews of the Mallee RCS and VWMS where possible.

The review process will be driven by a series of key evaluation questions which provide the background to evaluating the effectiveness, appropriateness, efficiency, impact and legacy of the MWS and its implementation. The questions inform the direction of any information gathering efforts and provide a basis for determining the scope and scale required (see Table 3.6). They also test assumptions applied in the Program Logic, supporting improved rationale and knowledge in future planning cycles.

Table 3.6: Mallee Waterway Strategy Key Evaluation Questions.

Evaluation Purpose	Evaluation Intervals	Evaluation Questions
Effectiveness	annual, mid-point & end-point	To what extent have the planned activities and outputs been achieved? Why or why not?
Appropriateness	annual, mid-point & end-point	Have the management intervention methodologies employed conformed to 'best practice' throughout the delivery phase? If not, why not?
	annual, mid-point & end-point	To what extent has the MWS delivered against investor, stakeholder and community needs and expectations?
Efficiency	mid-point & end-point	Did the strategic management interventions delivered through the MWS produce the expected level of contribution to 8 year targets?
	mid-point & end-point	Are there alternative or additional intervention options available to improve the region's contribution to 8 year targets?
Impact	annual, mid-point & end-point	What impacts are apparent at the regional, Waterway Management Unit and individual waterway asset scale as a result of the management interventions delivered through the MWS?
	mid-point & end-point	What progress towards the 20 year objectives and goals has been identified? What level of progress can be attributed to the MWS?
	mid-point & end-point	What, if any, unanticipated positive or negative outcomes have resulted from MWS implementation?
Legacy	end-point	What is the status of and trend in the condition of Mallee waterways?

Knowledge Gaps and Research

A key outcome of developing Program Logic and Key Evaluation Questions is the identification of areas where critical knowledge gaps exist[1]. It is anticipated that a combination of collating existing information and undertaking new investigations will be required to address these gaps. These activities will be supported by the MWS (and the VWMS) where they:

- Provide essential knowledge to address critical short term and or/ strategic long term knowledge gaps; or
- Target knowledge gaps or low confidence in the relationship between outputs, management outcomes and long term resource condition outcomes.

New research should aim to investigate those relationships where there is little scientific evidence, or the confidence in available evidence is low.

It is also important that efforts to better understand the effectiveness of management activities are targeted to those activities which are likely to receive significant investment (e.g. controlling priority invasive plants and animals).

[1]Knowledge gaps identified through this process and the strategies for addressing them will be detailed within the MWS MERI Plan.

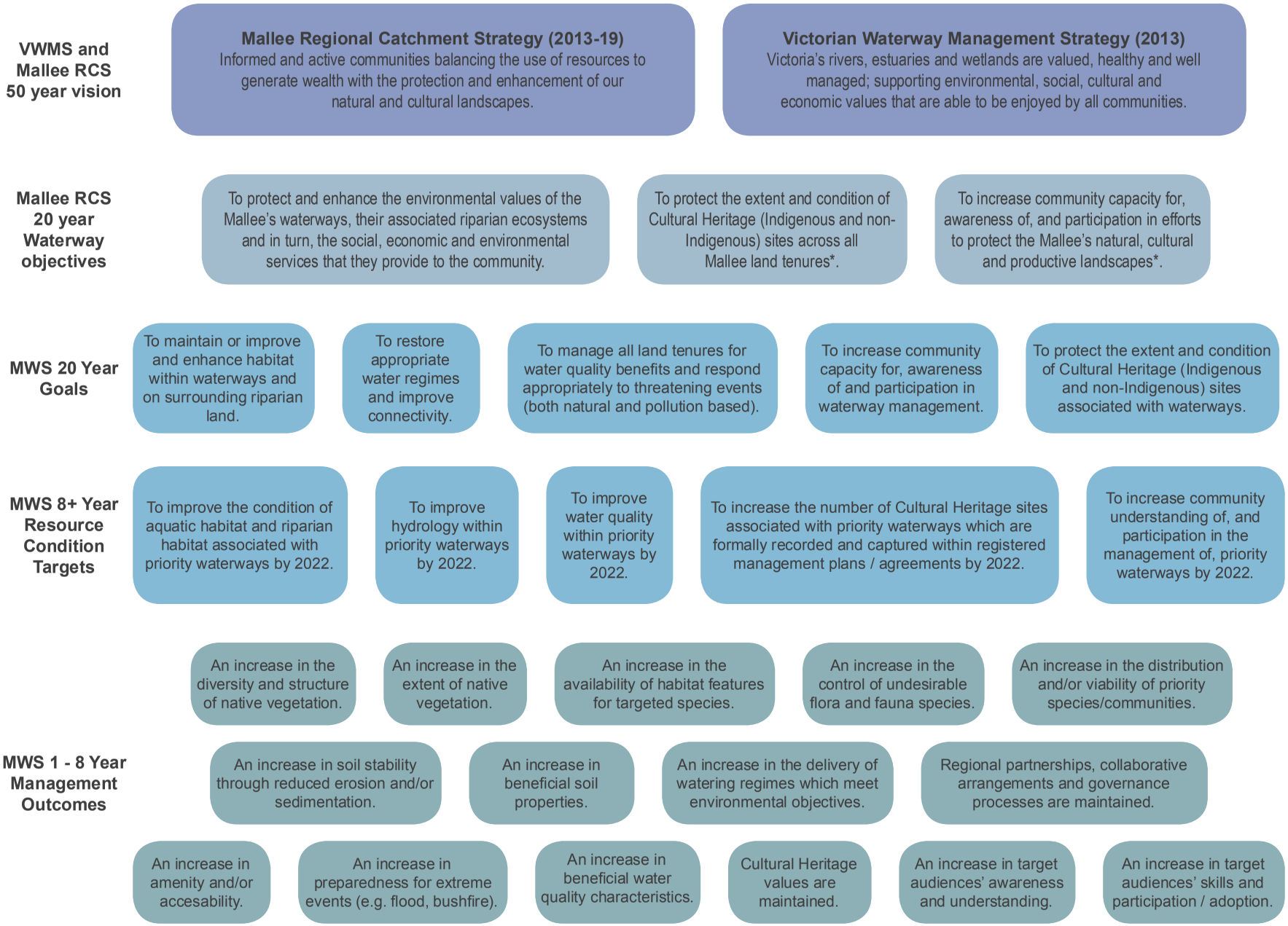


Figure 3.6: Program Logic for the Mallee Waterway Strategy (*denotes secondary linkages to RCS 20 year objectives**).**

Section 4

Implementing the Strategy

Regional Work Program

Regional Work Plans (RWPs) have been developed for priority waterways over an eight year (2014-22) period to underpin the development of annual work programs which will deliver against the MWS's management outcome and resource condition targets.

The specific management activities detailed within these plans have been developed at the Waterway Management Unit (WMU) scale to address key threats to the environmental, social, cultural and economic values present in the priority waterways occurring within these landscapes.

Delivery Partnerships

It is anticipated that the RWPs will be implemented through the combined efforts of government, community, industry and individuals.

To facilitate this partnership approach, already developed regionally and locally based plans were reviewed to ensure that existing commitments and priorities for priority waterways are captured within planned management activities.

Comprehensive engagement processes were also undertaken throughout the RWPs development phase to ensure that the expectations and priorities of our regional stakeholders have been considered.

Implementation Principles

Identification of the specific management activities and associated output targets detailed in the RWPs was undertaken using a combination of local knowledge and conceptual/logic models (see 'Setting Targets' in Section 3); to align with the following principles.

Implementing management activities on priority waterways - works will target high and medium priority waterways in the first instance; with works on low priority waterways subject to funding and, in some cases, further feasibility assessments.

Implementing management activities on non-priority waterways - while it is anticipated that the majority of the region's management activities will be conducted on priority waterways, it is also recognised that under some circumstances works will be required on other (non-priority) waterways. Specifically when those works:

- Address threats to priority waterways;
- Provide important connectivity between priority waterways;
- Address a serious risk to public infrastructure from waterway processes or an opportunity to reduce risks associated with extreme events;
- Maintain or strengthen community commitment to improving the condition of local waterways; or
- Are required to meet statutory or regulatory obligations.

Maintaining previous investment - is essential to ensure the ongoing effectiveness of significant work programs which have already been delivered throughout the region. Management activities to maintain outcomes being delivered by previous pest plant and animal control, fencing, revegetation, waterway structures etc. should be considered where required works are beyond the land manager's duty of care or legal obligations.

Applying a broad range of tools and approaches - management activities should include a combination of on-ground works, community engagement and awareness opportunities, and planning and investigations. The final mix of management activities applied should reflect the issue(s) being addressed, the region's level of understanding of that issue, the availability of effective interventions, and the urgency in which these interventions are required.

Invasive species management - is to be undertaken in-line with the state-wide 'biosecurity' approach. That is, priority will be given to activities preventing the introduction or eradication of newly establishing species over containment programs which reduce the impact of established species on assets. An asset based approach (i.e. protecting priority waterway values) will be adopted once species have become so widespread that prevention, eradication or containment options are no longer feasible.

Implementing a seasonally adaptive approach - while this eight year work program provides a level of certainty regarding priorities for waterway management in the region, annual implementation will be flexible so the most appropriate activities for the prevailing climatic conditions are undertaken. This may involve undertaking specific activities in some years but not others, or using a different approach to achieve the same outcome.

Feral pigs at Hattah Lakes. Photo: Mallee CMA.

Responding to extreme events - while the management activities detailed in the RWPs have been developed based on a 'typical year', should extreme shock to the system such as drought, flood or bush fire occur, adaptation may be required to reprioritise the delivery of specific actions in light of changed conditions and/or risks.

Supporting the adaptive capacity of waterways - the possible impacts of climate change should be considered in the planning phase to maximise the potential for management activities to contribute to the long term resilience and adaptive capacity of our waterways.

Determining the quantity of management activities to be undertaken - should consider what can be expected to be implemented over an eight year timeframe within indicative investment levels.

Implementing management actions is subject to available funding - Investment will need to be sought by stakeholders to support the delivery of planned outputs.

Regional Work Plans

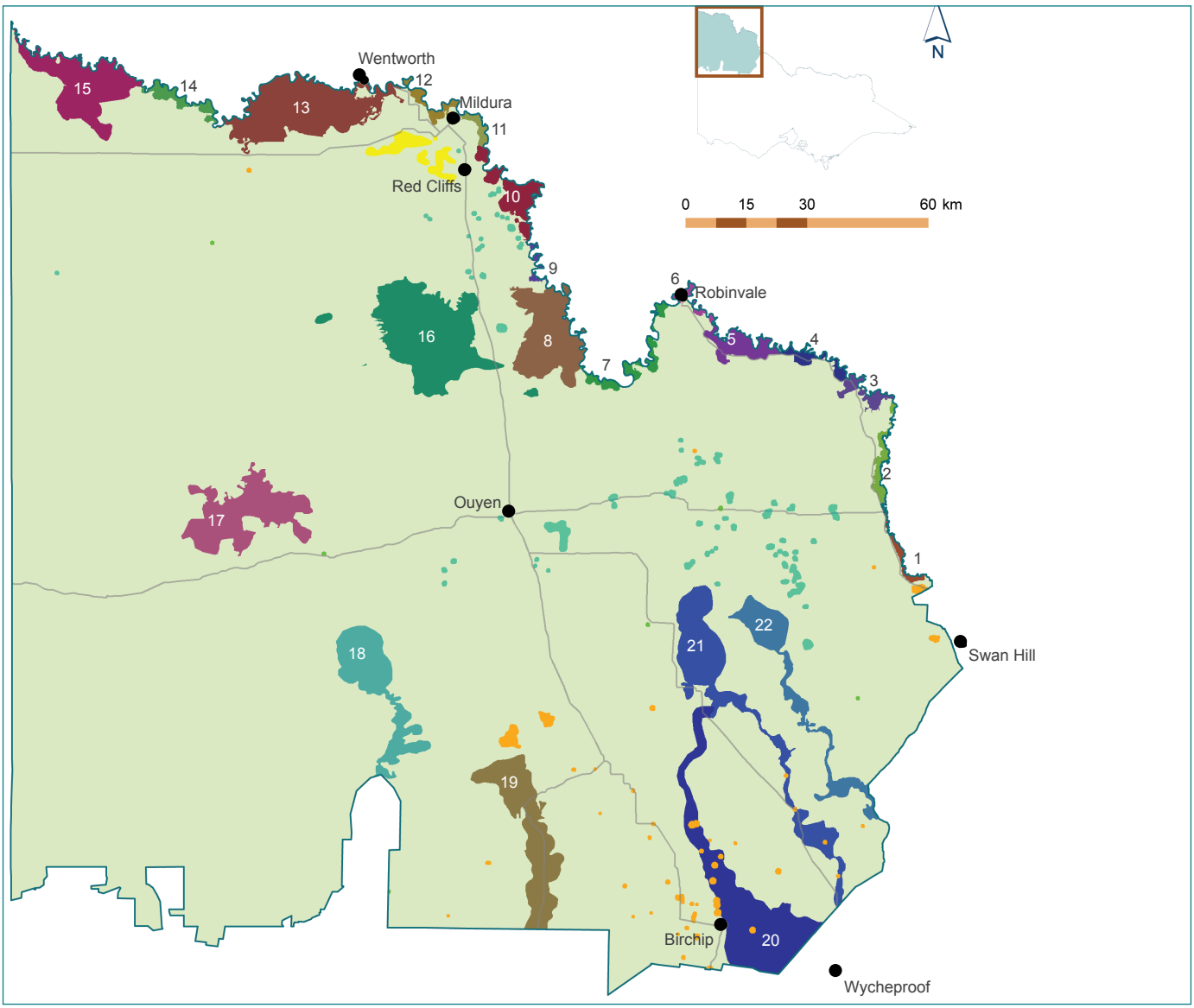
Individual work plans were developed for all of the region's WMUs, with the exception of 23B (dispersed natural saline wetlands), as no waterway assets were identified as a priority for future management within this unit (see Figure 4.1).

Explanations of the RWPs' key components are provided in Table 4.1.

The estimated cost of delivering individual work plans over the eight year (2014-2022) time frame is provided in Appendix 4A.

Table 4.1: Explanatory notes for Regional Work Plans.

Term	Description
General	Terminology used to describe the management outcomes, activities and outputs detailed within the RWPs has been adopted from the DEPI Output Data Standard (2013) to support the use of consistent information across planning, implementation and reporting processes.
RCS Catchment Asset	References the Catchment Asset the RWP is being delivered in.
Waterway Management Unit	References the WMU that the RWP is aligned to.
Waterway Management Unit Map	Identifies all high, medium and low priority wetlands and reaches occurring within the WMU. With individual sections of Murray River further defined according to reach number, for example (Murray River 14-7).
Waterway Condition	ISC (2010) and IWC (2009/10) data as an average across all assessed wetland and river reaches within the WMU to provide an overall statement of baseline condition (see Section 2 for further detail on ISC and IWC).
Values	Lists all value measures assessed as 'high' and therefore a priority for management (see Section 3 for further detail on assessment process).
Threats	Lists all threats where the feasibility of reducing them has been assessed as being medium-high and therefore a priority for management (see Section 3 for further detail on assessment process).
Long term Resource Condition Targets (RCT)	Lists each long term (8+ years) Resource Condition Target that implementation of the specific RWP is anticipated to contribute to (see Section 4 for further detail on RCTs). Each RCT has been listed A-F.
RCT Link	Identifies links to each Resource Condition Target associated with a specific Management Outcome, where: • Linkages demonstrated with letters A-F (i.e. a RCT link of 'A' demonstrates that delivery of that specific Management Outcome and associated Management Activities /Outputs will contribute to achieving an improvement in the condition of riparian habitat associated with high and medium priority waterways); • Bold letters indicate primary linkages and non-bold letters indicate secondary linkages; and • Numerals are added to the letters (e.g. A1, A2) where more than one Management Outcome has a primary link to the same Resource Condition Target.
Management Outcome Target	Lists each medium term Management Outcome Target that specific Management Activities have been identified as contributing to, where: • Only the primary linkage is identified even though it is understood that many Management Activities will deliver against multiple Management Outcomes.
Management Activity	Lists all Management Activities planned for the 8 year timeframe.
Management Output	Lists all short term Output targets for the 8 year timeframe. Where standardised calculations have been applied to determine the area over which an output will be delivered, they are identified by: • [1] = Area over which invasive terrestrial animals are to be controlled is calculated as the total area of terrestrial land in the WMU; • [2] = Area over which invasive terrestrial plants are to be controlled is calculated as the total area of buffer zones around high and medium priority waterways; • [3] = Area over which infrastructure and/or visitor facilities/accessibility are to be maintained is calculated as the total area of buffer zones around each high and medium priority waterway; • [4] = Area over which invasive aquatic animals and plants are to be controlled is calculated as the total area of each high and medium priority waterway; and • [5] = Area over which Cultural Heritage assessments are to be undertaken is calculated as the total area of terrestrial land in the WMU.
Regional Delivery Partners	Identifies the key stakeholders to be engaged in the implementation of each Management Activity. (See page 106 for associated acronyms).



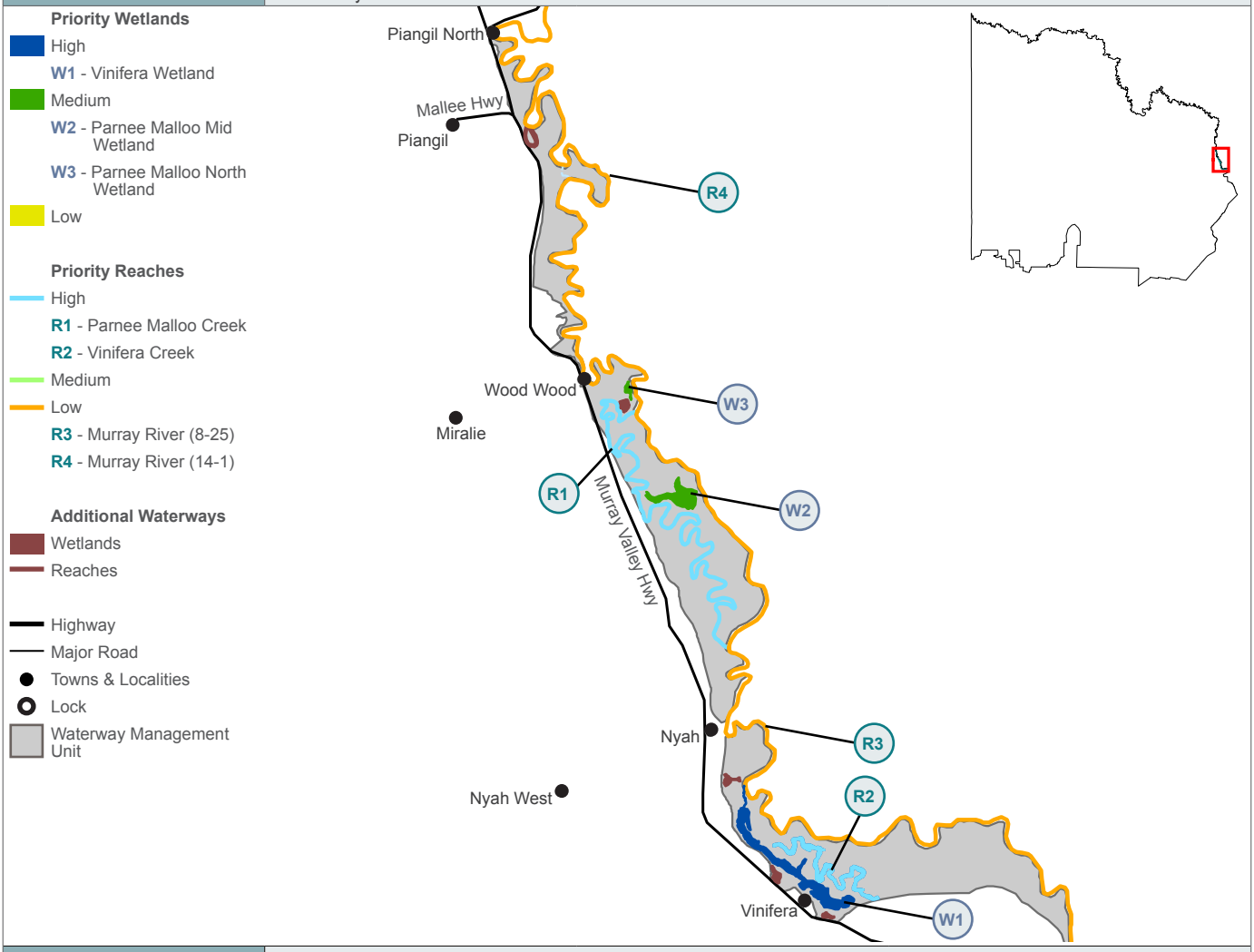
Waterway Management Unit			Priority Waterways				All Mapped Waterways
			Reaches		Wetlands		
No.	Name	Area (ha)	No.	Area (ha)	No.	Area (ha)	Area (ha)
	1. Nyah	2,195	4	268	3	90	410
	2. Burra	4,158	4	339	3	20	393
	3. Heywood	3,930	3	200	4	279	497
	4. Boundary Bend	3,721	3	235	3*	84	387
	5. Belsar Yungera	8,286	8*	378	4	203	703
	6. Bumbang	1,777	3	192	1	34	320
	7. Happy Valley	6,046	1	242	5*	355	806
	8. Hattah	29,210	4	479	13	1,026	2,014
	9. Nangiloc Coligan	1,214	1	283	0	-	295
	10. Karadoc	10,721	3	94	11	2,321	2,767
	11. Nichols Point	2,141	4	190	7	353	554
	12. Merbein	7,550	2	185	11	693	1,057
	13. Wallpolla	38,078	19	861	10	224	2,196
	14. Mulcra	4,735	6*	362	6	109	541
	15. Lindsay	28,021	14	751	2	904	2,495
	16. Raak Plain	53,389	0	-	1*	729	3,739
	17. Pink Lakes	32,971	0	-	2	110	555
	18. Wyperfeld	27,427	1	131	2	4,573	5,473
	19. Yarriambiack	32,071	1	170	3	737	1,056
	20. Dunmunckle	51,340	0	-	1	30	689
	21. Tyrrell	39,795	2	361	1	17,414	19,560
	22. Lalbert	22,260	1	153	4	1,722	5,978
	23. Dispersed Wetlands						
	A - Freshwater	#	-	-	29	116	638
	B - Saline - Natural+	#	-	-	0	-	2,080
	C - Saline - Irrigation Drainage	#	-	-	4*	550	985
	D - Artificial and Sewerage	#	-	-	2	34	59

Cannot determine area of WMU with dispersed assets.
*Includes creek complexes or wetland complexes.
+ A RWP has not been developed for this WMU grouping as it does not contain any waterway assets identified by the MWS as a priority for future management.

Figure 4.1: Mallee Waterway Management Units and their key attributes.

1. Nyah

RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #1 - Nyah			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	100	-
Wetland (IWC 2010)	-	100	-
Values	Significant Birds, Significant EVCs, Drainage, Significant Reptiles (Riparian), Flagship Species, Rural Water Source for Production, Community Groups, Camping		
Threats	Changed Water Regime, Degraded Water Quality, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Altered Wetland Form, Reduced Wetland Area, Soil Disturbance, Barriers to Fish Migration, Loss of Instream Habitat (Large Wood), Increase in Low Flow magnitude, Reduced Floodplain Connectivity, Altered Stream Flow Seasonality		



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are formally recorded and captured within registered management plans/agreements by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Establish management agreement for on-going management at Murphy's Island	1 management agreement established	Mallee CMA, PV, Landholder
		A1.2	Establish management agreement as first step to reinstating flows in south Vinifera Creek (private land)	1 management agreement established	Mallee CMA, Landholder
		A1.3	Maintain priority fences/bollards and roads/trails established under previous investment	400 ha over which infrastructure maintained[3]	Mallee CMA, PV, Landholders
A2 **B1** D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	2,109 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Review and where required, modify grazing management agreements within the WMU	3 management agreements reviewed 50 ha grazing regime modified	Mallee CMA, PV, DEPI, licensees
		A2.3	Control priority invasive terrestrial plants, as determined annually	400 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders, Local Comm.
		B1.1	Control priority invasive aquatic plants as required	64 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
A3 **B2** E F	An increase in the availability of habitat features for targeted species	A3.1	Build and install bird nest habitat (Regent Parrots) in partnership with local community groups	10 terrestrial habitats established	Mallee CMA, PV, DEPI, FotE, Local Comm.
		B2.1	Remove fish barrier (drop boards) at Old Stop Bank, north Parnee Malloo Creek	1 waterway structure removed	Mallee CMA, PV
B3 F	An increase in the distribution and/or viability of priority species/communities	B3.1	Use fresh waterways as potential refuges from Murray River black water events, physically moving Murray Crayfish if required as they exit Murray River channel; dependent upon completion of C1.1 and C1.2	1 emergency response to extreme event established	Mallee CMA, PV, DEPI, Landcare, FotE
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Install proposed water management works	8 waterway structures established	Mallee CMA, PV, GMW
		C1.2	Deliver water as per Nyah Vinifera EWMP	7 water regimes changed	Mallee CMA, PV, GMW, VEWH, CEWH
		C1.3	Work with Murray River Operators to implement more subtle changes in Murray River height to manage bank erosion	1 water regime changed	Mallee CMA, MDBA, GMW
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites.	2,109 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Work with indigenous community to manage Cultural Heritage sites, especially previously fenced mounds	1 km fence maintained/ modified 1 assessment established	Mallee CMA, PV, AAV, Indig. Comm.
F1	An increase in target audiences' awareness and understanding	F1.1	Review Nyah Vinifera EWMP	1 plan reviewed	Mallee CMA
		F1.2	Investigate options to reinstate flow in south Vinifera Creek (private property) after completion of A1.2 and A1.3	1 assessment established	Mallee CMA
		F1.3	Investigate opportunities to enhance habitat for community priority species	1 assessment established	Mallee CMA, Local Comm.
		F1.4	Investigate re-use of drainage water in Nyah and Vinifera	1 assessment established	Mallee CMA, SHRCC
F2	An increase in target audiences' skills and participation	F2.1	Plan and implement community projects that complement on-ground works and increase collaboration	16 engagement events coordinated	Mallee CMA, PV, Landcare, Local Comm.

F3 D E	An increase in amenity	F3.1	Remove unused pump along Parnee Malloo Creek	1 pump removed	Mallee CMA, PV, Pump owners
		F3.2	Maintain visitor facilities established under previous investment	400 ha over which visitor facilities maintained[3]	PV

2. Burra

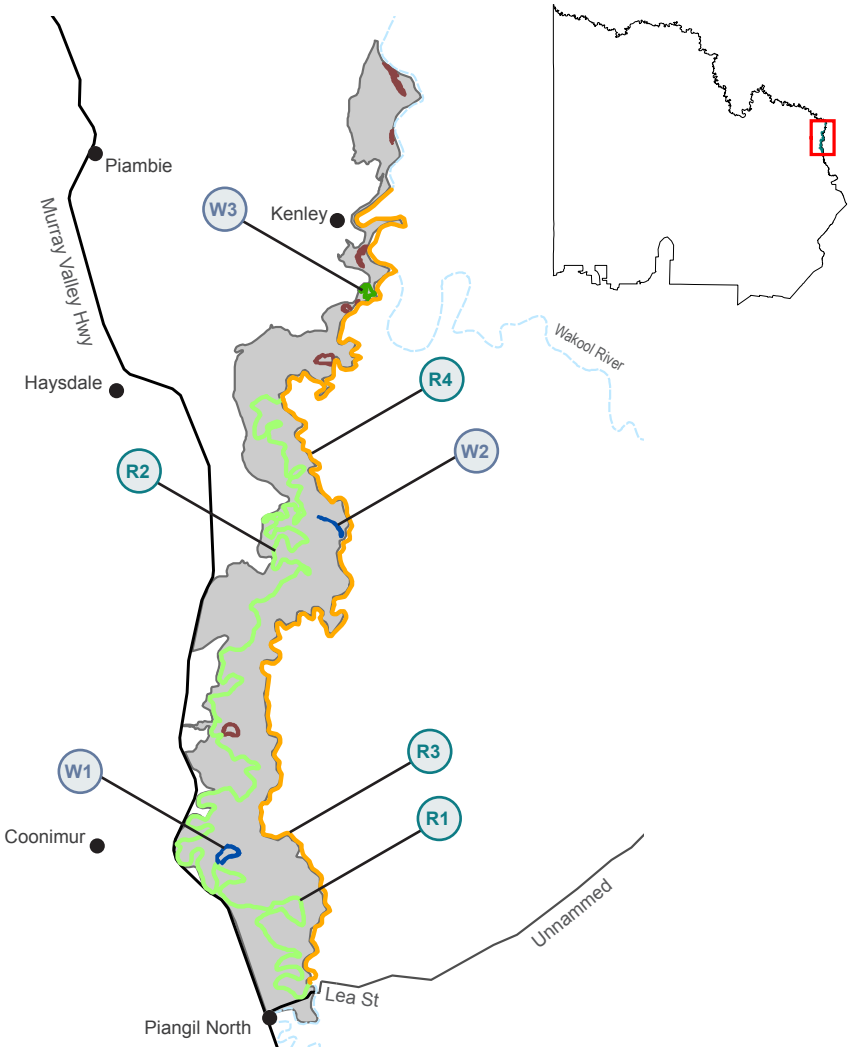
RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #2 - Burra			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	57	43
Wetland (IWC 2010)	-	100	-
Values	Significant EVCs, Landscape, Flagship Species, Drought Refuge, Significant Flora (Terrestrial), Riparian Vegetation Condition, Significant Birds (Riparian), Significant Birds (Waterway)		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Degraded Buffer, Livestock Access, Reduced Vegetation Width, Increase in Low Flow magnitude, Loss of Instream Habitat (Large Wood, Altered Stream Flow Seasonality		

Priority Wetlands
- High
  - W1 - Burra South Wetland
  - W2 - Burra North Wetland
- Medium
  - W3 - Major Mitchell Lagoon
- Low

Priority Reaches
- High
- Medium
  - R1 - Burra Creek South
  - R2 - Burra Creek North
- Low
  - R3 - Murray River (14-2)
  - R4 - Murray River (14-3)

Additional Waterways
- Wetlands
- Reaches

- Highway
- Major Road
- Towns & Localities
- Locks
- Waterway Management Unit



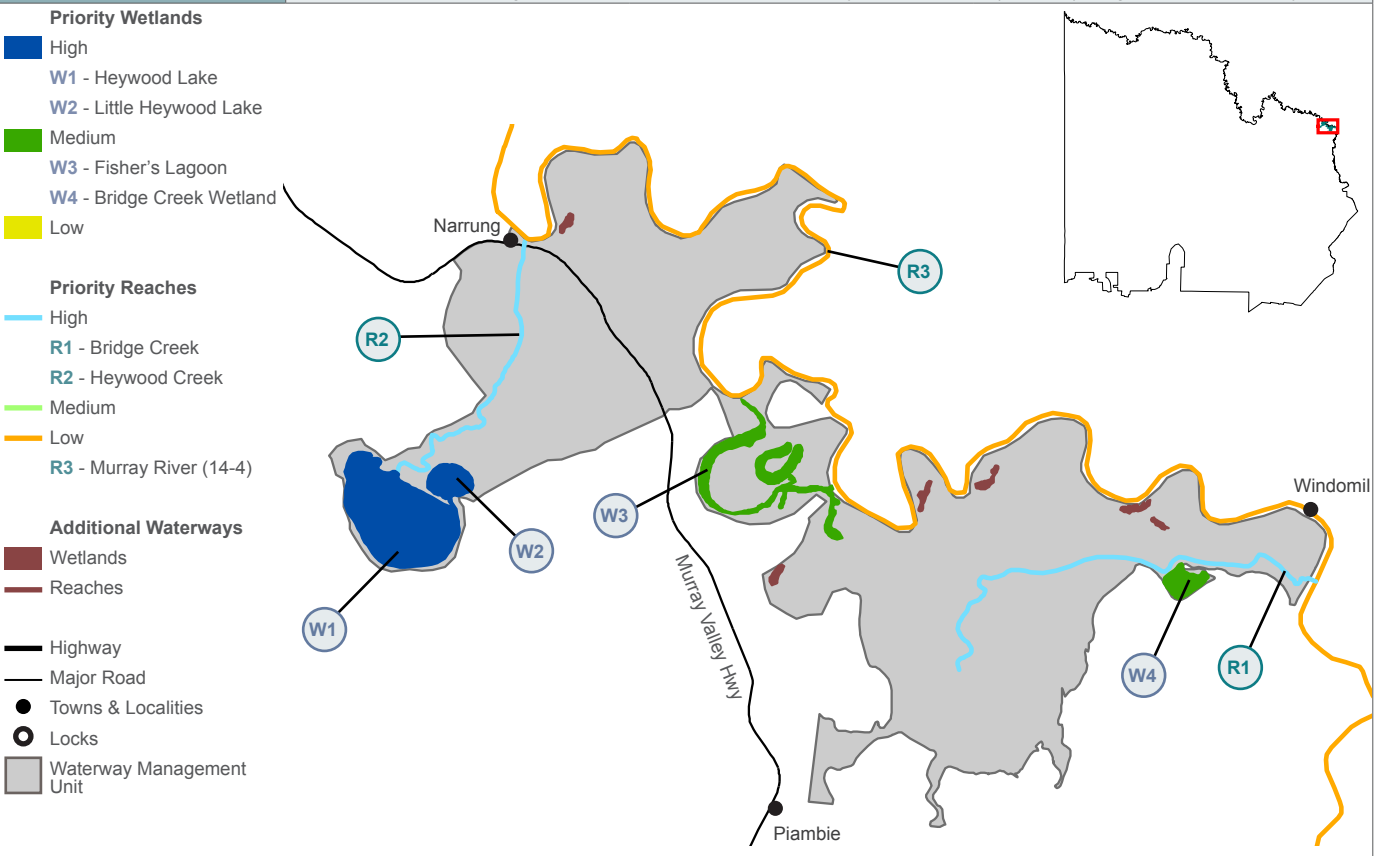
Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are formally recorded and captured within registered management plans/agreements by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and/or other infrastructure established under previous investment	868 ha over which infrastructure maintained[3]	Mallee CMA, PV, Landholders
A2 **B1** D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	3,596 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	868 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		A2.3	Review and modify as appropriate landholder riparian management agreements	3 management agreements modified 50 ha grazing regimes changed	Mallee CMA, PV, Landholders
		B1.1	Control priority invasive aquatic plants as required	185 ha over which invasive plants controlled[4]	Mallee CMA, PV
B2	An increase in the availability of habitat features for priority species	B2.1	Reposition three dead trees to provide instream habitat within Burra Creek	3 waterway structures installed	Mallee CMA, VRFish, DEPI, PV
B3 F	An increase in the distribution and/or viability of priority species / communities	B3.1	Use freshwater waterways as potential refuges from Murray River black water events, physically moving Murray Crayfish and Yabbies if required as they exit Murray River channel; dependent upon outcomes of F1.5	1 emergency response to extreme event established	Mallee CMA, PV, Landcare, VRFish, DEPI
C1 A B D E F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Replace bridges with regulators (maintaining vehicle access) along Burra Creek	5 bridges removed 5 waterway structures installed	Mallee CMA, PV, Landholders
		C1.2	Install regulator and raise vehicle tracks at north-end of Burra Creek	1 waterway structure installed 1 km earth works modified	Mallee CMA, PV
		C1.3	Modify impediments to flow due to Mannagarzo Channel at Burra Creek	2 waterway structures modified	Mallee CMA, PV, Landholders
		C1.4	Deliver water to Macredie Island and Major Mitchell's Lagoon	5 water regimes changed	Mallee CMA, PV, Landholders, VEWH, CEWH
		C1.5	Establish landholder management agreements for the delivery of water to private land	4 management agreements established	Mallee CMA, Landholders
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites.	3,596 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record oral history of Indigenous and non-Indigenous Cultural Heritage, combined with project at Heywood WMU	1 publication established 5 engagement events coordinated	Mallee CMA, PV, Indig. Comm., Local Comm.

F1	An increase in target audiences' awareness and understanding	F1.1	Establish an EWMP for the Burra WMU	1 plan established	Mallee CMA, PV, Local Comm.
		F1.2	Install a flow guage and height gauging boards along Burra Creek	4 monitoring structures installed	Mallee CMA, DEPI
		F1.3	Investigate options to improve water regime at Major Mitchell's Lagoon	1 assessment established	Mallee CMA, PV
		F1.4	Investigate biodiversity and recreational fishing opportunities	1 assessment established	Mallee CMA, VRFish, ARI, Local Comm., DEPI
		F1.5	Investigate flowing habitat options required to provide Murray Crayfish refuges	1 assessment established	Mallee CMA
		F1.6	Coordinate environmental water community engagement events	8 events coordinated	Mallee CMA, Local Comm.
F2	An increase in target audiences' skills and participation	F2.1	Engage community volunteers to undertake water quality monitoring at 4 new sites	4 assessments established	Mallee CMA, Local Comm.
F3	Regional partnerships and collaborative arrangements are maintained	F3.1	Establish partnership with Murray Land Services (NSW)	1 partnership established	Mallee CMA, MLS
F4 D E	An increase in amenity and/or accessibility	F4.1	Maintain visitor facilities established under previous investment	868 ha over which visitor facilities maintained[3]	PV
		F4.2	Remove, maintain, upgrade or relocate Murray River pump sites as per recommendations of previous assessments	65 pumps modified	Mallee CMA, PV, Pump owners

3. Heywood

RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #3 - Heywood			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	Insufficient Data		
Values	Significant EVCs, Significant Flora, Significant Amphibians, Use of Flagship Species, Significant Riparian Birds, Significant Waterway Birds, Camping, Significant Riparian Reptiles		
Threats	Changed water regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Reduced Wetland Area, Altered Wetland Form, Soil Disturbance, Barriers to Fish Migration, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood), Increase in Low Flow Magnitude, Reduced Riparian Connectivity, Invasive Flora (Wetland), Degraded Water Quality		



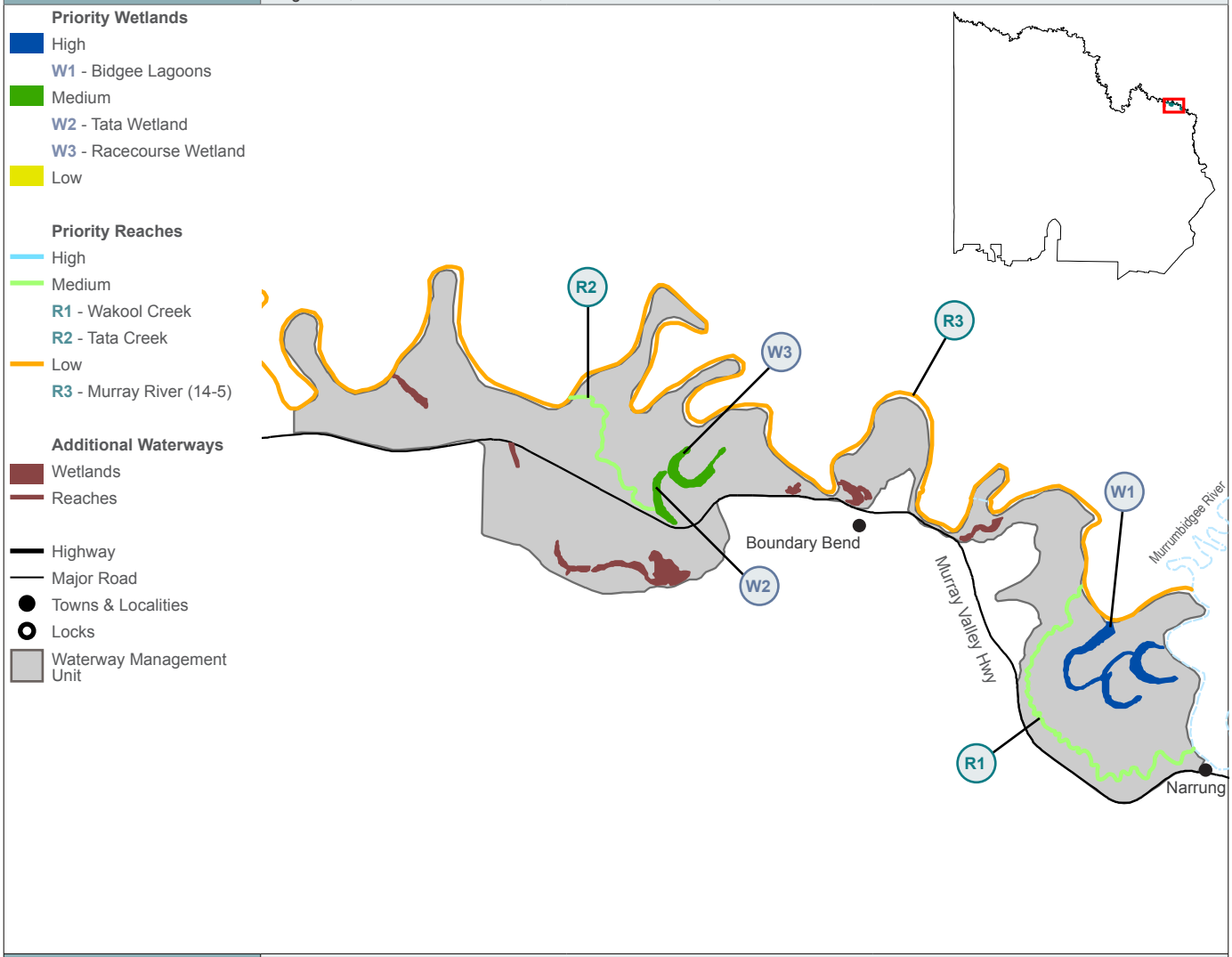
Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat within high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are formally recorded and captured within registered management plans/agreement by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fencing/bollards, roads/trails and firebreaks established under previous investment	414 ha over which infrastructure maintained[3]	Mallee CMA, PV, Landholders
A2 **B1** D E	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	3,679 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Maintain existing management agreement and establish new management agreements	1 management agreement maintained	Mallee CMA, PV, DEPI, TfN, licensees, Landholders
				2 management agreements established	
				300 ha grazing regime modified	Mallee CMA, PV, DEPI, licensees
		A2.3	Control priority invasive terrestrial plants, as determined annually	414 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		B1.1	Control priority invasive aquatic plants as required	287 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
B2	An increase in the distribution of priority species	B2.1	Introduce fingerlings to the Heywood Lake system (threatened native species and recreational species)	1 threatened species population established	Mallee CMA, VRFish, DEPI
C1 A B D E F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Installation of a regulator at Bridge Creek	1 waterway structure installed	Mallee CMA, PV, Landholders
		C1.2	Installation of service delivery point for temporary pumping to Bridge Creek	1 pump installed	Mallee CMA, LMW
		C1.3	Lower sill between Heywood Lake and Little Heywood Lake	1 waterway structure modified	Mallee CMA, PV, Indig. Stakeholders
		C1.4	Manage regulators to support changed water regimes	5 water regimes changed	Mallee CMA, PV, VEWH, CEWH, Landholders
		C1.5	Deliver water as per EWMP		
		C1.6	Modify irrigation infrastructure for improved efficiencies in environmental delivery	1 pump modified	Mallee CMA, PV, DEPI, Landholders
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	3,679 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Assess Cultural Heritage values at Heywood Lake and Little Heywood Lake, and consider recommendations in management plans.	1 assessment established	Mallee CMA, AAV, Indig. Stakeholders
		E1.3	Record oral history of indigenous and non-indigenous Cultural Heritage, combined with project at Burra WMU	1 publication established	Mallee CMA, Local. Comm, Landcare, Indig. Comm.
				5 engagement events coordinated	
F1	An increase in target audiences' awareness and understanding	F1.1	Review extent of Heywood EWMP	1 plan modified	Mallee CMA
		F1.2	Investigate options for improving water regime in Fisher's Lagoon and Bridge Creek West	1 plan established	Mallee CMA, PV, Landholders
		F1.3	Correct the spatial mapping of Murray River at Canally Island for the ISC assessments	1 information management system modified	Mallee CMA, DEPI
		F1.4	Assess topography with LiDAR to determine true waterway course of Bridge creek and its floodplain	1 assessment established	Mallee CMA, PV
		F1.5	Assess pump sites along Fisher's Lagoon and Bridge Creek to make recommendations for removal, maintenance or upgrade	4 assessments established	Mallee CMA, PV, LWM, Pump owners
F2 A	An increase in target audiences' skills and participation	F2.1	Plan and implement community projects that complement on-ground works and increase collaboration	24 engagement events coordinated	Mallee CMA, PV, SHRCC, Landcare, Local Comm.

F3 D	An increase in amenity	F3.1	Remove, maintain or upgrade pump sites as per recommendations, see F1.5	4 pumps modified	Mallee CMA, PV, LMW, Pump owners
		F3.2	Maintain visitor facilities established under previous investment	414 ha over which visitor facilities maintained[3]	PV, Landholders

4. Boundary Bend

RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #4 - Boundary Bend			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	Insufficient data		
Values	Significant Fauna (birds), Significant Fauna (Riparian Reptiles), Significant Wetland EVCs, Flagship species, Significant Flora Terrestrial		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Reduced Riparian Connectivity, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood), Increase in Low Flow Magnitude, Reduced Wetland Area, Altered Wetland Form, Soil Disturbance		

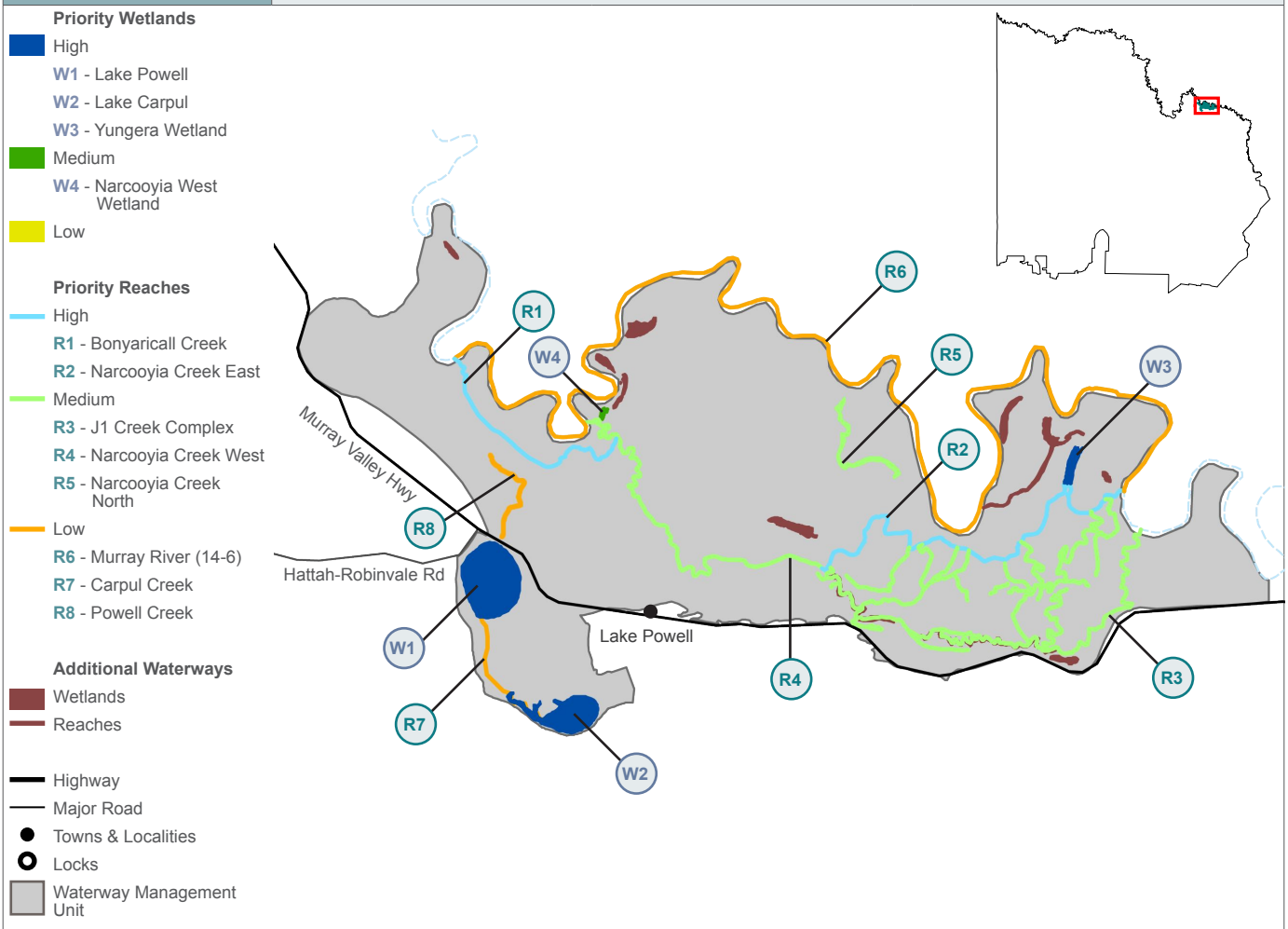


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	368 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Established management agreements	3 management agreements established	Mallee CMA, PV, Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	3,614 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	368 ha over which invasive plants controlled[2]	PV, Landholders
		B1.1	Control priority invasive aquatic plants as required	150 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
B2 F	An increase in the distribution and/or viability of priority species and communities	B2.1	Stock Bidgee Lagoons with priority native species and recreational species	1 threatened species population established	Mallee CMA, VRFish, ARI, PV, SHRCC, Boundary Bend Progress Association.
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Implement works established in the Murrumbidgee EWMP	1 waterway structure established 0.2 km earth works established 1 pump established	GMW, Mallee CMA, PV
		C1.2	Deliver water as per the Murrumbidgee EWMP	3 water regimes changed	Mallee CMA, PV, VEWH, CEWH
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites.	3,614 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Upgrade information sign at Murrumbidgee Junction	1 visitor facility modified	Mallee CMA, AAV, PV
F1	An increase in target audiences' awareness and understanding	F1.1	Establish an EWMP for the area Hopcroft Billabong to Conner's Billabong	1 plan established	Mallee CMA, DEPI
		F1.2	Review the Murrumbidgee EWMP to include recommendations for Wakool Creek and Pile Bend	1 plan reviewed	Mallee CMA
		F1.3	Investigate options to improve water regime of floodplain south side of Murray Valley highway, improving Black Box connectivity for Regent Parrots	1 assessment established 1 plan established	Mallee CMA
		F1.4	Undertake biodiversity surveys in Bidgee Lagoons and Tata Creek Wetlands	2 assessments established	Mallee CMA
		F1.5	Maintain depth gauges at Murrumbidgee Junction	1 waterway monitoring structure maintained	Mallee CMA
		F1.6	Coordinate environmental water community engagement events	6 events coordinated	Mallee CMA, PV Landholders
F2	An increase in amenity and accessibility	F2.1	Maintain visitor facilities established under previous investment	368 ha over which visitor facilities maintained[3]	Mallee CMA, PV, Landholders
		F2.2	Remove, maintain, upgrade or relocate Murray River pump sites as per recommendations of previous assessments	50 pumps modified	PV, LMW, Mallee CMA, Pump owners

5. Belsar Yungera

RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #5 - Belsar Yungera			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	20	80
Wetland (IWC 2010)	-	25	75
Values	Significant Birds, Significant EVCs, Significant Flora Wetland, Rural Water Source for Production, Flagship Species, Water Carriers, Significant Reptiles (Riparian)		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Altered Wetland Form, Soil Disturbance, Invasive Flora (Wetland), Reduced Wetland Area, Degraded Water Quality, Barriers to Fish Migration, Bank Instability, Increase in Low Flow Magnitude, Reduced Floodplain Connectivity, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood)		

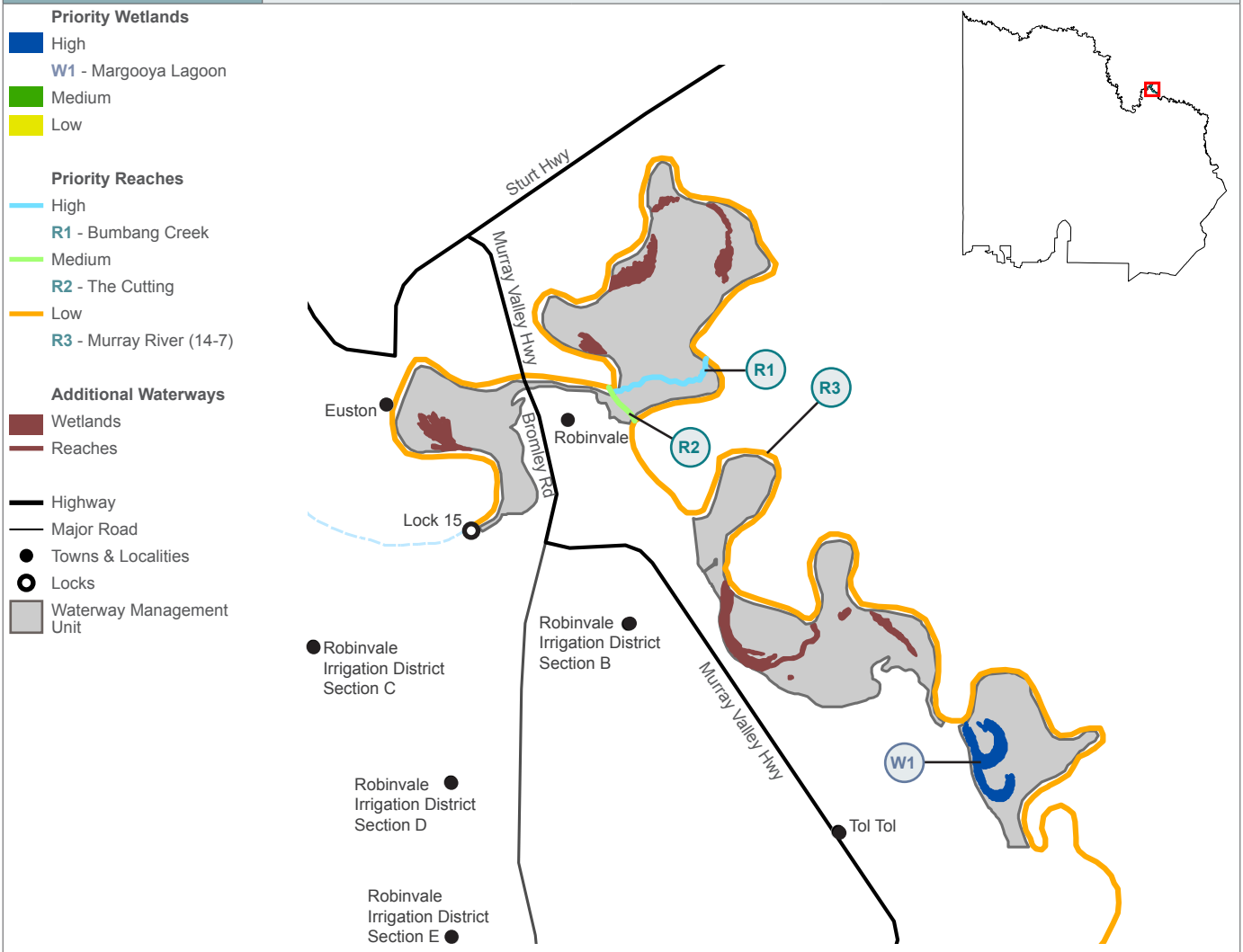


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	1,167 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Maintain management agreements, including covenants, and develop new management agreements	2 management agreements maintained	Mallee CMA, PV
				2 management agreements established	
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	7,856 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	1,167 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		B1.1	Control priority invasive aquatic plants as required	428 ha over which invasive plants controlled[4]	Mallee CMA, PV, LMW
		B1.2	Establish control measures to restrict European Carp entering Lake Powell, Carpul Creek and Lake Carpul.	190 ha over which invasive animal controlled[4]	Mallee CMA, Landholders
B2 F	An increase in the viability of priority species and communities	B2.1	Trial installation of self-cleaning fish screens on pumps along Narcooyia Creek	1 pump modified	Mallee CMA, Landholders
		B2.2	Install self-cleaning fish screens to pumps along Narcooyia, dependent upon results of trial, see B2.1	10 pumps modified	Mallee CMA, LMW, Landholders
C1 A B D E F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Implement works established in the Belsar and Yungera Islands EWMP	2 waterway structures established	Mallee CMA, PV
				0.4 km earth works modified	
		C1.2	Deliver water as per the Belsar and Yungera Islands EWMP	11 water regimes changed	Mallee CMA, PV, Landholders, CEWH, VEWH
		C1.3	Upgrade waterway structure with vehicle access at Narcooyia Creek East	1 waterway structure modified	Mallee CMA, PV, Landholder
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	7,856 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record Indigenous oral history	1 publication established	Mallee CMA, AAV, PV, Indig. Comm., Trad. Owners
				5 engagement events established	
		E1.3	Develop Cultural Heritage Management Plan	1 plan established	
F1	An increase in target audiences' awareness and understanding	F1.1	Investigate waterway condition required to support Murray Crayfish and native large-bodied fish along Narcooyia Creek	1 assessment established	Mallee CMA, DEPI, PV
		F1.2	Investigate options for future improvement to water regimes at Bonyaricall Creek	1 assessment established	Mallee CMA, PV, DEPI, LMW, Pump owners
		F1.3	Engage local community in environmental watering plans	6 events coordinated	Mallee CMA, PV Landholders, Local Comm.
				1 publication established	
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain access to the Murray River and irrigation infrastructure during environmental watering events	7,856 ha over which accessibility maintained[3]	Mallee CMA, PV, LMW, Landholders
		F2.2	Remove, maintain, upgrade or relocate Murray River and anabranch pump sites as per recommendations of previous assessments	5 pumps modified	Mallee CMA, PV, LMW, Pump owners
		F2.3	Maintain visitor facilities established under previous investment	1,167 ha over which visitor facilities maintained[3]	Mallee CMA, PV
		F2.4	Work with landholders to remove rubbish on private land	3 partnerships established	Mallee CMA, Landholders

6. Bumbang

RCS Catchment Asset #11 - Murray River & Floodplain - Nyah to Robinvale Waterway Management Unit #6 - Bumbang			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	Insufficient data		
Values	Significant EVCs, Significant Birds, Significant Indigenous Heritage, Drought Refuge		
Threats	Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Changed Water Regime, Reduced Wetland Area		

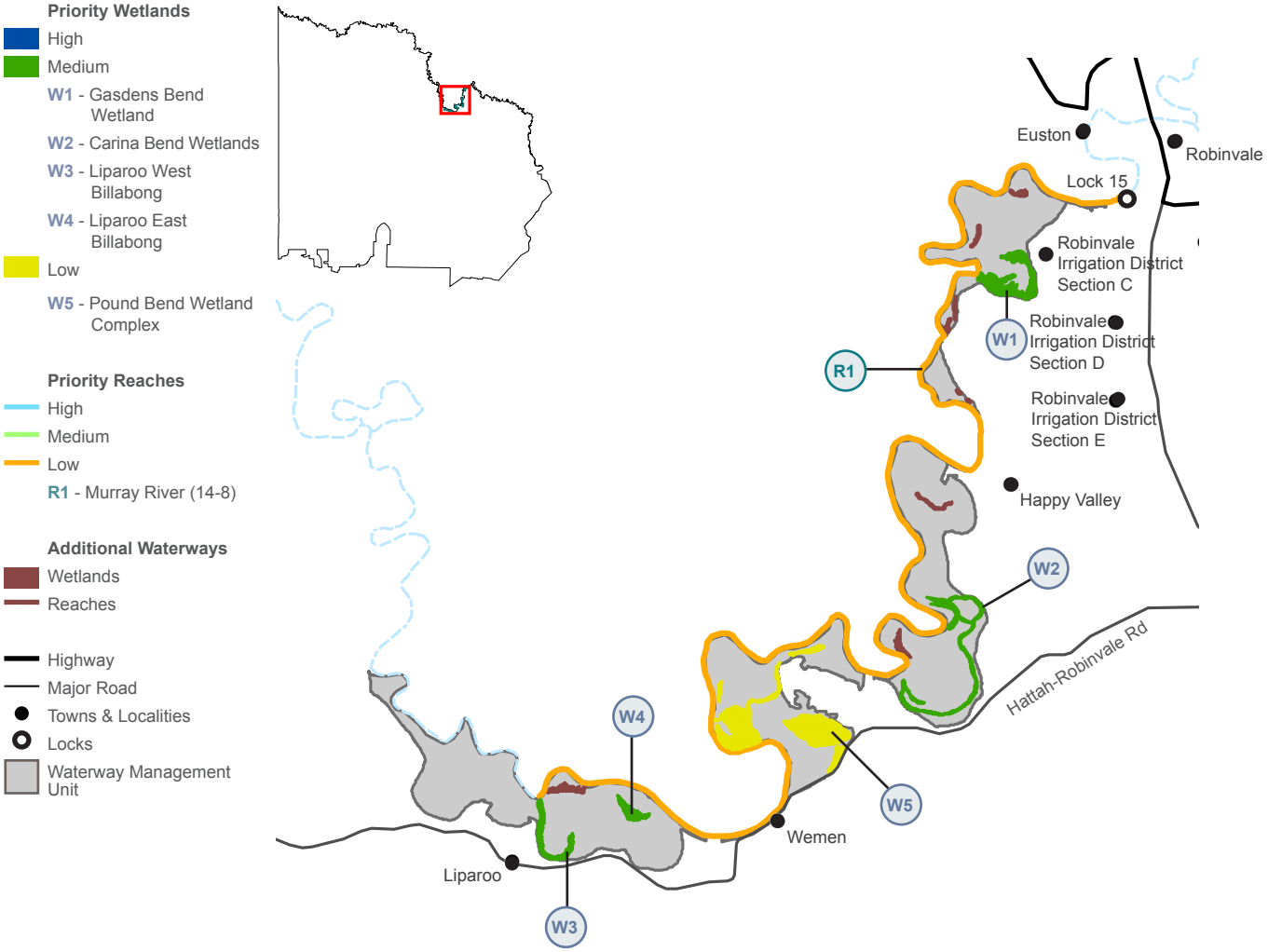


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	90 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	4 km track removed	Mallee CMA, PV
				20 visitor facilities installed	PV, Mallee CMA
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	884 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	90 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders, Landcare
		B1.1	Control priority invasive aquatic plants at Margooya Lagoon as required	41 ha over which invasive plants controlled[4]	Mallee CMA, PV
		B1.2	Control European Carp at Margooya Lagoon	41 ha invasive animals controlled[4]	Mallee CMA, MDFRC, VRFish, Landholders
B2	An increase in the distribution and/or viability of priority species/communities	B2.1	Support native fish breeding through improved water regime management at Margooyia Lagoon	1 threatened species population maintained	VRFish, Mallee CMA, DEPI, MDFRC
B3	An increase in soil stability through reduced erosion and sedimentation	B3.1	Combination of works to combat erosion along Robinvale Cutting, including placement of jute matting, revegetation and earth works	2 km erosion control	Mallee CMA, PV
		B3.2	Establish bollards along Murray River at sites with prevalence of bank erosion	16 km bollards established	Mallee CMA, PV
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Deliver water to Margooya Lagoon, as per the Margooya EWMP	1 water regime changed	Mallee CMA, PV, VEWH, CEWH
		C1.2	Support NSW Office of Water in Lock 15 Weir manipulations trials	1 water regime changed	NSW Office of Water, SHRCC, PV, Mallee CMA
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	884 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record oral history of Indigenous and non-indigenous Cultural Heritage	1 publication established	Mallee CMA, Indig. Comm., Local Comm., Landcare
				5 engagement events coordinated	
F1	An increase in target audiences' awareness and understanding	F1.1	Establish EWMP for Walsh's Bend, Bumbang Bend and Euston Bend	2 plans established	Mallee CMA, DEPI, PV
		F1.2	Install multi-lingual educational signage along popular recreational/visitor routes	5 visitor facilities established	Mallee CMA, DEPI, PV, Landcare
		F1.3	Investigate options to relocate houseboat moorings from within Robinvale Cutting to the Murray River	1 assessment established	Mallee CMA, PV
		F1.4	Coordinate Catch-A-Carp Day at Margooya Lagoon	2 engagement events coordinated	Mallee CMA, PV, DEPI, VRFish, SHRCC, Local Comm.
F2 A D E	An increase in amenity and accessibility	F2.1	Remove, maintain, upgrade or relocate pump sites as per recommendations of previous assessments	30 pumps maintained	Mallee CMA, PV, LMW, SHRCC, Pump owners
				4 pumps removed	
		F2.2	Implement recommendations of F1.3	1 visitor facility modified	Mallee CMA, PV
		F2.3	Maintain and upgrade visitor facilities, including boat ramps	41 ha over which visitor facilities are maintained	Mallee CMA, PV, SHRCC

7. Happy Valley

RCS Catchment Asset #4 - Murray River & Floodplain - Robinvale to Merbein Waterway Management Unit #7 - Happy Valley			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	Insufficient data		
Values	Significant EVCs, Significant Birds, Significant Flora, Flagship Species		
Threats	Invasive Fauna (Terrestrial), Changed Water Regime, Invasive Fauna (Aquatic), Reduced Wetland Area, Degraded Water Quality, Invasive Flora (Wetland)		



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	370 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	3 km track removed	Mallee CMA, PV
				20 visitor facilities installed	
		A1.3	Undertake revegetation works at Happy Valley	10 ha vegetation established	Mallee CMA, PV, Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	4,234 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	370 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders, Landcare
		B1.1	Control priority invasive aquatic plants as required	422 ha over which invasive plants controlled[4]	Mallee CMA, PV, LMW
B2	An increase in soil stability through reduced erosion and/or sedimentation	B2.1	Combination of works to combat erosion along Murray River, including placement of jute matting, revegetation and earth works	3 km over which erosion controlled	Mallee CMA, PV, Landholders
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Raise two tracks and install regulators, as recommended by the EWMPs	1 km road modified	Mallee CMA, PV, DEPI, LMW
				3 waterway structures established	
		C1.2	Deliver water as per the Wemen Liparoo EWMP	6 water regimes changed	Mallee CMA, PV, GMW, LMW , CEWH, VEWH
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	4,234 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders, Landcare
F1	An increase in target audiences' awareness and understanding	F1.1	Establish and review EWMPs across the WMU	2 plans established	Mallee CMA, PV
				2 plans reviewed	
		F1.2	Investigate surface water, groundwater and irrigation water interactions	1 assessment established	Mallee CMA, PV
				1 publication established	
		F1.3	Survey fish, nesting birds and bats	3 assessments established	Mallee CMA, PV
		F1.4	Investigate sites, such as Pound Bend, for Murray Hardyhead relocation opportunities	1 assessment established	Mallee CMA, DEPI
		F1.5	Install depth gauges and conduct survey in the Wemen Liparoo EWMP area using LiDAR	2 assessments established	Mallee CMA
		F1.6	Assess Murray River pump sites to make recommendations for removal, maintenance, upgrade or relocation	20 assessments established	Mallee CMA, PV, Pump owners
F2	Regional partnerships, collaborative arrangements and government processes are maintained	F2.1	Support the formation of a Friends of Happy Valley community group	1 partnership established	Mallee CMA, MRCC

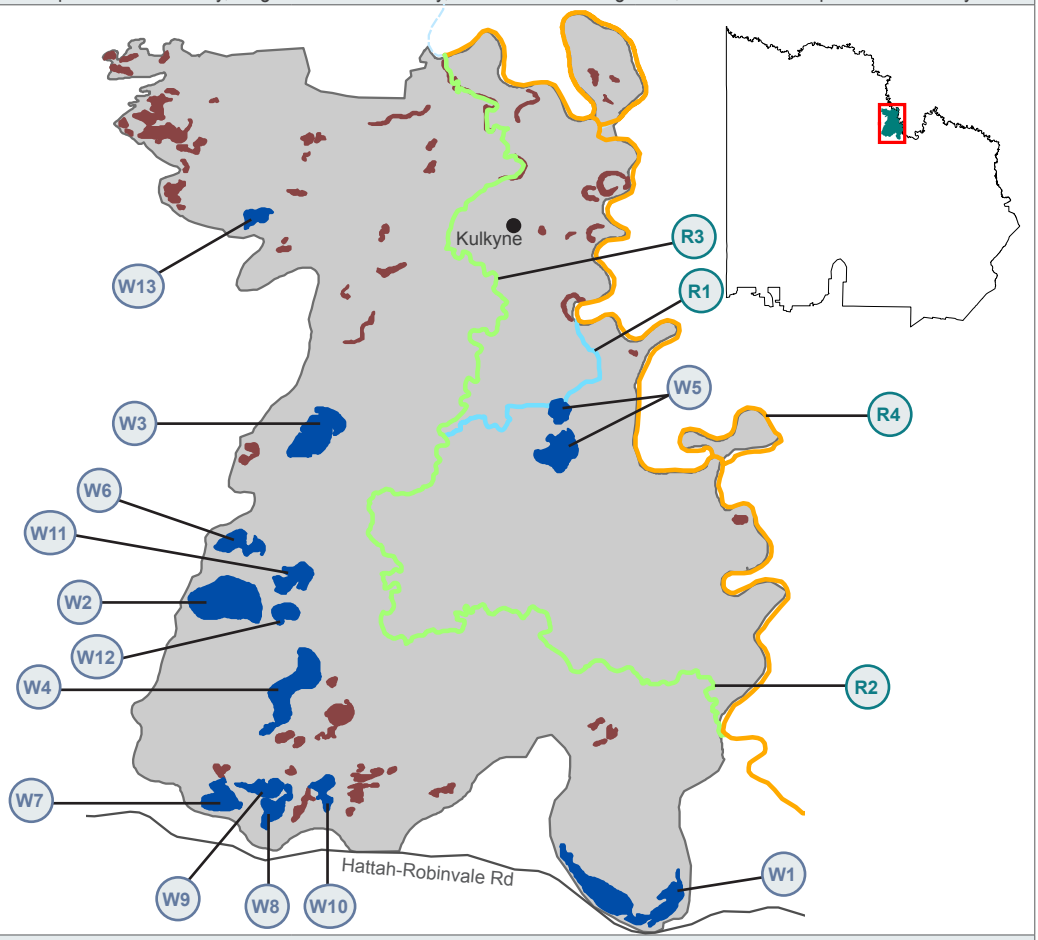
8. Hattah

RCS Catchment Asset #4 - Murray River & Floodplain - Robinvale to Merbein Waterway Management Unit #8- Hattah			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	50	25	25
Wetland (IWC 2010)	66	33	-
Values[1]	Significant Birds, Significant Flora (Wetland), Significant EVCs, Sightseeing, Significant Fish, Camping, Non-Motor Boating, Picnics and Barbecues, Drought Refuge, Important Bird Habitat, Flagship Species, Recreational Fishing, Significant Flora (Terrestrial), Significant reptiles (Riparian), Community Groups, significant Cultural Heritage.		
Threats[2]	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Altered Wetland Form, Degraded Buffer, Invasive Flora (Wetland), Loss of Instream Habitat (Large Wood), Reduced Vegetation Width, Increase in Low Flow Magnitude, Reduced Riparian Connectivity, Degraded Water Quality, Barriers to Fish Migration, Reduced Floodplain Connectivity.		

Priority Wetlands
- High
- W1 - Lake Kramen
- W2 - Lake Mournpall
- W3 - Lake Bitterang
- W4 - Lake Lockie
- W5 - Lake Cantala
- W6 - Lake Konardin
- W7 - Lake Hattah
- W8 - Arawak
- W9 - Lake Bulla
- W10 - Lake Brockie
- W11 - Lake Yelwell
- W12 - Lake Yerang
- W13 - Lake Boolca

Priority Reaches
- High
- R1 - Cantala Creek
- Medium
- R2 - Chalka Creek South
- R3 - Chalka Creek North
- Low
- R4 - Murray River (14-9)

Additional Waterways
- Wetlands
- Reaches
- Highway
- Major Road
- Towns & Localities
- Locks
- Waterway Management Unit



Long Term Resource Condition Target for Hattah-Kulkyne Lakes Ramsar site	To improve ecosystem services considered critical to the ecological character of the Hattah-Kulkyne Lakes Ramsar Site (near natural wetland type, physical habitat which support waterbird breeding and feeding, threatened species, biodiversity, ecological connectivity).
Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

[1] A summary of the risk level for each high value x high threat interaction identified for the Hattah-Kulkyne Lakes Ramsar Site is provided in Appendix 4B.
[2] See note 1 above.

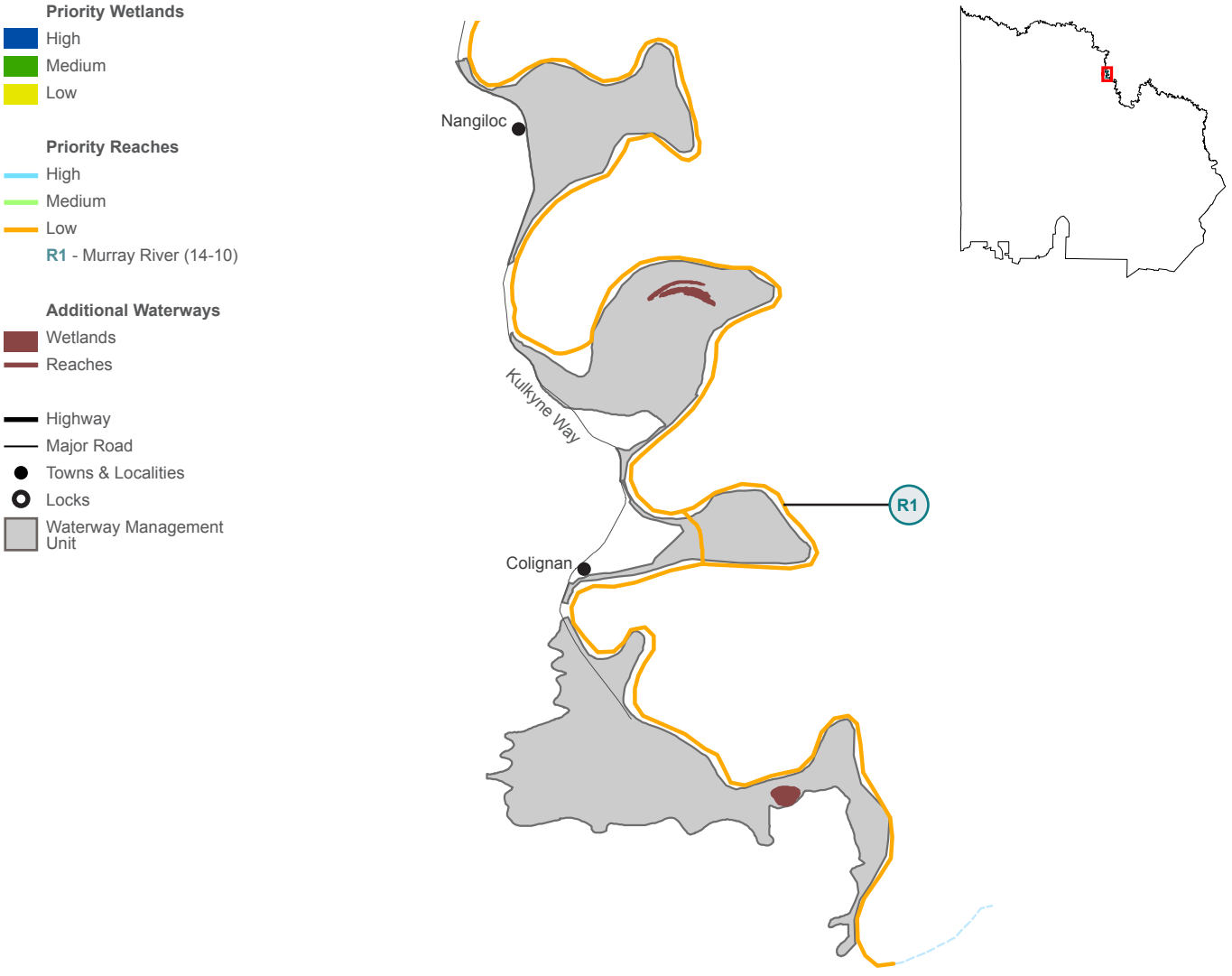
RCT link	Management Outcome Target[3]	Management Activity[4]		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fencing/bollards, roads/trails and firebreaks established under previous investment	1,760 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Ensure fire regime is appropriate for Ramsar site	1 fire regime maintained	Mallee CMA, PV, MDBC, DEPI
A2 **B1** D E	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, including pigs and goats taking into account best practice management control techniques	27,844 ha over which invasive animals controlled[1]	Mallee CMA, PV
		A2.2	Control priority invasive terrestrial plants within 200 m perimeter of the 12 Ramsar Lakes	1,760 ha over which invasive plants controlled[2]	Mallee CMA, PV
		A2.3	Control over-abundant wildlife (kangaroos) to agreed target densities to manage grazing levels	27,844 ha over which invasive animals controlled[1]	Mallee CMA, PV, DEPI
		B1.1	Exclude, and where required remove, large bodied invasive European Carp from four southern Ramsar Lakes	200 ha over which invasive animals controlled 2 waterway structures maintained	Mallee CMA, PV, GMW
		B1.2	Control priority invasive aquatic plants as required	1,348 ha over which invasive plants controlled[4]	Mallee CMA, PV
B2	An increase in the distribution and/or viability of priority species/communities	B2.1	Isolate floodplain waterways from Murray River black water events via appropriate management of pumps and regulators to create a freshwater refuge	1 emergency response to extreme event established	Mallee CMA, PV
		B2.2	Work with VRFish to improve native fish populations in the Hattah Lakes system	2 threatened species populations established	Mallee CMA, VRFish, DEPI
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Deliver water as per EWMP, including overbank flooding to promote natural regeneration of floodplains	10 water regimes changed	GMW, Mallee CMA, PV, MDBA, CEWH, VEWH
		C1.2	Maintain waterway structures established under previous investment	8 waterway structures maintained	Mallee CMA, PV, GMW, MDBA
		C1.3	Install or modify waterway structures to progress environmental water program in north Hattah	2 waterway structures established 1 waterway structure modified	Mallee CMA, PV, GMW, DEPI, MDBA
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	27,844 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Undertake visual inspection of burial sites identified in existing CHMP to assess level of impact pre and post an environmental watering event	8 assessments established	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.3	Review rabbit control management plan to incorporate new information on the protection of Cultural Heritage sites	1 plan reviewed	PV

[3] Management Outcome Targets specific to the Hattah-Kulkyne Lakes Ramsar Site and linkages to Hattah WMU Targets (together with associated management activities) are detailed in Appendix 4C.
[4] Further background to management activities planned for the Hattah-Kulkyne Lakes Ramsar Site is provided in Appendix 4C.

F1	An increase in target audiences' awareness and understanding	F1.1	Develop a long term European Carp Management Plan	1 plan established	Mallee CMA, ARI, CSIRO, PV, Local Comm., Indig. Comm.
		F1.2	Correct the spatial mapping of Murray River at Tarpaulin and Retail Islands for the ISC assessments	1 information management system modified	Mallee CMA, DEPI
		F1.3	Maintain existing telemetry equipment	1 monitoring structure maintained	Mallee CMA
		F1.4	Assess Murray River pump sites to make recommendations for removal, maintenance, upgrade or relocation	2 assessments established	Mallee CMA, PV Landholders
		F1.5	Coordinate community field trips and communications to promote understanding of values, threats and management interventions	30 engagement events coordinated 15 publications established	Mallee CMA, PV, Local Comm., Landcare
		F1.6	Continue to monitor and report ecological character status, guided by the monitoring requirements detailed in the Hattah Lakes Ramsar Site Ecological Character Description.	5 assessments and maintained and reported	Mallee CMA, DEPI, GMW
		F1.7	Investigate reintroduction of threatened fauna species and options to improve fish habitat	2 assessments established	Mallee CMA, DEPI
		F1.8	Review Environmental Water Management Plan	1 plan reviewed	Mallee CMA
F2	An increase in target audiences' skills and participation	F2.1	Coordinate volunteering events focussed on identification, monitoring, assessment and management activities	10 engagement events coordinated	Mallee CMA, PV, BirdLife Aus., Vic National Parks Association.
F3 A B D E	An increase in amenity and accessibility	F3.1	Remove, maintain, upgrade or relocate pump sites as per recommendations, see F1.4	2 pumps modified	Mallee CMA, PV, Pump owners
		F3.2	Manage River Red Gum saplings along wetland edge in accordance with Victorian native vegetation policy	2 visitor facilities maintained	PV, DEPI
		F3.3	Maintain visitor facilities established under previous investment	1,760 ha over which visitor facilities maintained	Mallee CMA, PV
		F3.4	Ensure tracks provide access to recreational facilities, commercial facilities and private property during large flood events	1,760 ha over which roads are modified	Mallee CMA, PV

9. Nangiloc Colignan

RCS Catchment Asset #4 - Murray River & Floodplain - Nyah to Merbein Waterway Management Unit #9 - Nangiloc Colignan			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	Insufficient data		
Values	Significant EVCs, Significant Flora Terrestrial, Motor Boating, Non-Motor Boating, Picnics and Barbecues, Swimming, Flagship Species, Significant Birds, Camping, Water Carriers		
Threats	Invasive Fauna (Terrestrial), Increase in Low Flow Magnitude, Reduced Floodplain Connectivity, Reduced Vegetation Width, Loss of Instream Habitat (Sedimentation)		



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with low priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with low priority waterways by 2022. **C**. To improve hydrology within low priority waterways by 2011. **D**. To improve water quality within low priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment along Murray River	169 ha over which infrastructure maintained	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	5 km track removed 20 visitor facilities established	Mallee CMA, PV
A2 D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	1,210 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Coordinate a cat de-sexing program for community to participate in free of charge, targeting cats north of Hattah Kulkyne National Park	1 invasive animal population controlled	Mallee CMA, PV, Landcare, VNPA
		A2.3	Control priority invasive terrestrial plants along Murray River, as determined annually	169 ha over which invasive plants controlled	Mallee CMA, PV, Landholders, Landcare
B1 A F	An increase in soil stability through reduced erosion and sedimentation	B1.1	Combination of works to combat erosion along Murray River, including placement of jute matting, revegetation and earth works	6 km over which erosion controlled	Mallee CMA, PV, Landholders
C1 A B	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Deliver water as per EWMP	1 water regime changed	Mallee CMA, PV, VEWH, CEWH
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	1,210 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record oral history relating to Indigenous and non-Indigenous Cultural Heritage	1 publication established 10 engagement events coordinated	Mallee CMA, AAV, PV, Indig. Comm., Trad. Owners
F1	An increase in target audiences' awareness and understanding	F1.1	Develop an EWMP for Nangiloc Colignan WMU	1 plan established	Mallee CMA, DEPI, PV
		F1.2	Conduct community education on the threat of wild cats to natural wildlife	16 community events coordinated 9 publications established	Mallee CMA, PV, Local Comm.
		F1.3	Investigate groundwater recharge in the south of WMU	1 assessment established	Mallee CMA, PV Landholders, Local Comm.
		F1.4	Investigate options for the protection of turtles	1 assessment established	Mallee CMA, PV, DEPI
F2 A B	In increase in target audiences' skills and participation/ adoption	F2.1	Establish landholder incentive grants to carry out on-ground works such as invasive animal and plant control, remnant vegetation protection, rubbish removal and waterway restoration	12 partnerships established	Mallee CMA, Landholders
F3 A D E	An increase in amenity and accessibility	F3.1	Remove, maintain, upgrade or relocate Murray River pump sites as per recommendations of previous assessments	40 pumps modified 8 pumps removed	Mallee CMA, PV, LMW, Pump owners

10. Karadoc

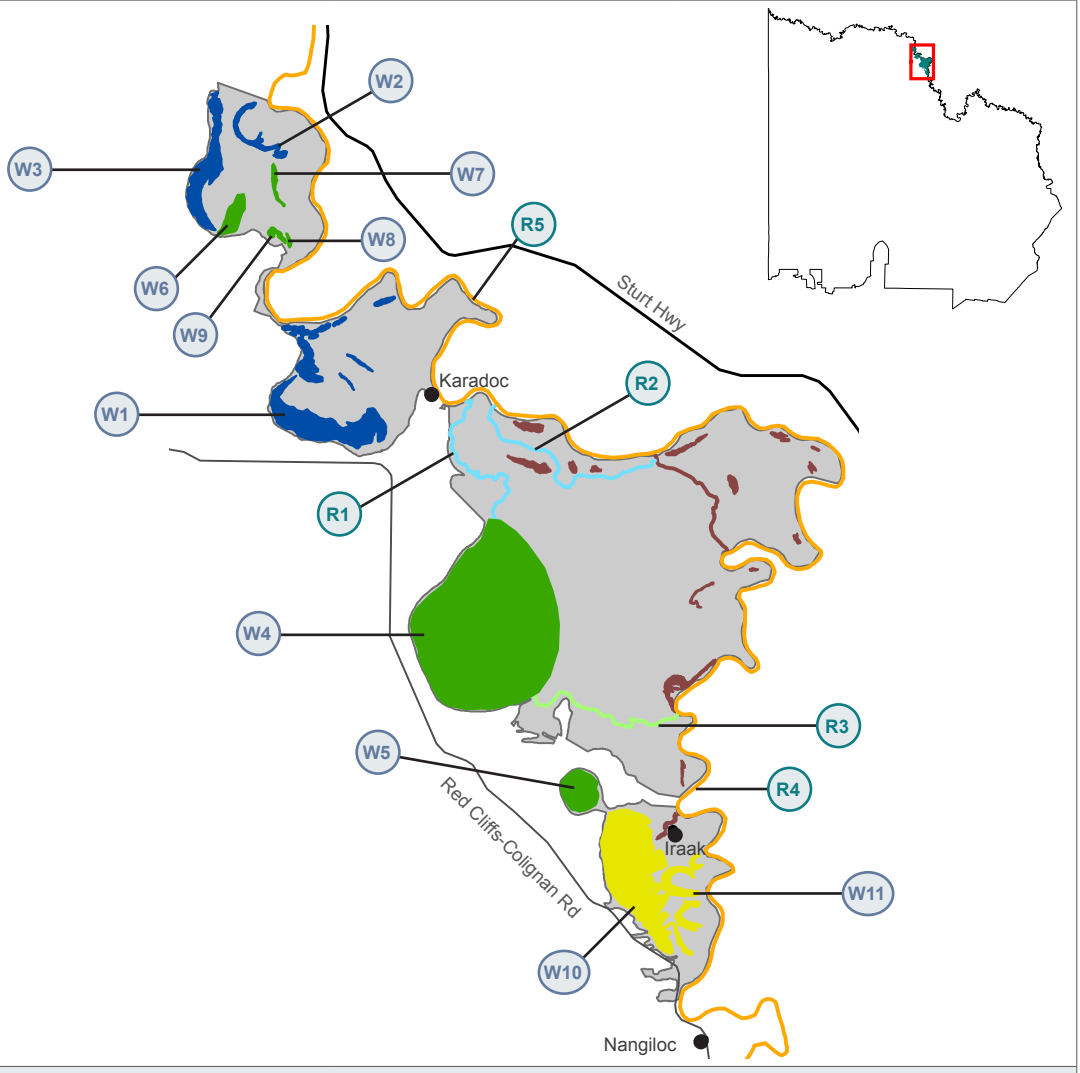
RCS Catchment Asset #4 - Murray River & Floodplain - Robinvale to Merbein Waterway Management Unit #10 - Karadoc			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	-	-	100
Values	Significant EVCs, Significant Birds, Significant Flora, Drought Refuge, Water Carriers, Rural Water Source for Production, Drainage, Community Group		
Threats	Invasive Fauna (Terrestrial), Reduced Vegetation Width, Reduced Riparian Connectivity, Increase in Low Flow Magnitude, Loss of Instream Habitat (Large Wood), Invasive Fauna (Aquatic), Degraded Water Quality, Disturbance of Acid Sulphate Soils, Changed Water Regime, Altered Wetland Form, Soil Disturbance, Invasive Flora (Wetland)		

Priority Wetlands
- High
  - W1 - Bottle Bend Wetland Complex
  - W2 - Psyche Lagoon
  - W3 - Woorlong Wetland
- Medium
  - W4 - Karadoc Swamp
  - W5 - Lake Iraak
  - W6 - Woorlong Drain
  - W7 - Psyche Runner
  - W8 - Power Station Wetland
  - W9 - Wonega Ave Drain
- Low
  - W10 - Bullock Swamp
  - W11 - Spences Bend Wetlands

Priority Reaches
- High
  - R1 - Outlet Creek
  - R2 - Towrie Creek
- Medium
  - R3 - Inlet Creek
- Low
  - R4 - Murray River (14-10)
  - R5 - Murray River (14-11)

Additional Waterways
- Wetlands
- Reaches

- Highway
- Major Road
- Locks
- Towns & Localities
- Waterway Management Unit

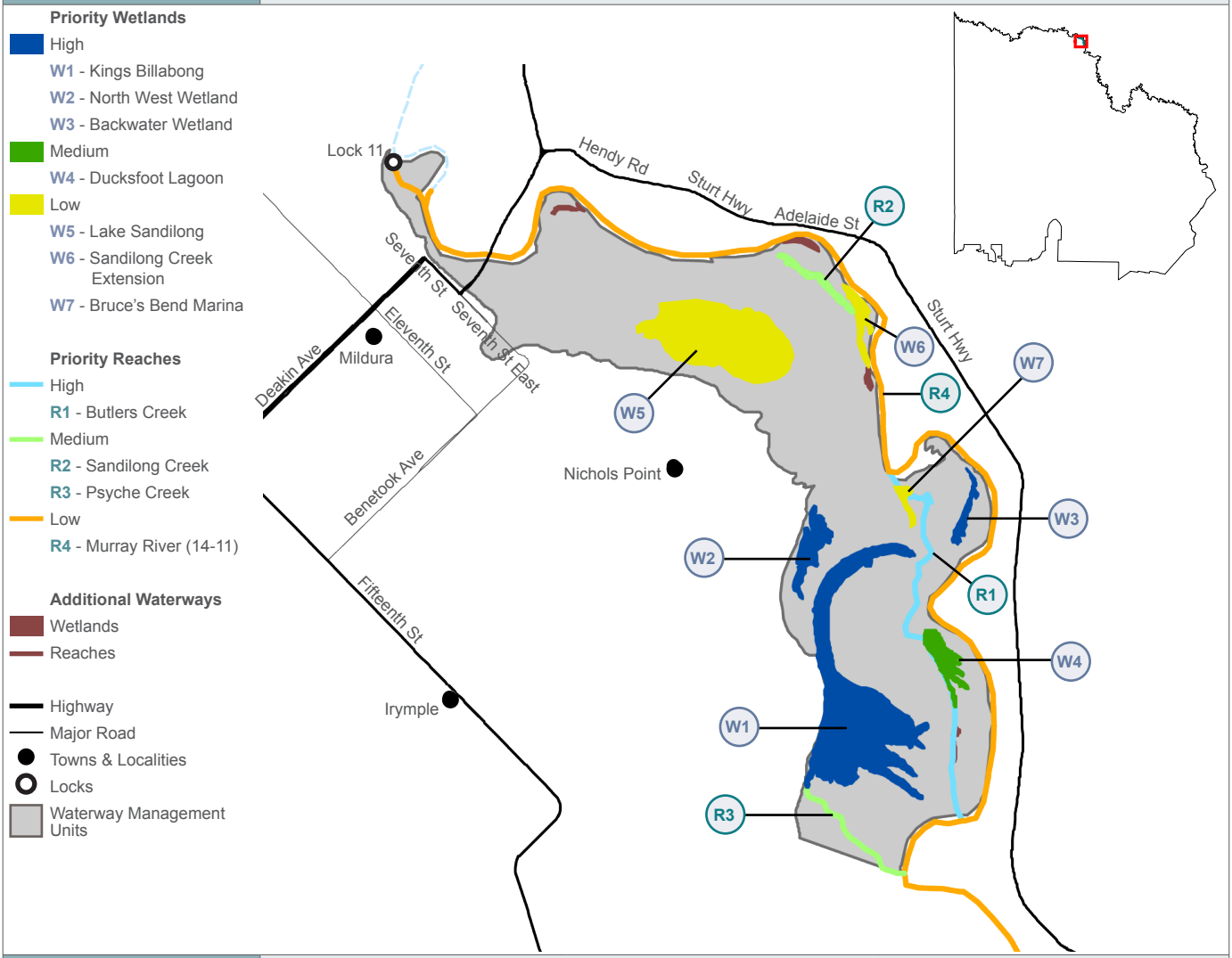


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	835 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish fencing and bollards where appropriate	10 km fencing/bollards established	Mallee CMA, PV, Landholders
		A1.3	Maintain previous riparian management agreements and develop new agreements	3 management agreements maintained 5 management agreements established	MCMA, Landholders
A2 **B1** D E	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	5,360 ha over which invasive animals controlled[1]	MCMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	835 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		B1.1	Control priority invasive aquatic plants as required	1,467 ha over which invasive plants controlled[4]	Mallee CMA, PV
		B1.2	Control European Carp as per F1.1	1,467 ha over which invasive animals controlled[4]	Mallee CMA, PV
B2	An increase in the distribution and/or viability of priority species/ communities	B2.1	Establish new Murray Hardyhead populations, depending upon recommendations of feasibility study	3 threatened species populations established	Mallee CMA, DEPI, MDFRC, LMW
C1 A B F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Raise tracks and install box culverts south of Psyche Lagoon as recommended in the Draft Psyche Woorlong EWMP	0.6 km tracks modified 2 waterway structures established	Mallee CMA, PV, Landholders
		C1.2	Upgrade regulators and install box culverts as recommended in the Draft Spence's Bend EWMP	2 waterway structures modified 3 waterway structures installed	Mallee CMA, PV, MRCC, Landholders
		C1.3	Deliver water as per recommendations of F1.2	7 water regimes changed	Mallee CMA, PV, VEWH, CEWH
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	5,360 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record oral history of Indigenous and non-Indigenous Cultural Heritage	1 publication established 5 engagement events coordinated	Mallee CMA, AAV, PV, Indig. Comm., Trad. Owners
F1	An increase in target audiences' awareness and understanding	F1.1	Develop European Carp Management Plan	1 plan developed	Mallee CMA, DEPI, PV
		F1.2	Establish EWMPs across whole WMU	4 plans developed	Mallee CMA, DEPI, PV
		F1.3	Continue to monitor groundwater bores for height and EC, and drainage water for flow and EC across the WMU	4 assessments maintained	Mallee CMA, LMW, PV, Local Comm.
		F1.4	Develop a pilot database of fisher catch records in the Murrray River	1 information management system established	Mallee CMA, VRFish
		F1.5	Assess Murray River pump sites to make recommendations for removal, maintenance, upgrade or relocation	20 assessments established	Mallee CMA, LWM, PV, Pump owners
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities, including boat ramps, signage and the removal of dumped rubbish	835 ha over which visitor facilities maintained[3]	Mallee CMA, PV, LMW, Landholders
		F2.2	Remove, maintain, upgrade or relocate pump sites as per recommendations of previous assessments and F1.3	30 pumps modified	Mallee CMA, LMW, PV, Pump owners

11. Nichols Point

RCS Catchment Asset #4 - Murray River & Floodplain - Robinvale to Merbein Waterway Management Unit #11 - Nichols Point			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	50	25	25
Values	Camping, Community Groups, Drought Refugees, Important Bird Habitats, Boating, Picnics & Barbecues, Riparian Veg. Condition, Rural Water Sources, Significant EVC's, Significant Flora Terrestrial, Significant Reptiles Riparian, Swimming, Timber & Firewood, Tracks, Water Carriers, Water Storages, Stormwater Drainage.		
Threats	Invasive Fauna (aquatic), Invasive Fauna (terrestrial), Invasive Flora (wetland), Loss of Instream Habitat, Low Flow Magnitude, Soil Disturbance.		



Long term Resource Condition Targets (RCT)	
	A. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are formally recorded and captured within registered plans/agreements by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fences/bollards and roads/trails established under previous investment	368 ha over which infrastructure maintained[3]	Mallee CMA, PV, MRCC, Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	884 ha over which invasive animals controlled[1]	Mallee CMA, PV, MRCC, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	368 ha over which invasive plants controlled[2]	Mallee CMA, PV, MRCC, RGC, Landholders, FKB
		B1.1	Control priority invasive aquatic plants as required	215 ha over which invasive plants controlled[4]	Mallee CMA, PV, MRCC, RGC
		B1.2	Maintain European Carp movement barriers	2 waterway structures maintained	Mallee CMA, PV, LMW, RGC
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Manage weirs and regulators to support changed water regimes.	7 water regimes changed	GMW, LMW, Mallee CMA, PV, VEWH, CEWH
		C1.2	Deliver water as per EWMP		
		C1.3	Raise tracks near Baggs Bridge and Jennings Bridge regulators to increase effectiveness of environmental water events	0.2 km earth works modified	Mallee CMA, PV
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	884 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Record oral history of Indigenous and non-indigenous Cultural Heritage	1 publication established	Mallee CMA, PV, FKB, Indig. Comm., Local Comm.
				10 engagement events coordinated	Mallee CMA, PV, FKB, Indig. Comm., Local Comm.
F1	An increase in target audiences' awareness and understanding	F1.1	Attend and support Catch-A-Carp Day - partnership with community to tackle European Carp in controlled locations	8 engagement events attended	Mallee CMA, PV, DEPI, RGC, MRCC, MDFRC, Landcare, FKB, Local Comm.
		F1.2	Investigate pest species control including: • Deterrent techniques for control of foxes, targeted at turtle nesting sites; • Improved overall control at King's Billabong Park; • European Carp movement in Butler's Creek, Ducksfoot Lagoon and Sandilong Creek; • European Carp management options in King's Billabong.	4 assessments established	Mallee CMA, FKB, PV, MDFRC, VRFish, RGC
				4 publications established	
		F1.3	Investigate options to improve connectivity between Sandilong Creek and Murray River	1 assessment established	Mallee CMA, MDFRC, RGC
		F1.4	Investigate options to improve fish passage to Butler's Creek and Ducksfoot Lagoon	1 assessment established	Mallee CMA, MDFRC, FKB
		F1.5	Review Ducksfoot Lagoon EWMP to include investigations for water delivery to North-west Wetland	1 plan reviewed	Mallee CMA, PV
		F1.6	Assess Murray River and Sandilong Creek pump sites to make recommendations for removal, maintenance, upgrade or relocation	12 assessments established	Mallee CMA, PV, LMW, MRCC, Pump owners
		F1.7	Develop a plant identification booklet for Kings Billabong Park	1 publication established	FKB, Mallee CMA
		F1.8	Develop a pilot database of fisher catch records	1 information management system established	VRFish, Mallee CMA

F2 A	An increase in target audiences' skills and participation.	F2.1	Plan and implement community projects that: • Complement on-ground works; • Improve community access to Murray River frontage; • Target culturally diverse communities	80 engagement events coordinated	Mallee CMA, MRCC, PV, RGC, FKB, Landcare, Indig. Comm., Local Comm.
F3 D	An increase in amenity	F3.1	Remove, maintain, upgrade or relocate Murray River and Sandilong Creek pump sites as per recommendations, see F1.6	12 pumps modified	Mallee CMA, PV, LMW, MRCC, Pump owners
		F3.2	Maintain visitor facilities established under previous investment	368 ha over which visitor facilities maintained[3]	PV, LMW, RGC, MRCC

12. Merbein

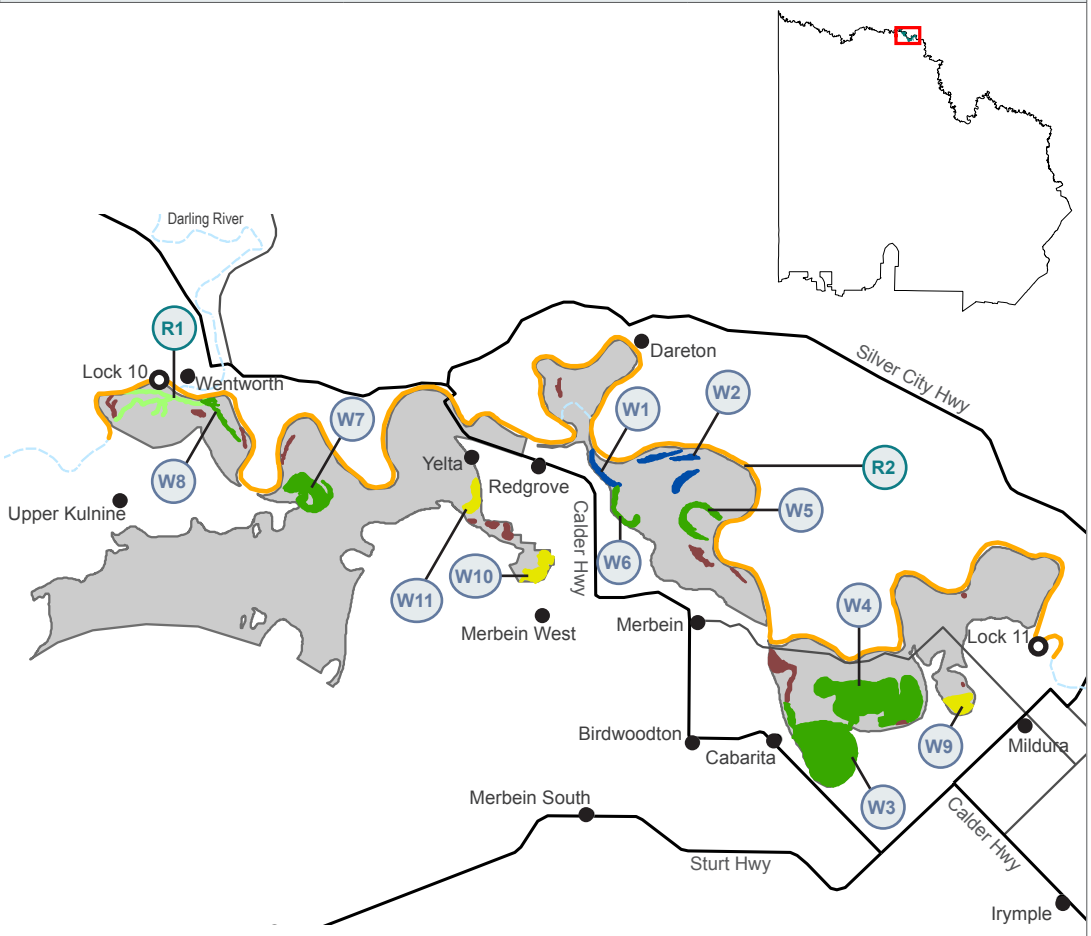
RCS Catchment Asset #4 - Murray River & Floodplain - Robinvale to Merbein Waterway Management Unit #12 - Merbein			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	-	-	100
Values	Community Groups, Picnics & Barbecues, Drought refuge, Water source for production, Significant birds, Significant EVCs, Significant fish, Significant reptiles (Terrestrial), Drainage, Significant frogs, Flagship species		
Threats	Changed Water Regime, Reduced Wetland Area, Degraded Water Quality, Altered Wetland Form, Invasive Fauna (Aquatic), Invasive Flora (Wetland), Invasive Fauna (Terrestrial)		

Priority Wetlands
- High
  - W1 - Cowanna Billabong
  - W2 - Black Box Track Lagoons
- Medium
  - W3 - Lake Hawthorn
  - W4 - Lake Ranfurly
  - W5 - Catfish Lagoon
  - W6 - Brickworks Billabong
  - W7 - Cowra Rocks
  - W8 - Darling Junction Wetland
- Low
  - W9 - Bob Corbould Wetland
  - W10 - Lambert's Swamp
  - W11 - Yelta Drains

Priority Reaches
- High
- Medium
  - R1 - Darling Junction Creeks
- Low
  - R2 - Murray River (14-12)

Additional Waterways
- Wetlands
- Reaches

- Highway
- Major Road
- Towns & Localities
- Locks
- Waterway Management Units



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are formally recorded and captured within registered plans/agreements by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fences/bollards and roads/trails established under previous investment	423 ha over which infrastructure maintained[3]	Mallee CMA, PV, MRCC, Landholders
		A1.2	Revegetate stormwater drainage areas located on high floodplain	1 ha vegetation established	Mallee CMA, MRCC, Landcare
		A1.3	Maintain previous riparian management agreements	1 management agreement maintained	Mallee CMA, Landholder
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	6,585 ha over which invasive animals controlled[1]	Mallee CMA, PV, MRCC, LMW, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	423 ha over which invasive plants control[2]	Mallee CMA, PV, MRCC, LMW, Landholders, Landcare
		B1.1	Manage regulators and pumping events to avoid European Carp spawning events and benefit native fish	434 ha over which invasive animals controlled[4]	Mallee CMA, PV, LMW
		B1.2	Install European Carp movement barrier on the Cowanna Billabong regulator	1 waterway structure modified	Mallee CMA, PV, LMW
		B1.3	Control priority invasive aquatic plants as required	434 ha over which invasive plants controlled[4]	Mallee CMA, PV, MRCC, LMW
B2	An increase in the distribution and viability of priority species	B2.1	Maintain a Murray Hardyhead population at Brickworks Billabong	1 threatened species population maintained	DEPI, Mallee CMA, MDFRC, PV, Landcare, FMC
B3	An increase in soil stability through reduced erosion	B3.1	Manage access to Cowanna Bend to reduce erosion	1 km fence established	Mallee CMA, PV
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Install regulators at Cowanna Billabong and Catfish Billabong to reinstate more natural water regimes	2 waterway structures established	Mallee CMA, PV
		C1.2	Modify regulator at Brickworks Billabong	1 waterway structure modified	Mallee CMA, PV
		C1.3	Deliver water as per EWMPs	5 water regimes changed	Mallee CMA, GMW, PV, DEPI, CEWH, VEWH
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	6,585 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, MRCC, GMW, Indig. Stakeholders
F1	An increase in target audiences' awareness and understanding	F1.1	Review EWMP for Merbein Common	1 plan reviewed	Mallee CMA, PV, DEPI, FMC, Landcare
		F1.2	Investigate environmental water options for Murray River gaining zones to manage impacts of salt on the landscape	1 assessment established	Mallee CMA, PV, MRCC, DEPI
		F1.3	Develop EWMPs for Chaffey Bend, Johnsons Bend and Ranfurly/Hawthorn areas, incorporating results from F1.2	3 plans established	Mallee CMA, PV, MRCC, DEPI, LMW, Landcare
		F1.4	Investigate the feasibility of establishing walking trails at Lake Ranfurly and Lake Hawthorn, with connections to existing trail along Murray River	1 assessment established	Mallee CMA, MRCC, Landcare
		F1.5	Investigate feasibility of re-establishing Murray Hardyhead populations at other wetlands within WMU	1 assessment established	DEPI, Mallee CMA, GMW, LMW, MRCC, MDFRC
		F1.6	Investigate ecological values and threats of Cowra Rocks, and investigate options for management	1 assessment established 1 publication established	Mallee CMA, Landholders
F2	An increase in target audiences' skills and participation	F2.1	Plan and implement community projects that complement on-ground works and increase collaboration	16 engagement events coordinated	Mallee CMA, PV, FMC, Landcare, Local Comm.

F3	Collaborative arrangements and governance processes are maintained	F3.1	Update governance arrangements at Lake Ranfurly and Lake Hawthorn	1 management agreement established	Mallee CMA, DEPI, PV, MRCC, LMW, GMW, Education Dept.
F4	An increase in amenity and accessibility	F4.1	Maintain visitor facilities established under previous investment	308 ha over which visitor facilities maintained	PV, MRCC

13. Wallpolla

RCS Catchment Asset #1 - Murray River & Floodplain - Merbein to SA Border Waterway Management Unit #13 - Wallpolla			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	-	54	46
Values	Significant EVCs, Significant Fish, Significant Reptiles, Significant Birds, Significant Frogs, Significant Flora, Significant Cultural Heritage, Flagship Species, Drought Refuge, Important Bird Habitat, Wetland Vegetation Condition, Landscape, Game Hunting, Non-motor Boating, Barbeques and Picnics, Recreational Fishing		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Degraded Water Quality, Increase in Low Flow Magnitude, Reduction in High Flow Magnitude, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood), Change in Monthly Streamflow Variance, Reduced Floodplain Connectivity, Reduced Riparian Connectivity, Bank Instability		

Priority Wetlands

High
- W1 - Wallpolla Wetland 792
- W2 - Wallpolla West Wetland 772
- W3 - Horseshoe Lagoon
- W4 - Wallpolla Wetland 786
- W5 - Lock 9 Wetland
- W6 - Wallpolla Wetland 819
- W7 - Wallpolla Wetland 804
- W8 - Wallpolla Wetland 821

Medium
- W9 - Big Paddock Wetland

Low
- W10 - Lake Cullulleraine

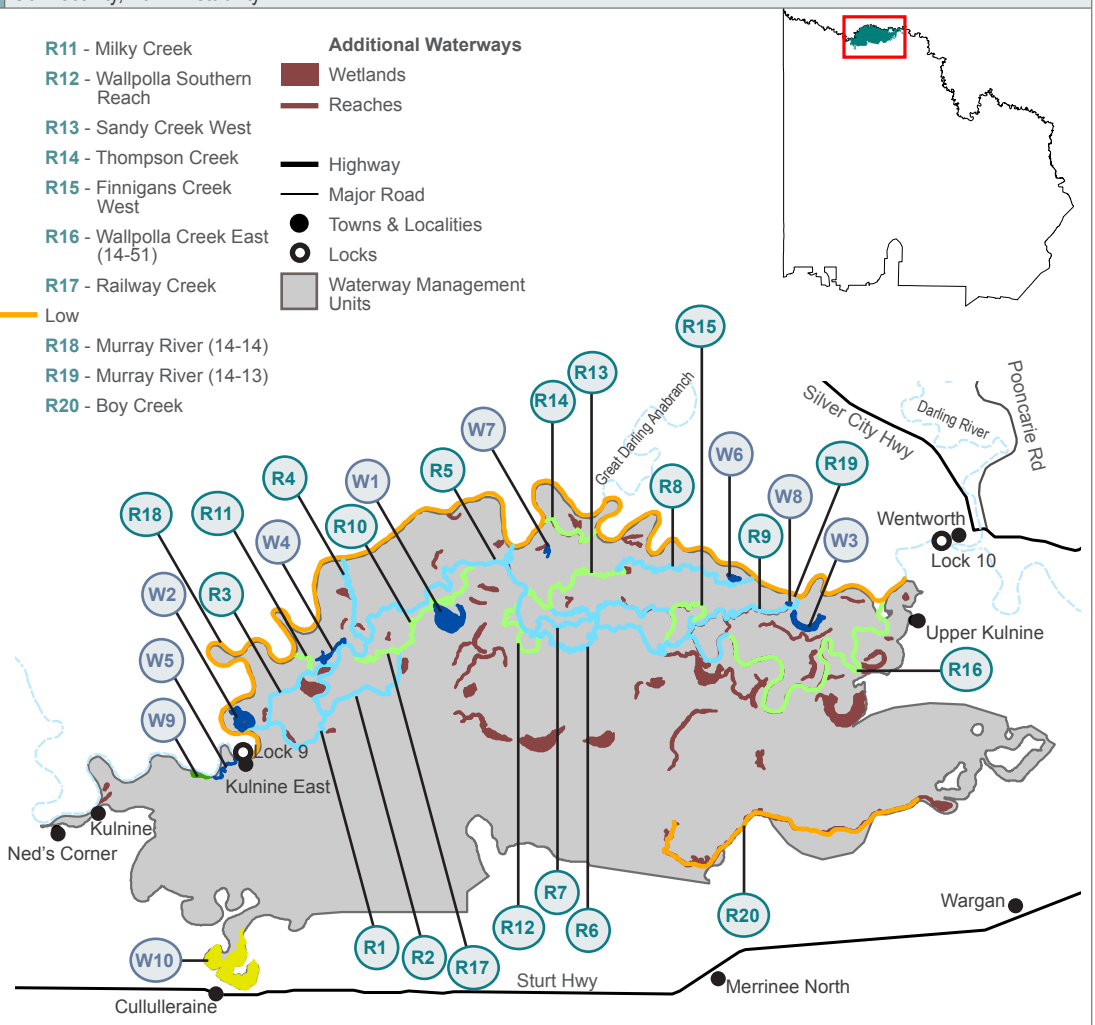
Priority Reaches

High
- R1 - Wallpolla Creek West (14-52)
- R2 - Ranka Creek
- R3 - Mullroo Creek
- R4 - Moorna Creek
- R5 - Dedmans Creek
- R6 - Wallpolla Creek Mid (14-50)
- R7 - Inner Wallpolla
- R8 - Sandy Creek East
- R9 - Finnigans Creek

Medium
- R10 - Willpenance Creek
- R11 - Milky Creek
- R12 - Wallpolla Southern Reach
- R13 - Sandy Creek West
- R14 - Thompson Creek
- R15 - Finnigans Creek West
- R16 - Wallpolla Creek East (14-51)
- R17 - Railway Creek

Low
- R18 - Murray River (14-14)
- R19 - Murray River (14-13)
- R20 - Boy Creek

Additional Waterways
- Wetlands
- Reaches
- Highway
- Major Road
- Towns & Localities
- Locks
- Waterway Management Units



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	2,901 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	5 km track removed	Mallee CMA, PV
				10 visitor facilities established	
		A1.3	Establish fencing and bollards where appropriate	60 km fencing/bollards established	Mallee CMA, PV
		A1.4	Maintain previous riparian management agreements and develop new agreements (including for the delivery of environmental water)	3 management agreements maintained	Mallee CMA, Landholders
				4 management agreements established	
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	37,464 ha over which invasive animals controlled[1]	Mallee CMA, PV, LMW, MRCC, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	2,901 ha over which invasive plants controlled[2]	Mallee CMA, PV, LMW, MRCC, Landholders
		B1.1	Control priority invasive aquatic plants as required	584 ha over which invasive plants controlled[4]	Mallee CMA, PV, LMW, MRCC, Landholders
C1 F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Maintain works established under previous TLM investment	1 waterway structure maintained	Mallee CMA, PV, Landholders
		C1.2	Install waterway structures to progress SDL environmental water program	10 waterway structures installed	Mallee CMA, PV
		C1.3	Deliver water as per EWMP	3,000 ha over which water regimes changed	Mallee CMA, TLM, SAWater, CEWH, VEWH, DEPI, PV, NSW OW, LMW
		C1.4	Support activities which provide increased variability in the Lock 9 weir pool	1 water regime changed	
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	37,464 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Work with Indigenous Stakeholders to determine appropriate rabbit control measures whilst protecting Cultural Heritage sites	1 partnership maintained	PV, Indig. Stakeholders, Mallee CMA
				1 assessment established	

F1	An increase in target audiences' awareness and understanding	F1.1	Establish an educational campaign to increase community understanding of values, threats and management interventions at Wallpolla Island	1 visitor facility (sign) established	Mallee CMA, DEPI, PV
				8 engagement events coordinated	
				2 publications established	
		F1.2	Investigate ecological impacts of proposed environmental watering works and prepare detailed design proposals	1 assessment established	Mallee CMA, PV,
				1 publication established	
		F1.3	Develop EWMP for Wallpolla WMU including Lock 9 weir pool	1 plan established	Mallee CMA, PV, DEPI, NSW OW
		F1.4	Monitor salinity activity in relation to watering events	1 assessment established	Mallee CMA, Irrigators
		F1.5	Investigate ecological requirements for yabbie and turtle populations	1 assessment established	Mallee CMA, MDFRC
		F1.6	Investigate ecological requirements for bat populations	1 assessment established	Mallee CMA
		F1.7	Develop a Field Guide to Bats	1 publication established	Mallee CMA, Landcare
F2	An increase in amenity and accessibility	F2.1	Improve signage of private property and public access points	8 visitor facilities (signs) established	Mallee CMA, PV, Landholders

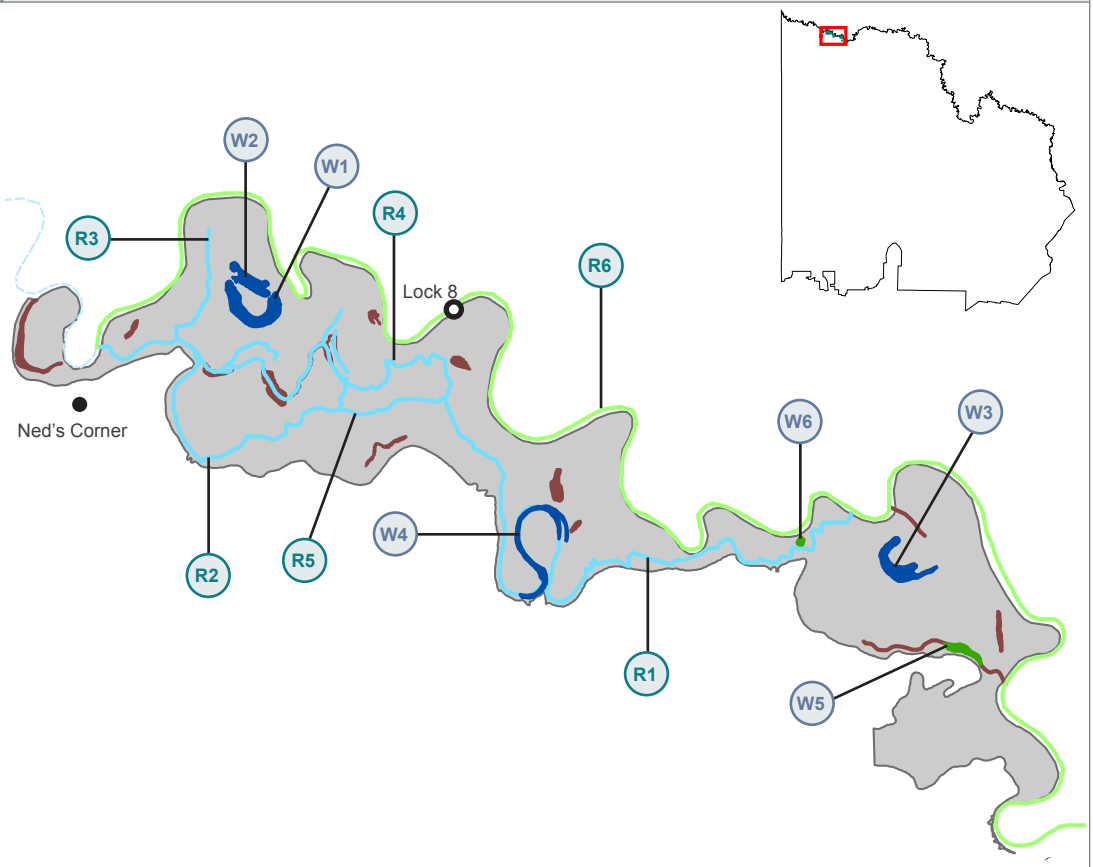
14. Mulcra

RCS Catchment Asset #1 - Murray River & Floodplain - Merbein to SA Border Waterway Management Unit #14 - Mulcra			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	29	29	42
Values	Significant EVCs, Significant Birds, Significant Frogs, Significant Flora, Significant Cultural Heritage, Flagship Species, Drought Refuge, Important Bird Habitat, Wetland Vegetation Condition, Landscape, Barbeques and Picnics, Community Group		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Degraded Water Quality, Increase in Low Flow Magnitude, Reduction in High Flow Magnitude, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood), Change in Monthly Streamflow Variance, Reduced Floodplain Connectivity, Reduced Riparian Connectivity, Barriers to Fish Migration, Loss of Instream Habitat (Sedimentation)		

Priority Wetlands
- High
  - W1 - Mulcra 726 South
  - W2 - Mulcra 726 North
  - W3 - Ned's Corner Lagoon
  - W4 - Snake Lagoon
- Medium
  - W5 - Old Tip Wetland
  - W6 - PK's Wetland
- Low

Priority Reaches
- High
  - R1 - Potterwalkagee Creek East
  - R2 - Potterwalkagee Creek West
  - R3 - Mulcra West Creek
  - R4 - Inner Potterwalkagee
  - R5 - Potterwalkagee Southern Connector
- Medium
  - R6 - Murray River (14-15)
- Low

Additional Waterways
- Wetlands
- Reaches
- Highway
- Major Road
- Towns & Localities
- Locks
- Waterway Management Units



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	1,124 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	2 km track removed	Mallee CMA, PV
				10 visitor facilities (signs) established	
		A1.3	Establish bollards where appropriate	5 km bollards established	Mallee CMA, Landholders, PV
		A1.4	Maintain existing scalded water ponding mounds to encourage natural regeneration	2 ha earth works maintained	Mallee CMA, PV Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	4,546 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	1,124 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders, Landcare
		B1.1	Control priority invasive aquatic plants as required	189 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
C1 F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Maintain works established under previous TLM investment	7 waterway structures maintained	Mallee CMA, PV, Landholders
		C1.2	Install waterway structures to progress environmental water program	3 waterway structures installed	Mallee CMA, PV
		C1.3	Deliver water to Mulcra Island and Ned's Corner	1,400 ha over which water regimes changed	TLM, CEWH, VEWH, MDBA, SA Water, Mallee CMA, DEPI, NSW OW, PV, Landholders
		C1.4	Support activities which provide increased variability to Lock 8 weir pool		
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	4,546 ha over which cultural assessments undertaken	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Investigate cultural flows trial at Mulcra Island, including objectives which differ to those of environmental flows and feasibility	1 assessment established	Mallee CMA, AAV, PV, Indig. Comm., Trad. Owners
F1	An increase in target audiences' awareness and understanding	F1.1	Establish educational signs at Ned's Corner on environmental water management interventions	2 visitor facilities (signs) established	Mallee CMA, DEPI, PV, TfN
		F1.2	Support community engagement and education activities at Ned's Corner and Mulcra Island	8 engagement events attended	TfN, Mallee CMA, PV
		F1.3	Develop EWMP for Mulcra WMU including Lock 8 weir pool	1 plan established	Mallee CMA, PV,
		F1.4	Guide wetland monitoring on private land (including Ned's Corner) using the Murray Wetlands Working Group booklet	3 assessments established	Mallee CMA, MWWG, PV Landholders
		F1.5	Investigate the reintroduction of Murray Crayfish to Potterwalkagee Creek (flowing habitat)	1 assessment established	MDFRC, PV, Mallee CMA, TfN, DEPI
		F1.6	Investigate breeding requirements for native fish and waterbirds	2 assessments established	Mallee CMA, MDFRC, DEPI
		F1.7	Monitor salinity activity in relation to watering events	1 assessment established	Mallee CMA, Irrigators
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities, including boat ramps, signage and the removal of dumped rubbish	1,124 ha over which visitor facilities maintained[3]	Mallee CMA, PV, SA Water, Landholders

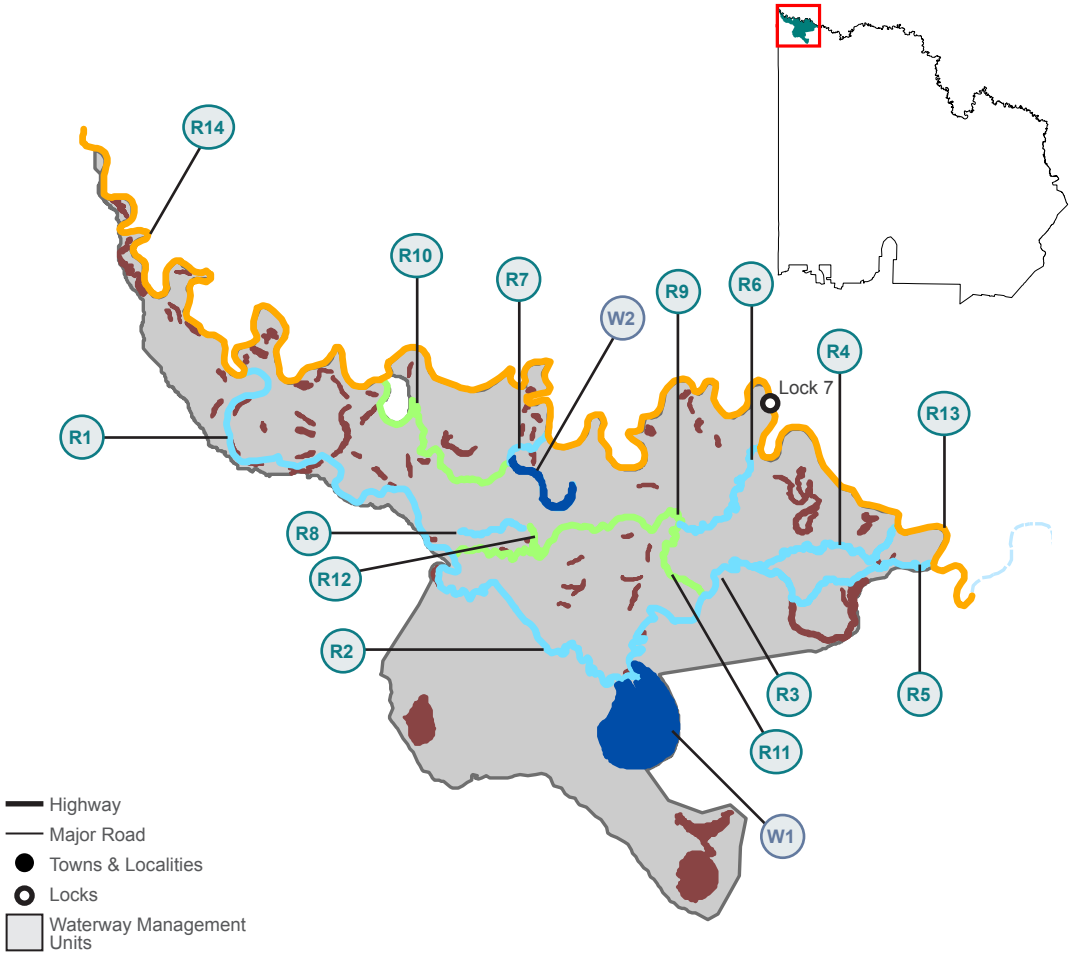
15. Lindsay

RCS Catchment Asset #1 - Murray River & Floodplain - Merbein to SA Border Waterway Management Unit #15 - Lindsay			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	-	-	100
Wetland (IWC 2010)	21	22	57
Values	Significant EVCs, Significant Birds, Significant Fish, Significant Frogs, Significant Reptiles, Significant Flora, Significant Cultural Heritage, Flagship Species, Drought Refuge, Important Bird Habitat, Landscape, Riparian Vegetation Condition, Barbeques and Picnics, Camping, Motor Boating, Recreational Fishing, Water Carrier		
Threats	Changed Water Regime, Invasive Fauna (Terrestrial), Invasive Fauna (Aquatic), Invasive Flora (Wetland), Degraded Water Quality, Increase in Low Flow Magnitude, Reduction in High Flow Magnitude, Reduced Vegetation Width, Loss of Instream Habitat (Large Wood), Change in Monthly Streamflow Variance, Reduced Floodplain Connectivity, Reduced Riparian Connectivity, Barriers to Fish Migration, Bank Instability, Reduced Wetland Area		

Priority Wetlands
- High
  - W1 - Lake Wallawalla
  - W2 - Webster's Lagoon
- Medium
- Low

Priority Reaches
- High
  - R1 - Lindsay River (14-71)
  - R2 - Lindsay River (14-70)
  - R3 - Lindsay River (14-69)
  - R4 - Lindsay River (14-67)
  - R5 - Lindsay River (14-68)
  - R6 - Mullaroo Creek (14-72)
  - R7 - Toupnein Creek (14-75)
  - R8 - Parallel to Mullaroo West
- Medium
  - R9 - Mullaroo Creek (14-73)
  - R10 - Toupnein Creek (14-76)
  - R11 - Mullaroo Lindsay Connector
  - R12 - Woodcutters Creek
- Low
  - R13 - Murray River (14-16)
  - R14 - Murray River (14-17)

Additional Waterways
- Wetlands
- Reaches



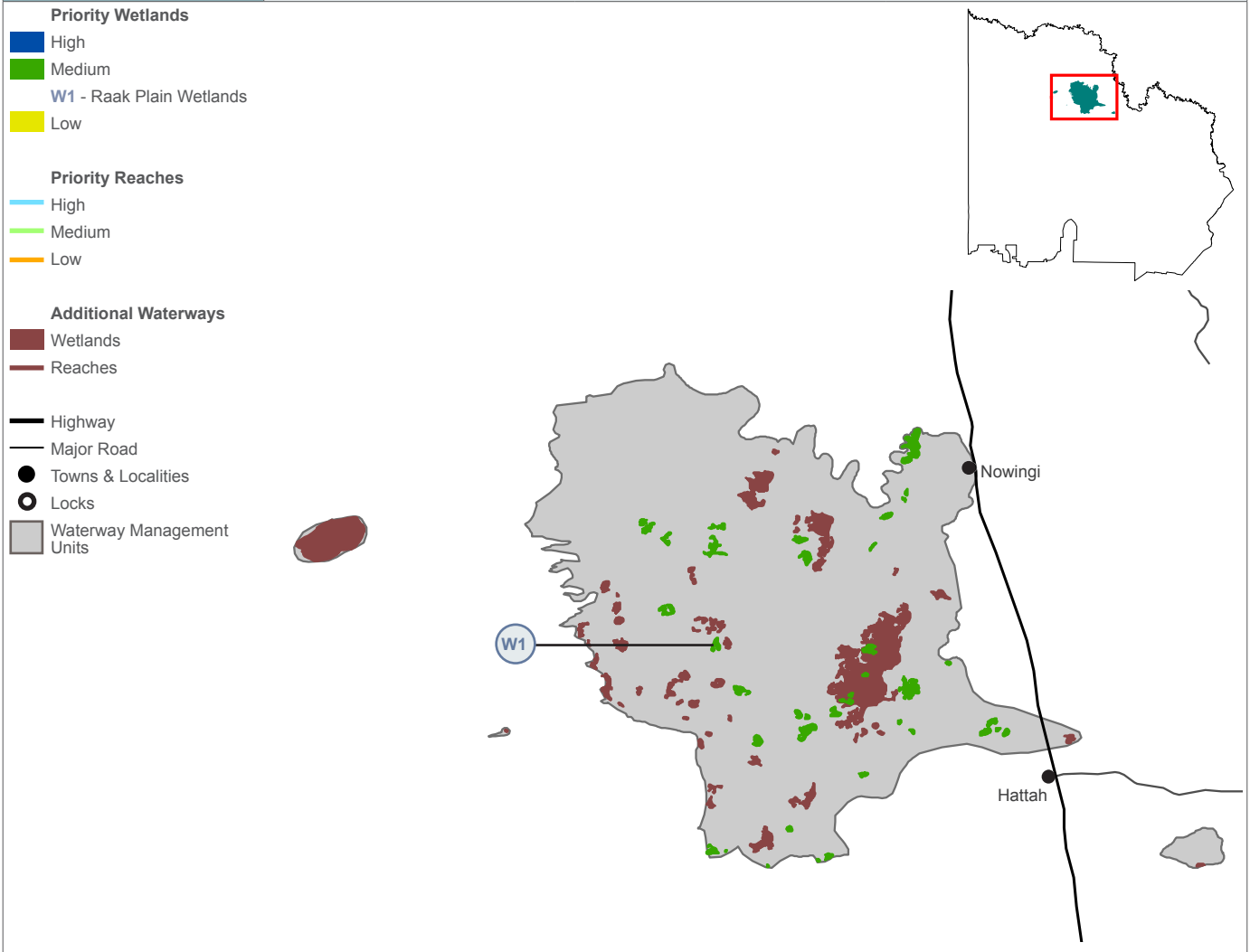
Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	2,275 ha over which infrastructure maintained[3]	Mallee CMA, PV
		A1.2	Establish track rationalisation works, with accompanying directional signage installed	4 km track removed 10 visitor facilities (signs) established	Mallee CMA, PV
		A1.3	Establish bollards where appropriate	10 km bollards established	Mallee CMA, PV, Landholders
		A1.4	Establish riparian managements agreements	2 management agreements established	PV, Mallee CMA, Landholders
		A1.5	Maintain existing scalded water ponding mounds to encourage natural regeneration	1 ha earth works maintained	Mallee CMA, PV Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	26,780 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders
		A2.2	Control priority invasive terrestrial plants, as determined annually	2,275 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		A2.3	Remove cattle from Lindsay Island	15,000 ha grazing regime removed	PV, Mallee CMA
		A2.4	Manage over-abundant wildlife to agreed target densities to manage grazing levels (whole Lindsay and part Berribee Parks Victoria Management Units)	26,780 ha over which over-abundant animals controlled	PV, Mallee CMA, DEPI
		B1.1	Control priority invasive aquatic plants as required	1,341 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
B2 **A3** F	An increase in the distribution and viability of priority species/ communities	B2.1	Reintroduce threatened Murray Crayfish to appropriate fast flowing environments	2 threatened species populations established	Mallee CMA, DEPI, PV, MDFRC
		B2.2	Maintain fishway on Mullaroo Creek	1 waterway structure maintained	Mallee CMA, SA Water, MDBA
		B2.3	Maintain integrity of Murray Cod breeding population in Mullaroo Creek	1 threatened species population maintained	Mallee CMA, PV, DEPI
		A3.1	Enhance linkages for Regent Parrot flyways to the west (State Forest and F1 Grazing Licence at Lindsay Point)	4 ha vegetation established 1 threatened species population maintained	Mallee CMA, PV, DEPI
		A3.2	Work with Indigenous Stakeholders to manage turtle nesting sites in culturally sensitive areas	1 threatened species population maintained	Mallee CMA, AAV, Indig. Stakeholders
C1 F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Maintain works established under previous TLM investment	6 waterway structures maintained	Mallee CMA, PV, SA Water, MDBA, Landholders
		C1.2	Install Stage 2 Structures as per SDL proposals	7 waterway structures installed	Mallee CMA, PV, SA Water, MDBA
		C1.3	Coordinate the delivery of environmental water	5,000 ha over which water regimes changed	TLM, CEWH, VEWH, MDBA, SA Water, Mallee CMA, DEPI, NSW OW, PV, Landholders
		C1.4	Support activities which provide opportunities for increased variability of Lock 6 and 7 weir pools		
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	26,780 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Maintain original cairn on VIC/SA border, and original survey marker on VIC/NSW border	2 heritage sites maintained	Mallee CMA, PV

F1	An increase in target audiences' awareness and understanding	F1.1	Work with houseboat operators to target community education around appropriate mooring and rubbish procedures	1 publication established	Mallee CMA, Houseboat Operators, Local Comm.
				2 engagement events coordinated	Mallee CMA, Houseboat Operators, Local Comm.
		F1.2	Develop EWMP for Lindsay WMU including Lock 6 and 7 weir pools	1 plan established	Mallee CMA, PV, SA Water, NSW Office of Water
		F1.3	Monitor salinity activity in relation to watering events	1 assessment established	Mallee CMA, Irrigators
		F1.4	Investigate the ecological requirements of fish larvae	1 assessment established	Mallee CMA
				1 publication established	Mallee CMA
		F1.5	Investigate lateral fish movement within and between creeks, floodplain and Murray River	1 assessment established	Mallee CMA
		F1.6	Correct the spatial mapping of Murray River at Pollard's Island for the ISC assessments	1 information management system modified	DEPI, Mallee CMA
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities, including boat ramps, signage and the removal of dumped rubbish	2,275 ha over which visitor facilities maintained[3]	Mallee CMA, PV, SA Water, Landholders

16. Raak Plain

RCS Catchment Asset #6 Raak Plain Waterway Management Unit #16 - Raak Plain			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Wetland (IWC 2010)	67	33	-
Values	Drought Refuge, Significant Birds, Significant Flora		
Threats	Invasive Fauna (Terrestrial), Invasive Flora (Terrestrial)		

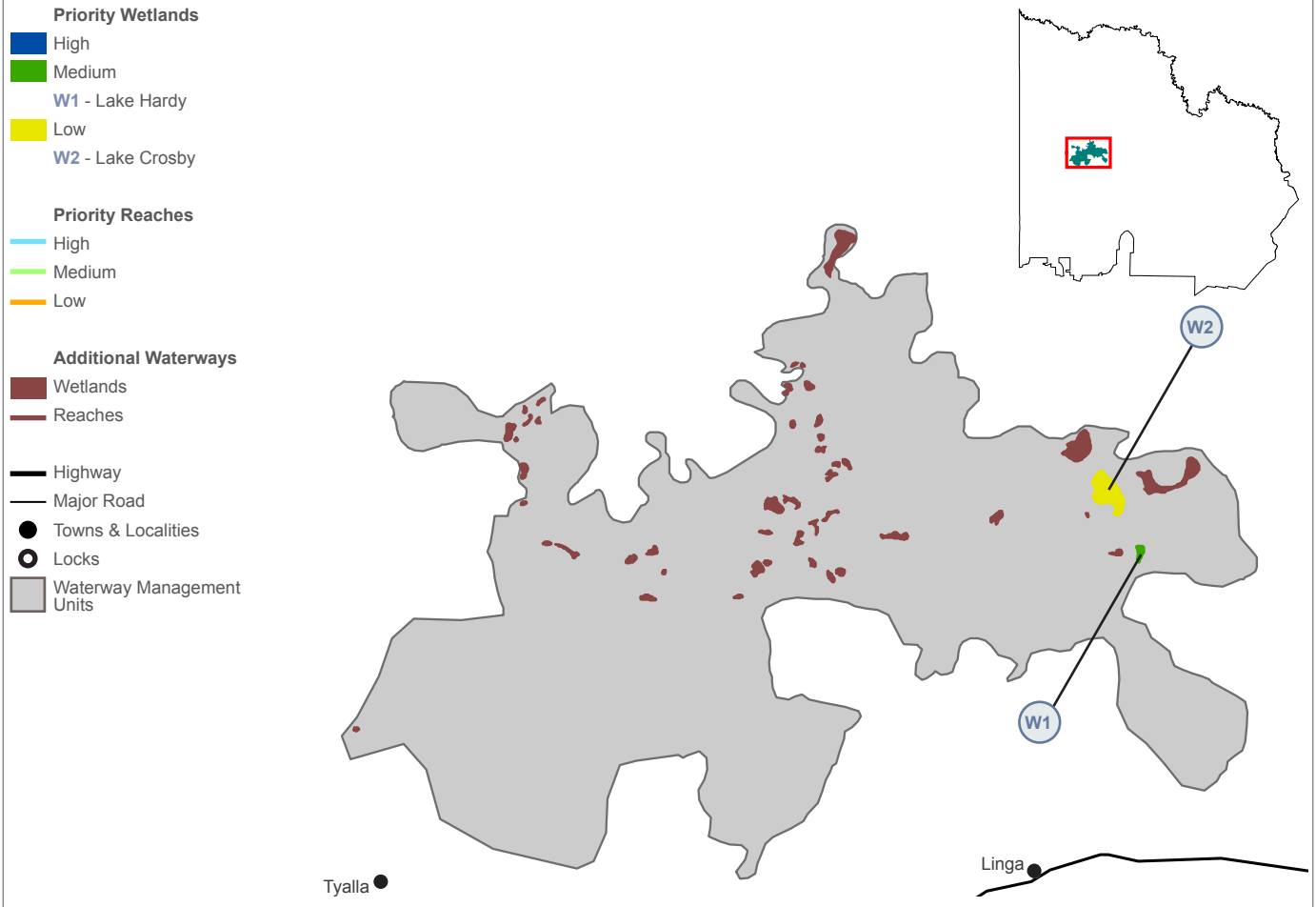


Long term Resource Condition Targets (RCT)	**A.** To improve the condition of riparian habitat associated with medium priority waterways by 2022. **D.** To improve water quality within medium priority waterways by 2022. **E.** To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F.** To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	2,817 ha over which infrastructure maintained[3]	Mallee CMA, PV, DEPI, Licensees
		A1.2	Renegotiate Land Management Plans/Licences (State Forest areas)	2 management agreements reviewed	DEPI, Mallee CMA, PV, Licensees
A2 D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	50,282 ha over which invasive animals controlled[1]	Mallee CMA, PV, DEPI, Licensees
		A2.2	Control over-abundant wildlife (kangaroos), including investigating cultural kill opportunities	50,282 ha over which over-abundant wildlife removed	Mallee CMA, DEPI, PV, Indig. Stakeholders, Licensees
		A2.3	Control priority invasive terrestrial plants, as determined annually	2,817 ha over which invasive plants controlled[2]	Mallee CMA, PV, DEPI, Licensees
E1 F	Cultural Heritage values are maintained	E1.1	Assess for the presence of Indigenous Cultural Heritage sites prior to commencing on-ground works	50,282 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, DEPI, Indig. Stakeholders
		E1.2	Assess for the presence of non-Indigenous heritage sites, and make recommendations for formal recording as required	1 assessment established	Mallee CMA, Heritage Victoria
F1	An increase in target audiences' awareness and understanding	F1.1	Collate information on saline groundwater dependant ecosystems and make recommendations for future investigations	1 publication established	Mallee CMA, DEPI, PV
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities	2,817 ha over which visitor facilities maintained[3]	PV, DEPI
		F2.2	Remove old, unrequired, fence lines	32 km fence removed	Mallee CMA, PV, DEPI

17. Pink Lakes

RCS Catchment Asset #8 - Pink Lakes Waterway Management Unit #17 - Pink Lakes			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Wetland (IWC 2010)	Insufficient data		
Values	Drought Refuge, Camping, Barbeques and Picnics, Important Bird Habitat, Wetland Vegetation Condition, Significant Wetland Flora		
Threats	Invasive Fauna (Terrestrial), invasive Flora (Terrestrial)		

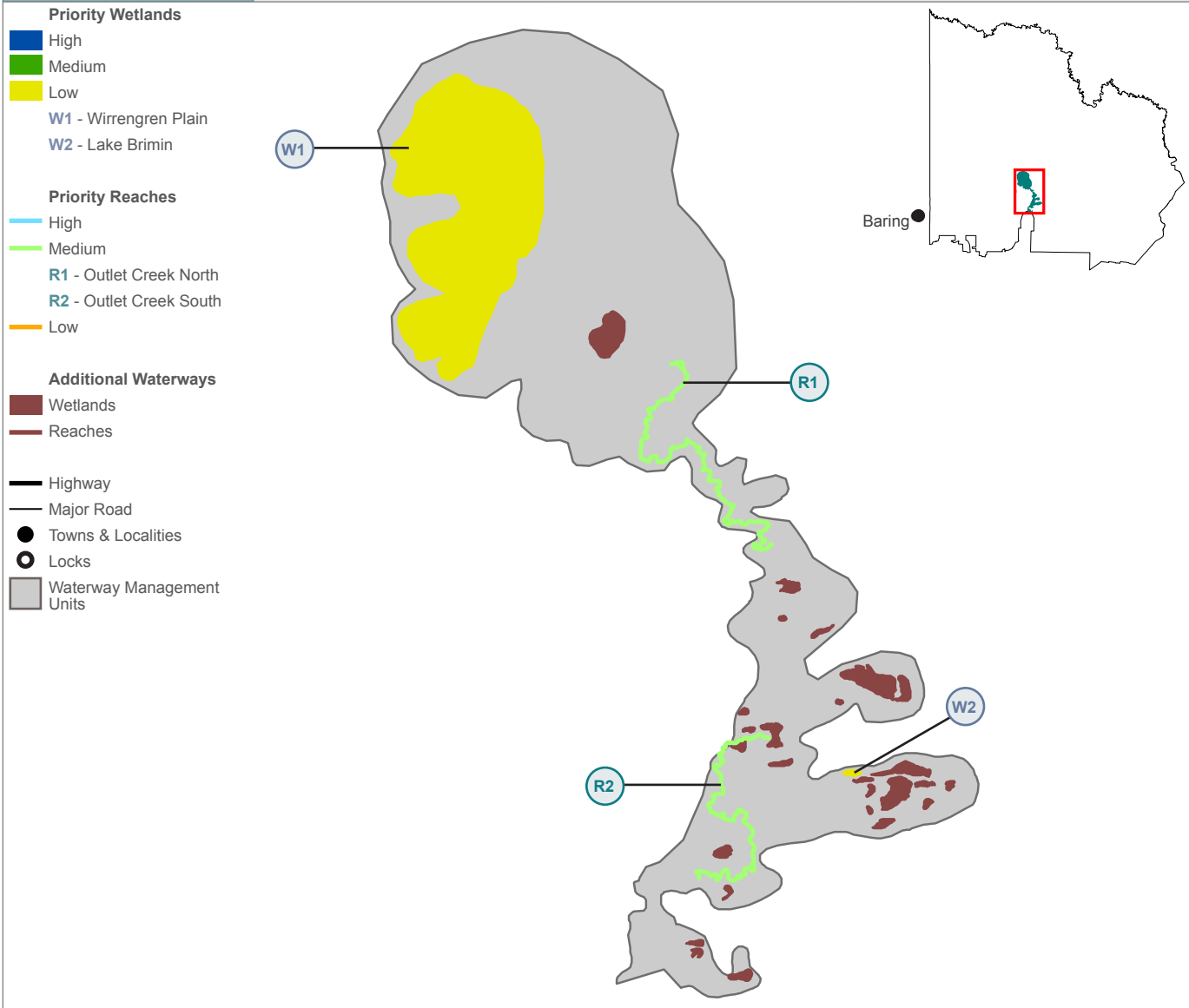


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with medium priority waterways by 2022. **D**. To improve water quality within medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	19 ha over which infrastructure maintained[3]	Mallee CMA, PV, DEPI
A2 D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	32,682 ha over which invasive animals controlled[1]	Mallee CMA, PV, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	19 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders, Landcare
		A2.3	Control over-abundant wildlife (kangaroos) to agreed target densities to manage grazing levels	32,682 ha over which invasive animals controlled[1]	PV, DEPI, Mallee CMA
B1 F	An increase in the availability of habitat features for priority species	B1.1	Continue to rehabilitate old gypsum mine sites on lake beds to reinstate natural wetland form and enhance habitat for Avocets	2 km earth works modified 20 ha vegetation established	Mallee CMA, Landholders
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	32,682 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, DEPI, Indig. Stakeholdes
F1	An increase in target audiences' awareness and understanding	F1.1	Collate information on saline groundwater dependant ecosystems and make recommendations for future investigations	1 publication established	Mallee CMA, DEPI, PV
		F1.2	Plan and implement community projects that complement on-ground works and increase collaboration	4 engagement events coordinated	Mallee CMA, PV, DEPI, Landcare
		F1.3	Review Land Management Plans (State Forest areas)	4 plans reviewed	Mallee CMA, DEPI
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities	19 ha over which visitor facilities maintained[3]	PV, DEPI

18. Wyperfeld

RCS Catchment Asset #14 - Outlet Creek & Wirrengen Plains Waterway Management Unit #18 - Wyperfeld			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	-	-	100
Values	Significant EVCs, Significant Flora, Important Bird Habitat, Riparian Vegetation Condition		
Threats	Invasive Fauna (Terrestrial), Invasive Flora (Terrestrial)		

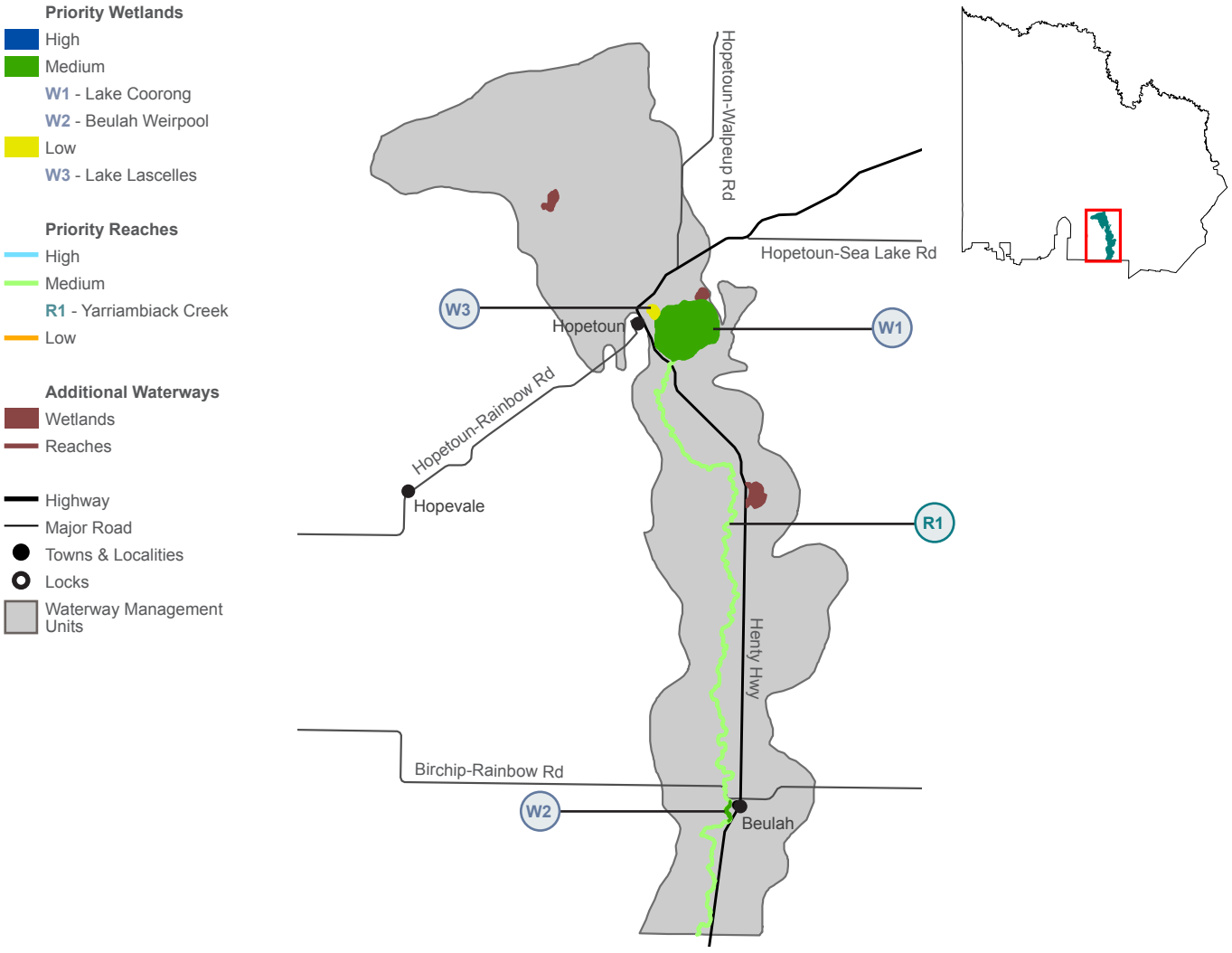


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with medium priority waterways by 2022. **D**. To improve water quality within medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	632 ha over which infrastructure maintained[3]	Mallee CMA, PV, DEPI
		A1.2	Undertake revegetation works	1ha vegetation established	Mallee CMA, PV
A2 D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually, including escaped bees from hives to tree hollows	22,316 ha over which invasive animals controlled[1]	Mallee CMA, PV, Bee Keepers, Landholders
		A2.2	Manage large piles of coarse woody debris to minimize harbour of pest animals and fire risk		
		A2.3	Control priority invasive terrestrial plants, as determined annually	632 ha over which invasive plants controlled[2]	Mallee CMA, PV, Landholders
		A2.4	Control over-abundant wildlife (kangaroos and galahs) to agreed target densities to manage grazing levels	22,316 ha over which over-abundant wildlife controlled[1]	Mallee CMA, PV, DEPI, Landholders
A3 B1	An increase in the availability of habitat features for priority species	A3.1	Install habitat targeted at Regent Parrots and Major Mitchell Cockatoos	8 terrestrial habitat features installed	Mallee CMA, PV, DEPI
		B1.1	Ensure fire suppression and containment earth works are fully rehabilitated to maintain physical form of Outlet Creek	1 km earth works modified	Mallee CMA, PV, DEPI
E1	Cultural Heritage values are maintained	E1.1	Assess for the presence of Indigenous Cultural Heritage sites prior to commencing on-ground works	22,316 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, DEPI, Indig. Stakeholders, BGLC
		E1.2	Assess for the presence of non-Indigenous heritage sites, and make recommendations for formal recording as required	1 assessments established	Mallee CMA, Heritage Victoria, BGLC
F1	An increase in target audiences' awareness and understanding	F1.1	Investigate options (including feasibility assessment) to increase water in the landscape	1 assessment established	Mallee CMA, DEPI, PV, Wimmera CMA, VEWH
		F1.2	Review Land Management Plan (State Forest areas)	1 plan reviewed	Mallee CMA, PV
F2 A D E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities	632 ha over which visitor facilities maintained[3]	PV, DEPI

19. Yarriambiack

RCS Catchment Asset #17 - North Wimmera Creeklines Waterway Management Unit #19 - Yarriambiack			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	Insufficient data		
Values	Significant Birds, Significant EVCs, Significant Fish, Significant Flora, Swimming, Barbeques and Picnics, Recreational Fishing, Motor Boating, Non-Motor Boating, Camping		
Threats	Invasive Fauna (Aquatic), Barriers to Fish Migration, Invasive Fauna (Terrestrial), Reduced Vegetation Width, Degraded Water Quality, Reduced Floodplain Connectivity, Changed Water Regimes, Invasive Flora (Wetland), Reduced Wetland Area, Altered Wetland Form		

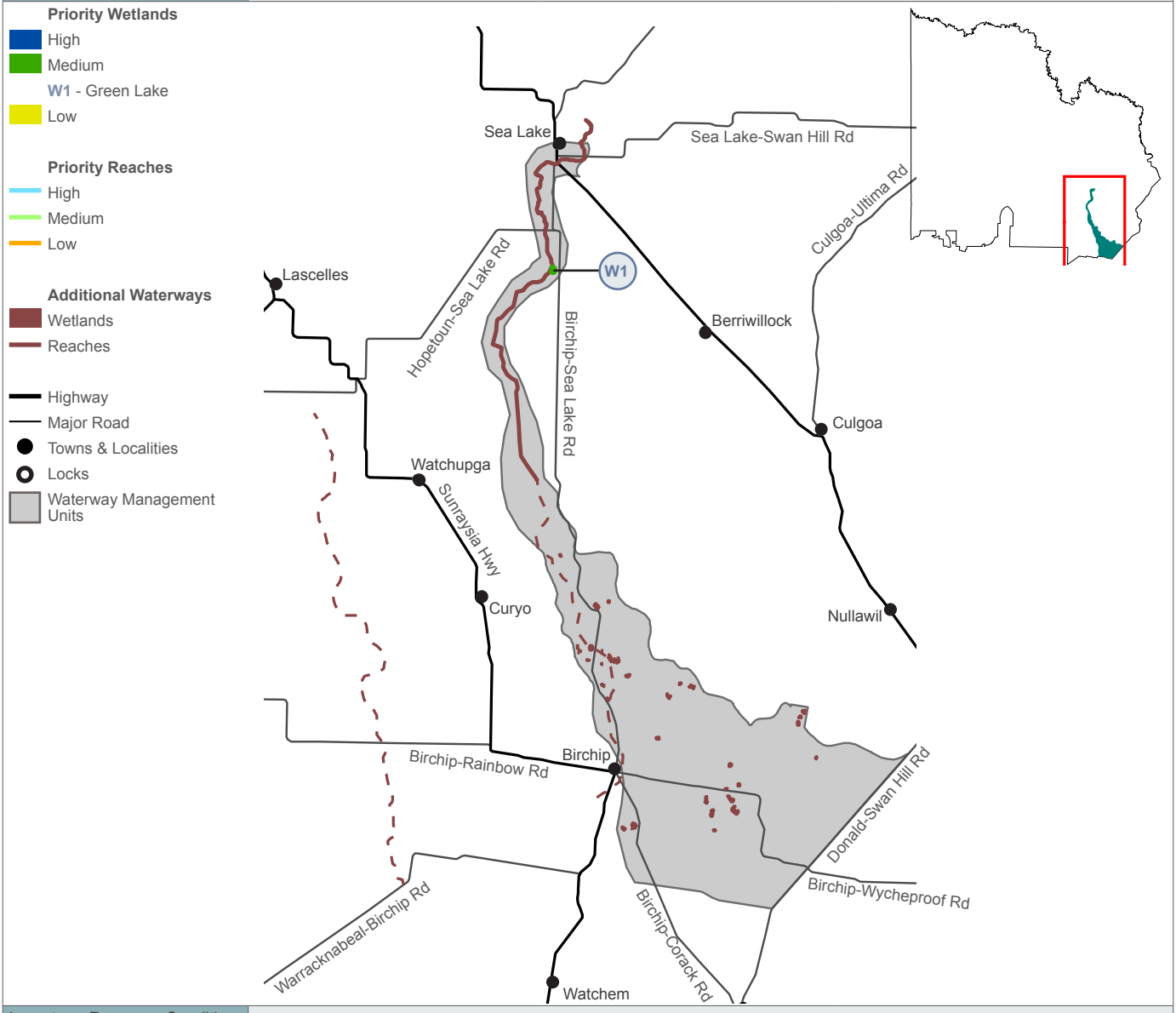


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain or establish riparian management agreements along Yarriambiack Creek and modify licences as appropriate to extend management of riparian zone along whole length of creek	7 management agreements maintained 3 management agreements established	Mallee CMA, Landholders, DEPI
		A1.2	Install fencing where appropriate	2 km fencing established	Mallee CMA, Landholders
		A1.3	Maintain priority roads/track and fences/bollards established under previous investment	963 ha over which infrastructure maintained[3]	Mallee CMA, DEPI, YSC
A2 D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	31,136 ha over which invasive animals controlled[1]	Mallee CMA, DEPI, Landholders, YSC
		A2.2	Establish and maintain rabbit exclusion fencing around Lake Coorong on private and public land	7 km fence established 2 km fence maintained	Mallee CMA, DEPI
		A2.3	Control priority invasive terrestrial plants, as determined annually	963 ha over which invasive plants controlled[2]	Mallee CMA, DEPI, Landholders, YSC, Landcare
B1 F	An increase in the availability of habitat features for priority species	B1.1	Establish a native fish refuge in wetland adjacent to Lake Lascelles and increase its in-stream habitat	0.1 km channel established 3 waterway structures (logs) installed	VRFish, Mallee CMA, YSC, DEPI
B2 D E F	An increase in soil stability through reduced erosion	B2.1	Control bank erosion at Beulah weir pool through maintenance of previous revegetation investment	5 ha vegetation maintained	Mallee CMA, YSC, GWM Water, BWPC, Landcare
C1 A B D E F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Implement wetting and drying regime at Beulah weir pool and Yarriambiack Creek upstream of Beulah weir pool	2 water regimes changed	Mallee CMA, GWM Water, BWPC
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	31,136 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
F1	An increase in target audiences' awareness and understanding	F1.1	Include Yarriambiack Creek to Lake Coorong into the Wimmera EWMP	1 plan established	Mallee CMA, WCMA, BWPC, YCAC
		F1.2	Review Beulah EWMP and Yarriambiack Creek Management Plan	2 plans reviewed	Mallee CMA, BWPC, YCAC, WCMA
		F1.3	Investigate water-dependent flora and fauna ecosystem in Beulah weir pool, Yarriambiack Creek and Lake Coorong	3 assessment established 1 publication established	Mallee CMA
		F1.4	Investigate stocking of both recreational and priority native fish species at Beulah Weir Pool to create a dispersal point during high flows	1 assessment established	Mallee CMA, VRFish, BWPC
		F1.5	Conduct community education around the importance of Black Box vegetation and Carpet Python habitat	8 engagement events coordinated 4 publications established	Mallee CMA, Landcare, Local Comm., Landholders
		F1.6	Trial a pilot database of fisher catch records at Lake Lascelles and Tchum Lake South (see Dunmunkle WMU work plan) to monitor fish populations	1 information management system established	Mallee CMA, VRFish, Local Comm.
F3	An increase in amenity and/or accessibility	F3.1	Maintain visitor facilities along Yarriambiack Creek and around Lake Coorong, Lake Lascelles and Beulah Weir Pool	963 ha over which amenity maintained[3]	Mallee CMA, Landcare, DEPI, YSC, Landholders

20. Dunmunkle

RCS Catchment Asset #12 - Avoca Basin Terminal Lakes System & Creeklines Waterway Management Unit #20 - Dunmunkle			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Wetland (IWC 2010)	Insufficient data		
Values	Significant Birds, Drought Refuge, Community Group, Camping, Barbeques and Picnics		
Threats	Reduced Wetland Area, Degraded Water Quality, Altered Wetland Form, Changed Water Regime		

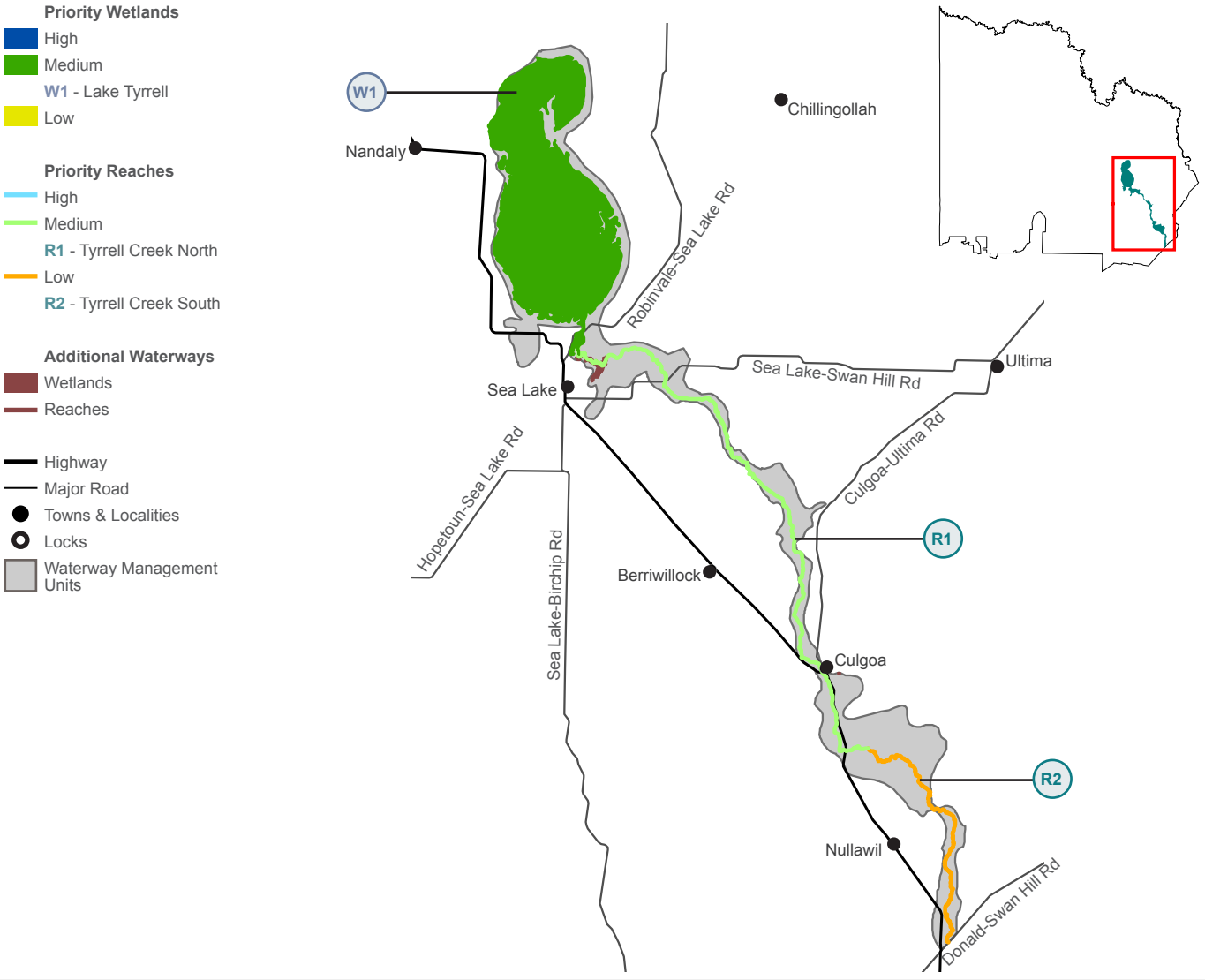


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with medium priority waterways by 2022. **C**. To improve hydrology within medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority roads/tracks and fences/ bollards established under previous investment	24 ha over which infrastructure maintained[3]	Mallee CMA, DEPI, Landholders
		A1.2	Maintain previous riparian management agreements and develop new management agreements	3 management agreements maintained 3 management agreements established	Mallee CMA, Landholders
A2 **B1** D E F	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial animals, as determined annually	50,976 ha over which invasive animals controlled[1]	Mallee CMA, DEPI, BSC, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	24 ha over which invasive plants controlled[2]	Mallee CMA, DEPI, BSC, Landholders, Landcare
		B1.1	Control priority invasive aquatic plants as required	2 ha over which invasive plants controlled[4]	Mallee CMA, DEPI, BSC
C1 F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Reinstate natural flow routes through priority Black Box vegetation communities with on-ground works such as culverts under roads and removing unused channels, taking results of F1.1 into account	8 waterways structures (culverts) established 10 km channel removed 8 water regimes changed	Mallee CMA, BSC, VicRoads, DEPI, Landholders
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	50,976 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
F1	An increase in target audiences' awareness and understanding	F1.1	Investigate impediments to flow along the Dunmunkle Creek floodplains, including options to reinstate natural flows	1 assessment established	Mallee CMA
		F1.2	Monitor groundwater bores at Green Lake and investigate capability to hold water	2 assessments established	Mallee CMA, BSC, Local Comm.
F2	An increase in amenity and/or accessibility	F2.1	Maintain and upgrade visitor facilities	24 ha over which visitor facilities maintained[3]	PV, DEPI

21. Tyrrell

RCS Catchment Asset #12 - Avoca Basin Terminal Lakes System & Creeklines Waterway Management Unit #21 - Tyrrell			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	100	-	-
Values	Significant EVCs, Significant Flora Terrestrial, Significant Flora Wetland, Drought Refuges, Important Bird Habitats, Flagship Species, Significant Reptiles Riparian, Wetland Vegetation Condition, Extractive Industry		
Threats	Invasive Fauna (Terrestrial), Degraded Buffer, Reduced Vegetation Width, Degraded Water Quality		

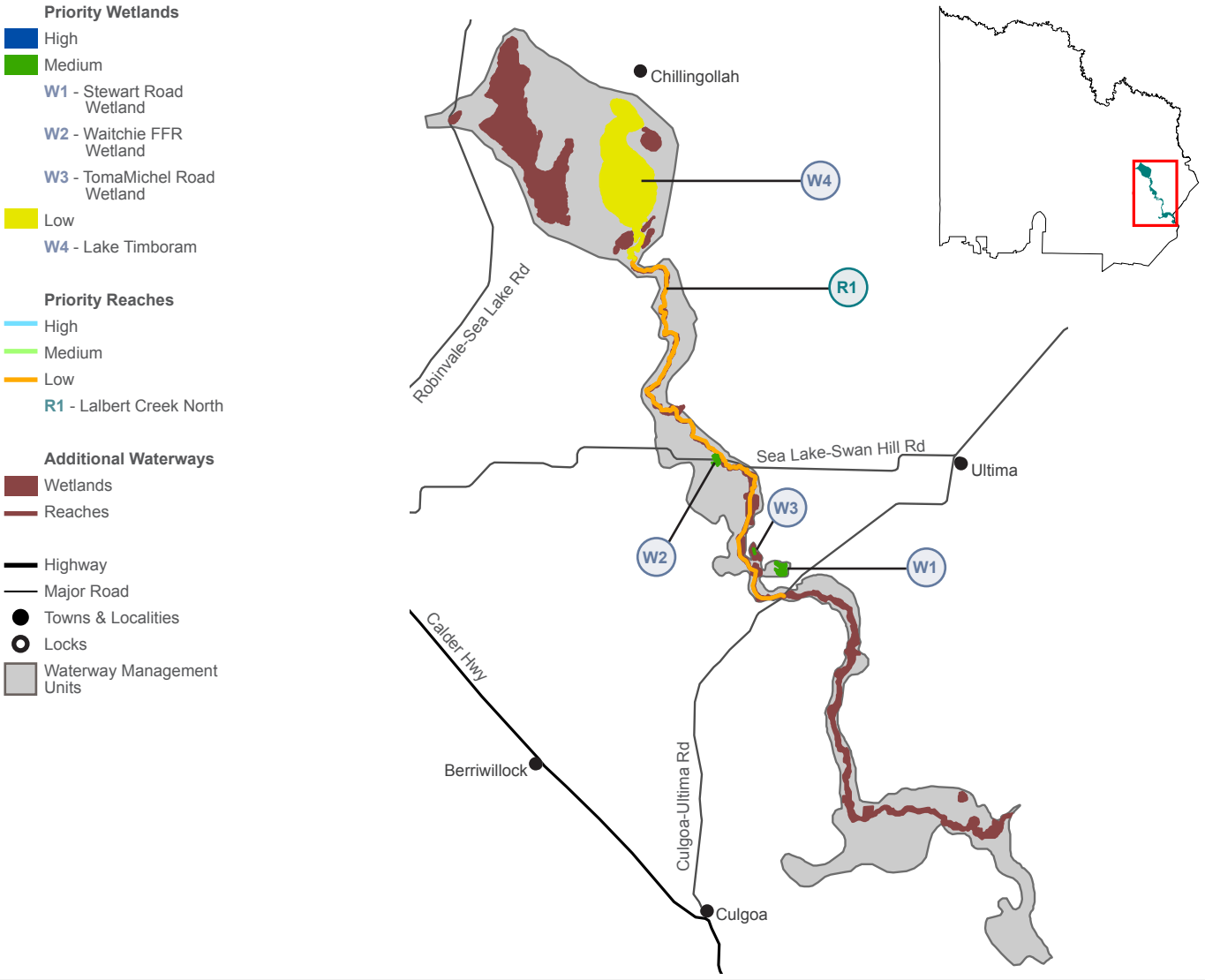


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **D**. To improve water quality within medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain or establish riparian management agreements along Tyrrell Creek, and modify licences as appropriate	32 management agreements maintained 2 management agreements established	Mallee CMA, DEPI, Landholders, Licencees
		A1.2	Maintain priority roads/tracks and fences/ bollards established under previous investment	2,312 ha over which infrastructure maintained[3]	Mallee CMA, DEPI, Landholder
		A1.3	Complete fencing works along Tyrrell Creek, as recommended in the Lalbert and Tyrrell Creeks Management Plan	6 km fencing established	Mallee CMA, DEPI, PV, Landholders
		A1.4	Revegetate riparian zones along Tyrrell Creek, sites to be determined annually	4 ha vegetation established	Mallee CMA, DEPI, PV, Landcare, Local Comm.
		A1.5	Reduce duplication of track network	2 km tracks modified	Mallee CMA, DEPI
A2 D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	20,375 ha over which invasive animals controlled[1]	Mallee CMA, DEPI, PV, BSC, Landholders, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	2,312 ha over which invasive plants controlled[2]	Mallee CMA, DEPI, PV, BSC, Landholders, Landcare
A3 E F	An increase in the availability of habitat features for targeted species	A3.1	Maintain natural Carpet Python habitat (hollowed logs), through firewood collection education, see F1.2	2,312 ha over which terrestrial habitat features maintained	Mallee CMA, DEPI, Landholders, Local Comm.
		A3.2	Install Carpet Python habitat	4 terrestrial habitat features installed	Mallee CMA, DEPI, Landholders, Landcare
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	20,375 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Establish on-going community education around cultural values and the need for E1.1	4 engagement events attended 1 publication established	Mallee CMA, DEPI, PV, Landcare, Landholders
		E1.3	Survey cultural sites as per Lalbert and Tyrrell Creeks Management Plan to monitor condition, establish current threats and make recommendations	1 assessment established	Mallee CMA, AAV, Indig. Comm.
F1	An increase in target audiences' awareness and understanding	F1.1	Collate information on saline groundwater dependant ecosystems and make recommendations for future investigations	1 publication established	Mallee CMA
		F1.2	Develop a fauna educational program, targeting Carpet Python and Grey-crowned Babbler as per recommendations of the Lalbert and Tyrrell Creeks Management Plan	4 engagement events coordinated 2 publications established 4 signs established	Mallee CMA, Local Comm.
		F1.3	Investigate options to improve connectivity and habitat availability for priority species (including connectivity between Tyrrell and Lalbert Creeks)	1 plan developed 1 publication established	Mallee CMA, BSC
		F1.4	Investigate options to reduce impediments to flow along Tyrrell Creek	1 assessment established 1 publication established	Mallee CMA, DEPI, GWM Water
		F1.5	Compile pre-existing flood photos for utilisation in future flood planning	1 publication established	Mallee CMA
		F1.6	Survey bat and kangaroo populations along Tyrrell Creek	2 assessments established	Mallee CMA
F2 D E	An increase in amenity and accessibility	F2.1	Maintain visitor facilities along Tyrrell Creek and Lake Tyrrell, including those adjacent to Calder Highway	2,312 ha over which visitor facilities maintained[3]	Mallee CMA, DEPI, VicRoads, Landholders

22. Lalbert

RCS Catchment Asset #12 - Avoca Basin Terminal Lakes System & Creeklines Waterway Management Unit #22 - Lalbert			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	100	-	-
Values	Significant EVCs, Significant Flora Terrestrial, Significant Flora Wetland, Drought Refuges, Important Bird Habitats, Flagship Species, Significant Reptiles Riparian, Wetland Vegetation Condition, Extractive Industry		
Threats	Invasive Fauna (Terrestrial), Degraded Buffer, Reduced Vegetation Width, Degraded Water Quality		



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with medium priority waterways by 2022. **C**. To improve hydrology within medium priority waterways by 2022. **D**. To improve water quality within medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain or establish riparian management agreements along Lalbert Creek and modify licences as appropriate to extend management of riparian zone along whole length of creek	3 management agreements maintained 10 management agreements established	Mallee CMA, DEPI, Landholders
		A1.2	Install riparian fencing where appropriate	1 km fencing established	Mallee CMA, Landholders
		A1.3	Maintain priority roads/tracks and fences/ bollards established under previous investment, including along Lalbert Creek	877 ha over which infrastructure maintained[3]	Mallee CMA, DEPI, Landholders
A2 D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	18,768 ha over which invasive animals controlled[1]	Mallee CMA, BSC, Landholders
		A2.2	Control priority invasive terrestrial plants, as detrmined annually	75 ha over which invasive plants controlled[2]	Mallee CMA, BSC, Landholders
A3 E F	An increase in the availability of habitat features for targeted species	A3.1	Install Carpet Python habitat (hollowed logs)	4 terrestrial habitat features installed	Mallee CMA, DEPI, Landcare, Landholders
E1 F	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	18,768 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
		E1.2	Survey cultural sites as per Lalbert and Tyrrell Creeks Management Plan to monitor condition, establish current threats and make recommendations	1 assessment established 1 publication established	Mallee CMA, AAV, Indig. Comm.
F1	An increase in target audiences' awareness and understanding	F1.1	Review groundwater bores to establish future monitoring requirements	1 assessment established	Mallee CMA, DEPI
		F1.2	Develop a fauna educational program, targeting Carpet Python and Grey-crowned Babbler as per recommendations of the Lalbert and Tyrrell Creeks Management Plan	4 engagement events coordinated 2 publications established 4 signs established	Mallee CMA, Local Comm., Landcare, DEPI, BSC, VicRoads
		F1.3	Investigate options to improve connectivity and habitat availability for priority species (including connectivity between Tyrrell and Lalbert Creeks	1 plan developed 1 publication established	Mallee CMA, BSC
		F1.4	Investigate options to reduce impediments to flow, including overbank flows to remnant vegetation such as Brimy Bill Wildlife Reserve	1 assessment established	Mallee CMA
		F1.5	Investigate options to deliver water to wetlands within Waitchie FFR	1 assessment established	Mallee CMA
		F1.6	Survey bat populations along Lalbert Creek	1 assessment established	Mallee CMA
		F1.7	Conduct assessments at Lake Timboram and Lake Wahpool to identify values and establish baseline data	2 assessments established	Mallee CMA
F2 E	An increase in amenity and accessibility	F2.1	Maintain and upgrade visitor facilities along Lalbert Creek	877 ha over which visitor[3]	Mallee CMA, DEPI, BSC, Landholders
		F2.2	Install visitor facilities at Waitchie FFR (along Sea Lake Swan Hill Road)	1 visitor facility installed	Mallee CMA, DEPI, VicRoads

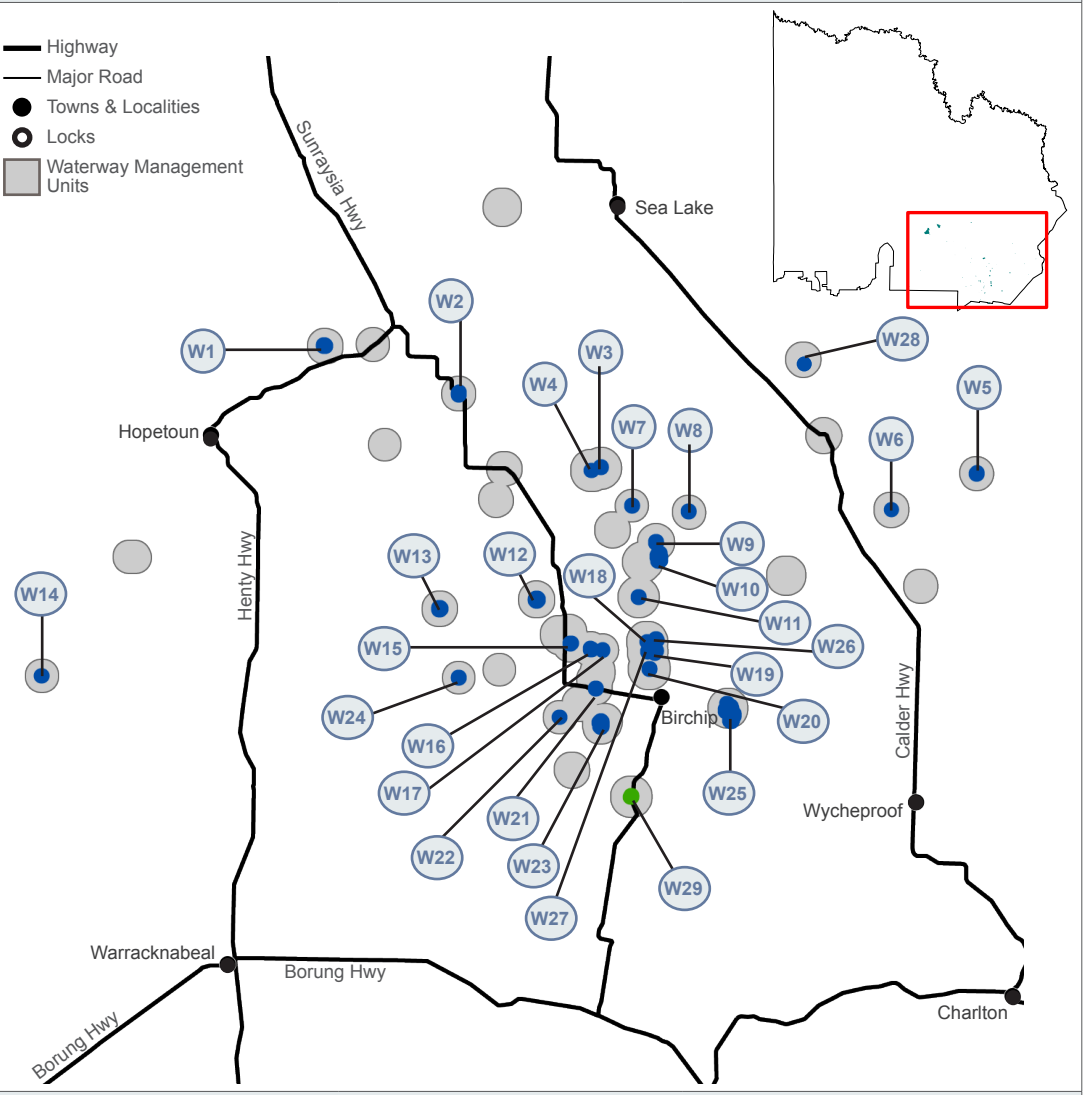
23A. Dispersed Wetlands - Freshwater

RCS Catchment Asset #18 - Agricultural land Waterway Management Unit #23A - Dispersed Wetlands - Freshwater			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	Insufficient data		
Values	Significant EVCs, Significant Birds, Significant Flora, Significant Reptiles (Terrestrial), Flagship Species, Drought Refuge, Community Group, Barbeques and Picnics		
Threats	Changed Water Regime, Altered Wetland Form, Invasive Flora (Wetland), Invasive Fauna (Terrestrial), Reduced Wetland Area, Degraded Water Quality, Invasive Fauna (Aquatic), Degraded Buffer		

Priority Wetlands

High
- W1 - Chiprick
- W2 - Cronomby Tanks
- W3 - Coundons Wetland
- W4 - Rickard Glenys Dam
- W5 - Cokym Bushland Reserve
- W6 - Poyner
- W7 - R Ferrier Dam
- W8 - J Ferrier Wetland
- W9 - Broom Tank
- W10 - Lake Marlbed
- W11 - Clinton Shire Dam
- W12 - Bull Swamp
- W13 - Lake Danaher Bushland Reserve
- W14 - John Ampt Wetland
- W15 - Gould's Reserve
- W16 - Barber's Swamp
- W17 - Mahoods Corner
- W18 - Kath Smith Dam
- W19 - Hill Paddock Wetland
- W20 - Pam Juergens Dam
- W21 - Part of Gap Reserve
- W22 - Roselyn Wetland/ Reid's Dam
- W23 - Greens Wetland
- W24 - Shannons Wayside
- W25 - Tchum Lakes
- W26 - Karyrie Bushland Reserve
- W27 - Homelea Wetland
- W28 - Considines on Tyrrell

Medium
- W29 - Morton Plains Reserve

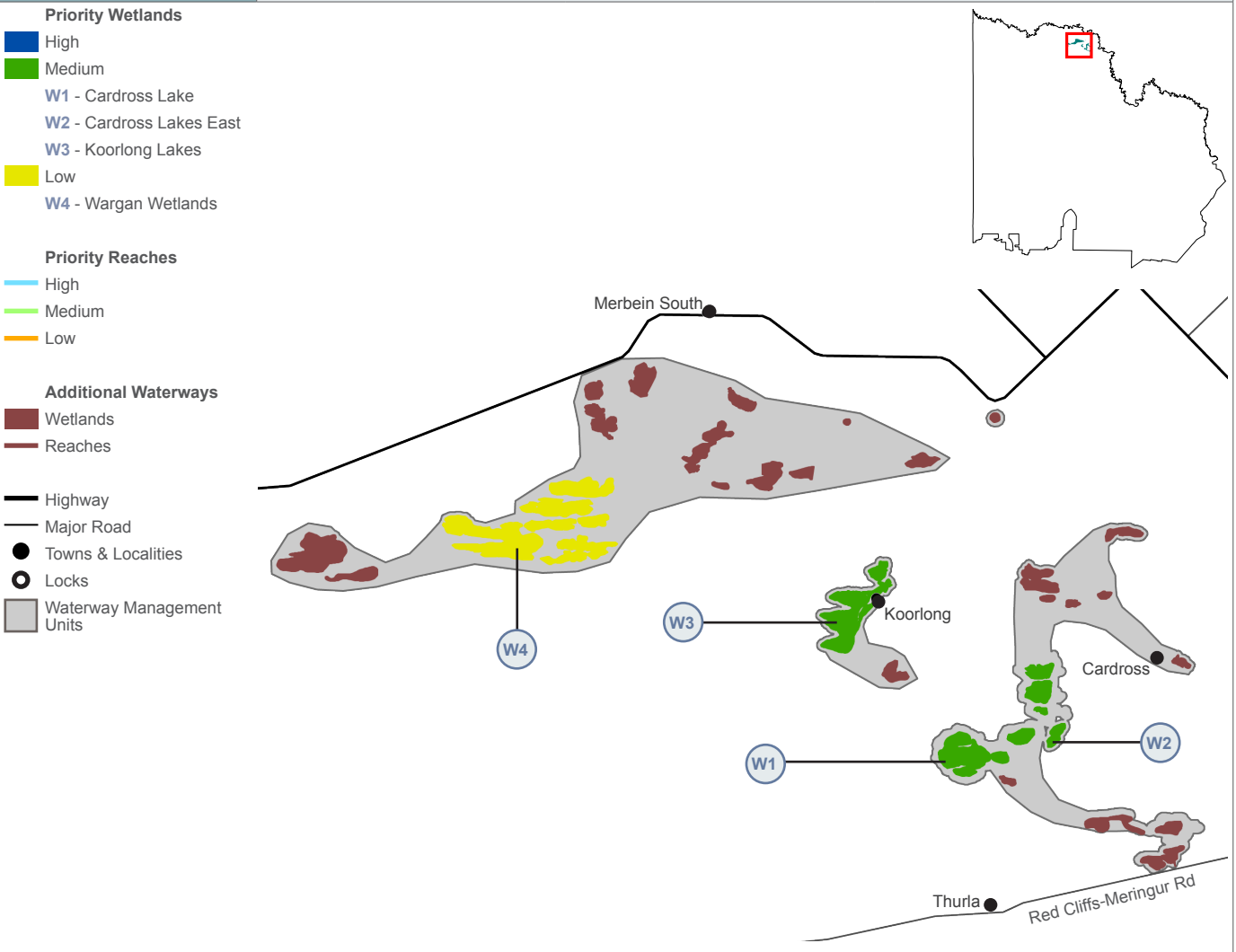


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 F	An increase in the diversity and structure of native vegetation	A1.1	Maintain existing riparian management agreements	17 management agreements maintained	Mallee CMA, Landholders
		A1.2	Carry out fencing and revegetation works at Carpet Python targeted sites	1.4 km fencing established	Landcare, Mallee CMA, Local Comm.
				1 ha vegetation established	
A2 **B1** D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually (cats and foxes)	323,600ha over which invasive animals controlled[1]	Mallee CMA, DEPI, PV, Landholders, BSC, Landcare
		A2.2	Control priority invasive terrestrial plants, as determined annually	175 ha over which invasive plants controlled[2]	Mallee CMA, DEPI, PV, Landholders, BSC, Landcare
		B1.1	Control priority invasive aquatic plants as required	110 ha over which invasive plants controlled[4]	Mallee CMA, PV, Landholders
A3 B2 D E F	An increase in the availability of habitat features for targeted species	A3.1	Install Carpet Python habitat	8 terrestrial habitat features installed	Mallee CMA, Landcare, Landholders, DEPI
		B2.1	Establish trial site; Modify wetland form to create ideal habitat for wading birds (graduating slope); Assess, see F1.3	0.2 km earth works established	Mallee CMA, Landholder
C1 A B D E F	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Establish agreements for flooding public and private land	31 management agreements established	Mallee CMA, GWM Water, DEPI, Landholders
		C1.2	Coordinate the delivery of environmental water to wetlands	31 water regimes changed	Mallee CMA, PV, GWM Water, VEWH, MDBC, CEWH, Landholders
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	323,600 ha cultural sites over which assessments undertaken[5]	Mallee CMA, AAV, PV, Indig. Stakeholders
F1	An increase in target audiences' awareness and understanding	F1.1	Review EWMP for Wimmera Mallee Pipeline wetlands in the Mallee CMA region, including the water regime requirements and ecological objectives for each wetland	1 plan reviewed	Mallee CMA, PV, GWM Water
		F1.2	Monitor water delivery area for vegetation condition, frogs and birds, both private and public land	17 assessments established	Mallee CMA, PV, Landholders, DEPI
				1 publication established	
		F1.3	Investigate social values associated with wetlands	1 assessment established	Mallee CMA, PV, Landholders, Local Comm.
		F1.4	Investigate options to increase water in the landscape	1 assessment established	Mallee CMA, PV, GWM Water, Landholders, Landcare
F2 A B	An increase in target audiences' skills and participation	F2.1	Plan and implement community projects that complement on-ground works and increase collaboration	16 engagement events coordinated	Mallee CMA, PV, Landcare, Local Comm.
F3	An increase in amenity and accessibility	F3.1	Construct walking tracks and erect advisory and directional signs at Cronomby Tanks	0.5 km track established	Woomelang Development Association, YSC, Local Comm.
				4 visitor facilities established	
		F3.2	Maintain and upgrade visitor facilities at wetlands on public land	175 ha over which visitor facilities are maintained	DEPI, PV, Mallee CMA, BSC

23C. Dispersed Wetlands - Saline Irrigation Drainage

RCS Catchment Asset #3 - Cardross Lakes/Koorlong State Forest Waterway Management Unit #23C - Dispersed Wetlands - Saline Irrigation Drainage			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Wetland (IWC 2010)	Insufficient data		
Values	Significant Fish, Significant Birds, Significant Reptiles (Aquatic), Flagship Species, Drought Refuge, Irrigation Wastewater Discharge		
Threats	Degraded Water Quality, Invasive Fauna (Terrestrial), Invasive Flora (Wetland), Changed Water Regime, Invasive Fauna (Aquatic), Altered Wetland Form, Degraded Buffer		

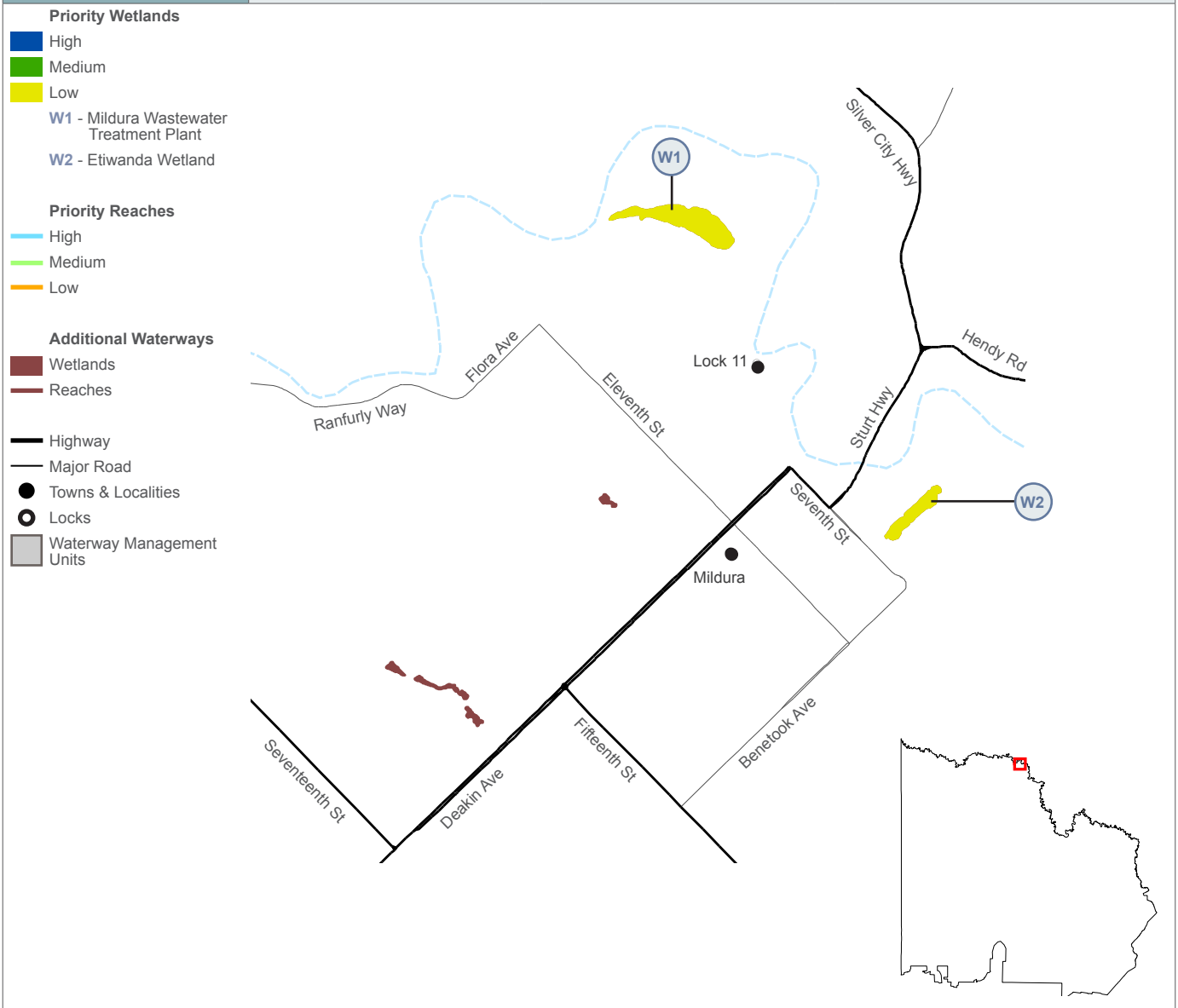


Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with high and medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with high and medium priority waterways by 2022. **C**. To improve hydrology within high and medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **E**. To increase the number of Cultural Heritage sites associated with priority waterways which are captured within registered management plans by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D E F	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fencing/bollards, roads/trails established under previous investment	1,103 ha over which infrastructure maintained[3]	Mallee CMA, DEPI, MRCC, Landholders
A2 **B1** D E F	An increase in the control of undesirable flora and fauna species	A2.1	Control priority invasive terrestrial animals, as determined annually	4,817 ha over which invasive animals controlled[1]	Mallee CMA, DEPI, Landholders, MRCC, LMW
		A2.2	Control priority invasive terrestrial plants, as determined annually	1,103 ha over which invasive plants controlled[2]	Mallee CMA, DEPI, Landholders, MRCC, LMW
		B1.1	Control priority invasive aquatic plants as required	699 ha over which invasive plants controlled[4]	Mallee CMA, DEPI, LMW, MRCC
B2	An increase in the distribution and/or viability of priority species/ communities	B2.1	Maintain existing Murray Hardyhead populations, and where feasible establish new populations	2 threatened species populations maintained 1 threatened species population established	DEPI, Mallee CMA, MDFRC
C1 A B D E	An increase in the delivery of watering regimes which meet environmental objectives	C1.1	Install one regulator at Cardross Lakes and two regulators at Koorlong Lakes, as recommended in the Cardross and Koorlong Lakes EWMP	3 waterway structures installed	Mallee CMA, LWM, DEPI
		C1.2	Deliver water as per the Cardross and Koorlong Lakes EWMP	4 water regimes changed	Mallee CMA, LMW, VEWH, MDBC, MDFRC, DEPI, CEWH
E1	Cultural Heritage values are maintained	E1.1	Assess all proposed works areas for the presence of Indigenous Cultural Heritage sites	4,817 ha over which cultural assessments undertaken[5]	Mallee CMA, AAV, PV, DEPI, Indig. Stakeholders
F1	An increase in target audiences' awareness and understanding	F1.1	Develop EWMP for Wargan Basins, and review EWMP for Cardross and Koorlong Lakes EWMP	1 plan established 1 plan reviewed	Mallee CMA, DEPI, GMW, Landholders
		F1.2	Investigate the option to replace open delivery channels to Cardross and Koorlong Lakes with pipes	1 assessment established	Mallee CMA, LMW, MRCC, DEPI, Landholders
		F1.3	Install depth gauges and conduct bathymetric survey	2 assessments established	Mallee CMA, LMW
		F1.4	Continue to conduct water quality, water depth and biodiversity assessments, especially of bird nesting habitats, native fish and aquatic flora	4 assessments maintained 1 assessment established	Mallee CMA, MDFRC, DEPI
		F1.5	Maintain existing telemetry equipment	1 monitoring structure maintained	Mallee CMA
F2 A	An increase in target audiences' skills and participation	F2.1	Plan and implement community projects that complement on-ground works and increase collaboration	16 engagement events coordinated	Mallee CMA, Local Comm.

23D. Dispersed Wetlands - Artificial and sewerage

RCS Catchment Asset #4 - Murray River & Floodplain – Robinvale to Merbein Waterway Management Unit #23D - Dispersed Wetlands - Artificial and sewerage			
Waterway Condition	**Excellent or Good %**	**Moderate %**	**Poor or Very Poor %**
Reach (ISC 2010)	Insufficient data		
Wetland (IWC 2010)	Insufficient data		
Values	Stormwater Drainage, Significant Birds, Significant Flora, Picnics and Barbeques, Sightseeing.		
Threats	Invasive Fauna (Terrestrial), Invasive Flora (Wetland), Degraded Water Quality		



Long term Resource Condition Targets (RCT)	**A**. To improve the condition of riparian habitat associated with medium priority waterways by 2022. **B**. To improve the condition of aquatic habitat associated with medium priority waterways by 2022. **D**. To improve water quality within high and medium priority waterways by 2022. **F**. To increase community understanding of, and participation in the management of, priority waterways by 2022.

RCT link	Management Outcome Target	Management Activity		Management Output Target	Regional Delivery Partners
A1 D	An increase in the diversity and structure of native vegetation	A1.1	Maintain priority fences/bollards and roads/trails established under previous investment	1,103 ha over which infrastructure maintained[3]	MRCC, LMW
		A1.2	Establish and maintain revegetation sites at Council wetlands	1 ha vegetation established 3 ha vegetation maintained	MRCC
A2 **B1** D	An increase in the control of undesirable fauna and flora species	A2.1	Control priority invasive terrestrial plants	24 ha over which invasive plants controlled[2]	MRCC, LMW
		B1.1	Control priority invasive aquatic plants as required	34 ha over which invasive plants controlled[4]	MRCC, LMW
D1 B	An increase in beneficial water quality characteristics	D1.1	Maintain waterway structures and processes designed to improve water quality at constructed wetlands such as gross pollutant traps	3 waterway structures maintained	MRCC
F1 A B D	An increase in target audiences' skills and participation	F1.1	Plan and implement community projects that promote understanding of wetland values and processes	4 engagement events coordinated	Mallee CMA, MRCC, Landcare, Local Comm.
F2	An increase in amenity	F2.1	Maintain visitor facilities established under previous investment	24 ha over which visitor facilities maintained[3]	MRCC

Section 5

Reference Material

Acronyms

AAV - Aboriginal Affairs Victoria

ARG - Aboriginal Reference Group

ARI - Arthur Rylah Institute (DEPI)

AVIRA - Aquatic Value Identification and Risk Assessment (database)

BB Progress Association - Boundary Bend Progress Association

BGLC - Barengi Gadjin Land Council

BSC - Buloke Shire Council

BWPC - Beulah Weir Pool Committee

CaLP Act - *Catchment and Land Protection Act 1994*

CEWH - Commonwealth Environmental Water Holder

CMA - Catchment Management Authority

CSIRO - Commonwealth Scientific and Industrial Research Organisation

DEPI - Department of Environment and Primary Industries

DIWA - Directory of Important Wetlands-Australia

DPCD - Department of Planning and Community Development

EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)

EVC - Ecological Vegetation Community

EWMP - Environmental Water Management Plan

EWR - Environmental Water Reserve

FFG Act - *Flora and Fauna Guarantee Act 1988* (Victoria)

FFR - Flora and Fauna Reserve

FKB - Friends of Kings Billabong

FMC - Friends of Merbein Common

FotE - Friends of the Earth

FV - Fisheries Victoria

GMW - Goulburn-Murray Water

GWM Water - Grampians Wimmera Mallee Water

ISC - Index of Stream Condition

IWC - Index of Wetland Condition

LMW - Lower Murray Water

Mallee RCS - Mallee Regional Catchment Strategy 2013-19

MDBA - Murray Darling Basin Authority

MDFRC - Murray Darling Freshwater Research Centre

MERI - Monitoring, evaluation, reporting and improvement

MLS - Murray Land Services (NSW)

MRCC - Mildura Rural City Council

MRHS - Mallee River Health Strategy 2006

MWS - Mallee Waterway Strategy 2014-22

MWWG - Mallee Wetlands Working Group

NRM - Natural Resource Management

NSW OW - New South Wales Office of Water

PV - Parks Victoria

RCT - Resource Condition Target

RGC - Riverside Golf Club

RWP - Regional Works Plan

SA Water - South Australia Water

SDL - Sustainable Diversion Limit

SEPP (WoV) - State Environment Protection Policy (Waters of Victora)

SHRCC - Swan Hill Rural City Council

SWS - Sustainable Water Strategy

TAC - Technical Advisory Committee

TfN - Trust for Nature

TLM - The Living Murray

VEWH - Victorian Environmental Water Holder

VNPA - Victorian National Parks Association

VRFish - Victorian Recreational Fishing

VROTS - Victorian Rare or Threatened Species

VWMS - Victorian Waterway Management Strategy 2013

WMU - Waterway Management Unit

YCAC - Yarriambiack Creek Advisory Committee

YSC - Yarriambiack Shire Council

Glossary

Anabranch - A branch of a river that eventually re-enters the main channel.

Aquifer - A layer of underground sediments which holds groundwater or allows water to flow through it.

Bathymetry - the study of underwater depth.

Biota - All of the living organisms within a specific geographic region or at a specific point in time.

Boinka - Broad, shallow depressions occurring as discrete groundwater discharge features which contain a distinct suite of landforms (i.e. sand plains, gypsum flats, gypsite (copi) hills, salinas and bordering dunes).

Catchment/Basin - An area of land whereby rainwater travels across the landscape towards the same destination such as a main river or lake.

Connectivity - The physical linkage of ecosystems, either terrestrial or aquatic, to provide the necessary habitat requirements for species. Connectivity can refer to linkages of vegetation, landforms and water flow.

Ecological Vegetation Class (EVC) - A classification to describe a floristic community associated with a recognisable landscape and climatic niche. Vegetation within one EVC have a common set of adaptive responses suitable for their particular environment.

Ecosystem - A diverse and changing set of living organisms within a community, interacting with each other and with the physical elements of the environment in which they are found. Ecosystems are identified at various scales.

Ecosystem services - The goods and services provided by ecosystems that are valued by people because of the role they play. They include provisioning services such as food and water; regulating services such as maintenance of soil health and resistance against pest species invasion; cultural services such as sense of place; and supporting services such as water and nutrient cycling.

Environmental flow - A managed release of water to a river, creek, lake or wetland for environmental purposes, specifically to improve a waterway's hydrological regime.

Environmental Water Reserve - A share of water set aside to maintain environmental flows and other environment dependant water services.

Ephemeral - Describes a waterway (usually a wetland) that requires a cycle of both wet and dry periods to be healthy.

Erosion - The process whereby soil particles are dislodged and removed from their original position, by forces such as wind or water. Soil particles can then pollute the air or waterways.

Discharge site - Location where groundwater reaches the soil surface.

Flood mitigation services - The process whereby wetlands collect and hold floodwaters, reducing damaging impacts to natural and built environments. Over time, this floodwater recharges to groundwater, evaporates or is released back into main river channels.

Floodplain - The area of land adjacent to a river or creek which is subject to inundation to the highest flood level.

Groundwater - Water located beneath the earth's surface in soil pore spaces or in the fractures of rock formations.

Habitat - The living space of a species or community, providing a particular set of environmental conditions.

Hydrological regime - The pattern of water flow, and subsequent water volume and depth, associated with a waterway, naturally influenced by season and climate trends. Due to river regulation, hydrological regimes of floodplain waterways have been altered from their natural state and must be reinstated with various management interventions. (also: water regime, flow regime).

Intermittent - Describes a waterway (usually a creek) where flow is variable, including no flow periods.

Invasive animal - An introduced animal species declared by the Minister under the CaLP Act 1994 in one of four pest animal classes: 'prohibited pest animal', 'controlled pest animal', 'regulated pest animal' and 'established pest animal'.

Invasive plant - An introduced plant species declared by the Minister under the CaLP Act 1994 in one of four weed categories: 'state prohibited weeds', 'regionally prohibited weeds', 'regionally controlled weeds', and 'restricted weeds'.

LiDAR - remote sensing technology that measures distance by illumination a target with a laser and analysing the reflected light.

Recharge - Process where water moves downwards in the soil from the surface to below the plant roots, and becomes groundwater.

Refugia - An area (terrestrial or aquatic) that has escaped ecological changes occurring elsewhere and so provides a suitable habitat and resources for vulnerable species.

Remnant Vegetation - Native vegetation remaining in the landscape where surrounding vegetation been cleared.

Riparian zone - The area of land that adjoins, regularly influences, or is influenced by a waterway.

River reach - A longitudinal section of river with similar characteristics, defined for management purposes.

River regulation - The measures taken (e.g. building of weirs) to manage river channels and water resources for human consumption uses such as irrigated food production and town water supplies. River regulation alters the natural hydrological regime of the adjacent floodplains, anabranches and wetlands, as well as the river itself.

Salinity - The concentration of dissolved salts in groundwater or surface water, usually expressed in Electrical Conductivity (EC) units.

Salt interception - A management intervention used to prevent saline surface water or groundwater from entering a freshwater environment, by intercepting and diverting the saline water (usually towards evaporation basins).

Sustainable Diversion Limit - an environmentally sustainable level of water use, set by the Murray Darling Basin Authority.

Telemetry - an automated communications process by which measurements or other data is collected remotely.

Track rationalisation - The process of reducing multiple vehicle tracks to the one destination (usually river access points) and improving main access routes, in order to protect riparian land and subsequent habitat areas.

Traditional Owner - An Aboriginal person who, in accordance with Aboriginal Tradition, has social, economic or spiritual affiliations with, and responsibilities for, a site or object.

Turbidity - Visible pollution due to suspended material in water causing a reduction in the transmission of light.

Wetland - Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (as adopted by the Ramsar Convention, 1971).

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Appendices

Appendix 1A: Key legislation and policy which have informed the development of this MWS.

International	The Australian Government has ratified several international **human rights** instruments that recognise and protect Indigenous peoples' special connection to land and waters and provide for the right to practice, revitalise, teach and develop culture, customs and spiritual practices and to utilise natural resources (for example, the United Nations Declaration of Rights of Indigenous Peoples).
	The **Convention on Wetlands of International Importance** (the Ramsar Convention) provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. The Convention encourages 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).
Federal	At the federal level, water reform has been guided by the **National Water Initiative (NWI)** since 2004. Under this agreement, governments across Australia have committed to actions to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices, and trades water. The NWI recognises the need to build on the water reforms of the 1994 Council of Australian Government (COAG) agreement to ensure increased productivity and efficiency of Australia's water use. It includes clear steps to return river and groundwater systems to environmentally sustainable levels of extraction and achieve integrated management of environmental water.
	There has also been significant legislative reform in water resource management at the federal level. The ***Water Act 2007 (Cth)*** established the Murray-Darling Basin Authority (MDBA) and 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 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.
	The ***Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)*** enables the Commonwealth to intervene and, where necessary, preserve and protect areas and objects of particular significance to Australia's Aboriginal or Torres Strait Islander peoples from being desecrated or injured.

State	The **Victorian Waterway Management Strategy (VWMS)** provides the framework for government, in partnership with the community, to manage rivers, estuaries and wetlands so they can support environmental, social, cultural and economic values now and into the future. The VWMS updates the Victorian River Health Strategy (VRHS) which was a significant milestone for river management in Victoria. It outlined clear principles for making regional decisions on river protection and restoration, identifying regional priorities for management activities and state-wide direction on important management issues affecting river health.
	Victoria's water allocation framework provides the basis for the management of Victoria's water resources. Under the ***Water Act 1989,*** the Victorian Government retains the overall right to the use, flow and control of all surface water and groundwater on behalf of all Victorians. All water taken for consumptive purposes is done so under entitlements set out in the Water Act. 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.
	The Water Act also defines the **Environmental Water Reserve (EWR)** as the amount of water set aside to meet environmental needs. The Victorian Environmental Water Holder was established in 2011, under the Water Act, as an independent statutory body responsible for making decisions on the most efficient and effective use of Victoria's environmental entitlements.
	The key state-wide policy framework for water quality protection in Victoria is the ***State Environment Protection Policy (Waters of Victoria)***. It provides a statutory framework for State and local government agencies, businesses and communities to work together to protect and rehabilitate Victoria's surface water environments. The SEPP(WoV) identifies beneficial uses of water and sets the environmental quality objectives and policy directions required to address higher risk impacts and activities.
	The ***Flora and Fauna Guarantee Act 1988*** (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The FFG lists threatened species and ecological communities and threatening processes. The FFG (2010-15) provides for the preparation of a Flora and Fauna Guarantee Strategy. The "strategy" was launched as Victoria's Biodiversity Strategy.
	The ***Fisheries Act 1995*** sets up arrangements to provide for the management, development and use of Victoria's fisheries, aquaculture industries and associated aquatic biological resources in an efficient, effective and ecologically sustainable manner. It promotes sustainable commercial fishing and quality recreational fishing opportunities for the present and future generations.
	The ***Emergency Management Act 1986*** sets up arrangements to provide for the management and organisation of the prevention, response and recovery phases of emergencies, involving all relevant government and non-government agencies. The Act defines 'emergency' as an event that endangers the safety or health of persons, or which destroys, damages or threatens property or endangers or threatens the natural environment in Victoria.
	The ***Planning and Environment Act 1987*** sets out the framework for planning the use, development and protection of land in Victoria. It establishes objectives for planning in Victoria, planning schemes and the planning permit system.
Regional	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 10 catchment region's of Victoria. The Mallee Catchment Management Authority is responsible for preparing the Mallee RCS and co-ordinating and monitoring its implementation. The Mallee RCS is the overarching strategy, under which are a range of sub-strategies and action plans for the Mallee region. The long term objectives and priorities for action in the Mallee RCS that relate to waterways will be implemented through this Strategy.
	Regional planning processes for waterway management were established in 2002 under the Victorian River Health Strategy and implemented through the 10 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 Strategy is a statutory requirement under the Water Act and will replace the RRHS.
	Water resource planning in Victoria is addressed through development of regional ***Sustainable Water Strategies (SWSs)*** that set out long term regional plans to secure water for regional growth, while safeguarding the future of its rivers and other natural water sources. They investigate the range of potential changes to water availability under several climate change scenarios. The regional SWSs examine future consumptive demand and environmental needs and set out proposed options to balance and secure water for all users. The SWSs are where the Victorian Government, in partnership with regional communities, decides whether additional water is required for the environment.

Appendix 1B: MWS engagement and communications activities conducted.

Overview of stakeholders 'directly engaged to inform the development of this 2014-2022 MWS.

Audience	Representation	No. Workshops
Mallee CMA Board	Comprised of 8 Ministerially appointed community members	7
Water Technical Advisory Committee	Comprised of representatives from: • Dept. of Environment and Primary Industries; • GWM Water; • Lower Murray Water; • Mallee CMA; • Mildura Rural City Council; • Murray Darling Freshwater Research Centre; and • Parks Victoria.	8
Biodiversity Technical Advisory Committee	Comprised of representatives from: • Dept. of Environment and Primary Industries; • Lower Murray Water; • Mallee CMA; • Mildura Rural City Council; • Parks Victoria; • Swan Hill Rural City Council; and • Trust for Nature.	4
Mallee Land and Water Advisory Committee	Comprised of 14 Mallee community members	4
Mallee Aboriginal Reference Group	Comprised of representatives from: • Aboriginal Elders; • Traditional Owner Representatives; • Dept. of Environment and Primary Industries; • Mallee CMA; and • Parks Victoria	7
Traditional Owner Groups and other Indigenous Stakeholders	Latje Latje, Mutti Mutti, Tati Tati, Wadi Wadi, Nyeri Nyeri, Dadi Dadi, Wemba Wemba, Wergaia, Ngintait, Barengi Gadjin Land Council, Mildren, North West Native Title	24
The Living Murray Community Reference Group	Comprised of 18 Mallee community members	4
Southern Wetland Community Group	Comprised of representatives from: • Mallee CMA; • Parks Victoria; • GWM Water; • Dept. of Environmental and Primary Industries, and • 5 community members.	3
Other Interest Groups/ Organisations	Private Diverter Groups - Irrigators; Swan Hill Field Naturalists; Yarriambiack Creek Committee; Mallee Landcare Groups; and Local recreational angling clubs	15

Overview of 'indirect' communications used to promote the MWS development process and to encourage feedback from all stakeholders as it was being developed.

Medium	Media	Audience	No.
Media Articles and Paid Advertisements	Newspapers: Mildura Weekly, Sunraysia Daily, Robinvale Sentinel, Swan Hill - The Guardian, Hopetoun Courier, Ouyen North West Express, Rainbow Argus, Sea Lake Times, The Buloke Times	Mallee Community	16
Television and Radio	WIN News regional round-up, 3SH radio interview	Mallee Community	2
Newsletter Articles	Walkabout Indigenous newsletter, Mallee Farmer, Mallee Catchment News	Indigenous Community, dryland farmers and agribusiness industry groups, Mallee Community	7
Surveys	Various (e.g. online, email, flyers)	Mallee stakeholders and broader community	103 returned
Progress Updates	Email	Mallee stakeholders and community groups	5 x 129 receipients
Fact Sheets	Handouts at relevant forums.	Mallee stakeholders and community groups	50

Appendix 2A: Waterway dependant significant fauna and flora species

The table below lists the species found in the Mallee region which are waterway dependant AND have a conservation status (Australian or Victorian) of Vulnerable, Endangered or Critically Endangered. Conservation status in Australia is defined by the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC). Conservation status in Victoria is defined by the DEPI Advisory lists of Threatened Species in Victoria 2013, with only those species listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act) represented here.

Scientific Name	Common Name	Conservation Status in Australia (EPBC)	Conservation Status in Victoria (DEPI Advisory list)
Frogs			
Litoria raniformis	Growling Grass Frog	Vulnerable	Endangered
Birds			
Ardea alba	Great Egret		Vulnerable
Ardea intermedia	Intermediate Egret		Critically Endangered
Botaurus poiciloptilus	Australasian Bittern		Endangered
Calidris tenuirostris	Great Knot		Endangered
Egretta garzetta nigripes	Little Egret		Endangered
Gelochelidon nilotica macrotarsa	Gull-billed Tern		Endangered
Grus rubicunda	Brolga		Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle		Vulnerable
Ixobrychus minutus	Little Bittern		Endangered
Lophoictinia isura	Square-tailed Kite		Vulnerable
Oxyura australis	Blue-billed Duck		Endangered
Porzana pusilla palustris	Baillon's Crake		Vulnerable
Polytelis anthopeplus	Regent Parrot	Vulnerable	Vulnerable
Polytelis swainsonii	Superb Parrot	Vulnerable	Endangered
Rallus pectoralis	Lewin's Rail		Vulnerable
Rostratula benghalensis	Australian Painted-Snipe	Vulnerable	Critically Endangered
Stictonetta naevosa	Freckled Duck		Endangered
Fish			
Bidyanus bidyanus	Silver Perch		Vulnerable
Craterocephalus fluviatilis	Murray Hardyhead	Vulnerable	Critically Endangered
Maccullochella peelii	Murray Cod	Vulnerable	Vulnerable
Melanotaenia fluviatilis	Murray-Darling Rainbowfish		Vulnerable
Tandanus tandanus	Freshwater Catfish		Endangered
Reptiles			
Macrochelodina expansa	Broad-shelled Turtle		Endangered
Morelia spilota metcalfei	Carpet Python		Endangered
Plants			
Casuarina obesa	Swamp Sheoak		Endangered
Cullen cinereum	Hoary Scurf-pea		Endangered
Cyperus nervulosus	Annual Flat-sedge		Endangered
Cyperus rigidellus	Curly Flat-sedge		Endangered
Dysphania simulans	Spiked Pigweed		Endangered
Eleocharis obicis	Striate Spike-sedge	Vulnerable	Vulnerable
Euphorbia planiticola	Plains Spurge		Endangered
Hemichroa diandra	Mallee Hemichroa		Endangered
Isolepis congrua	Slender Club-sedge		Vulnerable
Lepidium monoplocoides	Winged Peppercress	Endangered	Endangered
Myriophyllum porcatum	Ridged Water-milfoil	Vulnerable	Vulnerable
Swainsona murrayana	Slender Darling-pea	Vulnerable	Endangered
Swainsona purpurea	Purple Swainson-pea		Endangered

Appendix 2B: Ramsar Criteria

Ramsar criteria met by the Hattah-Kulkyne Lakes site when listed in 1982 (and currently) are detailed in the table below. This represents five of a possible nine criteria being met

Ramsar criteria which form basis of Hattah-Kulkyne Lakes listing (as detailed in Hattah-Kulkyne Lakes Ramsar Site Ecological Character Description Hale, J. and Butcher, R., 2011 for Department of Sustainability, Environment, Water, Population and Communities)**.**

Number	Description	Summary of justification
1	A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.	The Hattah-Kulkyne Lakes are the largest series of floodplain lakes along the Murray River and the site is considered representative of a good example of a series of large, hydrologically connected, permanent and intermittent floodplain lakes. The lakes are approximately 15 kilometres from the Murray River with most being fed by Chalka Creek and lie within a national park. The lakes are the central feature of the floodplain and national park and are representative of a large relatively intact section of Murray River floodplain.
2	A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	Hattah-Kulkyne Lakes is considered to be an important site for three wetland dependent threatened species that are listed at the national and/or international level: the Australian Painted Snipe (*Rostratula australis*), Regent Parrot (eastern) (*Polytelis anthopeplus monarchoides*) and Winged Peppercress (Lepidium monoplocoides). There is a low degree of certainty that the site is important for other listed threatened species that are known to occur at the site, including the Australasian Bittern (*Botaurus poiciloptilus*), Silver Perch (*Bidyanus bidyanus*), Murray Cod (*Maccullochella peelii*) and Flat-headed Galaxias (*Galaxias rostratus*).
3	A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.	The Ramsar site and the surrounding national park support considerable biodiversity, with flora and fauna representative of Murray River floodplain and mallee country. Species richness is high across several groups of biota including plants and waterbirds, being comparable to several other Ramsar sites in the Murray-Darling Basin. The soil seed bank from within the lakes has high species richness and is comparable to that recorded from entire floodplain systems such as Narran Lakes. Native fauna diversity is higher than some nearby floodplain forest systems, which is noteworthy given that the Ramsar boundary does not include significant areas of floodplain, just the lakes up to the high water mark.
4	A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	The Hattah-Kulkyne Lakes Ramsar site provides habitat for 70 species of wetland birds, of which 34 have been recorded breeding within the site. In addition, the site supports a number of migratory species, notably waterbirds and fish, with 12 waterbirds listed as migratory under the EPBC Act as well as under international migratory species treaties. The site is also considered important for fish breeding.
8	A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.	This site is considered to be an important nursery area for native fish. Recruitment of juveniles back into the adult population is dependent on the water levels of the lakes being maintained, and for large bodied river specialists there needs to be reconnection to the Murray River for species to return to the riverine habitat. Small bodied wetland specialists breed in the site, with young of the year from Fly-specked Hardyhead (*Craterocephalus stercusmuscarum*), Carp Gudgeon (*Hypseleotris spp.*), Flat-headed Gudgeon (*Philpnodon grandiceps*) and Australian Smelt (*Retropinna semoni*) recorded from the site.

Appendix 2C: Hattah-Kulkyne Lakes Ramsar Site values

Table below details the ecosystem services that are considered critical to the ecological character of the Hattah-Kulkyne Lakes Ramsar Site, benchmarked to time of listing. Limits of Acceptable Change (LACs) and assessments regarding the current status of these LAC's for each of the sites critical services is also provided.

Critical Ecosystem Services, LAC's and Current Status (as detailed in Hattah-Kulkyne Lakes Ramsar Site Ecological Character Description Hale, J. and Butcher, R., 2011 for Department of Sustainability, Environment, Water, Population and Communities).

Ecosystem service	Benchmark description	Limit of acceptable change (LAC)	Does not exceed LAC	Exceeds LAC	No data / No LAC set
Near natural wetland type	Represents the largest series of floodplain lakes along the Murray River and is in relatively good condition. Supports wetlands representative of two of Victoria's six natural wetland types including a depleted wetland type (in Victoria) (DSE 2010).	This critical service is linked principally to changes in the hydrology as well as changes in extent and condition of wetland vegetation. Therefore no direct LAC has been developed and instead the critical service is assessed indirectly through changes in herbland vegetation and frequency of flow events.			X
Physical habitat which supports waterbird breeding & feeding	Provides habitat that supports waterbird breeding and feeding. Seventy species of waterbird frequent the site with 34 having used the Ramsar site for breeding	This critical service is linked to changes in the frequency of wetland wetting and drying periods as well as changes in the extent and condition of wetland and floodplain vegetation. Therefore no direct LAC has been developed and instead the critical service is assessed indirectly through the LACs for hydrology and lake bed herbland vegetation.			X
Threatened species	Supports seven nationally or internationally listed species (Australasian Bittern - *Botaurus Poiciloptilus*, Australian Painted Snipe - *Rostratula Australis*, Regent Parrot (eastern) - *Polytelis Anthopeplus monarchoides*, Murray Cod - *Maccullochella peelii*, Silver Perch - *Bidyanus bidyanus*, Flat-headed Galaxias - *Galaxias rostratus*, Winged Peppercress - *Lepidium monoplocoides*). However, only three of these species, Australian Painted Snipe, Regent Parrot (eastern) and Winged Peppercress are considered as critical to the ecological character of the site.	Presence of Regent Parrot (eastern) within Ramsar site on an annual basis.	X		
		Presence of Winged Peppercress between Lake Hattah and Lake Bulla in years when conditions are suitable.			X
Biodiversity	The site supports regionally significant range and number of species comparable to other sites within the Murray-Darling Basin. This includes supporting a large number and variety of waterbirds, including breeding habitat for many waterbird species, a rich and diverse flora and seed bank.	The site is hydrologically connected with the river and on the floodplain there are interconnections between some of the lakes in which wetland dependent species establish. The wetting and drying of the lakes promotes diversity and this service is maintained by hydrology. Therefore no direct LAC has been developed and instead the critical service is assessed indirectly through changes in hydrology.			X

Ecosystem service	Benchmark description	Limit of acceptable change (LAC)	Does not exceed LAC	Exceeds LAC	No data / No LAC set
Ecological connectivity	Hattah-Kulkyne Lakes are hydrologically and ecologically connected and provide semipermanent surface water in a semi arid environment therefore ensuring ecological persistence of aquatic habitats. The relative importance of this service is a knowledge gap, but is believed to be important in shaping the character of the site.	The site is hydrologically connected with the river and on the floodplain there are interconnections between some of the lakes in which fish populations and other aquatic biota establish. This service is maintained by hydrology and can also be indicated by the species richness of native fish. The key elements of connectivity are unimpeded flow and reconnection to the Murray River to allow recruitment of species into the regional population. The delivery of environmental water by pumping may affect connectivity. Therefore no direct LAC has been developed and instead the critical service is assessed indirectly through changes in hydrology and native fish populations.			X

The table below describes critical components and processes associated with the Hattah-Kulkyne Lakes Ramsar Site, Limits of Acceptable Change (LAC) relating to these, and assessments regarding the current status of each LAC.

Critical Components and Processes, LAC's and Current Status (as detailed in *Hattah-Kulkyne Lakes Ramsar Site Ecological Character Description* Hale, J. and Butcher, R., 2011 for Department of Sustainability, Environment, Water, Population and Communities).

Critical Component of process	Benchmark description	Limit of acceptable change	Does not exceed LAC	Exceeds LAC	No data / No LAC set
Hydrology	Lakes are filled via Chalka Creek with commence to flow occurring at 36,700 megalitres per day in the Murray River downstream of Euston. Impacts from river regulation and modifications to flow paths on the floodplain have altered the hydrology of the site, reducing frequency and duration of inundation, as well as timing of peak flows. The majority of the lakes dry within 12 months after inflows cease, Lakes Mournpall and Hattah can retain water for several years post flooding.	No less than three filling events for Lakes Lockie, Hattah, Yerang and Mournpall in any 10 year period.	X		
		No less than two filling events for Lakes Cantala and Bulla in any 10 year period.		X	
		No less than one filling event for Lakes Arawak, Brockie, Bitterang, Konardin and Yelwell in any 10 year period.		X	
		No less than one filling event at Lake Kramen in any 20 year period.	X		
Lake bed herbland vegetation	Dominant vegetation across all lakes is EVC 107 lake bed herbland. It shifts from being dominated with aquatic and amphibious species with some terrestrial species on the edges in the wet phase, to being dominated by terrestrial species in the dry phase. The relative length of each inundation event and subsequent dry phase also influences the community structure. Aquatic macrophyte growth is variable across lakes, and data is limited. Seed bank species richness is high and suggests establishment of beds of aquatic macrophytes is possible with the right antecedent conditions.	Extent of lake bed herbland vegetation to be no less than 776 hectares.		X	

Critical Component of process	Benchmark description	Limit of acceptable change	Does not exceed LAC	Exceeds LAC	No data / No LAC set
Fish	Ecological connectivity between lakes is evident with the fauna of a particular lake being most similar to that of the lake immediately upstream. Intervention monitoring associated with the delivery of environmental water has shown the fish fauna to be dominated with small bodied native species. Relatively few exotic species have been recorded which may in part relate to the pumping mechanisms (e.g. water pumped from deep pools that are not favoured by Eastern Gambusia (*Gambusia holbrooki*), which prevents them from entering via the pumped water).	Presence of the following wetland specialist species of native fish recorded over any three sampling events over a five year period in which at least three of the lakes are inundated: • Australian Smelt - *Retropinna semoni* • Bony Herring - *Nematalosa erebi* • Carp Gudgeon - *Hypseleotris spp.* • Western Carp Gudgeon - *Hypseleotris klunzingeri* • Fly-specked Hardyhead - *raterocephalus stercusmuscarum*	X		
Waterbirds - number of species	Supports 70 species of waterbirds, 12 of which are covered by international migratory bird treaties. Thirty four species breed at the site. Functional guilds are dominated by ducks, which is unusual in the major wetland systems of the Murray River.	At least eight of the following species in at least 10 years of any 20 year period in which at least three of the lakes are inundated: • Australian Pelican - *Pelecanus conspicillatus* • Australian Wood Duck - *Chenonetta jubata* • Black-winged Stilt - *Himantopus himantopus* • Australian Darter - *Anhinga novaehollandiae* • Great Cormorant - *Phalacrocorax carbo* • Great Crested Grebe - *Podiceps cristatus* • Little Black Cormorant - *Phalacrocorax sulcirostris* • Masked Lapwing - *Vanellus miles* • Pacific Black Duck - *Anas superciliosa* • White-faced Heron - *Egretta novaehollandiae* • Yellow-billed Spoonbill - *Platalea flavipes*	X		

Appendix 2D: Hattah-Kulkyne Lakes Ramsar Site threats

The table below provides a summary of threats to the ecological character of the Hattah-Kulkyne Lakes Ramsar Site; their impact, likelihood and timing.

Summary of main threats (as detailed in *Hattah-Kulkyne Lakes Ramsar Site Ecological Character Description* Hale, J. and Butcher, R., 2011 for Department of Sustainability, Environment, Water, Population and Communities).

Actual or likely threat	Potential impact(s) to wetland components, processes and/or service	Likelihood[1]	Timing
Increased water resource development	Reduced frequency and duration of inundation leading to loss of habitat and diversity of hydrological regimes. Impacts on waterbirds, fish and aquatic macrophytes are likely.	Low	Current
Climate change	Declining rainfall and increased summer rainfall intensity will alter flood behaviour, but catchment conditions at the time of each rainfall event (soil moisture conditions and levels in major water storages) will affect the degree of change. Water quality may decline due to lower flows and higher temperatures, with a likely increase in the incidence of algal blooms.	Certain	Long term
Grazing	Uncontrolled grazing from native and introduced herbivores has the potential to change vegetation community structure and affect recruitment of woody vegetation such as river red gum.	Certain	Current
Invasive species	Increased numbers of invasive fish species leading to loss of value of site as having a high proportion of native fish. Increased predation on waterbirds. Disruption of sediment by pigs leading to loss of species and increased weed invasion. River red gum encroachment leading to change in habitat.	Certain	Current

[1] Certain is defined as known to occur at the site or has occurred in the past; Medium is defined as not known from the site but occurs at similar sites; and Low is defined as theoretically possible, but not recorded at this or similar sites.

Appendix 2E: Hattah-Kulkyne Lakes Ramsar Site monitoring needs

The table below provides an overview of monitoring required at the Hattah-Kulkyne Lakes Ramsar Site to set baselines for key components and processes and to assess against Limits of Acceptable Change (LAC).

Monitoring needs for Hattah-Kulkyne Lakes Ramsar Site (as detailed in *Hattah-Kulkyne Lakes Ramsar Site Ecological Character Description* Hale, J. and Butcher, R., 2011 for Department of Sustainability, Environment, Water, Population and Communities).

Component/ Process	Purpose	Indicator	Locations	Frequency	Priority
Hydrology	Assessment against LAC	Daily flow at Euston. Number of events of specified magnitude and duration Number of filling events (from above-threshold flows and/or environmental watering) within the Lakes	Euston gauge Murray River Lakes within Ramsar site	Continuous	High
Waterbirds	Assessment against LAC	Abundance and species identifications, breeding observations	Entire Ramsar site.	Event based or as per TLM monitoring guidelines.	High
Lake bed herbland vegetation	Assessment against LAC	Extent	Entire Ramsar site.	Once every five years.	High
Fish	Assessment against LAC	Abundance, species richness, young of year	Entire Ramsar site.	As per TLM monitoring guidelines and opportunist surveys of irregularly filled wetlands	High
Threatened species	Assessment against LAC	Location, abundance	Targeted within Ramsar site	Targeted surveys for each species	Low

Appendix 2F: Index of Stream Condition

Sub-indices and overall condition scores for reaches assessed within the Avoca, Mallee and Wimmera Basins (*source: Index of Stream Condition: The Third Benchmark of Victorian River Condition - Mallee Region. DEPI, 2013*).

Avoca Basin

Basin	Reach	Reach length (Kms)	River	Hydrology	Physical form	Streamside zone	Water quality	Aquatic life	ISC Score	Condition
8	21	34.2	Lalbert Creek		5	7				Insufficient Data
8	22	84.8	Lalbert Creek		7	7				Insufficient Data
8	23	30.3	Tyrrell Creek		5	6				Insufficient Data
8	24	30.4	Tyrrell Creek		10	8				Insufficient Data
8	25	61.1	Murray River[1] Nyah South	2	8	6	8		25	Moderate
8	26	17.3	Parnee Malloo Creek[1]	2	9	7			25	Moderate

Mallee Basin

Basin	Reach	Reach length (Kms)	River	Hydrology	Physical form	Streamside zone	Water quality	Aquatic life	ISC Score	Condition
14	1	19.4	Murray River[2] (Nyah North)	2	9	7	8		28	Moderate
14	2	18.8	Murray River[2] (Burra South)	2	8	10	6		27	Moderate
14	3	21.1	Murray River (Burra North)	2	5	8	7		23	Poor
14	4	38.4	Murray River (Heywood)	2	5	8			21	Poor
14	5	47.7	Murray River (Boundary Bend)	2	5	7			21	Poor
14	6	32.4	Murray River (Belsar Yungera)	2	4	8			20	Poor
14	7	46.0	Murray River (Bumbang)	2	5	8			21	Poor
14	8	60.9	Murray River (Happy Valley)	2	5	8			21	Poor
14	9	62.9	Murray River (Hattah)	2	5	7			21	Poor
14	10	71.0	Murray River (Nangiloc Colignan)	2	5	7			21	Poor
14	11	38.5	Murray River (Nichols Point)	1	5	7	8		21	Poor
14	12	38.3	Murray River (Merbein)	1	5	7			17	Very Poor
14	13	46.7	Murray River (Wallpolla East)	1	5	7			17	Very Poor
14	14	29.7	Murray River[2] (Wallpolla West)	1	5	8	6		20	Poor
14	15	51.3	Murray River[2] (Mulcra)	1	5	7	6		20	Poor
14	16	35.0	Murray River (Lindsay East)	1	5	5			17	Very Poor
14	17	46.0	Murray River (Lindsay West)	1	5	7			17	Very Poor
14	18	27.6	Burra Creek South	2	7	7			22	Poor
14	19	16.0	Burra Creek North	2	7	7			22	Poor
14	20	2.5	Unnamed Creek	2	5	4			17	Very Poor
14	21	5.0	Heywoods Creek	2	6	5			18	Very Poor
14	22	8.5	Wakool Creek	2	6	6			21	Poor
14	24	9.3	Narcooyia Creek	2	5	8			21	Poor
14	25	9.3	Narcooyia Creek	2	6	8			22	Poor
14	39	42.2	Chalka Creek	2	6	7			21	Poor
14	40	8.3	Cantala Creek	2	5	5			18	Very Poor
14	41	9.0	Chalka Creek	2	6	7			21	Poor
14	42	6.0	Inlet Creek	2	7	6			21	Poor
14	43	4.0	Towrie Creek	2	7	5			21	Poor

Basin	Reach	Reach length (Kms)	River	Hydrology	Physical form	Streamside zone	Water quality	Aquatic life	ISC Score	Condition
14	44	6.2	Towrie Creek	2	5	5			18	Very Poor
14	45	11.5	Outlet Creek	2	5	3			14	Very Poor
14	46	2.1	Powell Creek	2	9	6			24	Moderate
14	47	1.7	Carpul Creek	2	8	6			22	Poor
14	48	5.2	Butlers Creek	1	5	6			16	Very Poor
14	50	18.3	Wallpolla Creek	1	5	7			17	Very Poor
14	51	17.2	Wallpolla Creek (East)	1	6	5			16	Very Poor
14	52	20.4	Wallpolla Creek	1	6	7			20	Poor
14	53	3.9	Finnigans to Sandy to Wallpolla	1	7	5			17	Very Poor
14	54	4.2	South of Sandy South	1	5	7			17	Very Poor
14	55	4.4	Wallpolla Southern Runner	1	5	5			16	Very Poor
14	56	8.0	Sandy Creek East	1	5	5			16	Very Poor
14	57	7.5	Sandy Creek West	1	3	6			13	Very Poor
14	58	7.2	Sandy Creek South	1	6	7			20	Poor
14	59	9.7	Willipanance Creek	1	6	7			20	Poor
14	60	5.1	Ranka Creek	1	6	7			20	Poor
14	61	4.6	Mullroo Creek	1	6	8			20	Poor
14	62	1.8	Milky Creek	1	6	8			20	Poor
14	63	7.7	Finnigans Creek	1	5	6			16	Very poor
14	64	16.2	Potterwalkagee Creek	1	5	5			16	Very poor
14	65	11.5	Potterwalkagee Creek	1	3	7			20	Poor
14	66	2.3	Mulcra Creek West	1	5	5			16	Very poor
14	67	12.5	Lindsay River	1	4	7			16	Very poor
14	68	9.5	Lindsay River	1	4	7			16	Very poor
14	69	11.8	Lindsay River	1	3	6			13	Very poor
14	70	10.3	Lindsay River	1	4	7			16	Very poor
14	71	17.4	Lindsay River[2]	1	5	7	6		20	Poor
14	72	6.9	Mullaroo Creek	1	6	7			20	Poor
14	73	12.1	Mullaroo Creek	1	6	8			20	Poor
14	74	4.4	Mullaroo Lindsay Connection	1	7	5			17	Very poor
14	75	6.3	Toupnein Creek East	1	5	5			16	Very poor
14	76	10.9	Toupnein Creek West[2]	1	5	7	5		19	Very poor
14	77	3.4	Thompson Creek	1	7	6			20	Poor
14	78	1.7	Woodcutters Creek	1	5	6			16	Very poor
14	79	2.6	Parallel to Mullaroo West	1	5	3			12	Very poor
14	81	13.8	Boy Creek		7	4				Insufficient data

[1] Used hydrology results from 2004 ISC

[2] Only 1 year water quality data available

Wimmera Basin

Basin	Reach	Reach length (Kms)	River	Hydrology	Physical form	Streamside zone	Water quality	Aquatic life	ISC Score	Condition
15	24	43.1	Yarriambiack Creek	3	3	6			18	Very Poor
15	91	8.2	Outlet Creek		3	7				Insufficient data

Appendix 2G: Index of Wetland Condition

Mallee Basin

Map ID	Wetland	Catchment	Physical form	Hydrology	Water properties	Soils	Biota	IWC Score	Condition
1	Lindsay 655	20	20	0	17	20	15	7	Good
2	Lindsay 660	20	20	0	15	20	12	6	Moderate
3	Lindsay 663	20	20	0	17	20	14	7	Good
4	North Berribee	16	20	0	17	20	15	7	Good
5	South of Pollards Island	14	20	0	17	19	3	4	Poor
6	South of Pollards Island	18	20	0	17	20	10	6	Moderate
7	Mullaroo	14	20	0	17	20	17	7	Good
8	Websters Lagoon	20	10	0	17	20	5	5	Moderate
9	East Lindsay 710	20	18	20	17	20	16	9	Excellent
10	East Lindsay	20	20	0	17	20	18	8	Good
11	East Lindsay	20	20	0	17	20	14	7	Good
12	Lindsay	16	20	0	17	20	11	6	Moderate
13	Lake Wallawalla	20	20	0	17	20	10	6	Moderate
14	Lindsay 694	20	20	0	17	20	14	7	Good
15	East Lindsay	20	20	0	20	19	11	7	Good
16	Lindsay	20	20	0	17	20	13	7	Good
17	Lindsay 697	20	20	0	17	20	2	5	Moderate
18	East Lindsay	16	20	0	20	20	11	6	Moderate
19	Mullaroo	20	20	0	17	20	6	5	Moderate
20	Mulcra 726	20	20	0	17	19	16	7	Good
21	Mullaroo	20	20	0	17	20	2	5	Moderate
22	East Lindsay	20	20	0	17	18	18	8	Good
23	Mulcra	20	20	0	17	19	17	7	Good
24	Mulcra 730	20	20	0	17	20	13	7	Good
25	Mulcra	20	20	0	17	20	9	6	Moderate
26	Snake Lagoon	20	20	0	17	19	12	6	Moderate
27	Unnamed Wetland, Mulcra	20	20	0	17	19	13	7	Good
28	Ned's Corner	20	20	0	17	19	11	6	Moderate
29	Wallpolla 794	20	20	0	17	14	19	8	Good
30	Wallpolla 758	5	20	0	17	17	12	5	Moderate
31	Wallpolla 789	20	20	0	14	20	8	5	Moderate
32	Wallpolla 800	7	20	0	15	6	18	6	Moderate
33	Wallpolla	20	20	0	17	19	15	7	Good
34	Wallpolla West 804	20	20	0	17	20	19	8	Good
35	Wallpolla	20	20	0	17	19	11	6	Moderate
36	Wallpolla	20	20	0	17	19	17	7	Good
37	Wallpolla 819	20	20	0	17	20	12	7	Good
38	Wallpolla 821	18	20	0	17	19	10	6	Moderate
40	Wallpolla	18	20	0	17	19	9	6	Moderate
41	Wallpolla	20	20	0	17	20	15	7	Good
42	Wallpolla near Horseshoe	14	20	0	17	17	15	7	Good
43	Lake Hattah	20	20	0	17	20	15	7	Good
44	Lake Mournpall	20	20	0	20	20	19	8	Good
45	Lake Konardin	20	20	0	17	20	10	6	Moderate

Map ID	Wetland	Catchment	Physical form	Hydrology	Water properties	Soils	Biota	IWC Score	Condition
46	Lake Bulla	20	20	0	17	20	16	7	Good
47	Lake Arawak	20	20	0	17	19	16	7	Good
48	Lake Lockie	20	10	0	17	20	14	7	Good
49	Lake Yerang	14	20	0	17	20	16	7	Good
50	Lake Yelwell	11	20	0	17	20	9	5	Moderate
51	Lake Brockie	20	20	0	20	19	15	7	Good
52	Lindsay 657	20	20	0	17	20	11	6	Moderate
54	Lignum Plain	20	20	0	17	20	12	6	Moderate
57	Raak Plain State Forest	16	20	20	20	20	17	9	Excellent
58	Raak Plain Private	16	20	0	10	14	15	6	Moderate
59	Raak Plain State Forest	20	20	20	20	20	-	-	Insufficient data
60	Raak Plain State Forest	18	20	20	20	20	17	9	Excellent
61	Lake Ranfurly	7	20	0	0	18	7	3	Poor
62	Woorlong Wetlands (Basin 12)	9	18	10	8	18	8	5	Moderate
64	Bruces' Bend Marina	13	20	0	17	19	17	7	Good
65	Ducksfoot Lagoon	20	20	0	10	19	16	6	Moderate
66	Kings Billabong	20	20	0	10	16	5	4	Poor
67	Kings Billabong Backwater	18	20	0	17	19	18	7	Good
68	Lake Tyrrell	11	20	20	17	20	18	9	Excellent
70	Lake Carpul	18	20	0	20	20	17	8	Good
71	Narcooyia West Wetland	20	20	0	17	20	12	6	Moderate
72	Carp Hole Wetland	20	20	0	17	20	12	7	Good
73	Cattle Yard Wetland	20	20	0	17	20	12	7	Good
74	Toma Michel Road Wetland	6	12	10	17	15	14	7	Good
75	Parnee Malloo North Wetland	18	20	0	17	20	11	6	Moderate
76	Parnee Malloo Mid Wetland	18	20	0	17	20	8	6	Moderate
79	Major Mitchell Lagoon	16	20	0	17	20	8	5	Moderate
80	Burra Creek North	20	20	0	17	17	10	6	Moderate
81	Burra Creek	6	20	0	15	20	9	5	Moderate
82	Lake Bitterang	10	20	0	20	19	16	7	Good
83	Lake Cantala	12	20	0	17	20	9	5	Moderate
84	Lake Kramen	11	20	10	17	20	10	6	Moderate
85	Waitchie FFR Wetland	18	18	10	17	20	17	8	Good
86	Cardross Lakes	9	18	0	8	20	4	3	Poor
87	Lindsay 666	20	20	0	17	19	17	7	Good

Appendix 3A: Partners and their roles and responsibilities in Mallee waterway management

Category	Partners	Roles and responsibilities/links with waterways
State Government Agencies and statutory bodies	Catchment Management Authority (Mallee)	The Mallee CMA, along with nine other CMAs was established in 1997 by the Victorian Government, under the *Catchment and Land Protection Act 1994*, with the aim of creating a whole of catchment approach to natural resource management in the state. The primary goal of the Victorian CMAs is to ensure the protection and restoration of land and water resources, the sustainable development of natural resource based industries and the conservation of our natural and Cultural Heritage. Under Part 10 of the *Water Act 1989*, CMAs are designated with specific responsibility for the management of waterways, drainage and floodplains. The range of waterway related functions that the Mallee CMA undertakes include: • Developing a regional Waterway Strategy and associated action plans; • Developing and implementing work programs; • Authorising works on waterways, acting as a referral body for planning applications, licences to take and use water and construct dams for water use and other water health related issues; • Identifying regional priorities for environmental watering and facilitating water delivery; • Providing input into water allocation processes; • Developing and co-ordinating regional floodplain management plans; • Managing regional drainage, as appropriate; • Responding to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms; and • Undertaking community participation and awareness programs.
	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 that are of relevance to waterways, including: • Overseeing the catchment planning framework to promote integrated catchment management throughout Victoria; • Managing biodiversity; • Managing public land, including crown frontages. Including licensing for riparian management and for grazing, and ensuring compliance with licence conditions. Also have a direct onground responsibility for unlicensed frontages; • Some aspects of waterways on public land; • 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; and • 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 (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 the achievement of water quality objectives; and • Acting in partnership with DEPI and regional bodies to monitor water quality and waterway health, and enable 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, and natural features reserves. They create, manage and maintain visitor sites and manage a range of assets, including visitor facilities and access points, many of which are associated with waterways.
	Victorian Environmental Water Holder	The Victorian Environmental Water Holder (VEWH) 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.

Category	Partners	Roles and responsibilities/links with waterways
State Government Agencies and statutory bodies. *cont*	Water Corporations (Goulburn-Murray Water, Grampians Wimmera Mallee 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. In the Mallee this encompasses a combination of irrigation services, domestic and stock services, bulk water supply services and urban water and wastewater services. Their link with the MWS includes: • Broader catchment health and improved water quality links to water supply; and • Water reform, operational role in environmental water management.
National	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 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; and • Engaging and educating the Australian community about the Basin's water resources.
	Commonwealth Environmental Water Holder	The Commonwealth Environmental Water Holder (CEWH) is appointed under the *Water Act 1989* to manage the Commonwealth's environmental water holdings to protect and improve the environmental assets of the Murray-Darling Basin. The Commonwealth Environmental Water Holder: • Make decisions about the use of Commonwealth water holdings, including providing water to the VEWH for use in Victoria; • Liase with the VEWH to ensure co-ordinated use of environmental water in Victoria; and • Report on management of Commonwealth water holdings.
Local Government	Rural City of Mildura, Rural City of Swan Hill, Buloke Shire, Yarriambiack Shire, Hindmarsh Shire, West Wimmera Shire, Gannawarra Shire	Councils are involved in the management of waterways in Victoria through their role as responsible planning authorities, managers of stormwater drainage and onsite domestic wastewater systems, users of integrated water systems, land managers, emergency management bodies, and supporters of community groups. Specifically with regard to waterways, local government has the following roles and responsibilities: • Incorporate waterway and catchment management objectives, priorities and actions into strategic and statutory planning processes; • Undertake elements of floodplain management in accordance with the renewed Victorian Floodplain Management Strategy; • Develop and implement urban stormwater plans; • Manage on-site domestic wastewater systems; • Manage sections of waterways where formal agreements are in place; and • Manage rural drainage 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 Traditional Owner boards or councils that prepare management plans and/or provide advice about the management of specific areas.
	Groups	Groups (such as the Mallee CMA Aboriginal Reference Group) participate in regional planning, priority setting and the implementation of regional work programs.
Community	Landholders	Landholders are vital to successful implementation of this strategy, as most works are on privately owned land or affect areas that require private co-operation, and their land management practices have a vital role in catchment health. Under the *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; and • 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 work 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 3B: AVIRA value catergories, measures and associated scores/categories indicating 'High' value

Value Category	Value Measure	High Value Score/ category
Environmental Values		
Formally Recognised - Int. Significance	Ramsar Sites (wetlands only)	Yes
Formally Recognised - National	East Asian-Australasian Flyway sites (wetlands/estuaries only)	Yes
	Nationally Important Wetlands	Yes
	Living Murray Icon Sites	Yes
	National Heritage Sites	Yes
	Heritage Rivers	Yes
	Icon Rivers	Yes
	Essentially Natural Catchments	Yes
	Victorian Parks and Reserves	Yes
	Victorian Heritage Sites	Yes
Representativeness	Representative Rivers	Yes
Rare or threatened species/communities	Significant fish	4-5
	Significant birds	4-5
	Significant amphibians (rivers/wetlands only)	4-5
	Significant invertebrates (rivers and wetlands only)	4-5
	Significant reptiles	4-5
	Significant mammals (rivers and wetlands only)	4-5
	Significant flora	4-5
	Significant riparian EVCs (rivers only)	5
	Significant wetland EVCs (wetlands only)	4-5
	Significant estuarine EVCs (estuaries only)	4-5
Naturalness	Aquatic invertebrate community condition (rivers/ wetlands only)	4-5
	Native fish communities (rivers only)	4-5
	Riparian vegetation condition (rivers only)	4-5
	Wetland vegetation condition (wetlands only)	4-5
	Drought refuges	3-5
	Important bird habitat	5
	Biosphere Reserves	Yes

Social Values		
Activity	Recreational fishing	5
	Non-motor boating	4-5
	Motor boating	4-5
	Camping	4-5
	Swimming	5
	Beside Water Activities: • Walking, hiking, cycling; • Sightseeing; and • Picnics/barbecues.	5
	Game hunting	5
	Landscape	5
People	Community groups	5
	Use of Flagship species	5
Cultural Values		
Heritage	Aboriginal Cultural Heritage	Known
	Post-European heritage	Known
Economic Values		
Water	Urban/rural township water sources	3-5
	Rural water sources for production	3-5
	Water carriers (rivers/wetlands only)	5
	Waste water discharges	5
	Water storages (rivers/wetlands only)	3-5
Power Generation	Hydro-electricity (rivers/wetlands only)	3-5
Other Resources	Commercial fishing	5
	Extractive industries	5
	Timber harvesting and firewood collection	3-5

Appendix 3C: AVIRA threat categories, their associated measures for river reaches and wetlands, and threat severity scores indicating 'High' threat

Threat Categories	Threat Measures		High Threat Score
	River Reaches	Wetlands	
Altered Water Regimes	Altered Flow Regimes: • Increase in Low Flow Magnitude; • Reduction in High Flow Magnitude; • Increase in Proportion of Zero Flow; • Change in Monthly Streamflow Variability; and • Altered Streamflow Seasonality.	Changed Water Regime	3-5
Altered Physical Form	Bank Instability	Reduced Wetland Area	3-5
	Bed Instability (Degradation)	Altered Wetland Form	3-5
Poor Water Quality	Degraded Water Quality	Changed Water Properties	3-5
	Thermal Water Pollution	Disturbance of Acid Sulphate Soils	3-5
	Disturbance of Acid Sulphate Soils		3-5
Degraded Habitats	Degraded Riparian Vegetation	Soil Disturbance	3-5
	Loss of Instream Habitat		3-5
	Livestock Access		3-5
Invasive Flora and Fauna	Invasive Flora (Riparian)	Invasive Flora (Wetland)	3-5
	Invasive Flora (Aquatic)	Invasive Fauna (Terrestrial)	3-5
	Invasive Fauna (Terrestrial)	Invasive Fauna (Aquatic)	3-5
	Invasive Fauna (Aquatic).		3-5
Reduced Connectivity	Barriers to Fish Migration	Reduced Wetland Connectivity	3-5
	Reduced Riparian Connectivity		3-5
	Reduced Floodplain Connectivity		3-5

Appendix 3D: High Value Waterways and their associated values

The table below lists wetlands (W) and reaches (R) with 'High Value' status. They have one or more value measures (within the indicated Value Categories) which are considered high value as per Appendix 3B.

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Heritage	Water	Other Resources
R	Parnee Malloo Creek	Nyah		X	X	X	X	X	X	
R	Vinifera Creek	Nyah		X			X	X	X	
W	Vinifera Wetland	Nyah		X			X	X		
W	Parnee Malloo North Wetland	Nyah			X	X	X	X		
W	Parnee Malloo Mid Wetland	Nyah		X		X	X	X		
R	Murray River (8-25)	Nyah	X	X	X	X	X	X	X	
R	Murray River (14-01)	Nyah	X	X	X	X	X	X	X	
W	Burra North Wetland	Burra		X				X		
W	Burra South Wetland	Burra		X				X		
R	Burra Creek North	Burra		X	X			X	X	
R	Burra Creek South	Burra		X	X			X	X	
W	Major Mitchell Lagoon	Burra	X	X			X	X		
R	Murray River (14-02)	Burra	X	X	X	X	X	X	X	
R	Murray River (14-03)	Burra	X	X	X	X	X	X	X	
R	Bridge Creek	Heywood		X				X		
R	Heywood Creek	Heywood		X			X	X		
W	Heywood Lake	Heywood	X	X	X	X	X	X		
W	Little Heywood Lake	Heywood		X	X		X	X		
W	Bridge Creek Wetland	Heywood		X				X		
W	Fisher's Lagoon	Heywood		X			X	X		
R	Murray River (14-04)	Heywood	X	X	X	X	X	X	X	
W	Bidgee Lagoons	Boundary Bend		X				X		
W	Racecourse Wetland	Boundary Bend		X				X		
R	Tata Creek	Boundary Bend		X				X		
W	Tata Wetland	Boundary Bend		X				X		
R	Wakool Creek	Boundary Bend		X	X		X	X		
R	Murray River (14-05)	Boundary Bend	X	X	X	X	X	X	X	
R	Bonyaricall Creek	Belsar Yungera					X	X	X	
W	Lake Carpul	Belsar Yungera		X	X		X	X		
W	Lake Powell	Belsar Yungera		X			X	X		
R	Narcooyia Creek East	Belsar Yungera	X	X	X		X	X		
W	Yungera Wetland	Belsar Yungera		X				X		
R	Narcooyia Creek North	Belsar Yungera	X	X				X		
R	Narcooyia Creek West	Belsar Yungera	X	X	X		X	X		
W	Narcooyia West Wetland	Belsar Yungera	X			X		X		
R	J1 Creek Complex	Belsar Yungera		X			X	X		
R	Carpul Creek	Belsar Yungera		X			X	X		
R	Murray River (14-06)	Belsar Yungera	X	X	X	X	X	X	X	
R	Powell Creek	Belsar Yungera		X			X	X		

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	Unnamed (14~25~W3)	Belsar Yungera	X					X		
W	Carp Hole	Belsar Yungera	X					X		
R	Bumbang Creek	Bumbang						X		
W	Margooya Lagoon	Bumbang		X	X			X		
R	The Cutting	Bumbang	X	X		X	X	X	X	
R	Murray River (14-07)	Bumbang	X	X	X	X	X	X	X	
W	Bumbang Wetlands	Bumbang						X		
W	Carina Bend Wetlands	Happy Valley		X				X		
W	Gasdens Bend Wetland	Happy Valley		X				X		
W	Liparoo Billabong East	Happy Valley		X				X		
W	Liparoo Billabong West	Happy Valley		X			X	X		
R	Murray River (14-08)	Happy Valley	X	X	X	X	X	X	X	
W	Pound Bend Wetland Complex	Happy Valley		X				X		
R	Cantala Creek	Hattah	X	X		X	X	X		
W	Lake Arawak	Hattah	X	X	X	X	X	X		
W	Lake Bitterang	Hattah	X	X	X	X	X	X		
W	Lake Boolca	Hattah	X				X	X		
W	Lake Brockie	Hattah	X	X	X	X	X	X		
W	Lake Bulla	Hattah	X	X	X	X	X	X		
W	Lake Cantala	Hattah	X	X	X	X	X	X		
W	Lake Hattah	Hattah	X	X	X	X	X	X		
W	Lake Konardin	Hattah	X		X	X	X	X		
W	Lake Kramen	Hattah	X	X	X	X	X	X		
W	Lake Lockie	Hattah	X	X	X	X	X	X		
W	Lake Mournpall	Hattah	X	X	X	X	X	X		
W	Lake Yelwell	Hattah	X	X	X	X	X	X		
W	Lake Yerang	Hattah	X	X	X	X	X	X		
R	Chalka Creek North	Hattah	X	X	X		X	X		
R	Chalka Creek South	Hattah	X	X	X	X	X	X		
R	Murray River (14-09)	Hattah	X	X	X	X	X	X	X	
R	Murray River (14-10)	Nangiloc Colignan	X	X	X	X	X	X	X	
W	Bottle Bend Wetland Complex	Karadoc		X				X		
R	Outlet Creek	Karadoc		X				X		
W	Psyche Lagoon	Karadoc		X			X	X	X	
R	Towrie Creek	Karadoc		X	X			X		
W	Woorlong Wetland	Karadoc		X			X	X	X	
R	Inlet Creek	Karadoc		X	X			X	X	
W	Karadoc Swamp	Karadoc		X				X	X	
W	Lake Iraak	Karadoc		X				X	X	
W	Power Station Wetland	Karadoc		X			X	X		
W	Psyche Runner	Karadoc		X			X	X		
W	Wonega Ave Drain	Karadoc			X		X		X	

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	Woorlong Drain	Karadoc		X			X		X	
W	Bullock Swamp	Karadoc		X	X			X		
W	Spences Bend Wetlands	Karadoc		X				X		
W	Backwater Wetland	Nichols Point	X	X	X		X	X		
R	Butlers Creek	Nichols Point	X	X	X	X	X	X		
W	Kings Billabong	Nichols Point	X	X	X	X	X	X	X	
W	North West Wetland	Nichols Point	X	X			X	X		
W	Duck's Foot Lagoon	Nichols Point	X	X	X	X	X	X		
R	Sandilong Creek	Nichols Point			X	X	X	X		
W	Bruce's Bend Marina	Nichols Point	X		X	X	X	X		
W	Lake Sandilong	Nichols Point		X			X	X		
R	Murray River (14-11)	Nichols Point	X	X	X	X	X	X	X	
R	Psyche Creek	Nichols Point	X				X	X		
W	Sandilong Creek Extension	Nichols Point		X			X	X	X	
W	Black Box Track Lagoons	Merbein		X			X	X		
W	Cowanna Billabong	Merbein		X	X	X	X	X	X	
W	Brickworks Billabong	Merbein		X			X	X	X	
W	Catfish Lagoon	Merbein		X			X	X		
W	Cowra Rocks, Yelta	Merbein				X		X		
R	Darling Junction Creeks	Merbein						X		
W	Darling Junction Wetland	Merbein		X				X		
W	Lake Hawthorn	Merbein		X	X		X	X	X	
W	Lake Ranfurly	Merbein	X	X	X		X	X	X	
W	Bob Corbould Wetland	Merbein		X			X	X		
W	Lambert's Swamp, Yelta	Merbein		X				X	X	
R	Murray River (14-12)	Merbein	X	X	X	X	X	X	X	
W	Yelta Drains	Merbein		X				X	X	
W	Carmen's Wetland, Junction	Merbein						X		
R	Dedmans Creek	Wallpolla	X	X			X	X		
R	Finnigans Creek	Wallpolla	X		X	X	X	X		
W	Horseshoe Lagoon	Wallpolla	X	X	X		X	X		
R	Inner Wallpolla	Wallpolla	X	X	X		X	X		
W	Lock 9 Wetland	Wallpolla	X	X	X		X	X		
R	Moorna Creek	Wallpolla	X			X	X	X		
R	Mullroo Creek	Wallpolla	X	X	X		X	X		
R	Ranka Creek	Wallpolla	X	X	X	X	X	X		
R	Sandy Creek East	Wallpolla	X	X	X		X	X		
R	Wallpolla Creek Mid (14-50)	Wallpolla	X	X	X	X	X	X		
R	Wallpolla Creek West (14-52)	Wallpolla	X	X	X	X	X	X		
W	Wallpolla West Wetland 772	Wallpolla	X	X	X		X	X		
W	Wallpolla Wetland 786	Wallpolla	X	X	X		X	X		
W	Wallpolla Wetland 792	Wallpolla	X	X	X		X	X		

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	Wallpolla Wetland 804	Wallpolla	X	X	X		X	X		
W	Wallpolla Wetland 819	Wallpolla	X		X		X	X		
W	Wallpolla Wetland 821	Wallpolla	X		X		X	X		
W	Big Paddock Wetland	Wallpolla	X	X	X		X	X		
R	Finnigans Creek West	Wallpolla	X	X	X		X	X		
R	Milky Creek	Wallpolla	X	X	X	X	X	X		
R	Sandy Creek West	Wallpolla	X	X	X		X	X		
R	Thompson Creek	Wallpolla	X	X			X	X		
R	Wallpolla Creek East (14-51)	Wallpolla	X	X	X	X	X	X		
R	Wallpolla Southern Reach	Wallpolla	X	X			X	X		
R	Willpenance Creek	Wallpolla	X	X	X		X	X		
R	Boy Creek	Wallpolla	X	X				X		
W	Lake Cullulleraine	Wallpolla		X	X	X	X	X	X	
R	Murray River (14-13)	Wallpolla	X	X	X	X	X	X	X	
R	Murray River (14-14)	Wallpolla	X	X	X	X	X	X		
W	Unnamed (14~13~W2)	Wallpolla	X				X	X		
W	Unnamed (14~14~W2)	Wallpolla	X				X	X		
W	Unnamed (14~51~W2)	Wallpolla	X				X	X		
W	Unnamed (14~51~W3)	Wallpolla	X				X	X		
W	Unnamed (14~52~W1)	Wallpolla	X				X	X		
W	Unnamed (14~52~W2)	Wallpolla	X				X	X		
W	Unnamed (14~52~W3)	Wallpolla	X				X	X		
W	Unnamed (14~57~W1)	Wallpolla	X				X	X		
W	Unnamed (14~77~W1)	Wallpolla	X				X	X		
W	Unnamed (10615)	Wallpolla	X				X	X		
W	Unnamed (10624)	Wallpolla	X				X	X		
W	Steve's Swamp West	Wallpolla						X		
W	Steve's Swamp East	Wallpolla						X		
W	Pender's Wetland	Wallpolla						X		
W	Wood's Lagoon	Wallpolla	X				X	X		
R	Inner Potterwalkagee	Mulcra	X	X			X	X		
W	Mulcra 726 North	Mulcra	X	X			X	X		
W	Mulcra 726 South	Mulcra	X	X	X		X	X		
R	Mulcra West Creek	Mulcra	X	X	X		X	X		
W	Ned's Corner Lagoon	Mulcra		X			X	X		
R	Potterwalkagee Creek East	Mulcra	X	X	X	X	X	X		
R	Potterwalkagee Creek West	Mulcra	X	X	X	X	X	X		
R	Potterwalkagee Southern Connector	Mulcra	X				X	X		
W	Snake Lagoon	Mulcra	X	X			X	X		
R	Murray River (14-15)	Mulcra	X	X	X	X	X	X		
W	Old Tip Wetland	Mulcra		X				X		

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	PK's Wetland	Mulcra	X	X	X		X	X		
W	Unnamed (14~64~W2)	Mulcra	X				X	X		
W	Unnamed (14~65~W1)	Mulcra	X				X	X		
W	Unnamed (14~65~W2)	Mulcra	X				X	X		
W	Dooley's Bus Runner	Mulcra	X				X	X		
W	Cracking Wetland	Mulcra	X				X	X		
W	Piglet Lagoon	Mulcra	X				X	X		
W	Clare's Lagoon	Mulcra						X		
W	Lake Wallawalla	Lindsay	X	X	X		X	X		
R	Lindsay River (14-67)	Lindsay	X	X	X	X	X	X		
R	Lindsay River (14-68)	Lindsay	X	X	X	X	X	X		
R	Lindsay River (14-69)	Lindsay	X	X	X	X	X	X		
R	Lindsay River (14-70)	Lindsay	X	X	X	X	X	X		
R	Lindsay River (14-71)	Lindsay	X	X	X	X	X	X	X	
R	Mullaroo Creek East	Lindsay	X	X	X	X	X	X		
R	Parallel to Mullaroo West	Lindsay	X			X	X	X		
R	Toupnein Creek East	Lindsay	X	X	X		X	X		
W	Webster's Lagoon	Lindsay	X	X	X		X	X		
R	Mullaroo Creek (14-72)	Lindsay	X	X	X	X	X	X		
R	Mullaroo Lindsay Connector	Lindsay	X	X	X		X	X		
R	Toupnein Creek West	Lindsay	X	X	X		X	X		
R	Woodcutters Creek	Lindsay	X	X			X	X		
R	Murray River (14-16)	Lindsay	X	X		X	X	X		
R	Murray River (14-17)	Lindsay	X	X	X	X	X	X	X	
W	Unnamed (14~16~W1)	Lindsay	X				X	X		
W	Unnamed (14~16~W2)	Lindsay	X				X	X		
W	Unnamed (14~16~W3)	Lindsay	X				X	X		
W	Unnamed (14~16~W4)	Lindsay	X				X	X		
W	Unnamed (14~16~W5)	Lindsay	X				X	X		
W	Unnamed (14~17~W1)	Lindsay	X				X	X		
W	Unnamed (14~17~W2)	Lindsay	X				X	X		
W	Unnamed (14~17~W3)	Lindsay	X				X	X		
W	Unnamed (14~17~W4)	Lindsay	X				X	X		
W	Unnamed (14~17~W5)	Lindsay	X				X	X		
W	Unnamed (14~67~W1)	Lindsay	X				X	X		
W	Unnamed (14~67~W2)	Lindsay	X				X	X		
W	Unnamed (14~72~W1)	Lindsay	X				X	X		
W	Unnamed (14~72~W2)	Lindsay	X				X	X		
W	Unnamed (14~72~W3)	Lindsay	X				X	X		
W	Unnamed (14~72~W4)	Lindsay	X				X	X		
W	Unnamed (14~73~W1)	Lindsay	X				X	X		

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	Unnamed (14~76~W1)	Lindsay	X				X	X		
W	Unnamed (14~76~W2)	Lindsay	X				X	X		
W	Unnamed (14~76~W3)	Lindsay	X				X	X		
W	Unnamed (14~77~W1)	Lindsay	X				X	X		
W	Unnamed (14~78~W1)	Lindsay	X				X	X		
W	Unnamed (10001)	Lindsay	X				X	X		
W	Unnamed (14.48.001)	Lindsay	X				X	X		
W	Little Wallwalla	Lindsay	X				X	X		
W	Raak Plain Wetlands	Raak Plain	X	X	X			X		
W	Unnamed (14~10~W5)	Raak Plain	X					X		
W	Unnamed (14~10~W6)	Raak Plain	X					X		
W	Unnamed (14~10~W7)	Raak Plain	X					X		
W	Unnamed (14~10~W8)	Raak Plain	X					X		
W	Unnamed (14~10~W9)	Raak Plain	X					X		
W	Lake Hardy	Pink Lakes	X	X	X	X		X		
W	Lake Crosby	Pink Lakes	X	X	X	X	X	X		
W	Clay Lake	Pink Lakes	X					X		
W	Lake Agnes	Pink Lakes	X					X		
R	Outlet Creek	Wyperfeld	X	X	X		X	X		
W	Lake Brimin	Wyperfeld	X	X				X		
W	Wirrengren Plain	Wyperfeld	X	X			X	X		
W	Lignum Plain	Wyperfeld	X					X		
W	Beulah Weirpool	Yarriambiack		X		X	X			
W	Lake Coorong	Yarriambiack		X		X		X		
R	Yarriambiack Creek	Yarriambiack		X	X	X	X	X		
W	Lake Lascelles	Yarriambiack		X		X	X	X		
W	Green Lake	Dunmunckle		X		X	X	X		
W	Lake Tyrrell	Tyrrell	X	X	X			X		X
R	Tyrrell Creek North	Tyrrell	X	X	X	X		X		
R	Tyrrell Creek South	Tyrrell	X	X	X	X		X		
W	Stewart Road Wetland	Lalbert		X				X		
W	TomaMichel Road Wetland	Lalbert	X	X				X		
W	Waitchie FFR Wetland	Lalbert	X	X	X			X		
W	Lake Timboram	Lalbert		X				X		
R	Lalbert Creek North	Lalbert	X	X	X			X		
R	Lalbert Creek South	Lalbert	X					X		
W	Lake Wahpool	Lalbert						X		
W	Barber's Swamp	Freshwater Dispersed		X	X		X	X		
W	Broom Tank	Freshwater Dispersed		X	X		X	X		
W	Bull Swamp	Freshwater Dispersed			X		X	X		
W	Chiprick	Freshwater Dispersed			X		X	X		

Waterway Type	Waterway name	Waterway Management Unit	Environmental Values			Social Values		Cultural Values	Economic Value	
			Formally Recognised Significance	Rare or Threatened species/communities	Naturalness	Activity	People	Hertitage	Water	Other Resources
W	Clinton Shire Dam	Freshwater Dispersed			X		X	X		
W	Cokum Bushland Reserve	Freshwater Dispersed			X	X	X	X		
W	Considines on Tyrrell	Freshwater Dispersed		X	X		X	X		
W	Cronomby Tanks	Freshwater Dispersed			X	X	X	X		
W	Coundons Wetland	Freshwater Dispersed			X		X	X		
W	Gould's Reserve	Freshwater Dispersed			X		X	X		
W	Greens Wetland	Freshwater Dispersed		X	X		X	X		
W	Hill Paddock Wetland	Freshwater Dispersed		X	X		X	X		
W	Homelea Wetland	Freshwater Dispersed			X		X	X		
W	J Ferrier Wetland	Freshwater Dispersed			X		X	X		
W	John Ampt Wetland	Freshwater Dispersed			X		X	X		
W	Karyrie Bushland Reserve	Freshwater Dispersed		X				X		
W	Kath Smith Dam	Freshwater Dispersed			X		X	X		
W	Lake Danaher Bushland Reserve	Freshwater Dispersed		X	X		X	X		
W	Lake Marlbed	Freshwater Dispersed			X		X	X		
W	Mahoods Corner	Freshwater Dispersed			X		X	X		
W	Pam Juergens Dam	Freshwater Dispersed			X		X	X		
W	Part of Gap Reserve	Freshwater Dispersed			X		X	X		
W	Poyner	Freshwater Dispersed		X	X		X	X		
W	R Ferrier Dam	Freshwater Dispersed			X		X	X		
W	Rickard Glenys Dam	Freshwater Dispersed			X		X	X		
W	Roselyn Wetland/Reids Dam	Freshwater Dispersed			X		X	X		
W	Shannons Wayside	Freshwater Dispersed		X	X		X	X		
W	Tcham Lakes	Freshwater Dispersed		X	X	X	X	X		
W	Morton Plains Reserve	Freshwater Dispersed		X	X		X	X		
W	Round Swamp	Freshwater Dispersed						X		
W	The Crater	Freshwater Dispersed						X		
W	Double Yards Shire Dam	Freshwater Dispersed						X		
W	Mosquito Tank Shire Dam	Freshwater Dispersed						X		
W	Cardross Lake	Saline Irrigation Dispersed	X	X	X		X	X	X	
W	Cardross Lakes East	Saline Irrigation Dispersed	X	X	X		X	X	X	
W	Koorlong Lakes	Saline Irrigation Dispersed		X	X			X	X	
W	Wargan Wetlands	Saline Irrigation Dispersed	X	X				X	X	
W	Etiwanda Wetlands	Artificial and Sewerage				X	X		X	
W	Mildura Wastewater Treatment Plant	Artificial and Sewerage		X					X	
W	Mildura South Wetlands	Artificial and Sewerage								

Appendix 3E: Priority Waterways

The table below lists wetlands (W) and reaches (R) that are a priority for management activity. Waterways with values which link to at least one of the regions environmental condition goals were analysed in the prioritisation process (i.e. Waterways which are aligned with only the Cultural Heritage and/or Community Capacity goals are considered to be of high value but not a priority for for future management). Analysis was based on a waterway's values and threats, the risk level of the threats against values and the technical feasibility to reduce threats with management intervention.

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
				To maintain or improve habitat within waterways and on surrounding riparian land[1]	To restore appropriate water regimes and improve connectivity[2]	To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based)[3]	To protect the extent and condition of Cultural Heritage sites associated with waterways (Indigenous and non-Indigenous)[4]	To increase community capacity for, awareness of and participation in waterway management[5]		
R	Parnee Malloo Creek	Nyah	High	X	X	X	X		M	H
R	Vinifera Creek	Nyah	High	X		X	X	X	M	H
W	Vinifera Wetland	Nyah	High	X			X	X	H	H-M
W	Parnee Malloo North Wetland	Nyah	Medium		X	X	X		M	M
W	Parnee Malloo Mid Wetland	Nyah	Medium	X		X	X		M	M
R	Murray River (8-25)	Nyah	Low	X	X	X	X	X	M-L	M
R	Murray River (14-01)	Nyah	Low	X	X	X	X	X	M	M
W	Burra North Wetland	Burra	High	X			X		VH	H
W	Burra South Wetland	Burra	High	X			X		M	H-M
R	Burra Creek North	Burra	Medium	X	X	X	X		L	H
R	Burra Creek South**	Burra	Medium	X	X	X	X		L	H
W	Major Mitchell Lagoon	Burra	Medium	X			X		H	M
R	Murray River (14-02)	Burra	Low	X	X	X	X	X	M-L	M
R	Murray River (14-03)	Burra	Low	X	X	X	X	X	L	M
R	Bridge Creek	Heywood	High	X			X		H-M	H-M
R	Heywood Creek	Heywood	High	X			X	X	M	H
W	Heywood Lake	Heywood	High	X	X	X	X	X	M	H-M
W	Little Heywood Lake	Heywood	High	X	X		X	X	VH	M
W	Bridge Creek Wetland**	Heywood	Medium	X			X		VH-H	M-L
W	Fisher's Lagoon	Heywood	Medium	X			X		M	M
R	Murray River (14-04)	Heywood	Low	X	X	X	X	X	M	M
W	Bidgee Lagoons	Boundary Bend	High	X			X		VH-H	M
W	Racecourse Wetland	Boundary bend	Medium	X			X		VH-H	M
R	Tata Creek	Boundary Bend	Medium	X			X		H-M	M
W	Tata Wetland	Boundary Bend	Medium	X			X		VH-H	M
R	Wakool Creek	Boundary Bend	Medium	X	X		X		M	H-M
R	Murray River (14-05)	Boundary Bend	Low	X	X	X	X	X	M	M
R	Bonyaricall Creek	Belsar Yungera	High			X	X	X	M	H
W	Lake Carpul	Belsar Yungera	High	X	X		X	X	VH-H	H-M
W	Lake Powell	Belsar Yungera	High	X			X		M	H-M
R	Narcooyia Creek East	Belsar Yungera	High	X	X	X	X	X	H	H
W	J1 Wetland	Belsar Yungera	High	X			X		H	H
R	Narcooyia Creek North	Belsar Yungera	Medium	X			X		M	H-M

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
				To maintain or improve habitat within waterways and on surrounding riparian land[1]	To restore appropriate water regimes and improve connectivity[2]	To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based)[3]	To protect the extent and condition of Cultural Heritage sites associated with waterways (Indigenous and non-Indigenous)[4]	To increase community capacity for, awareness of and participation in waterway management[5]		
R	Narcooyia Creek West	Belsar Yungera	Medium	X	X	X	X		M	H
W	Narcooyia West Wetland	Belsar Yungera	Medium			X	X		M	H-M
R	Yungera Creek Complex	Belsar Yungera	Medium	X			X		M	H-M
R	Carpul Creek	Belsar Yungera	Low	X			X		L	H
R	Murray River (14-06)	Belsar Yungera	Low	X	X	X	X	X	L	M
R	Powell Creek	Belsar Yungera	Low	X			X		L	H
R	Bumbang Creek	Bumbang	High		X		X		M	H
W	Margooya Lagoon	Bumbang	High	X	X		X		H	H-M
R	The Cutting	Bumbang	Medium	X	X	X	X	X	L	H-M
R	Murray River (14-07)	Bumbang	Low	X	X	X	X	X	L	M
W	Carina Bend Wetlands	Happy Valley	Medium	X			X		H	M
W	Gasdens Bend Wetland	Happy Valley	Medium	X			X		VH-H	M-L
W	Liparoo East Billabong	Happy Valley	Medium	X			X		M	H-M
W	Liparoo West Billabong	Happy Valley	Medium	X			X		M	H-M
R	Murray River (14-08)	Happy Valley	Low	X	X	X	X	X	M	M
W	Pound Bend Wetland Complex	Happy Valley	Low	X			X		L	H
R	Cantala Creek	Hattah	High	X		X	X	X	M	H
W	Lake Arawak	Hattah	High	X	X	X	X	X	H	H
W	Lake Bitterang	Hattah	High	X	X	X	X	X	H	H
W	Lake Boolca	Hattah	High	X			X	X	H	H
W	Lake Brockie	Hattah	High	X	X	X	X	X	H	H
W	Lake Bulla	Hattah	High	X	X	X	X	X	H	H
W	Lake Cantala	Hattah	High	X	X	X	X	X	H	H
W	Lake Hattah	Hattah	High	X	X	X	X	X	M	H
W	Lake Konardin	Hattah	High	X	X	X	X	X	H	H
W	Lake Kramen	Hattah	High	X	X	X	X	X	M	H
W	Lake Lockie	Hattah	High	X	X	X	X	X	H	H
W	Lake Mournpall	Hattah	High	X	X	X	X	X	H	H
W	Lake Yelwell	Hattah	High	X	X	X	X	X	H	H
W	Lake Yerang	Hattah	High	X	X	X	X	X	H	H
R	Chalka Creek North	Hattah	Medium	X	X		X	X	L	H
R	Chalka Creek South	Hattah	Medium	X	X	X	X	X	L	H
R	Murray River (14-09)	Hattah	Low	X	X	X	X	X	M	M
R	Murray River (14-10)	Nangiloc Colignan	Low	X	X	X	X	X	M	M
W	Bottle Bend Wetland Complex	Karadoc	High	X			X		H	M
R	Outlet Creek	Karadoc	High	X			X		M	H
W	Psyche Lagoon	Karadoc	High	X		X	X	X	M	H

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
				To maintain or improve habitat within waterways and on surrounding riparian land[1]	To restore appropriate water regimes and improve connectivity[2]	To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based)[3]	To protect the extent and condition of Cultural Heritage sites associated with waterways (Indigenous and non-Indigenous)[4]	To increase community capacity for, awareness of and participation in waterway management[5]		
R	Towrie Creek	Karadoc	High	X	X		X		M	H
W	Woorlong Wetland	Karadoc	High	X		X	X	X	M	M
R	Inlet Creek**	Karadoc	Medium	X	X	X	X		L	H
W	Karadoc Swamp	Karadoc	Medium	X		X	X		H	M
W	Lake Iraak	Karadoc	Medium	X		X	X		H	M
W	Power Station Wetland	Karadoc	Medium	X			X		M-L	H
W	Psyche Runner	Karadoc	Medium	X			X		L	H
W	Wonega Ave Drain	Karadoc	Medium		X	X			M	H-M
W	Woorlong Drain	Karadoc	Medium	X		X			M	H-M
W	Bullock Swamp	Karadoc	Low	X	X		X		L	M
W	Spences Bend Wetlands	Karadoc	Low	X			X		L	M
W	Backwater Wetland	Nichols Point	High	X	X		X	X	H	M
R	Butlers Creek	Nichols Point	High	X	X	X	X	X	M	H
W	Kings Billabong	Nichols Point	High	X	X	X	X	X	M	H
W	North West Wetland	Nichols Point	High	X			X	X	H	H
W	Ducksfoot Lagoon	Nichols Point	Medium	X	X	X	X	X	M	H-M
R	Sandilong Creek	Nichols Point	Medium		X	X	X	X	M	M
W	Bruce's Bend Marina	Nichols Point	Low		X	X	X	X	M	M-L
W	Lake Sandilong	Nichols Point	Low	X			X		M	M-L
R	Murray River (14-11)	Nichols Point	Low	X	X	X	X	X	M	M
R	Psyche Creek	Nichols Point	Low		X	X	X	X	M	M-L
W	Sandilong Creek Extension	Nichols Point	Low	X		X	X		M	M
W	Black Box Track Lagoons	Merbein	High	X		X	X	X	M	H
W	Cowanna Billabong	Merbein	High	X	X	X	X	X	M	H
W	Brickworks Billabong	Merbein	Medium	X	X	X	X	X	M	M
W	Catfish Lagoon	Merbein	Medium	X		X	X	X	M	H-M
W	Cowra Rocks, Yelta*	Merbein	Medium			X	X		M	M
R	Darling Junction Creeks*	Merbein	Medium		X	X	X		H	M-L
W	Darling Junction Wetland	Merbein	Medium	X			X		M	M
W	Lake Hawthorn	Merbein	Medium	X	X	X	X	X	H	M
W	Lake Ranfurly	Merbein	Medium	X	X	X	X	X	H	M
W	Bob Corbould Wetland	Merbein	Low	X	X		X	X	M	L
W	Lambert's Swamp, Yelta	Merbein	Low	X		X	X		M	M-L
R	Murray River (14-12)	Merbein	Low	X	X	X	X	X	M	M
W	Yelta Drains	Merbein	Low	X		X			L	M-L
R	Dedmans Creek	Wallpolla	High	X			X	X	VH	H-M
R	Finnigans Creek	Wallpolla	High		X	X	X	X	M	H
W	Horseshoe Lagoon	Wallpolla	High	X	X		X	X	H	H

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
				To maintain or improve habitat within waterways and on surrounding riparian land[1]	To restore appropriate water regimes and improve connectivity[2]	To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based)[3]	To protect the extent and condition of Cultural Heritage sites associated with waterways (Indigenous and non-Indigenous)[4]	To increase community capacity for, awareness of and participation in waterway management[5]		
R	Inner Wallpolla	Wallpolla	High	X	X		X	X	M	H
W	Lock 9 Wetland	Wallpolla	High	X	X		X		M	H-M
R	Moorna Creek	Wallpolla	High			X	X	X	H-M	H-M
R	Mullroo Creek	Wallpolla	High	X	X		X	X	M	H
R	Ranka Creek*	Wallpolla	High	X	X	X	X	X	M	H
R	Sandy Creek East	Wallpolla	High	X	X		X	X	L	H
R	Wallpolla Creek Mid (14-50)	Wallpolla	High	X	X	X	X	X	M	H
R	Wallpolla Creek West (14-52)	Wallpolla	High	X	X	X	X	X	M	H
W	Wallpolla West Wetland 772	Wallpolla	High	X	X		X	X	H	M
W	Wallpolla Wetland 786	Wallpolla	High	X	X		X	X	VH	H
W	Wallpolla Wetland 792	Wallpolla	High	X	X		X	X	H	H-M
W	Wallpolla Wetland 804	Wallpolla	High	X	X		X	X	VH	H
W	Wallpolla Wetland 819	Wallpolla	High	X	X		X	X	H	H
W	Wallpolla Wetland 821	Wallpolla	High		X		X	X	H	H
W	Big Paddock Wetland	Wallpolla	Medium	X	X		X		M	M
R	Finnigans Creek West	Wallpolla	Medium	X	X		X	X	M-L	H
R	Milky Creek	Wallpolla	Medium	X	X	X	X	X	M	H
R	Sandy Creek West	Wallpolla	Medium	X	X		X	X	M	H
R	Thompson Creek	Wallpolla	Medium	X			X	X	L	H
R	Wallpolla Creek East (14-51)	Wallpolla	Medium	X	X	X	X	X	M-L	H
R	Wallpolla Southern Reach	Wallpolla	Medium	X			X	X	L	H
R	Willpenance Creek*	Wallpolla	Medium	X	X		X	X	L	H
R	Boy Creek	Wallpolla	Low	X			X		H	L
W	Lake Cullulleraine	Wallpolla	Low	X	X	X	X	X	M	M-L
R	Murray River (14-13)	Wallpolla	Low	X	X	X	X	X	M	M
R	Murray River (14-14)	Wallpolla	Low	X	X	X	X	X	L	M
R	Inner Potterwalkagee	Mulcra	High	X			X	X	H-M	H-M
W	Mulcra 726 North	Mulcra	High	X			X	X	VH	H
W	Mulcra 726 South	Mulcra	High	X	X		X	X	H	H
R	Mulcra West Creek	Mulcra	High	X	X		X	X	H-M	H
W	Ned's Corner Lagoon*	Mulcra	High	X			X		H	H-M
R	Potterwalkagee Creek East	Mulcra	High	X	X	X	X	X	H-M	H
R	Potterwalkagee Creek West	Mulcra	High	X	X	X	X	X	M	H
R	Potterwalkagee Southern Connector	Mulcra	High				X	X	VH	M
W	Snake Lagoon	Mulcra	High	X			X	X	H	H
R	Murray River (14-15)	Mulcra	Medium	X	X	X	X	X	M	H-M
W	Old Tip Wetland*	Mulcra	Medium	X			X		L	H
W	PK's Wetland	Mulcra	Medium	X	X		X	X	M	H-M

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
				To maintain or improve habitat within waterways and on surrounding riparian land[1]	To restore appropriate water regimes and improve connectivity[2]	To manage all land tenures for water quality benefits and respond appropriately to threatening events (both natural and pollution based)[3]	To protect the extent and condition of Cultural Heritage sites associated with waterways (Indigenous and non-Indigenous)[4]	To increase community capacity for, awareness of and participation in waterway management[5]		
W	Lake Wallawalla	Lindsay	High	X	X		X	X	M	H
R	Lindsay River (14-67)	Lindsay	High	X	X	X	X	X	M	H
R	Lindsay River (14-68)	Lindsay	High	X	X	X	X	X	M	H
R	Lindsay River (14-69)	Lindsay	High	X	X	X	X	X	M	H
R	Lindsay River (14-70)	Lindsay	High	X	X	X	X	X	M	H
R	Lindsay River (14-71)	Lindsay	High	X	X	X	X	X	M	H
R	Mullaroo Creek (14-72)	Lindsay	High	X	X	X	X	X	M	H
R	Parallel to Mullaroo West	Lindsay	High			X	X	X	M	H
R	Toupnein Creek (14-75)	Lindsay	High	X	X		X	X	M	H
W	Webster's Lagoon	Lindsay	High	X	X		X	X	H	H-M
R	Mullaroo Creek (14-73)	Lindsay	Medium	X	X	X	X	X	L	H
R	Mullaroo Lindsay Connector	Lindsay	Medium	X			X	X	L	H
R	Toupnein Creek (14-76)	Lindsay	Medium	X			X	X	M-L	H
R	Woodcutters Creek	Lindsay	Medium	X			X	X	L	H
R	Murray River (14-16)	Lindsay	Low	X		X	X	X	L	M
R	Murray River (14-17)	Lindsay	Low			X	X	X	L	H-M
W	Raak Plain Wetlands	Raak Plain	Medium	X	X		X		H	M
W	Lake Hardy	Pink Lakes	Medium		X	X	X		M	M
W	Lake Crosby	Pink Lakes	Low	X	X	X	X		L	M
R	Outlet Creek	Wyperfeld	Medium	X			X		H-M	M-L
W	Lake Brimin	Wyperfeld	Low	X			X		M	M
W	Wirrengren Plain	Wyperfeld	Low	X			X		H-M	M-L
W	Beulah Weirpool	Yarriambiack	Medium		X	X		X	M	M
W	Lake Coorong	Yarriambiack	Medium	X		X	X		H	M
R	Yarriambiack Creek	Yarriambiack	Medium	X		X	X	X	M	H-M
W	Lake Lascelles	Yarriambiack	Low	X		X	X	X	M	M-L
W	Green Lake	Dunmunkle	Medium	X	X	X	X	X	M	M
W	Lake Tyrrell	Tyrrell	Medium	X	X		X		H-M	M
R	Tyrrell Creek North	Tyrrell	Medium			X	X		M-L	H-M
R	Tyrrell Creek South	Tyrrell	Low			X	X		L	H-M
W	Stewart Road Wetland	Lalbert	Medium	X	X		X		VH-H	M-L
W	TomaMichel Road Wetland*	Lalbert	Medium	X			X		H-M	M
W	Waitchie FFR Wetland	Lalbert	Medium	X	X		X		M	M
W	Lake Timboram	Lalbert	Low	X			X		M	M-L
R	Lalbert Creek North	Lalbert	Low	X			X		M	M
W	Barber's Swamp*	Freshwater Dispersed	High	X	X		X	X	M	H-M
W	Broom Tank	Freshwater Dispersed	High	X	X		X	X	H	H-M
W	Bull Swamp	Freshwater Dispersed	High		X		X	X	H	M
W	Chiprick	Freshwater Dispersed	High		X		X	X	H	M

Type: reach (R) or wetland (W)	Waterway name	Waterway Management Unit	Priority Category	Waterway contains values which link to regional goals					Median Risk level: very high (VH), high (H), moderate (M), low (L) or very low (VL)[6]	Average Feasibility level: high (H), moderate (M) or low (L)[7]
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W	Clinton Shire Dam	Freshwater Dispersed	High		X		X	X	H	M
W	Cokum Bushland Reserve	Freshwater Dispersed	High		X		X	X	M	M
W	Considines on Tyrrell*	Freshwater Dispersed	High	X	X		X	X	H	M
W	Cronomby Tanks	Freshwater Dispersed	High		X	X	X	X	M	H-M
W	Coundons Wetland*	Freshwater Dispersed	High		X		X	X	H	M
W	Gould's Reserve	Freshwater Dispersed	High		X		X	X	H	M
W	Greens Wetland*	Freshwater Dispersed	High	X	X		X	X	H	H-M
W	Hill Paddock Wetland*	Freshwater Dispersed	High	X	X		X	X	H	M
W	Homelea Wetland*	Freshwater Dispersed	High		X		X	X	H	M
W	J Ferrier Wetland*	Freshwater Dispersed	High		X		X	X	H	M
W	John Ampt Wetland*	Freshwater Dispersed	High		X		X	X	H	M
W	Karyrie Bushland Reserve	Freshwater Dispersed	High	X			X		H	H-M
W	Kath Smith Dam*	Freshwater Dispersed	High		X		X	X	H	M
W	Lake Danaher Bushland Reserve	Freshwater Dispersed	High	X	X		X	X	H	M
W	Lake Marlbed	Freshwater Dispersed	High		X		X	X	H	H
W	Mahoods Corner	Freshwater Dispersed	High		X		X	X	H	M
W	Pam Juergens Dam*	Freshwater Dispersed	High		X		X	X	H	M
W	Part of Gap Reserve	Freshwater Dispersed	High		X		X	X	H	M
W	Poyner*	Freshwater Dispersed	High	X	X		X	X	H	M
W	R Ferrier Dam*	Freshwater Dispersed	High		X		X	X	H	M
W	Rickard Glenys Dam*	Freshwater Dispersed	High		X		X	X	H	M
W	Roselyn Wetland/Reids Dam*	Freshwater Dispersed	High	X	X		X	X	H	M
W	Shannons Wayside	Freshwater Dispersed	High		X		X	X	H-M	M
W	Tchum Lakes	Freshwater Dispersed	High	X	X	X	X	X	H	M
W	Morton Plains Reserve	Freshwater Dispersed	Medium	X	X		X	X	H	M
W	Cardross Lake	Saline Irrigation Dispersed	Medium	X	X	X	X	X	M	H-M
W	Cardross Lakes East	Saline Irrigation Dispersed	Medium	X	X	X	X	X	M	H-M
W	Koorlong Lakes	Saline Irrigation Dispersed	Medium	X	X		X		M	H-M
W	Wargan Wetlands*	Saline Irrigation Dispersed	Low	X	X	X	X		M	M
W	Etiwanda Wetlands	Artificial and Sewerage	Low		X	X		X	M	L
W	Mildura Wastewater Treatment Plant	Artificial and Sewerage	Low	X		X			M	M-L

* Waterway on private land

** Waterway on both private and public land

Criteria to determine alignment with goals are based on a selection of waterway values (environmental, social, cultural and economic). An 'X' indicates the waterway has one or more values which have been rated as high and link to the goal category. The waterway values used for each goal category are as follows;

[1] - The presence of waterway-dependant threatened species and/or vegetation communities (with vulnerable, endangered or critically endangered conservation status) at the waterway and its riparian zone.

[2] - A recognition of the waterway as a drought refuge or having high quality riparian vegetation.

[3] - A recognition of the waterway as a place of high social activity (eg recreational fishing, camping, swimming) or being a high economic asset (eg providing a rural water source for production or receiving irrigation drainage).

[4] - A recognition of the waterway as an area of cultural significance.

[5] - The presence of an active community group with interest in the waterway and its riparian zone.

[6] - Each waterway has undergone multiple risk assessments (ie one for each threat against each identified waterway value), with the median risk level of all assessments provided in this column.

[7] - Each waterway has undergone multiple assessments on the feasibility of reducing threat levels against waterway values, with the average of these assessments provided in this column.

Appendix 3F: Summary Report from Recreational Fisheries Management Priorities Workshop

Mallee Recreational Fisheries Management Priorities

Acknowledgements

Workshop attendees: Rob Loats and Russell Conway (VRFish), Tim Curmi (Native Fish Australia), Alan Digby (Mid-Northern Association of Angling Clubs), Alan Hutcheon (Sunraysia Lure Casters and Got One Tackle Store), Ron Woods (Coomealla Angling Club), Des Thompson (Euston Resort Fishing Club) Rachael Slorach, Louise Searle and Peter Kelly (Mallee Catchment Management Authority), Renae Ayres (Arthur Rylah Institute, Fish Habitat Network), David Caittlin, Gary Hodges, Anthony Forster and Taylor Hunt (Fisheries Victoria).

Workshop invitees: Australian Trout Foundation, Futurefish Foundation, Wentworth Angling Club, Barham Angling Club, Murray Downs Angling Club, Mildura RSL Angling Club, Colin Mansell, Hopetoun Angling Club and Lake Boga Angling Club.

Background

Recreational fishing makes an important social and economic contribution to Victorian regional communities. In particular, the Mallee Catchment Management Authority (CMA) 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 Mallee CMA to identify and collaborate on habitat related projects that lead to better fishing outcomes.

Key recreational fisheries in the Mallee Catchment

The Mallee CMA region includes many popular recreational fisheries. In 2012, a survey of recreational fishers highlighted that important fisheries in the Mallee CMA region include the Murray River, Lake Cullulleraine, Hattah Lakes, Kings Billabong and Lindsay River.

A more complete assessment of Victoria’s recreational fishing waters can be found in a Guide to Inland Angling Waters of Victoria at: ***www.depi.vic.gov.au/fishing-and-hunting/fishing-guides/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 21 November 2013, Fisheries Victoria and the Mallee CMA 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.

No.	Fishery management priorities
1	Develop a pilot database of fisher catch records in the Mallee CMA region as a cost effective and community engaging method for monitoring and reporting of fish populations and fisheries.
2	Work with Mallee CMA to enhance native fish breeding and survival in wetlands adjacent to Margooya Lagoon (Robinvale).
3	Enhance recreational fishing by altering water regimes, improving water quality and increasing in-stream habitat in Lake Lascelles and other waters supported by the Wimmera-Mallee pipeline.
4	Investigate opportunities to enhance native fish populations in the Hattah Lakes system e.g. broodstock translocation, fish stocking, habitat enhancement etc.
5	Investigate populations status of Murray Crayfish in the Mallee CMA region (in consultation with NSW Fisheries).
6	Improve ways to engage representative and local recreational fishers for input in Mallee CMA project planning, implementation and monitoring.
7	Support efforts to incorporate a responsible fishing message in community education programs (e.g. FV education trailer, Waterwatch, Landcare, Culturally and Linguistically Diverse (CALD) products etc.)
8	Investigate the adequacy of current measures to protect spawning fish immediately below barriers and fishways in the Mallee CMA region.

Appendix 4A: Estimated eight-year work plan budget

The estimated cost of delivering each of the WMU work plans over the eight year (2014-2022) MWS timeframe is provided in the table below. These have been broadly grouped across four key delivery areas:

- Environmental Watering – Infrastructure;
- Environmental Watering – Delivery;
- 'Other' On-ground Works – Increasing native vegetation, habitat features, priority species/communities, and undesirable fauna/flora control; and
- Community Capacity/Cultural Heritage – Assessments, planning, engagement, communications, partnerships, amenity/accessibility.

It is important to note that the budgets provided for activities planned in each WMU are indicative only. There is no commitment to funding of activities and funding will be sought by regional stakeholders through a broad range of investment opportunities.

Waterway Management Unit	Environmental Watering - Infrastructure ($)	Environmental Watering - Delivery ($)	'Other' On-ground Works ($)	Community Capacity and Cultural Heritage ($)	Total Work Plan ($)
Nyah	7,700,000	980,000	382,040	1,223,544	10,285,584
Burra	4,200,000	490,000	596,808	2,157,632	7,444,440
Heywood	500,000	580,000	565,584	474,393	2,119,977
Boundary Bend	500,000	546,000	506,568	885,645	2,438,213
Belsar Yungera	35,000,000	798,000	1,136,512	1,375,751	38,310,263
Bumbang	0	0	299,160	710,647	1,009,807
Happy Valley	1,300,000	879,200	632,880	489,099	3,301,179
Hattah	7,000,000	8,505,000	4,287,204	1,827,482	21,619,686
Nangiloc Colignan	0	0	299,904	878,886	1,178,790
Karadoc	3,000,000	9,177,000	931,240	946,924	14,055,164
Nichols Point	750,000	588,000	156,568	824,247	2,318,815
Merbein	1,000,000	420,000	891,328	513,820	2,825,148
Wallpolla	35,000,000	1,050,000	5,194,456	1,335,424	42,579,880
Mulcra	500,000	357,000	1,344,064	405,328	2,606,392
Lindsay	45,000,000	985,000	5,662,420	1,185,103	52,832,523
Raak Plain	0	0	1,728,378	123,525	1,851,903
Pink Lakes	0	0	1,148,810	52,941	1,201,751
Wyperfeld	0	0	2,263,764	129,008	2,392,772
Yarriambiack	0	0	988,408	386,802	1,375,210
Dunmunkle	1,000,000	0	52,464	156,588	1,209,052
Tyrrell	0	0	1,035,992	422,834	1,458,826
Lalbert	0	0	805,920	609,689	1,415,609
Dispersed Wetlands	0	61,400	2,119,400	1,378,124	3,558,924
Saline Irrigation	2,000,000	713,000	395,360	531,434	3,639,794
Artificial & Sewerage	0	0	93,744	10,000	103,744
Total Costs	**$ 144,450,000**	**$ 26,129,600**	**$ 33,518,976**	**$ 19,034,870**	**$ 223,133,446**

Appendix 4B: Hattah-Kulkyne Lakes Ramsar Site Risk Assessment

The table below provides a summary of risk level for each high value x high threat interaction identified for the 12 wetlands which make up the Hattah-Kulkyne Lakes Ramsar Site. The highest level of risk identified for each interaction is reported.

	Changed Water Regime	Reduced Wetland Area	Altered Wetland Form	Degraded Water Quality	Degraded Buffer	Soil Disturbance	Invasive Flora (Wetland)	Invasive Fauna (Terrestrial)	Invasive Fauna (Aquatic)
Significant Fish									
Significant Birds									
Significant Wetland Flora									
Significant Wetland EVCs									
Drought Refuge									
Important Bird Habitat									
Non-motor Boating									
Camping									
Flagship Species									
Picnics and Barbeques									
Sightseeing									

Key

Very High	
High	
Moderate	
Low	
Very Low	
No risk identified	

Appendix 4C: Hattah-Kulkyne Lakes Ramsar Site Management Outcome Targets

The table below details targets relating to the Hattah-Kulkyne Lakes Ramsar site, which is located within WMU #8 (Hattah). Specifically:

- A long term (8+ year) resource condition target to improve the five ecosystem services considered critical to the ecological character of the site (further detail on these ecosystem services and their limits of acceptable change (LACs) is provided in Appendix 2B);
- Medium term (8 year) management outcome targets to increase measures of the four critical components/processes associated with the site (further detail on these critical components and their limits of acceptable change (LACs) is provided in Appendix 2B).

Interactions between Ramsar Targets and Management Outcome Targets established for the Hattah WMU as a whole are also provided. These linkages demonstrate where the delivery of specific management activities associated with these WMU targets will also contribute to achieving Ramsar targets.

Hattah-Kulkyne Lakes Ramsar Site Targets		**Links to Hattah WMU Management Outcome Targets**			
Long Term Resource Condition Target	Management Outcome Targets	An increase in the diversity and structure of native vegetation	An increase in the control of undesirable fauna and fora species	An increase in the distribution and/or viability of priority species/communities	An increase in the delivery of watering regimes which meet environmental objectives
To improve ecosystem services considered critical to the ecological character of the Hattah-Kulkyne Lakes Ramsar site (near natural wetland type, physical habitat which supports breeding and feeding, threatened species, biodiversity, ecological connectivity).	An increase in delivery of watering regimes which meet environmental objectives				X
	An increase in the extent of lakebed herbland vegetation	X	X		X
	An increase in the abundance of priority fish species.	X	X	X	X
	An increase in the abundance and diversity of waterbird species	X	X		X

Appendix 4D – Background to Management Activities Planned for the Hattah-Kulkyne Lakes Ramsar Site

An ecological character description (ECD) for the Hattah-Kulkyne Lakes Ramsar Site identifies:

- Ecosystem services/benefits, components and processes which are considered critical to the ecological character of the site and their limits of acceptable change (Appendix 2C);
- Key threats to the ecological character of the site (Appendix 2D); and
- Parameters which need to be regularly measured to monitor the ecological character of the site (Appendix 2E).

A risk assessment was undertaken assessing threats to the significant values supported by the Hattah-Kulkyne Lakes Ramsar Site (Appendix 4B). Changed water regime represented a very high or high risk to all environmental values. Although river regulation associated with water resource development was in place at the time the site was listed, the ECD states that negative impacts of regulation are still developing, particularly when these impacts are exacerbated by long term drought such as the Millennium drought and possible climate change. The 2011 review of the status of the Ramsar Site showed that, the LAC for the critical process of hydrology has been exceeded for two lakes (Lake Cantala and Lake Bitterang) with filling events below the required frequency threshold indicated by the LAC (Appendix 2C).

The ECD states that during recent dry years River Red Gum has encroached onto the lake beds of most of the lakes with an obvious band of regenerating trees in the shallow areas of the lakes. This is considered a potential threat to the character of the Site as the band of regenerating trees occupies a zone which would otherwise support lakebed herbland vegetation. The LAC for the critical component of the extent of lakebed herbland vegetation has been exceeded since listing (Appendix 2C). Invasive species are also a significant threat to the site.

The management objective for the Hattah-Kulkyne Lakes Ramsar Site is to improve the ecological character of the Site. The long term resource condition target and the management outcome targets for the Ramsar Site are linked to the targets for the Hattah WMU as a whole (Appendix 4C).

Management activities for the Ramsar Site are set out in Section 4 (Hattah WMU#8). The management activities are based on continuation of existing programs. These include environmental watering guided by an environmental water management plan and a series of planned works under The Living Murray initiative to restore natural flooding regimes to the Hattah Lakes system as a whole. The Mallee Parks Management Plan (1996) also guides the management of invasive species, fire management and visitor access and amenities.

Australia reports the ecological character of its Ramsar Sites through a national Ramsar Site rolling review. The findings are included in Australia's national report to the triennial Conventions of Contracting Parties to the Ramsar Convention. The broad aims of the Ramsar Rolling Review program are to:

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

The Hattah WMU work program includes monitoring the ecological character of the Ramsar Site and reporting on the status of ecological character every three years as part of the national Ramsar Site rolling review.