



*Balancing the protection
of the Yanco-Colombo & Billabong Creeks'
Riparian needs with the Community*

YACTAC

**The Yanco Creek & Tributaries
Advisory Council Inc.**

McCaughey
Memorial Pty Ltd

 **Murray**
CMA CATCHMENT MANAGEMENT AUTHORITY

Acknowledgements

The Executive of the Yanco Creek and Tributaries Advisory Council acknowledges the substantial assistance and financial support provided by the following organisations to assist it in preparing a management plan for the creek system, to implement critical actions and to undertake further studies. Without this support, the desire to balance the protection of the natural environment of the Yanco, Colombo and Billabong Creeks with the supply of water for people, stock, and irrigation needs would not be achieved.

***Members of the Yanco Creek and Tributaries Advisory Council
(138 community landholders)***

***Landholders in the Yanco, Colombo and Billabong Creek System
Murray Catchment Management Authority***

Australian Government "Caring for our Country" program

McCaughey Memorial Pty Ltd

***River Environmental Restoration Program (RERP),
Department of Environment Climate Change and Water***

State Water Corporation

Water for Rivers

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This document has been prepared by the Yanco Creek and Tributaries Advisory Council to provide an overview of the Yanco Creek, Colombo Creek and Billabong Creek System in southern NSW, and document the works undertaken to date to improve natural resource management in this part of the Murray and Murrumbidgee Catchments.

More remains to be done and we look forward to continued partnerships with organisations to achieve our goals for the Yanco, Colombo and Billabong Creek Systems.

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FOREWORD

The Yanco Creek System is part of the regulated water source of the Murrumbidgee River System. Our community has recognised the need to improve water distribution efficiency and improve the environmental health of the system. To that end the community has developed a plan for the future. To date, initiatives implemented have:

- provided 34 GL for environmental use (this being the single biggest contribution to the Snowy River);
- improved the health of the creeks' system;
- improved the efficiency of water supply for critical human needs, livestock and for irrigated agriculture.

It has been suggested that the Yanco Creek System could be shut down and water savings be used to service key environmental assets within the southern Murray Darling Basin. However, the Yanco Creek System is the only source of water for:

- critical human needs for six towns and villages;
- domestic and stock water for the landholders in the region;
- irrigated agriculture that has an economic value to the region of over \$200m.

The following overview has been prepared to inform decision makers of the importance of the Yanco Creek System. This approach has been taken over the past decade to improve regulated water management, and the community commitment and goodwill to achieve improved environmental health of the creeks.

I encourage you to take the time to become more informed about the Yanco Creek System, the linkage it provides between the Murray and Murrumbidgee River Systems, the role it plays to provide critical water needs to the region, and the works undertaken to improve the efficient delivery of water for irrigated agriculture and improved environmental health of the creeks.

Future initiatives to address water availability and use within the region must build on the planned approach in place and the associated investment being made, and recognise the role the creek system provides as the sole source of surface water to this central area of the Southern Riverina. It is imperative that an operational plan is developed and implemented to maximise all efficiencies of the entire system.

The current uncertainty in climate and future flow regimes will require a cautious approach, as any major changes have the potential of initiating unforeseen environmental effects, followed by an unreliable and unpredictable supply of water for stakeholders. Therefore any reduction in base line flow requires a new assessment of the creeks and how they operate. This system needs to be treated equally with the overall Murrumbidgee / Murray River System.

Richard Sleight

Chairman

The Yanco Creek and Tributaries Advisory Committee

OVERVIEW

The Yanco Creek System, located in southern NSW, traverses the Riverine plain between the Murrumbidgee River near Narrandera and the Murray River System upstream of Moulamein. It is a managed system to achieve a balance between protecting the creeks' natural environment and supplying water for people, livestock and economic production.

Specifically, the Yanco Creek System;

- provides an environmental corridor for terrestrial and aquatic species linking the Murrumbidgee and Murray River Systems. The creek system provides important habitat for many rare, threatened and endangered fish, birds and mammals;
- supports one of the few remaining populations of native catfish and key wetlands along the creek system, which provide breeding, feeding and roosting habitat for a range of water bird species, including migratory and endangered species;
- provides the sole critical water supply for the local towns and villages of Morundah, Oaklands, Urana, Conargo, Jerilderie and Wanganella;
- is the only source of farm stock and domestic water supply, and water for the irrigated agriculture within the region. In 1999 the region's irrigated agriculture was estimated to have a farm gate value of production of \$68m. There are 249 active water licenses on the creek system.

Therefore, regulation of the water source and the development of irrigated agriculture in the region in the 1950s have subsequently provided the region's community with a challenge to establish an improved balance between environmental health of the creek system and a reliable and efficient water supply for critical human needs, livestock and irrigation use.

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Development of a Natural Resource Management Plan

A holistic Natural Resource Management Plan (NRMP) was developed for the Yanco Creek and Tributaries in 2004. This Plan provides the basis for government and community investment in works and measures to improve the environmental health of the creek system and improve water delivery efficiency of the system to water users. The Plan has four specific objectives.

Four key issues are:

- maintain and improve the health of the creek and mimic natural flooding events where possible;
- maintain and improve the riparian habitat / creek corridor biodiversity along the creek system;
- improve the overall deliverability and efficiency of supply for the entire creek system;
- develop community ownership, participation and empowerment to improve the future management of the systems natural resources.

Actions resulting from the Natural Resource Management Plan

- the community has established a self imposed user levy to help fund the NRMP program of works and measures. This levy is managed by the Yanco Creek and Tributaries Advisory Council (YACTAC), has a 100% acceptance rate by water users and is the only levy of its kind endorsed by the NSW Independent Pricing and Regulatory Tribunal;
- critical issues such as willow removal, accurate monitoring of water flow and extractions, removal of in stream structures and regulating flows into wetland areas have been addressed since 2005. A range of studies continue to be undertaken to guide future investment to improve water delivery efficiency and environmental health;
- strategic investment in improved water management by Waters for Rivers has led to 34.7GL water becoming available for use to achieve enhanced environmental outcomes;
- future management initiatives need to build on the community goodwill and recent major investment made by individual landholders, the YACTAC levy, the Murray and Murrumbidgee Catchment Management Authorities, Water for Rivers, and the NSW and Australian Governments.



THE CREEK SYSTEM AND ITS HISTORY

The Yanco Creek System includes the Yanco Creek, Colombo Creek & Billabong Creek downstream of the confluence of the Colombo Creek to Moulamein and Forest Creek to Warriston Weir. The creek system is 799km long and includes 66 flood runners including oxbows and 175 wetlands.

The **Yanco Creek** is an effluent stream of the Murrumbidgee River with its origins west of Narrandera. Under natural conditions, the Yanco Creek would have been a mostly dry intermittent system that received flows only when the daily Murrumbidgee River flows exceeded 40,000ML per day. The Yanco Creek has a relatively flat gradient and meanders over a length of 258km, traversing the Riverine plain in a south westerly direction. It meets the Billabong Creek upstream of the Conargo township.

The **Colombo Creek** is an effluent of the Yanco Creek which commences at Morundah. It then flows in a southerly direction and meets the Billabong Creek upstream of Jerilderie. The Colombo Creek is approximately 148km long and includes 11 oxbows and flood runners. The Colombo Creek has a relatively steep gradient and has intermittent patches of natural woody vegetation along its banks.

The **Billabong Creek** rises in the eastern Riverina in the Holbrook area. It flows in a westerly direction and joins the Edward River at Moulamein. The Billabong Creek between its confluence with the Colombo Creek and the Edward River is approximately 380km in length.

The **Forest Creek** is an effluent of the Billabong Creek and also flows in a westerly direction. The Wanganella Swamp is supplied with water from the Forest Creek.

In the 1850s, lobbying by pastoralists allowed the Yanco Creek offtake on the Murrumbidgee River to be enlarged to provide increased flows into the system. Numerous weirs were constructed by landholders along the system to retain water when flows ceased.

The Tarabah Weir was constructed downstream of the diversion point of the Colombo Creek from the Yanco Creek at Morundah, which increased water flow into the Colombo Creek.

In the late 1880's an eight mile cutting was made and modified to link the Yanco Creek with the Murrumbidgee River. In the 1920's the Yanco Weir was constructed on the Murrumbidgee River and handed over to the Yanco, Colombo and Billabong Creeks Water Trust.

Irrigation Development

In 1950 limited irrigation of 12.5ha per riparian landholder was permitted. The irrigated area was expanded in subsequent years following modifications to the wall height on Burrinjuck Dam on the Murrumbidgee River, and the construction of Blowering Dam on the Tumut River.

Irrigation licences were granted in the 1970's and riparian holdings were subdivided in the 1970's. In 1980 the Yanco, Colombo and Billabong Creeks Trust was dissolved and control of the system was assumed by the NSW Department of Water Resources. An embargo was placed on the issue of further water licences. The permanent removal of drop boards from the many private weirs constructed was undertaken at that time.

In the late 1980's, the NSW Department of Water Resources allowed licenced pumpers on the Yanco Creek System to grow rice, winter / summer cereals, pastures, horticulture and viticulture. Within a short period current licences were activated or expanded and the volume of water used for irrigation increased markedly. The increase in demand for water involved a review of the water resource allocation.

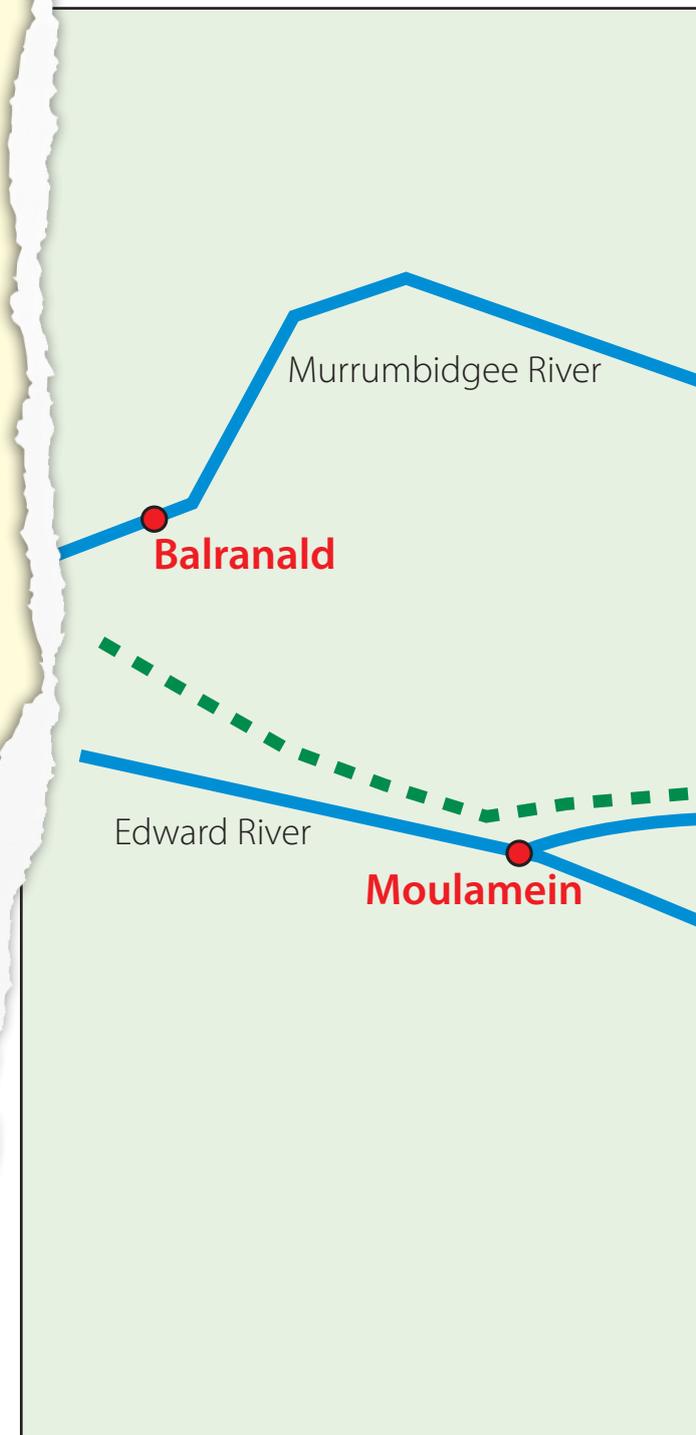
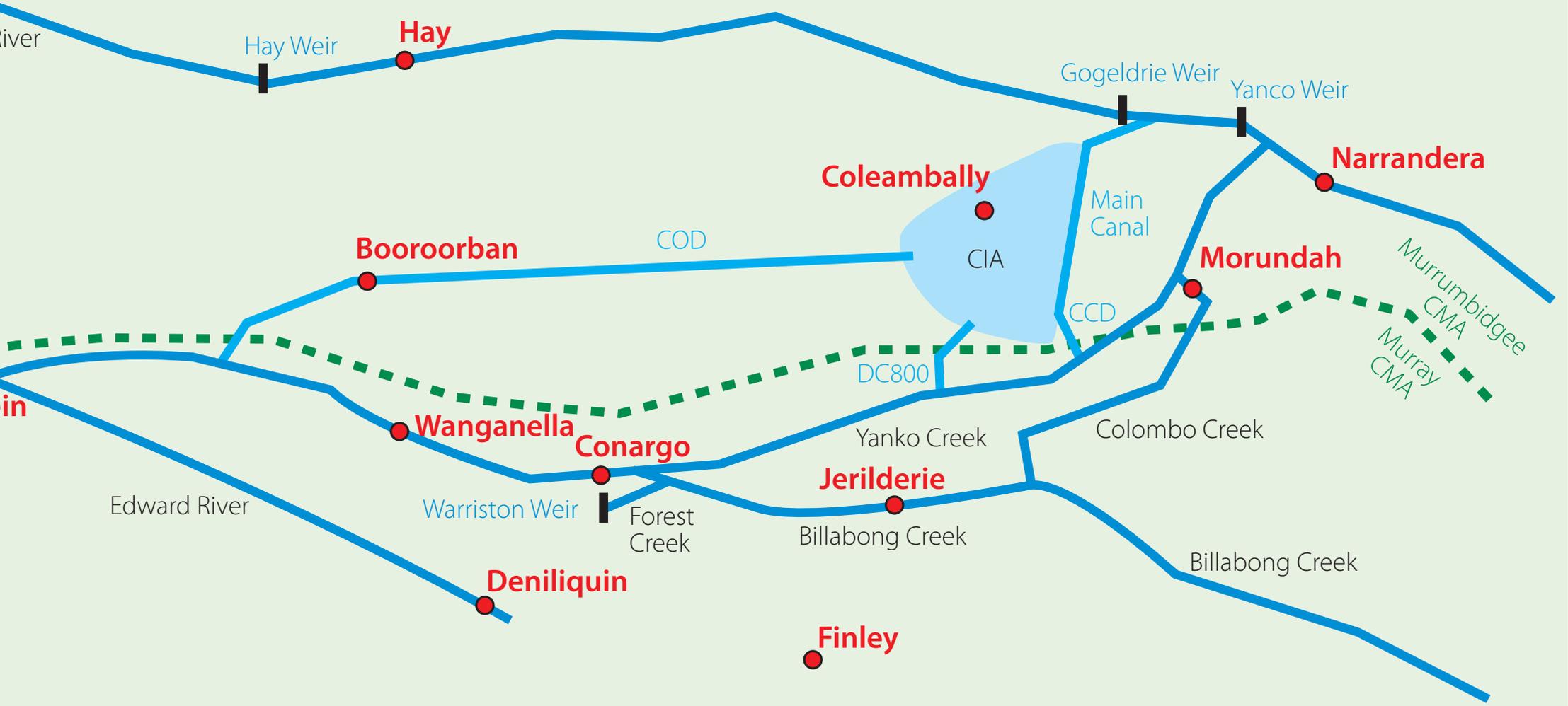


Figure 1: Yanco Creek System



Irrigation Development

There are approximately 250 licensed water users on the Yanco Creek System who use slightly over 2.5% of the water available for irrigation in NSW. The value of irrigated agricultural production from the region was estimated to be \$68m in 1999, based on the Agricultural Census. In economic terms the value of all rural production from this region is estimated to be \$200m - \$340m per annum.

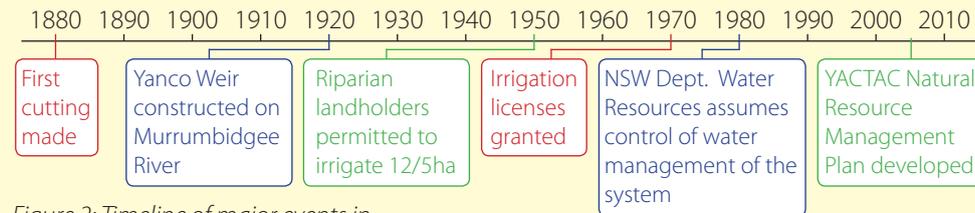


Figure 2: Timeline of major events in Yanco-Colombo-Billabong Creek management

Regulated Water Supply

The Yanco Creek System is the sole source of critical needs water for the towns and villages of Morundah, Urana, Oaklands, Jerilderie, Conargo and Wanganella. The creek system is also the only source of domestic water for the farms in the region and surface water for livestock and irrigation.

The bulk of the water entering The Yanco Creek System is supplied via the Yanco offtake, located on the Yanco Weir pool on the Murrumbidgee River. Supplementary flows are provided by three outfall drains from the Coleambally Irrigation Area and numerous drains, and escapes along the Billabong Creek from the Murray Irrigation area of operations. In addition to the unregulated flows from the Upper Billabong Creek, the Yanco Creek System has 3 public weirs that regulate water flow. Flows at the Yanco offtake are regulated based on predicted flow requirements, water orders and downstream inflows. The volumetric entitlement summary for the Yanco Creek System is presented in Table 1.

Table 1 Yanco Creek System Volumetric Entitlement Summary

No. Licences	Total Area (ha)	Irrig (ML)	Town (ML)	Other ML	Total (ML)	Pumping Capacity (ML/Day)
249	29,558	144,013	1,437	6,078	154,687	5,718

It takes approximately 5-6 weeks for regulated flows to pass from the Murrumbidgee River storages (Burrinjuck and Blowering) through the Yanco Creek System to Moulamein. This includes a period of 7-8 days for the water to be transferred from the river storages to the Yanco Creek offtake.

Linking the Murray and Murrumbidgee River Corridors

The Yanco Creek System forms an important environmental corridor between the Murray and Murrumbidgee Rivers. The riparian corridor of Black Box (*Eucalyptus largiflorens*) woodland and areas of River Red Gum (*Eucalyptus camaldulensis*) provide important habitat for numerous bird species along the fringes of the waterways. Other vegetation species having an association with the Black Box woodland include Cooba (*Acacia salicina*) River Cooba (*Acacia stenophylla*), Hooked Needlewood (*Hakea tephrosperma*), Miljee (*Acacia oswalsii*), Bull Oak (*Allocasuarina luehmannii*) shrub species Lignum (*Muehlenbeckia florulenta*), Short leaved Bluebush (*Mairena brevifolia*) and Nitre Goosefoot (*Chenopodium nitrariaceum*).

The Yanco Creek System supports one of the few remaining populations of native catfish in the Murrumbidgee / Murray region and is considered to be an important passage for fish migration between the Murray and upper Murrumbidgee Rivers.

The various wetlands along the creek, particularly Wanganella Swamp, Rhyola, Dry Lake and Molleys Lagoon wetlands and a series of wetland complexes throughout the system provide breeding, feeding and roosting habitat for a range of water bird species, including migratory and endangered species. The wetlands occur as either natural low lying areas or as weir pools created by the construction of weirs.

Development of a Natural Resource Management Plan

The transition of an ephemeral waterway to a regulated water supply system has led to economic development generating in the order of \$200m of agricultural productivity annually. The increased and regulated flow in the creek system has also resulted in impacts on stream health including willow infestation, restricted fish movement due to weir construction and reduced water quality due to carp invasion. Unseasonal wetting of wetlands has resulted from time to time, due to high flows being provided to meet summer and autumn irrigation demand. Stream flow impediments have also forced flow into some wetland areas.

In 2002 the Yanco Creek and Tributaries Advisory Council initiated the development of a natural resources management plan for the Yanco Creek System. The following four issues were identified and supported by 30 key management actions:

- maintain and improve the health of the creek and mimic natural flooding events where possible;
- maintain and improve the riparian habitat / creek corridor biodiversity along the creek system;
- improve the overall deliverability and efficiency of supply for the entire creek system;
- develop community ownership, participation and empowerment to improve the future management of the system's natural resources.

The focus of each of the key issues identified included:

Improve Deliverability and Efficiency of Supply

- Understanding the capacity and capability of the system to deliver irrigation water, including stream flow information during the season.
- System transmission flows and unaccounted diversions.
- Seasonal delivery to meet irrigation needs and to minimise impacts on the natural environment, including water ordering for irrigation.
- Creek flow improvement by removing impediments including willows, large woody debris and excessive cumbungi growth.
- Environmental and economic impacts of weirs.
- Adequate water supplies for stock and domestic needs be received in the lower Forest Creek area.

Maintain and Improve Creek Health

- High seasonal flows impacting in-stream ecology and linked wetlands.
- A need to maintain and enhance wetlands.
- Strategic monitoring to improve water quality knowledge and ecological outcomes.
- Improved water quality in part via managing flow to return to more natural flow regimes.
- Integrated water quality and ecological monitoring to evaluate outcomes of the plan.
- Enhancement of all wetland complexes.

Maintain and Improve Riparian Habitat

- Removing willow and cumbungi infestations and minimise the spread of other introduced weed species.
- Managing stock grazing to minimise impacts on riparian areas.
- Identify and protect riparian areas of high conservation value .
- Improve community awareness of the benefits of protecting and regenerating riparian habitat.
- Addressing impact of common carp on water quality, stream bank erosion and native fish breeding.
- Ensure future infrastructure works be undertaken as part of a whole of system strategy.



Develop Community Ownership

- Adequate consultation and participation to guide natural resource plan implementation and review.
- Sites of cultural significance be protected.
- Importance of irrigated agriculture for food production be recognised.

Taking Action

An implementation plan was developed and is being resourced via a landholder levy and government funding. A range of programs (figure 3) have been initiated including:

- mapping wetlands and creek elevation;
- willow removal;
- riparian protection, regeneration and restoration;
- review of weirs and improved fish passage;
- analysing water distribution efficiency and meter accuracy;
- aquatic ecosystem monitoring;
- biodiversity monitoring;
- water quality monitoring;
- landholder levy.

The following sections address these programs in more detail.

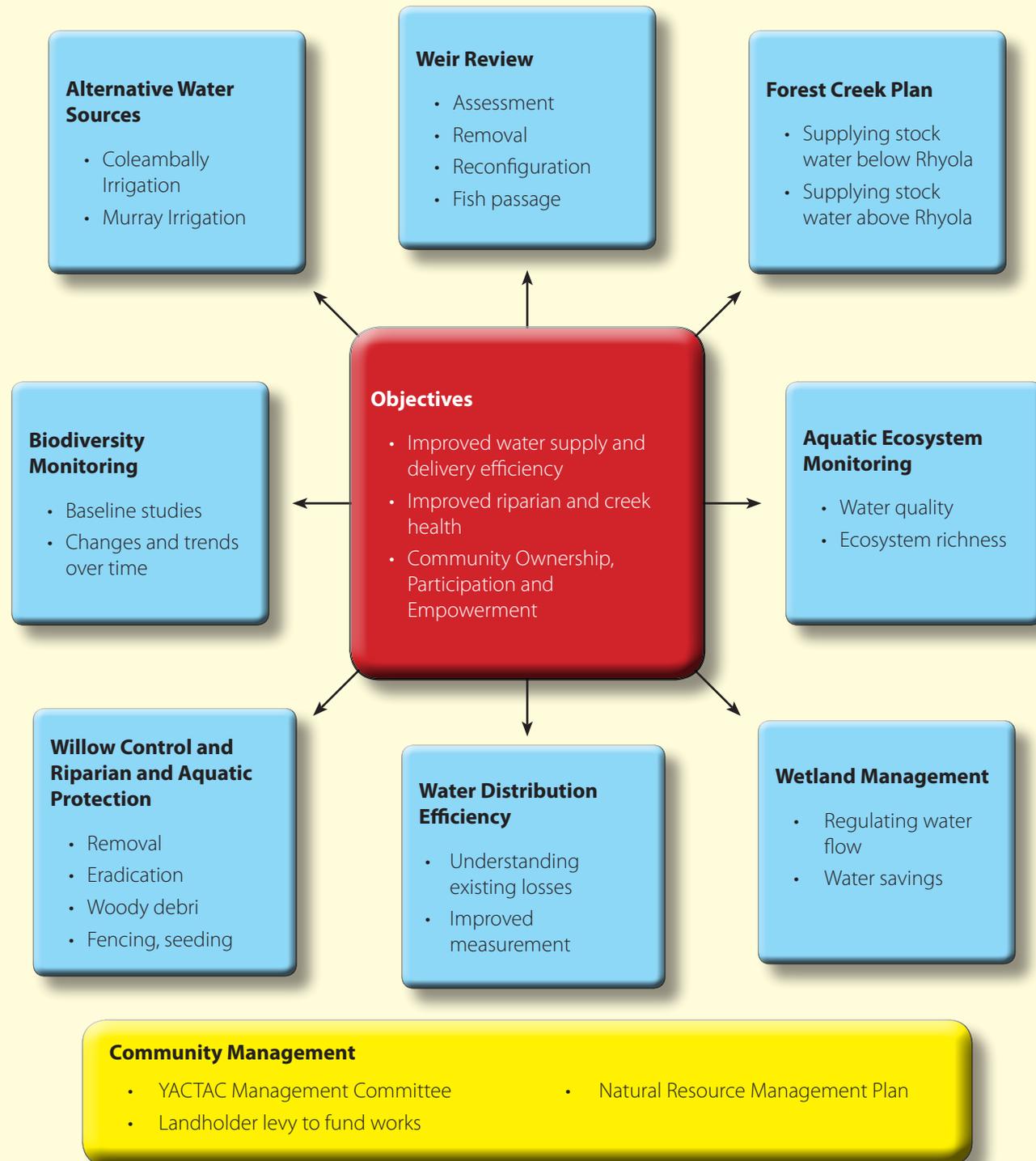
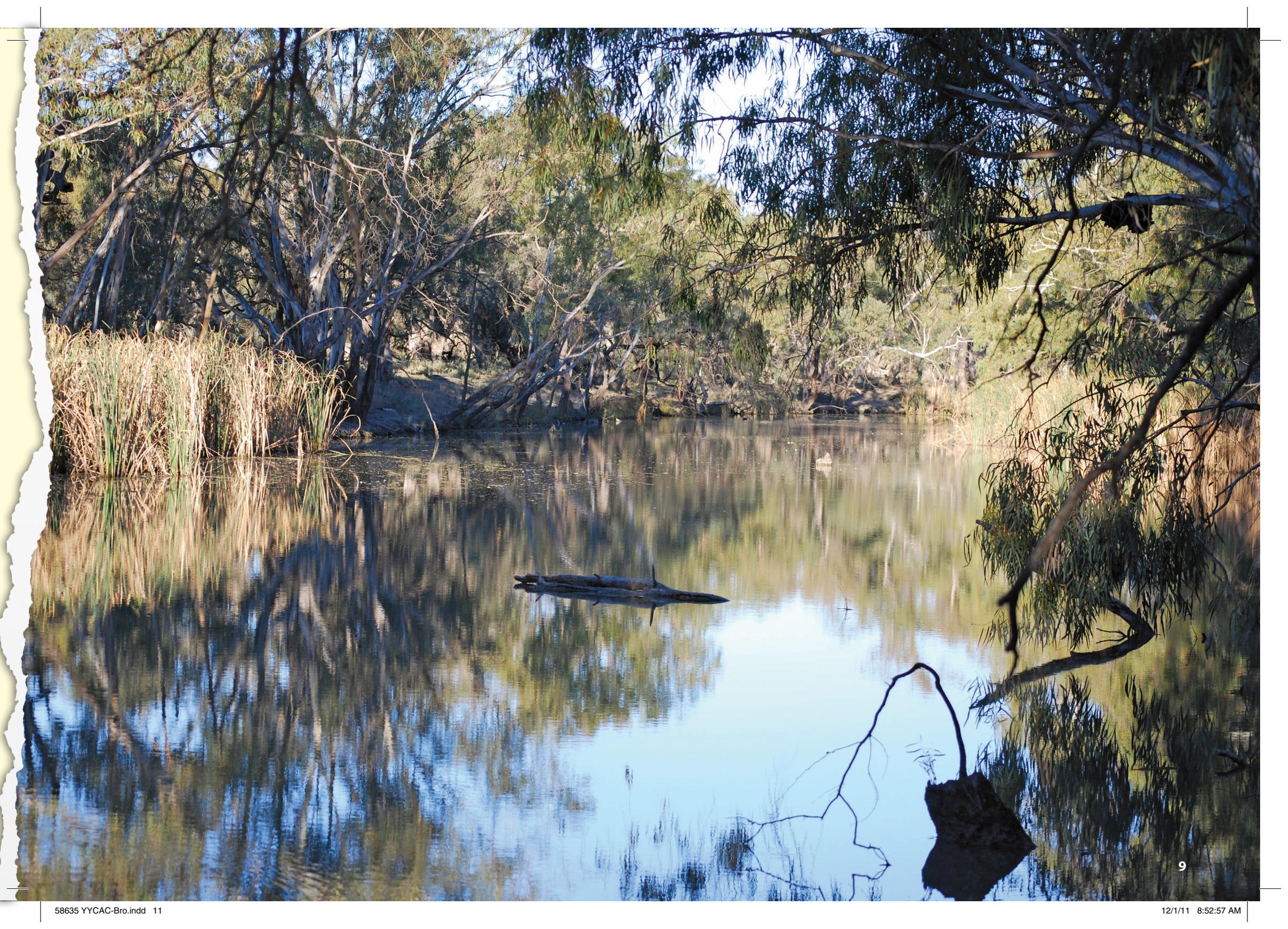


Figure 3: Overview of the program of works and measures implemented to achieve the objectives of the Natural Resource Management Plan



WILLOW CONTROL

Key Messages

- Over the past decade approximately \$2.3M has been invested in willow removal and riparian enhancements. The funding has been provided by the Murrumbidgee and Murray CMA, YACTAC, Community water grants and Caring for our Country.
- Willow removal requires a methodical and holistic approach.
- A control program operating since 2007/08 has removed willows from 93km of creek.
- Over 144km of fencing along the creek has been completed.
- Willows restrict flow, create a poor living environment for the native ecosystem and change flooding pattern.
- Willow removal requires a methodical and holistic approach.
- A control program operating since 2007/08 has removed willows from 93km of creek.
- Over 144km of fencing along the creek has been completed.

Willows were traditionally planted along the Yanco Creek System at weir sites and homesteads. The main species of willow (*Salix babylonica*) reproduces vegetatively from roots, twigs or branches deposited in moist soil. It was estimated in 2002 there were over 3500 willows.

The invasive nature of the willow has created a number of impacts on the natural health of the creek system, including:

- restricting flow causing up stream flooding and inadequate downstream flows;
- providing a totally different and poorer living environment for native plants and animals than the natural eco-system;
- silt buildup around the fibrous roots and in the streambed, reducing stream flow capacity, exacerbate flooding and changing flood patterns.

Effective willow removal requires a holistic and methodical approach to:

- minimise regrowth and reinvasion;
- reduce bank erosion and sedimentation;
- protect regrowth and regeneration of native flora and fauna.

The CSIRO estimated that net water savings from willow removal was in the range of -5 to +9 ML/ha/year with a mid range estimate of 2-4 ML/ha/year (Beynon et al).

Willow Eradication

The Murrumbidgee Catchment Management Authority and NSW State Water initiated a willow eradication program in 2005 for the upper reaches of the Yanco Creek System. A similar program was initiated in 2007/08 by the Murray Catchment Management Authority, NSW State Water and YACTAC.

The approval process for willow removal requires landholder approval, a cultural heritage assessment and the issuing of a works approval by the NSW Government.

Willow control has involved both the mechanical removal of the willows from the creek system and chemical injection of actively growing trees. Chemical injection is tedious and time consuming, given multiple injections within each main stem of each tree is required for successful control. There has been a more recent trend towards mechanical removal, with the refinement of excavation techniques and access to long reach excavation equipment.

Nearly all the old growth willows have been removed from the upper reaches of The Yanco Creek System. The majority of the focus within these upper reaches is control of regrowth. Large willow trees are still being removed from the central and lower reaches of the creeks system. Follow-up control of regrowth is also occurring.

The YACTAC intend continuing with the removal program. Follow-up control is critical where willows have been removed to ensure any regrowth is controlled. The continuation of the removal program will be dependant upon funding. The YACTAC has committed sponsoring the follow-up control to be carried out over the next five years at those sites where larger trees have been removed.

Regeneration and Revegetation

- 33 riparian sites revegetated.
- 18 properties have undertaken protection and enhancement works.
- 3600ha of remnant vegetation protected.
- 100ha of riparian streambank revegetated.
- 144km of streambank fenced to exclude stock and protect new plantings.
- \$1.25m funding for works provided by the Murray and Murrumbidgee Catchment Management Authorities.

The removal of grazing stock, fencing the riparian zone and seeding sections of stream bank where willows have been removed have all enhanced the capacity for regeneration, regrowth and revegetation of native flora.



Willow removal in progress

WEIR REVIEW AND IMPROVED FISH PASSAGE

Key Messages

- Weirs have provided landholders with better access to water during the unregulated era and periods of low flows.
- A weir study highlighted that a number of the weirs were in poor condition and required modification or removal to improve stream flow and fish passage.
- Removal of redundant weirs is expected to lead to improved fish passage and improved water distribution efficiency.

Many of the weirs and block banks within the creek system were constructed when creek flows were not regulated, to increase the reliability of water supply for stock and domestic use. A large number of the weirs and regulating structures are in poor condition.

Weirs create artificial wetlands and allow microhabitats for invasive species such as willows and cumbungi. In-stream structures also inhibit flow through the system and impact on the capacity of the system to supply sufficient water reliably downstream, given that most structures are overshot structures. The creation of weir pools also increases water loss via evaporation and seepage. The reregulation or removal of targeted weirs would improve the water distribution efficiency of the creek system.

A number of reports prepared (1994, 1999, 2006) have identified numerous instream structures which include 36 weirs and block banks within the Yanco Creek System, these identified structures formed the basis for the weir review conducted in 2006 and 2007.

Weir Review

A review of the 36 weirs and block banks was undertaken by State Water Corporation in 2007 with each structure assessed against criteria that included:

- their role and importance in the efficient regulation of flow;
- the value to adjoining landholders, businesses and towns and the potential impact of modifications or removal on these water users;
- the potential for automation and future value to re-regulation;
- the ability of the structure to meet OH&S and licensing requirements;
- the potential to generate water savings;
- the environmental impacts of modification or removal.

This study highlighted that a number of the weirs were in poor condition and required modification or removal to improve stream flow and fish passage.

A further study has been initiated to determine the potential water savings that may be achieved by lowering the height of some of the weirs, and hence reducing the size of the weir pools. This work has involved a study of the surface area and volume of each weir pool in order to estimate the evaporative losses.

Weir Efficiency

The removal of weirs is a challenging issue as it impacts on the reliability of water at those locations. Recommendations made for the 36 weirs and block banks included maintaining 18 weirs and installing fish ladders, upgrading or modifying 6 weirs and removing 12 weirs and block banks. There are plans to remove two redundant weirs in 2010/11 and to upgrade one of the major flow re-regulating structures.

A detailed weir review was also undertaken by the Murray CMA in 2006 which focused on barriers to fish passage in the unregulated section of the Billabong Creek. The review included 14 sites along the unregulated section of the Billabong Creek.



WETLANDS

Key Messages

- Wetlands are an important natural feature of the Creek system with over 170 present on the Yanco Creek System alone.
- Regulating stream flow has resulted in many wetlands being inundated for longer periods than ideal for the environment.
- Unseasonal inundation results in a reduction in water delivery efficiency and reduced wetland health.
- Modelling has indicated that water could be saved by restricting flows into wetlands during high summer and autumn flows.

Wetlands are an important natural feature of the Yanco Creek System, supporting a diverse range of plants and animals. Under natural flow conditions, wetlands would be expected to fill with water during high flow periods, usually in late winter and spring and dry out during the hotter drier months of the year. This drying phase is important to maintain the health of the wetlands.

Under regulated flow conditions, water levels are kept higher than the natural flow levels in the summer months. As a consequence, wetlands are connected to the creek for most of the year and remain inundated for longer periods. This results in both water loss from the wetland due to increased evaporation and seepage, a reduction in the efficiency of irrigation water and a decline in wetland health.

Permanent or semi-permanent inundation of the wetlands may result in death of river red gums, a reduction in aquatic plant species diversity and an increase in weed invasion.

Water savings from wetlands can be achieved by constructing flow regulating structures adjacent to the main creek channel so that inflows to the wetland can be controlled independently of water levels in the creek.

The Yanco Creek System communities are keen to see an environmental flow and recognition for these important ecological sites with any future flow regimes or water sharing plans.

Wetland Review

A wetland review was undertaken in two stages:

- Stage 1 comprised the Yanco Creek to Yanco Bridge and Colombo Creek to its confluence with the Billabong Creek, sponsored by the NSW Department of Natural Resources.
- Stage 2 comprised the Yanco Creek from Yanco Bridge to its confluence with the Billabong and the Billabong Creek from its confluence with the Colombo Creek to its confluence with the Edward River, sponsored by Water For Rivers.

The Stage 1 study undertaken in 2005 investigated the potential to prevent water losses to wetlands during the irrigation season. The study identified 175 wetlands of which 41 wetlands were identified as having potential to provide water savings through better management from an ecological point of view, by reducing the impact of high regulated flows. Annual average water savings were modelled as potentially being 3.69GL.

Eight wetlands, each larger than 10 ha, were selected for more detailed assessment. The assessment involved a topographic survey and hydrological modelling. The assessment also included the potential environmental impacts, condition of the wetland, impacts on landholders and cultural heritage considerations.

In 2006/07 the Yanco Creek system was granted funding under the River Environment Restoration Program by the

NSW Department of Environment and Climate Change to improve riparian and aquatic habitat and to identify water savings. This included weir removal, wetland recovery, improved fish passage and large woody debris realignment.

Wetland and Weir Pools

In 2007, Water for Rivers instigated a Light Detection and Ranging Aerial Survey, (LIDAR survey), of the creek system in conjunction with a bathymetric survey to assess the volume of water stored in the creek system, predominantly weir pools, wetlands and breakout areas.

Ground truthing of the LIDAR survey results identified 18 wetlands covering 447 ha as potential sites for works to improve water flow. Flow models have been completed for four wetlands in the upper Yanco Creek to identify flow regulator requirements. A review of environmental factors has been completed and works will be undertaken in 2010.



BIODIVERSITY ASSESSMENTS

Key Messages

- The Yanco Creek System is an important natural environmental corridor for native species linking the Murrumbidgee and Murray River Systems.
- The natural environment has been impacted by agricultural development and stream flow regulation.
- The Yanco Creeks' associated vegetation provides habitat for a number of threatened or rare bird species.
- The Yanco Creek also provides habitat for a great number of species that are only moderately common in the area.

The natural environment of the creek system includes the Black Box woodland, the River Red Gum riparian corridor and the in-stream environment. The riparian corridor has been impacted by grazing stock, unseasonal wetting of ephemeral wetlands and introduced flora which in turn has affected the quality of the habitat for mammals, invertebrates and birds. The in-stream environment has been impacted by flow regulation, constructed in stream structures and introduced flora species such as willows. Carp and Gumbosa (mosquito fish) have invaded much of The Yanco Creek System adversely contributing to the decline in the number of native fish species and frog species.

The level of cumbungi infestation increases where regulated low flows occur for extended periods. The cumbungi can extend across the full width of the creek. This exacerbates any flow restrictions, causing silt to be deposited and also provides habitat for introduced species such as feral pigs. Floods and extended periods of high flow reduce cumbungi presence. Any actions taken to control the spread or removal of cumbungi must be compliant with the Native Vegetation Act 2003.

Biodiversity studies

Biodiversity studies were undertaken in 2007 within the Murray Catchment and included the Colombo and Billabong Creek areas. The purpose of these surveys was to determine the habitat and local status of birds, reptiles, mammals and frogs. A biodiversity baseline monitoring

project was also initiated in 2007 to monitor and assess biodiversity changes, trends and factors contributing to changes to biodiversity over time. Vertebrate diversity including frogs and long necked turtles has also been investigated within the Billabong Creek environment.

The biodiversity surveys noted River Red Gum waterways like the Billabong Creek facilitate wildlife movement through the landscape. Intermittent flooding of red gum directly benefits water birds, frogs and bats.

The vertebrate biodiversity study was undertaken by CSIRO on 17 Riverina farms for seven years (2001-2007) including properties on the Yanco Creek System. The findings from the Yanco Creek System suggested that the presence of the creek and its associated riparian vegetation provided critical habitat for a number of important species not found elsewhere in the study.

This included the Inland Carpet Python, *Morelia Spilota*, a state-threatened species that has exhibited decline across its range. The species utilises hollows in trees along the creek and these are essential to their persistence there, although some individuals also utilised buildings and rabbit burrows.

A second significant species residing near and within Yanco Creek System is the Giant Banjo Frog, *Limnodynastes interioris*. A breeding population was found along The Yanco Creek System, and fluorescent powder tracking revealed that the species takes refuge in the creek itself. Giant Banjo Frogs were not found on the other farms, which didn't have major creeks or rivers. This species is not generally common.

The creek's system associated vegetation also provides habitat for a number of threatened or uncommon bird species such as the Brown Treecreeper (*Climacteris picumnus*), Superb Parrot (*Polytelis swainsonii*) and the Grey-crowned Babbler (*Pomatostomus temporalis*).

The Yanco Creek System also provides habitat for a number of species that are only moderately common in the area. These are often species that:

- prefer permanent water year round (e.g. Water Rat; Macquarie River Turtle, Eastern Long-neck Turtle);
- require considerable stands of trees to live (e.g. Lace Monitor, Echidna, Black Wallaby, Common Brushtail Possum, a number of bat species, and a great number of woodland bird species such as the Tawny Frogmouth - see Bourne, 2002); or
- require trees along watercourses for roosting (e.g. Nankeen Night Heron).

The existence of this wildlife in the Riverina is dependent on the creeks and nearby rivers and the associated riparian vegetation. Protecting and improving riparian vegetation along the Yanco Creek System is expected to maintain and promote vertebrate biodiversity in the Riverina.

The Nature Conservation Trust recently purchased a property (Hartwood Station) on the Billabong Creek. Fencing off areas of high value native vegetation has been undertaken and caveats placed on the title to ensure the long term protection of these areas of significant environmental value. The property is in the process of being resold.



WATER METERING AND DISTRIBUTION EFFICIENCY

Key Messages

- Unaccounted for differences between flows at gauging locations averaged 45GL during the more regulated flow period of October to April and 23GL for the less regulated period of May to September for the period 1998 to 2005.
- New metering systems with real time telemetry are being investigated for implementation within the Yanco Creek System.

Water distribution efficiency of natural streams is generally lower than constructed supply channel systems. Unaccounted for differences relate to inaccurate measurement, evaporation, unmeasured outflows such as groundwater recharge, water usage by invasive flora such as cumbungi and willow and extractions by landholders of Basic Landholder Rights for stock and domestic use.

There are a number of locations along the Yanco Creek where in-stream restrictions limit the volume of water that can be supplied to users. De-snagging occurred in the Colombo Creek in 1992 and achieved a 15% increase in flow capacity. Willows, large woody debris (snags) and cumbungi and other weed infestations are considered to be the major impediments to water flow within the creek system. It was estimated in 2004 there were over 3500 willows, 75 areas of weed infestation and over 12,980 large woody debris causing flow restrictions.

YACTAC with the CMA's and Caring for our Country have removed a large percentage of these willows and the eradication is continuing.

Water Balance Study

A water balance study was commissioned for the creek system in 2007 to investigate the unaccounted for differences within the system. Unaccounted for

differences were considered to be the difference between flows at gauging sites that cannot be explained from measured inflows, diversions and estimated reach rainfall and evaporation. They are the sum of true losses, measurement errors and unknown inflows and unknown outflows. For each reach a description was given for the factors that may be distorting the water balance such as flow measurement error and unknown or unmeasured inflows and outflows. The study analysed data for the period 1998/99 to 2005/06 and reported the unaccounted for differences on a seasonal basis to distinguish unregulated or flood flow losses from regulated flow losses.

The average annual unaccounted for differences for the whole of the Yanco, Colombo and Billabong Creek System was 55GL for the 7 year period to 2005/06. This was made up of 12GL in the low regulated months (May to September) and 43GL in the high regulated period. Annual licensed deliveries averaged 122GL for the same period and the total unaccounted for differences equated to 27% of the net diversions within the creek system.

We anticipate an improvement in these figures as a result of reduced entitlements due to buyback, and no further requirement to supply water over Warriston Weir plus the remedial action taken by YACTAC and its partners.

In the high regulated season, the unaccounted for differences were 11GL in the Colombo Creek, 12GL in the Billabong Creek between Conargo and Darlot and 9GL in the Yanco Creek upstream of Morundah.

New Metering

New metering systems with real time telemetry are currently being investigated for implementation within the Yanco Creek System. Water for Rivers in partnership with YACTAC has undertaken trials of the new metering technology. Seven individual meters, an automatic weather station and a new measurement system at the off-take have been installed. Information from these systems is reporting to a secure website, enabling farmers to monitor water use. The new metering technology also has the capacity to be connected directly into the on-farm management system, providing the opportunity for more efficient on-farm water usage. It provides the capacity for the on-farm system to monitor water distribution across the entire property and control bay outlets, channel depths and drainage water. The telemetry also provides the capacity for the remote monitoring and operation of pumps.



Tarabah Weir

FOREST CREEK PLAN

Key Messages

- The Water Sharing Plan for the Murrumbidgee Regulated Water Source includes a provision for an annual flow of 36.5 GL to Forest Creek below Warriston Weir.
- An agreement was reached for the supply of stock and domestic water to landholdings on the Forest Anabranche below Rhyola and on the Forest Creek below Warriston Weir. This reduced flows over Warriston Weir by 34.7GL per annum.

The Forest Creek System, an anabranche of Billabong Creek, comprises Forest Creek, Eight Mile Creek and Forest Anabranche. The Forest Creek System above Warriston Weir is a regulated watercourse. Prior to river regulation, the Forest Creek System only received water when the Murrumbidgee River was in flood, and when rainfall in the Billabong Creek catchment from local storms were sufficient to generate a sufficient flow at the Forest Creek offtake. The Water Sharing Plan for the Murrumbidgee Regulated Water Source includes a provision to make available a replenishment flow of 36.5GL to Forest Creek below Warriston Weir in each water year.

Action

In 2000, a stakeholder group prepared a draft management plan for the Forest Creek System. This included an assessment of environmental flow requirements and the development of management options. The draft plan was not formally adopted, nor were the majority of the recommended actions. An agreement was subsequently reached that involved the Billabong Creek supplying stock and domestic water supplies to landholders on the lower reaches of the Forest Anabranche. This agreement resulted in an increase in flow to the Billabong of 200ML per annum and a reduction in flows over Warriston Weir of 11.3GL per annum.

Part of that original plan which YACTAC is still pursuing, had a provision of 4GL per annum for environmental flooding of Wanganella Swamp which is a breeding site for several endangered and threatened native species and a refuge for migratory birds.

Further investigations were undertaken to explore options for additional water savings in Forest Creek from Warriston Weir to Rhyola. The second stage investigations resulted in an agreement to construct a piped stock and domestic water supply for all landholdings on the section of Forest Creek downstream of Warriston Weir. This created an additional water saving of 23.4GL for the Snowy River recovery.

ALTERNATE WATER SOURCES

Key Messages

- The Yanco Creek System has difficulty supplying irrigation water to licences, particularly in years of higher water allocations and high seasonal demand.
- Additional flows from the adjoining Coleambally and Murray Irrigation districts irrigation supply and drainage infrastructure, would help meet the water supply demand without impacting on the riparian environment at the top end.
- Strategic use of adjoining irrigation infrastructure to supply water supplies is expected to result in improved water delivery efficiency and improved health of the riparian environment.

The Yanco Creek System has experienced difficulties delivering water to downstream users when and where they need it. This is in part due to the overall length of the system, the generally flat gradient of the creek system, and the in-stream obstructions. This problem is pronounced during years of average to high allocations and associated water use demand, particularly in the lower reaches of the system. The advent of summer cropping in the 1980's exacerbated the water supply challenges and led to demand management as a critical issue.

The creek system receives flows from the Coleambally and Murray Irrigation districts which supplement ordered regulated flows diverted from the Murrumbidgee and Murray Rivers respectively.

Operation of the Finley Escape into the Billabong Creek has become an important conduit as an additional diversion option around the Barmah Choke.

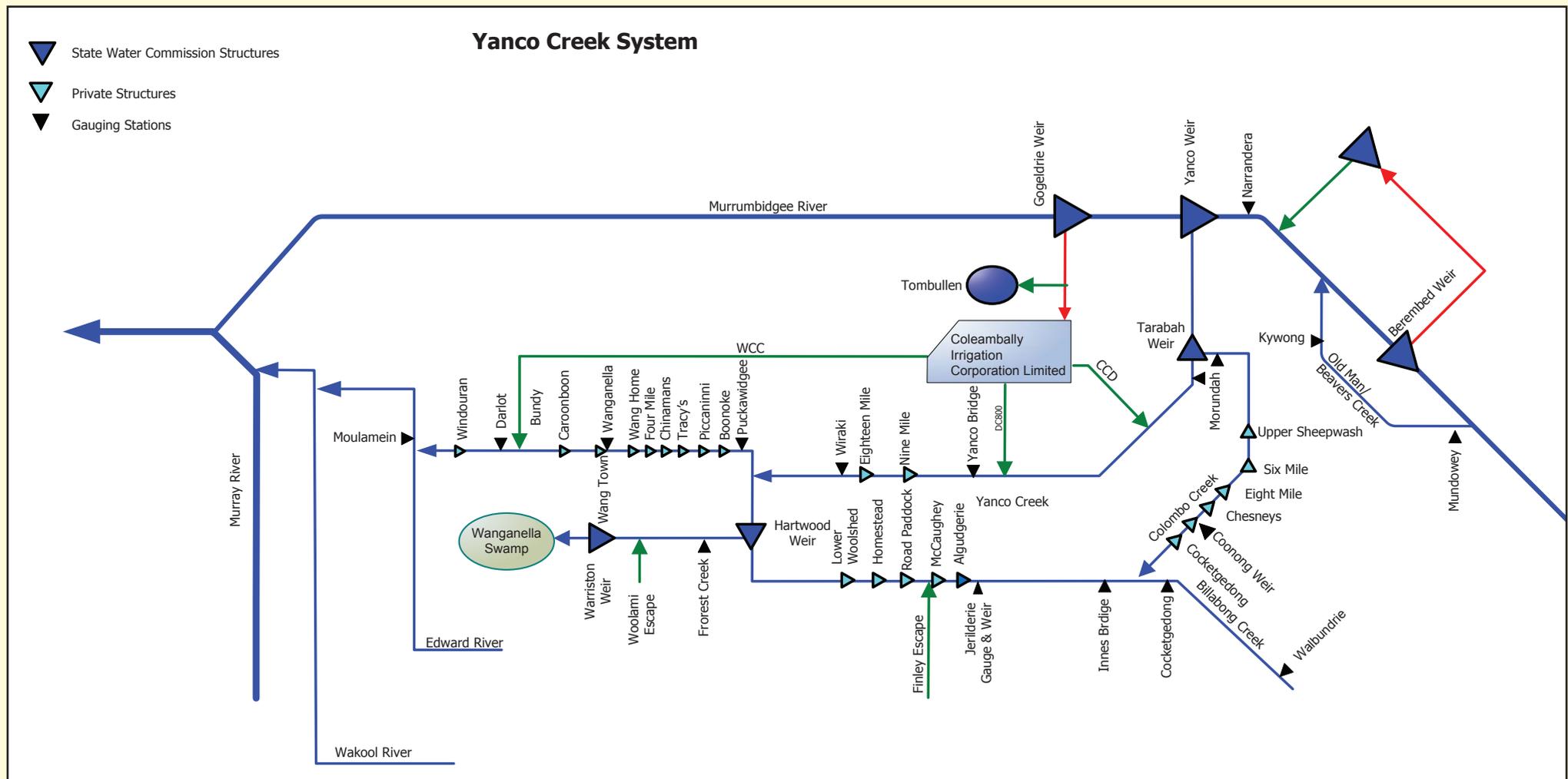
Strategic use of adjoining irrigation supply infrastructure is likely to result in:

- reduced losses and less un-seasonal wetland inundation in the upper reaches of the Yanco Creek System;
- reduced periods of high flow and associated impacts on the riparian environment;
- more timely and more efficient delivery of irrigation supplies to licensed works on the Creek.

Action

Preliminary work was undertaken to evaluate providing supplementary flows to the Yanco Creek System via the Coleambally and Murray Irrigation Ltd supply and drainage infrastructure. The potential capacity of existing infrastructure is being assessed as well as the possibility of upgrading the infrastructure or building new delivery channels.

Discussions are continuing with Murray Irrigation and Coleambally Irrigation to further cost and analyse the possible alternative delivery routes. Reliability of supply at peak demand is an important consideration for both the Yanco Creek System and the adjoining irrigation infrastructure networks.



WATER QUALITY MONITORING

Key Messages

- The Yanco Creek has been rated as being in better condition than the Colombo or Billabong Creeks, and the Billabong being rated in better condition than the Colombo Creek.
- A number of water quality monitoring programs have operated within the creek system in recent years.

Stream health relates to a combination of stream bank stability, water quality and the health and diversity of the riparian habitat. An assessment was conducted in 1999 by Molino Stewart on the quality of riparian and in-stream habitat present and the erosional stability of stream banks. In general terms the Yanco Creek was rated as being in better condition than the Colombo or Billabong Creeks and the Colombo was rated as being in poorer condition than the Yanco or Billabong Creeks (Table 2).

Stream Reach	Riparian Habitat Rating	In Stream Habitat Rating	Streambank Stability Rating
The Yanco Creek	1	1-2	1
Colombo Creek	3	2-3	2
Billabong u/s junction with Yanco	1-2	1-2	1
Billabong d/s of junction with Yanco	1-2	2	1

1 = excellent, 2 = moderate, 3 = poor

In stream ecosystem richness reflects the overall health of the waterway. A number of invertebrates are strongly associated with large woody debris including fresh water prawns, riffle beetles and shrimps which graze on the algae on the surface of the debris. These invertebrates are an important feed source for fish. Other invertebrates inhabit aquatic plants such as cumbungi and common reed. Many other species inhabit the water body, including water bugs, while others are associated with the sediment.

A number of water quality monitoring programs have been undertaken, including:

- monitoring of the Billabong Creek by Murray irrigation Ltd as part of its broader water quality monitoring program;
- a water watch program coordinated by the Murray Catchment Management Authority, involving water sampling of the Billabong Creek by Jerilderie school children;

- water quality monitoring at five sites on the Yanco Colombo System in past years by the NSW Government.

An analysis of the water quality data for The Yanco Colombo Creek System for the period 1993 - 2003 showed that total suspended sediment increased as water moved down the Yanco Creek but did not increase as water moved down the Colombo Creek. Turbidity measurements were similar to or higher than the ANZECC guidelines for water quality. Total phosphorus levels showed similar trends to sediment concentrations and were also generally higher than ANZECC guidelines. Dissolved oxygen levels declined from upstream to downstream and were below the ANZECC guidelines for lowland streams in the lower reaches of both streams. Salinity monitoring showed the electrical conductivity ranged from 50 - 350 uS/cm which is considered to be moderately low indicating that in stream salinity is not a major issue for the Yanco and Colombo Creeks.

Fish Restocking and Monitoring

A fish restocking program has been in operation over a number of years within the creek system. The main species restocked have been Golden Perch and Murray Cod. Over 82,000 Golden Perch were released into the Billabong in 2008 and almost 20,000 Murray Cod were released in 2007. A total of over 10,000 Golden Perch were released into the Yanco and Colombo Creeks in 2004 and 2005.

The Arthur Rhyllah Institute is undertaking a program to monitor the success of the fish stocking program. The restocked fish are treated prior to release, such that they can be identified if subsequently caught in monitoring programs. Four sites within the Billabong Creek are being monitored annually to determine the overall fish populations and to monitor the proportion of the population that originated from the stocking program and also the longevity and health of the introduced fish. The current program is focused on Golden Perch.

In recent years, YACTAC and landholders in partnership with the CMA's have completed a considerable level of riparian fencing and in stream invasive weed control. These measures all contribute to improving instream health.



FUTURE VISION FOR THE YANCO - COLOMBO - BILLABONG CREEK SYSTEM

Achieving a balance between managing the Yanco Creek System to protect its riparian environment and to supply critical water needs for communities and industry is a goal the local community is striving for.

A substantial investment in time and money, both government funding and community funding, has enabled the current program of works to be implemented.

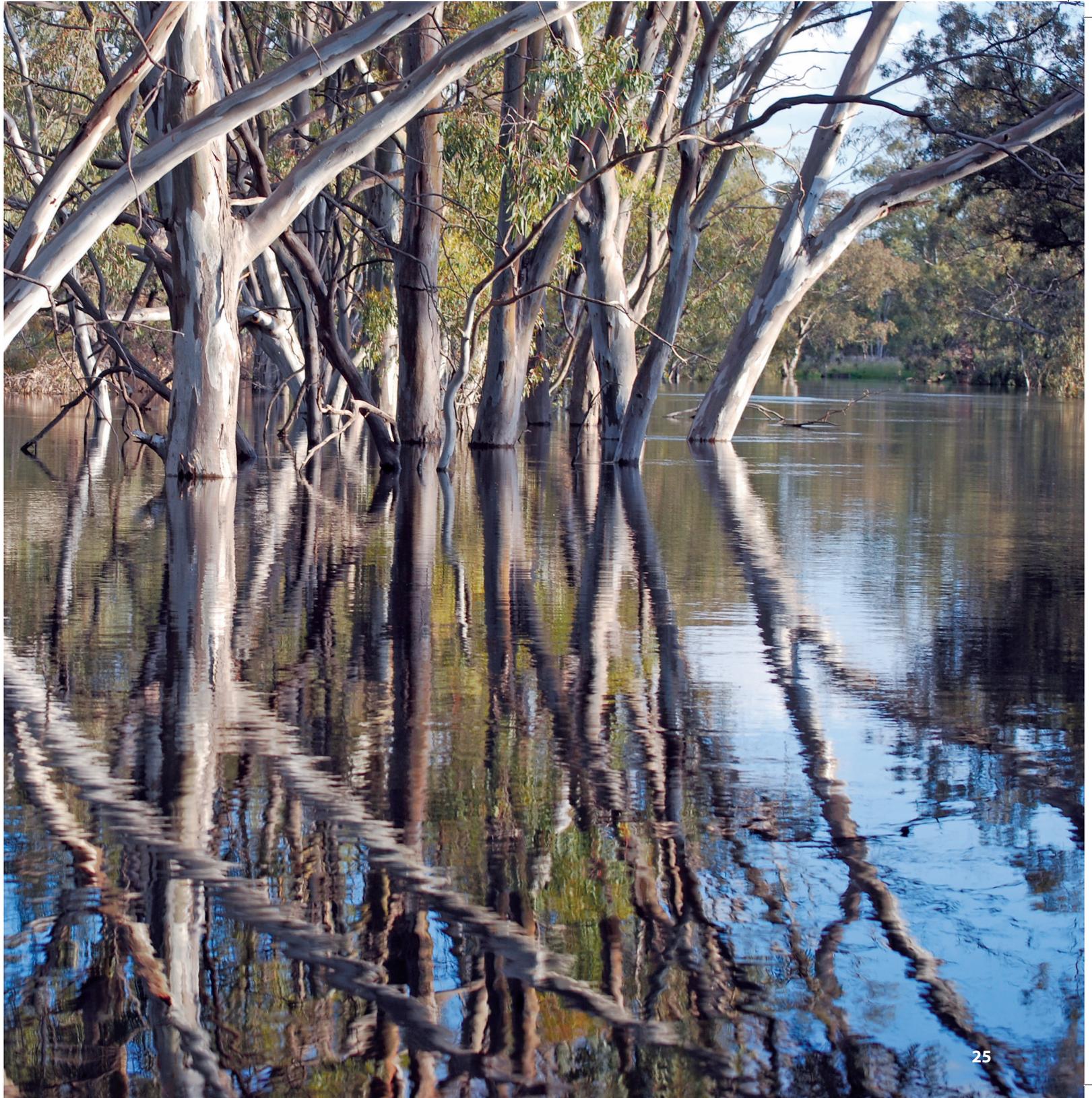
The creek system will continue to be an important environmental asset within the Riverine landscape and will also continue to be the source of water for the local communities within the region.

Further investment will be required to build on the programs that have been initiated, to achieve the balance required.

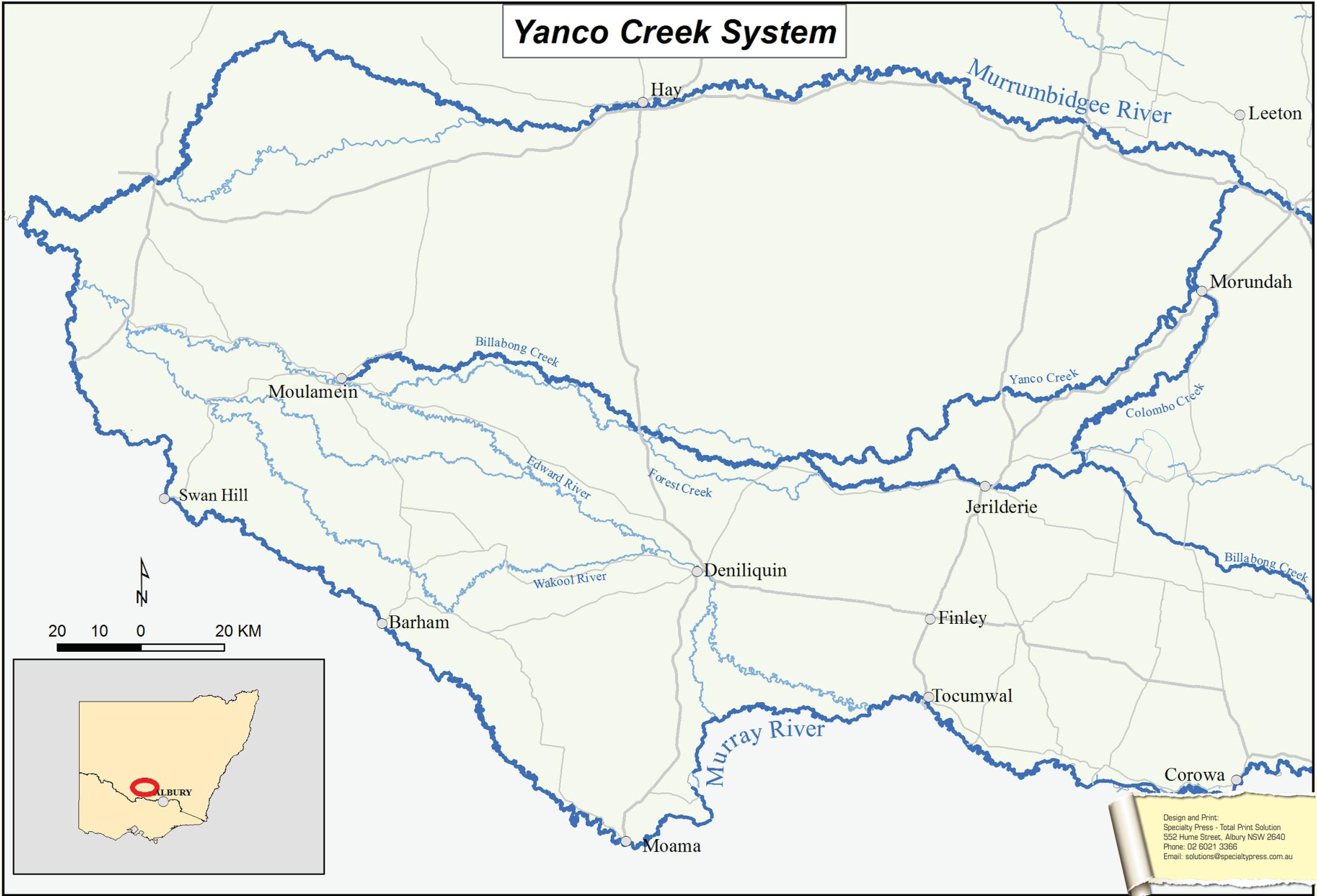
It is important that the local community works closely with the government at all levels and that future investment in time and funding is done in a strategic manner, to achieve the integrated objectives of providing a water supply and improving creek health.

The Yanco Creek and Tributary Advisory Committee is committed to that challenge.





Yanco Creek System



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