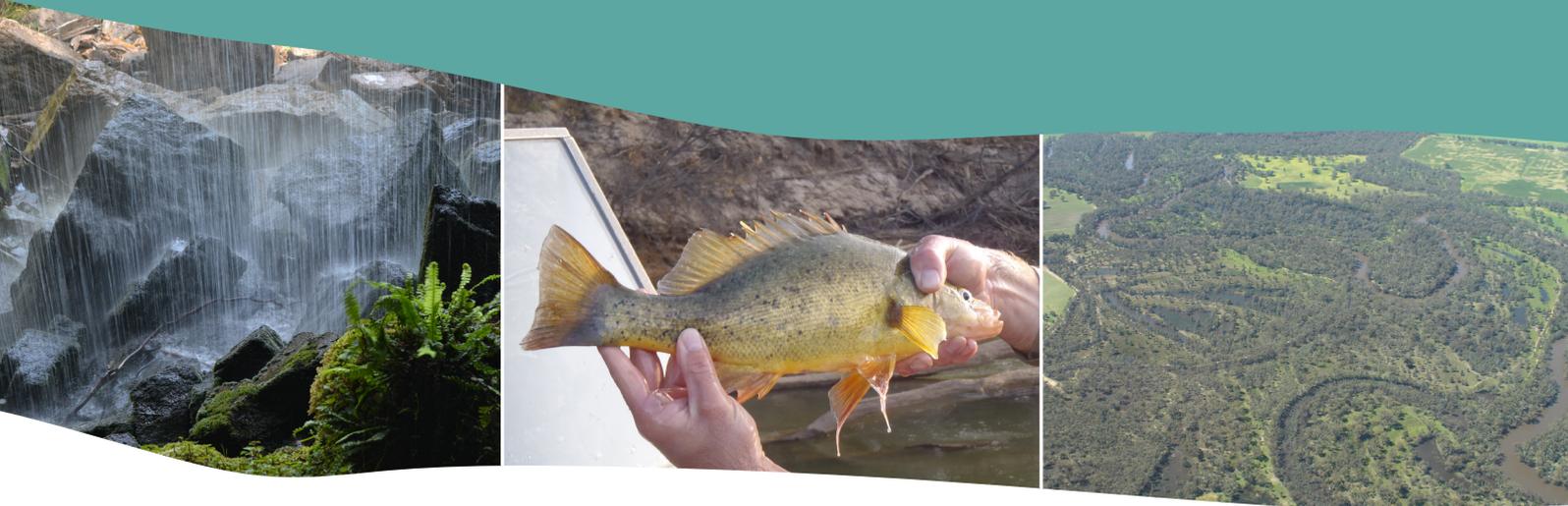




**GOULBURN
BROKEN**
CATCHMENT
MANAGEMENT
AUTHORITY

HEALTHY LANDSCAPES – HEALTHY RIVERS



ISSUE

When catchment planning began in the late 1980s, the flows in the two major river systems, the Goulburn and Broken, were greatest in summer and lowest in winter - almost the opposite of what the Traditional Owners had experienced for thousands of years. River management was focussed on the construction of levee banks, channelisation, and dam construction. Rivers were cleared of logs to provide access for boats and weirs constructed to divert water for irrigation and urban use. The weirs stopped fish travelling up stream to spawn and collected silt flowing downstream. This heavily silted water was released from time to time to protect the weirs having devastating impacts on fish and other aquatic species downstream.

The diversion of water for irrigation and urban use reduced overall volume of water flowing down the rivers to an average of 46% by the early 2000s. These diversions also significantly altered flow regimes and, in some areas, resulted in the water not reaching the correct temperature threshold to allow some species of fish to spawn. As fish numbers reduced, efforts to restock with native fish often failed due to the poor state of the rivers.

As an alternative to European carp, non-native 'alien' brown and rainbow trout and others species were introduced to boost recreational fishing opportunities but this further impacted on the native fish until it was reported in 2008 that over 60 per cent of the biomass in the Goulburn was not native.

Major changes had also been happening on land. Since European settlement over two thirds of the catchment had moved into private ownership and large tracts of native vegetation were removed for agriculture and urban development. Wetlands were drained and farmed resulting in significant loss of habitat for birds, fish and other native species. River banks and the nearby land was cleared to provide stock with direct access to the water. These activities resulted in serious erosion and silting problems in the rivers and creeks and by the early 1900s silting was a major factor responsible for the decline of native fish in streams in the northern half of the catchment.

Agricultural and urban development resulted in increased nutrient levels in many rivers and streams with intensive irrigation and sewerage farms identified as the highest polluters. In the late 1990s river water quality in the lower catchment was considered to be 'poor' or 'degraded' largely due to the high nutrient levels.

Although these changes to rivers and landscape supported significant expansion of agriculture, with the economic prosperity of the catchment growing to \$2.85 billion a year, it was also recognised that the impact on the environment had gone too far. Without urgent action and ongoing management the environment and the services it provides would collapse taking the economy of the catchment with it.

Addressing the legacy of early decisions would not be easy. The solutions lay in the clever weaving of actions on water and on the land and, given the huge amount of work required and that two thirds of the land was in private hands, building community support and action would be imperative.

INTERVENTION

River flows

A key part of restoring the health of the rivers has been dependent on ensuring there are at least minimum volumes of water flowing down the rivers all year around. Additional 'freshes' in spring, autumn and winter are used to encourage fish breeding and the growth of appropriate riparian and wetland vegetation. Providing the minimum flows and 'freshes' first required capturing some of the water that was historically allocated for agriculture and industry and making that available for the environment.

In the upper part of the catchment, capturing water for the environment focussed on the unregulated private dams and diversions that were having a significant impact on stream flows particularly in spring, summer and autumn. Since 2011, weirs across waterways, dams used for irrigation or commercial purposes and pumping of water from streams need to be approved, licensed and their use controlled. In addition, the combined volume that is diverted is kept below an agreed limit identified in stream-flow management plans.

In the irrigation region, capturing water for the environment now focusses on improvements in upgrading regional and private irrigation infrastructure. So far, 196 km of regional channels have been remediated and 825 km of redundant channels closed down saving 206 GL of water.

At critical points near the outfall of the regional drains, 34 drainage diversion dams have been constructed to divert nutrient rich water away from the rivers and back onto farms. On private land, the implementation of irrigation upgrades have rapidly followed irrigators who have completed a whole farm plan that ensures the proposed upgrades create water savings and reduce salt, water and nutrients leaving the farm. More than 52,100ha of upgrades have been completed creating water savings of 72GL that have been returned to the environment allowing 479,164ML of environmental watering across wetlands and streams to occur in 2016/17 in the Goulburn Broken catchment.

The changes in the dryland and irrigation areas of the catchment have moved a long way towards providing the water required for the environment. Research has been critical to guiding the decisions needed on how much environmental water to release, where and when across a range of climatic conditions as well as the ability to learn from experience and specific trials.

Environmental flows involve providing minimum flows in rivers and additional 'freshes' in spring, summer and autumn. The starting point for these flows is natural rainfall. Any additional water needed is drawn from water stored for the environment by the Victorian and Commonwealth Environmental Water Holders and the Murray Darling Basin Authority. How much is taken from each source is balancing the needs of Goulburn or Broken River with the ecological priorities for each of the three sources of environmental water. This is initially determined at the start of the year but as the season pans out, changes are discussed and agreed. Releases are now managed to provide the size and speed of flows and the water temperatures the environment requires. Throughout the year the ecology is monitored and at the end of the year data is reviewed and what has been learnt is then used to influence future decisions.

Weirs still exist across many waterways in the Goulburn Broken catchment although 17 fish barriers have been removed and four fish ladders have been installed opening up 312 km of waterway to fish passage.

Native fish species are now actively protected and managed. For example, after the 2009 fires some mature Macquarie perch were removed from the King Parrot Creek that was polluted with ash and sediment and kept healthy at the Snobs Creek Fish Hatchery until the water quality in the creek improved. In March 2016, native fish were removed from Rice's Weir pool on the Broken Creek near Barmah to further downstream after dissolved oxygen levels fell to critically low levels. In addition, native fish species are bred and released into the rivers and water bodies such as the Goulburn River alongside the popular introduced trout species. Research continues into the best way to control pest species such as carp.

Revegetation

From the top of the catchment to the bottom, re-vegetation of riparian zones adjacent to rivers has been critical for managing water for environmental, social and economic outcomes. Since 2008, 2000ha of riparian vegetation has been planted with over 1,000 km of fencing built to exclude stock so that the bank stability improves and water quality is protected.

Over 750km of willows and other riparian weeds have been removed from stream-sides and replaced with indigenous species that shade and cool the water and stabilize the banks. In the future, these indigenous species will drop limbs into the water and provide a crucial part of the habitat required by native fish and other creatures. To speed up this process, 2,650 snags have been deliberately put back into the rivers and streams immediately providing habitat and underwater links between existing pockets of remnant natural sites.

Nutrient water quality

Since the early 1990s, the irrigation industry has implemented an integrated package of regional and on-farm works to reduce the amount of water needed for agriculture, managing dairy effluent and stopping water leaving the farm and reaching rivers and streams. Over 680km of regional drains have been built with 34 nutrient removal systems integrated into the design. On private land, more 3400 re-use systems have been installed to capture irrigation run-off and dairy effluent systems re-designed and upgraded to cope with the ever increasing dairy herds. Monitoring and reporting of the quality of the water in drains has become mandatory with action taken as soon as levels are above the acceptable standard. As a result, the estimated percentage of the applied water and the associated nutrients running off farms into the region's drains and waterways has reduced from 20% in 1994 to less than 5% currently.

Community involvement and action in building the health of the rivers and wetlands has been critical. As part of the 10 year community-based RiverConnect program in Shepparton a large number of informative presentations and tours have been held with community and school groups. In addition, five river ecology courses, an annual Waterwatch series, a research forum and a range of other activities have been held to build community capability and involvement. In addition to a weekly newspaper article, a range of general and social media has been implemented to build community awareness and to get rapid feedback. Regular meetings are held with key interest groups and 45 past participants in waterway programs have been surveyed to gather their perspectives. Community members are an important part of the structured decision making forums including the development of the Goulburn Broken Waterway Strategy, wetland management plans and the continual environmental water use planning.

OUTCOMES

River ecology is starting to recover due to more natural flows, improved water quality combined with the re-vegetation of wetlands and the riparian zone, re-snagging of the rivers, control of pest species and implementation of fish ladders. Hollands Creek is an example of where this combination has been put in place and the result has been between a two and six-fold increase in the numbers of monitored native fish species as well as an increased distribution along the creek. Monitoring of the behavior of freshwater catfish in Tahbilk Lagoon has meant a targeted program of works have been implemented that has not only led to increases in fish numbers but also the first sighting of the endangered broad-shelled turtle. Indigenous species dominate the Goulburn and Broken rivers with an average of six indigenous species to every one exotic species. Macquarie perch numbers are improving thanks to river health works on creeks including the Hughes and King Parrot. On sections of the Goulburn River, trout cod, a species of State and National significance, is now widespread and abundant. In addition, golden perch spawning and recruitment has been detected. Another measure of the improved fish numbers is that anglers say the Goulburn River is their favourite inland recreational fishing spot in Victoria.

The improved river environment means local councils and the State Government can see the opportunity for further tourism development using the natural beauty of the river and surrounds for new businesses and recreational facilities. Productive irrigated and dryland agriculture industries are also able to continue in harmony with the rivers providing a critical support to the region's economy.

NEXT CHALLENGES

The investment in restoring the rivers and streams in the Goulburn Broken has not only moved towards having more natural flows but has improved our knowledge of what is required to create a healthy and resilient riverine environment. We have learnt that it is not just about adding more water, rather it is critical to coordinate our activities up, down and across the rivers. If we provide the flows but don't re-vegetate then the water does not support the right biota or provide the cool shady spots that are critical for the native species. If we reduce the nutrients but don't control erosion we favour carp and not golden perch. If we re-vegetate the wetlands and riparian zones without controlling the cats and foxes, then the turtles don't survive. If we provide an environmental flow that results in fish spawning but don't provide the flow for them to reach a major river then fish numbers will not increase.

The next challenge is clearly to not 'just add water' but to integrate all the activities on land and in the water to create the conditions for the aquatic species to not only survive but thrive.