

Case study – Maximising benefits in the upper Murrumbidgee River

Key points

- Communities in the upper Murrumbidgee River region are increasingly expressing concern about the impacts of water and land management on environmental, cultural and social values (human health).
- Murrumbidgee River aquatic ecosystems within the ACT and surrounding region are in poor health resulting from an impaired flow regime; this is particularly evident in native fish populations. The flow regime is affected by water resource management within NSW and the operation of Tantangara Dam under the NSW Snowy licence.
- Improving the ecological, cultural and social outcomes in the upper Murrumbidgee River, the ACT and surrounding region, requires enhanced water releases from the Tantangara Dam, water management rules within NSW that protect environmental and cultural flows, water take compliance, and complementary NRM activities.

Background and a concerned community

This case study is provided in response to Basin Plan reporting requirements under Schedule 12, Matter 10 – demonstrating the implementation of the Basin Plan’s Environmental Management Framework. Specifically, the following case study discusses the challenges in achieving the outcomes of the Basin-wide Environmental Watering Strategy and annual priorities as relevant to the upper Murrumbidgee River, and the importance of working with community to maximise benefits. The case study focuses on the region between Tantangara Dam and Halls Crossing, which is at the downstream end of the river in the ACT.

The upper Murrumbidgee River has many natural, social and cultural values but scientific research and monitoring conducted over the last several years indicates that the river’s condition is in decline and its function impaired by river regulation and water management rules enabling a high level of water abstraction.

Communities in the region rely on a functioning river. At the height of the drought in November/December 2019, the Murrumbidgee River stopped flowing at the village of Tharwa. The cessation of flow occurred during a time when upstream inflows to Tantangara Dam were greater than 40ML/day. Water was trucked into Tharwa for drinking and other domestic purposes, as well as for the township’s fire-fighting reserves. The river within the upstream parts of the ACT is often subject to closure due to elevated bacterial levels that exceed human health guidelines.

In July 2021, the upper Murrumbidgee Catchment Network (UMCN) surveyed its [members](#) and associates about their understanding of, and concerns around, water quality and water security in the upper Murrumbidgee catchment. Respondents identified their top three issues of concern as river health and biodiversity (85%), water for the environment (78%), and climate change (66%). The UMCN is a network of individuals, community groups, businesses and organisations (both government and non-government) involved in natural resource management in the upper Murrumbidgee catchment.

Water quality and water for the environment was the top issue of concern for UMCN members, with most people surveyed considering environmental water to be as important as water for human consumption. Members also voiced their concerns that the management of environmental water in the upper Murrumbidgee was not adequately addressed in the Basin Plan.¹

¹ Full results of the UMCN member survey can be found at <https://umcn.org.au/water-quality-and-security/>

Water Management in the upper Murrumbidgee River

Tantangara Dam became operational in 1960 as part of the Snowy Mountains Hydro-electric Scheme. Approximately 96% of flow in the upper Murrumbidgee River is diverted to Lake Eucumbene for hydropower generation.

The ACT Office of the Commissioner for Sustainability and the Environment has developed a [storymap](#) that describes some of the impacts of river regulation within the upper Murrumbidgee River associated with the operation of Tantangara Dam and water abstraction.

The storymap illustrates the difference between modelled (expected) and actual flows at Mittagang Crossing (near Cooma), Lobbs Hole (near where the river enters the ACT from NSW), and Halls Crossing (where the river leaves the ACT for NSW). The impact of river regulation is most noticeable upstream of the ACT, and particularly in the winter and early spring months; during the month of August modelled flows are nearly five times higher than actual river flows. This is a critical impact to the river's ecology as elevated spring flows (often attributed to snow melt) stimulate reproductive behaviour in many native fish species, including the endangered Macquarie Perch.

Tantangara Dam is operated by Snowy Hydro under the Snowy Water Licence issued by the NSW Government. The licence requires Snowy Hydro to make limited environmental water releases from Tantangara Dam and an average of 27 GL a year is released from Tantangara to the Murrumbidgee River as environmental flows under these provisions.² The limited environmental water releases from Tantangara Dam are not protected from downstream abstraction under the NSW Water Sharing Plan for the Unregulated Murrumbidgee Water Sources.



UMCN focuses on networking, knowledge sharing and collaboration through regular community forums (Claire Sives, 2021).

Storms, water quality, sand slugs, and a lack of flushing flows

The Numeralla River is a tributary of the Murrumbidgee River upstream of the ACT. In January 2019, a short, intense, localised storm event occurred in the Numeralla River catchment creating a flow event in the Numeralla River with significantly high turbidity. The highly turbid flow event eventually reached the ACT where it contributed to raised levels of enterococci bacteria and contributed to sediment deposition in the river channel.

This is a natural storm-driven process; however, the increased mobilisation of soil containing high organic matter and bacterial loads from adjacent farmland is creating a human health risk within the ACT section of the Murrumbidgee River.

² Snowy Water Inquiry Outcomes Implementation Deed (SWIOID) 2002

Figure 1 (below) shows the discharge, turbidity and enterococci counts associated with the 2019 storm event.

Figure 1D shows that the guideline values for bacterial enterococci values, associated with human health, were exceeded on 15 January and as a result all ACT swimming beaches along the Murrumbidgee River were closed for more than a week.

Inflow events such as this can contribute significant amounts of sediment and organic material into waterways. Under the right conditions, major bacterial activity can occur which depletes dissolved oxygen from the water. This in turn can lead to fish-kill events.

Periods of elevated bacterial levels are not limited to being associated with storm events. There is emerging evidence indicating a relationship also exists between *low* flows and high enterococci levels. However, further research is needed to understand the mechanism for this process.

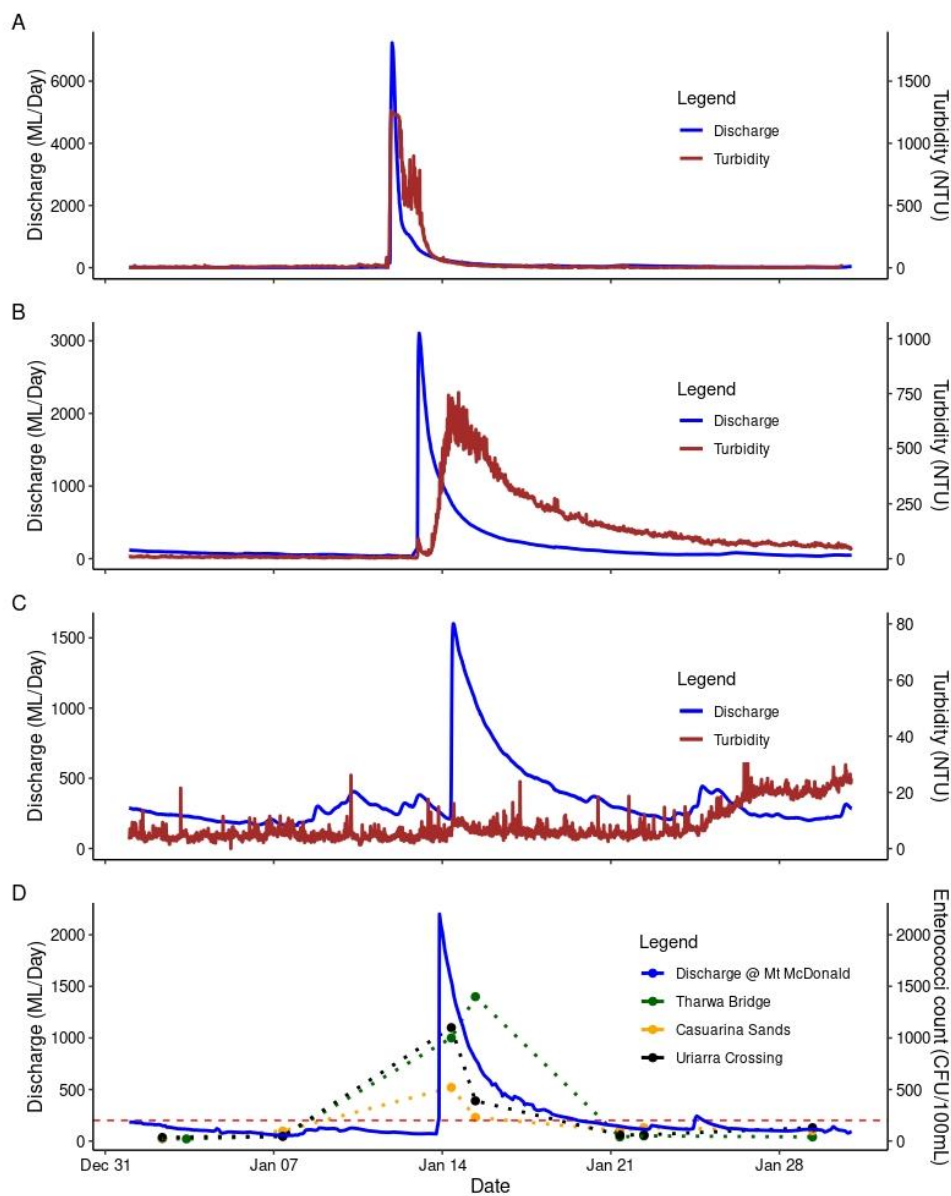


Figure 1. Plots of stream discharge (ML/Day) and Turbidity (NTU) at A) Numeralla River at Chakola, B) Murrumbidgee River at Angles Crossing (where flows enter the ACT) and C) Murrumbidgee River at Halls Crossing (where flows leave the ACT).

D) shows Enterococci counts (CFU/100mL) at Tharwa Bridge, Casuarina Sands and Uriarra Crossing and stream discharge (ML/Day) for the Murrumbidgee River at Mt McDonald (mid-point of the ACT). The red dashed line (200 CFU/100mL) indicates the threshold for enterococci counts above which swimming sites are closed to primary contact recreation.

Sedimentation and habitat loss

The relationship between flows and sediment transfer and deposition is well established and requires further consideration in the planning of catchment management activities. In the case of the 2019 storm event, much of the sediment carried by the turbid flow event was deposited in the upstream reach of the Murrumbidgee in the ACT. Data collected by flow gauges and turbidity sensors showed that the turbid water reached the ACT border (approximately 80km downstream). However, downstream of the ACT border much of the suspended sediment was deposited within the river channel. For example, turbidity was at 600 NTU at the upstream end of the ACT but only 10 NTU at the downstream end. A Waterwatch sample taken at Casuarina Sands during this time reported turbidity of 25 NTU.

Sections of the ACT are known to be sediment deposition zones. The ‘sand slug’ at Tharwa provides an example where sediment transported from NSW is deposited due to the low energy, low gradient nature of the river in this reach; refer to Figure 2.

The natural scouring of sediment build-up by river flow events is not occurring. Tantangara Dam prevents major periodic flushing events that are generated in the upper catchment from transiting the Murrumbidgee River. Considerably larger flows are now needed to scour and transport the accumulated sediment from the ACT.

The sedimentation of the Murrumbidgee River within the ACT represents a significant loss of a key hydrological function that is essential for maintaining river health and biodiversity. There are several other such deposition zones along the upper Murrumbidgee River.



Figure 2. Sand deposition at Tharwa (Mark Jekabsons, 18 Dec 2019).

Fish and flows

The upper Murrumbidgee catchment provides critical aquatic habitat for several threatened native fish and crayfish species:

- **Macquarie Perch** (listed as Endangered in the ACT, NSW, nationally)
- **Two-spined Blackfish** (listed as Vulnerable in the ACT)
- **Trout Cod** (listed as Endangered in the ACT, NSW, nationally)
- **Murray Cod** (listed as Vulnerable nationally)
- **Silver Perch** (listed as Vulnerable in the ACT, Vulnerable in NSW, Critically Endangered nationally)
- **Stocky Galaxias** (listed as Critically Endangered in NSW and nationally)
- **Murray Crayfish** (listed as Vulnerable in the ACT and NSW)

The upper Murrumbidgee is now one of only a few reaches of river where self-sustaining natural populations of Macquarie Perch survive. It also contains the longest stretch of river in the Murray-Darling Basin that supports this species; a 160km section that includes 90km of core breeding habitat between Numeralla and Yaouk. The Murrumbidgee River in the ACT is also home to a natural population of Murray Cod.

The Murray Crayfish is present locally in the Goodradigbee River, the Murrumbidgee River to Michelago, and the Lower Cotter River. This species is listed as vulnerable in the ACT and NSW, and is considered an iconic species due to its importance for Aboriginal subsistence fisheries and as an indicator of river health³.

Numerous threats exist to native fish species in the upper Murrumbidgee that include habitat destruction and discontinuity, alteration to flow regimes, changes to water quality, barriers to fish passage, alien species and disease, invasive weeds, translocation and stocking of inappropriate species, impacts of uncontrolled wildfire and overexploitation.⁴

River regulation is impacting native fish by removing flow variability. Periods of low flow affect water quality, increasing the likelihood of algal blooms and a reduction in dissolved oxygen.

The regulation of the upper Murrumbidgee River and resultant sedimentation of the river channel is reducing the aquatic habitat diversity and complexity favoured by native fish and acts as a barrier to fish movement along the river. The loss of deep refuge pools is particularly pronounced for larger fish and Murray Crayfish.

³ Noble et al. (2018) Looking beyond fishing: Conservation of keystone freshwater species to support a diversity of socio-economic values. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28, 1424-1433.

⁴ See Lintermans, M. (2002) Fish in the Upper Murrumbidgee Catchment: A review of current knowledge.

Available: https://www.environment.act.gov.au/_data/assets/pdf_file/0011/576686/fishintheuppermurrumbidgee1.pdf

And Lucas, Z., Evans, L., Beitzel, M., Jekabsons, M. (2019) Why can't fish cross the road? Barriers to fish passage in the national park and reserves of the ACT. Unpublished report, Research Report Series. Environment, Planning and Sustainable Development Directorate. Act Government, Canberra. Available:

https://www.environment.act.gov.au/_data/assets/pdf_file/0015/1451013/Research-Report-Why-Cant-Fish-Cross-the-Road.pdf

The results of waterbug surveys in the river reach at Tharwa, in addition to fish monitoring, supports the premise that the loss of structural habitat due to sedimentation affects all trophic levels of the aquatic ecosystem.

Community action to support river restoration

The upper Murrumbidgee Demonstration Reach (UMDR) is a collaborative partnership established in 2009 under the Native Fish Strategy to support recovery of native fish populations and improve river health. Project partners for the UMDR's work have expanded to include the Australian River Restoration Centre, Bush Heritage Australia, the ACT Government, upper Murrumbidgee Waterwatch, the University of Canberra, NSW Local Land Services and NSW DPI Fisheries. The focus area for this project also has expanded to include the upper Murrumbidgee River between Tantangara and Burrinjuck dams.

In June 2021, the UMDR ran a 'Fish and Flows' forum⁵ which brought river managers from NSW and the ACT together to share their work and gain a better understanding of issues affecting river health and fish in the upper Murrumbidgee River. The effect of water management on native fish was an underlying theme emerging from the forum.

The forum concluded that urgent management action is needed in response to the declining health of the river, including research to better understand the functional needs of the upper Murrumbidgee River, protection of environmental flows from extraction in NSW, improved regulation of illegal water take, increased resourcing for environmental flow ecological response monitoring, and increased river flows. Pressures associated with population growth and climate change were flagged as challenges that will exacerbate water management issues in the upper Murrumbidgee River.

During the Fish and Flows forum, the ACT Government's Conservation Research Branch presented on their fish monitoring conducted within the ACT and at sites upstream to Bredbo in NSW.



Figure 3. ACT Government's Conservation Research Branch's Matthew Beitzel presenting to the forum, and forum participants in a break-out session to identify key issues (Antia Brademann 2021).

The findings presented on fish monitoring tell a sobering story. Fish populations in the upper Murrumbidgee are in poor health with native fish outnumbered by carp. Historically, there were several listed threatened species present in abundance that are either no longer detected or encountered irregularly. Trout Cod continue to decline in their abundance.

Recent monitoring results indicate there is an increased abundance of juvenile Murray Cod but overall the population has been assessed as 'depleted' with few adult fish detected during 2021.

⁵ See <https://finterest.com.au/upper-murrumbidgee-recovery-reach-fish-and-flows-forum/>

The UMDR partnership continue to work with stakeholders across the region to improve native fish populations and overall river health in the upper Murrumbidgee River. Activities include:

- supporting the recovery of Macquarie Perch through the ‘Reaching for Recovery of the Macquarie perch project’, involving habitat assessments, recruitment surveys, genetic rescue and riparian habitat improvements (led by LLS with the involvement of the UMDR, NSW Fisheries, the University of Canberra, Rivers of Carbon, Landcare)
- instream habitat improvement works (UMDR, the ACT Government)
- erosion control to improve water quality and reduce sedimentation (the UMDR, LLS, the ACT Government)
- riparian habitat improvement (UMDR, Rivers of Carbon, the ACT Government, Landcare)
- environmental flow management (NSW DPIE Biodiversity Conservation Division)
- water quality monitoring (upper Murrumbidgee Waterwatch)
- habitat, weed, fish and platypus surveys (the UMDR, the ACT Government, NSW Fisheries, Upper Murrumbidgee Waterwatch).

The success of these interventions to improve native fish populations is dependent on being complemented by an appropriate flow management regime.

Opportunities to improve the Basin Plan and/or Environmental Watering Plan

The Basin-wide Environmental Watering Strategy sets out the objectives, outcomes and targets for river flows and connectivity, vegetation, waterbirds, and native fish to achieve the Basin Plan objectives. The ACT Water Resource Plan and Environmental Flow Guidelines contain environmental watering priorities in line with the Strategy’s outcomes and targets. The ACT’s ability to achieve the desired environmental outcomes is significantly impaired by the adequacy of river flows entering the ACT from NSW.

The flow regimes needed to protect priority environmental assets and ecosystem functions in the upper Murrumbidgee River require review. The ACT flow management regimes support a minimum flow regime representing the 80th and/or 90th percentile of the ‘natural’ flow. Maintaining this proportion of the flow regime has been generally accepted to support ecological processes. However, calculating the proportion of flow to be managed for the environment is based on flows *after* Tantangara Dam was constructed. This equates to only 30-50% of the 80th percentile flow for the river so is well below the amount of a natural flow prior to the dam’s construction.

The NSW Long-Term Watering Plan (LTWP) for the Murrumbidgee acknowledges that ‘water delivered through the Snowy Montane Rivers Increased Flows only provides a long-term average volume equivalent to about 30% of natural flow below Tantangara Dam and that this volume is insufficient to achieve some objectives such as maintaining channel form.’⁶ Flow rate thresholds for the ‘small fresh’ and ‘large fresh’ flow categories, important as native fish dispersal and spawning, are identified as knowledge gaps. The LTWP also notes the need to address authorised and unauthorised extraction of environmental water in the upper Murrumbidgee for purposes that are not consistent with LTWP objectives.

The adequacy of environmental releases to the upper Murrumbidgee River was comprehensively examined by the Snowy Scientific Committee in its 2010 report. The report found that ‘27GL scheduled for environmental release under the SWIOID (2002) for the upper Murrumbidgee is

⁶ Department of Planning, Industry and Environment (2020) Murrumbidgee Long Term Water Plan Part A: Murrumbidgee catchment, p76. Available: [Murrumbidgee Long Term Water Plan Part A: Murrumbidgee catchment \(nsw.gov.au\)](https://www.nsw.gov.au/murrumbidgee-long-term-water-plan-part-a)

inadequate to deliver all flow components'. The effectiveness of this environmental provision will be further diminished under current and predicted future climate change conditions.

There are opportunities to establish water management arrangements within the upper Murrumbidgee that support the environmental outcomes of the Basin-wide Environmental Watering Strategy. The NSW Water Resources Plan for the Murrumbidgee is being drafted and NSW's Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources (2012) is scheduled for review in 2023. Protecting environmental water will require rules to be established within the water sharing plan.

The Basin Plan has no effect on the Snowy licence; however, the Snowy Licence is currently subject to revision to implement recommendations from a licence review in 2019. Re-examining the flow objectives and allocations for montane flows, including to the Murrumbidgee River, could occur during this process of revision. The flow objectives and allocation require broadening to support the ecological, cultural and social values for the upper Murrumbidgee River and its communities.

The ACT Government looks forward to continuing to work with the MDBA, NSW DPIE and the catchment community to improve flows in the upper Murrumbidgee River in a way that can support the objectives of the Basin Plan and the outcomes of the Environmental Watering Strategy.