

Collaborative processes for prioritisation: a case study from western Victoria

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Key Points

- Environmental water is shared between the Wimmera and Glenelg catchments in western Victoria. The two catchments have vastly different environmental values, ecology and hydrology with varying and inconsistent ecological information available across the catchments.
- These differences increase the challenge in making decisions to maximise the environmental benefits across the two catchments through environmental water use, carryover and trade.
- Establishment of a collaborative and consistent planning process, convened by the VEWH, has aided environmental water decision-making in the region.
- The process emphasises the importance of local expertise coupled with up to date and consistent scientific information and technical input.
- The process has fostered strong partnerships and promoted continuous improvement in environmental water management in the western region of Victoria.

Abstract

There have been below average inflows since the floods in 2010 and 2011, and extremely dry conditions in the western region of Victoria since mid-2014. The environmental entitlement held by the Victorian Environmental Water Holder in the western region is shared between the Wimmera and Glenelg catchments, which necessitates cross-catchment prioritisation. A consistent planning approach and a collaborative group has been formed to advise on water sharing between the two catchments. Collaborative advice on cross-catchment prioritisation, improved operational monitoring, and access to technical advice has been successful in managing environmental risks associated with the dry conditions. Through this process, there has been continued refinement of scenario planning in the region, with a greater focus on multi-year planning to manage longer-term risk. Learnings from managing in these dry conditions will continue to inform future management of the western rivers, with valuable lessons that could be applied to other natural resource management problems.

Keywords

Environmental water, prioritisation, collaboration, Wimmera, Glenelg, water, Victorian Environmental Water Holder, western Victoria

Introduction

The Victorian Government uses a water entitlement and planning framework to balance the demands for water for consumption, the environment and other non-consumptive uses. The framework uses bulk entitlements, environmental entitlements, water shares, water licences and other instruments to share water between different users. An environmental water entitlement is a legal right to access a share of water available, subject to specific rules and conditions. The conditions on environmental water entitlements are similar to those for consumptive water entitlements used for towns, industry and irrigation. Environmental water entitlements have typically been created in systems where water regulation and harvesting have had a

significant impact on the hydrology and ecology of rivers or wetlands. In Victoria, environmental entitlements are largely held by the Victorian Environmental Water Holder (VEWH), the Commonwealth Environmental Water Holder (CEWH) and the Living Murray program (VEWH, 2015a), this article focuses on VEWH water holdings in the Western region.

With over 650 GL of environmental water entitlements across Victoria, the VEWH can use, carry over, or trade water in 18 river basins in Victoria. With imperfect ecological information, highly variable seasonal conditions, a wide range of environmental values across the state and competing interests, decision making on how best to use the water holdings is complex. One approach used in the western region of Victoria has combined scientific input with collaborative natural resource management (NRM) techniques to facilitate prioritisation and environmental water decision making in the region.

Background

Environmental water in Victoria is used to protect and improve the environmental values of Victoria's river systems and wetlands. The VEWH is an independent statutory body responsible for making decisions on the most efficient and effective use of Victoria's environmental water entitlements.

The Victorian environmental watering program is delivered in collaboration with our key delivery partners – catchment management authorities (CMAs) and Melbourne Water, storage managers, land managers and other water holders. It is delivered in an adaptive way, responding to changes in water availability, environmental need and seasonal conditions to optimise ecological outcomes. Each year, the CMAs and Melbourne Water develop seasonal watering proposals that inform the VEWH's seasonal watering plan.

The western region of Victoria

The Glenelg River flows for over 400 km from the western Grampians into Bass Strait near Nelson. The system is regulated by both Moora Moora Reservoir and Rocklands Reservoir (Figure 1). The lower section of the Glenelg River has been recognised as one of two biodiversity hotspots in Victoria due to the high-value aquatic life it supports. A unique feature of the Glenelg River is the fish assemblage it supports, which includes 18 indigenous species in the freshwater reaches alone. Of particular note is the high diversity of pygmy perch species (Nannopercidae), with two of the three species found in this area listed as vulnerable under state and federal legislation. Other priority aquatic species include the only population of the critically endangered Glenelg freshwater mussel (*Hyridella glenelgensis*) and the endangered Glenelg spiny freshwater crayfish (*Euastacus bispinosus*). The varying landforms and climate conditions along the river, combined with the connection with the estuary drive the diversity found in the Glenelg River.

The Wimmera River commences in the Pyrenees Range near Ararat and receives flow from several tributaries including the MacKenzie River and the Mount William, Burnt and Bungally creeks. All of these are heavily regulated waterways that can receive environmental water, as can the Wimmera River downstream of lower Mount William Creek. Just east of Mt Arapiles, the Wimmera River swings to the north and continues through Dimboola and Jeparit to Lake Hindmarsh (a nationally important wetland), and during exceptionally wet periods flows on to the Ramsar-listed Lake Albacutya. The waterways of the Wimmera catchment are rich with high-value ecological assets, are home to Victoria's only self-sustaining population of endangered freshwater catfish, and support threatened Western Swamp crayfish and Glenelg spiny crayfish, among other threatened flora and fauna. The Wimmera's lakes and waterways are also home to diverse bird populations, supporting 35 threatened species and 154 bird species overall.

Climatically, the Glenelg region is generally wetter than the semi-arid Wimmera region (Figure 2), the geography of the two catchments naturally resulting in different rainfall patterns. The Glenelg River also has more unregulated tributaries that often provide a large percentage of flow downstream of Rocklands River.

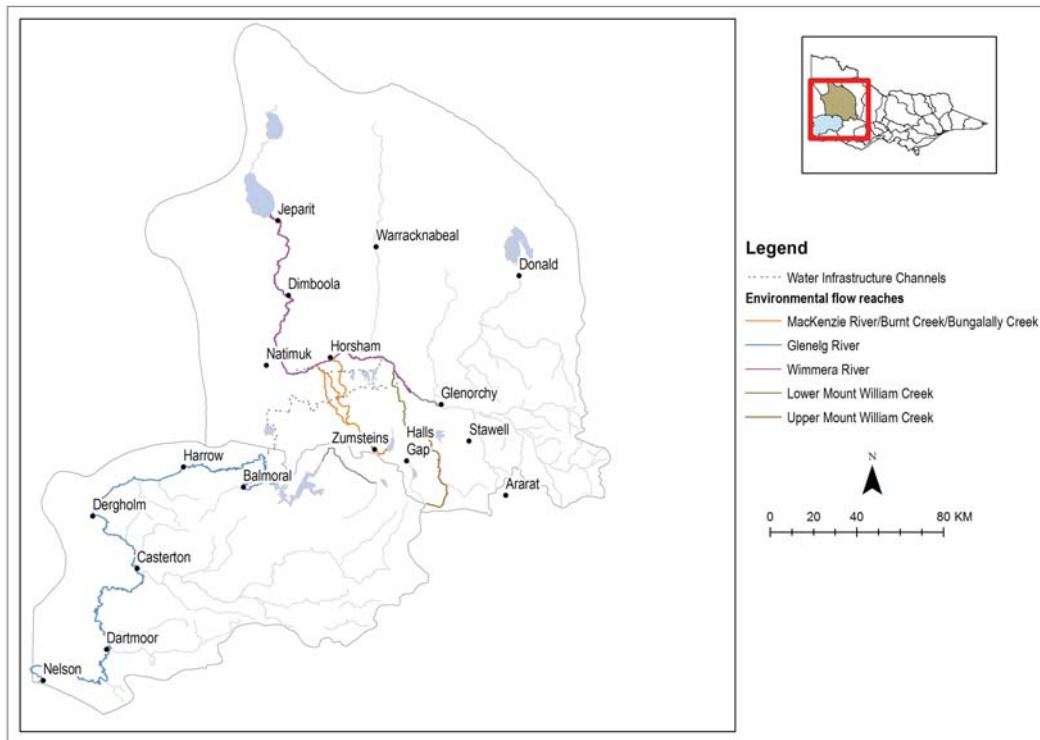


Figure 1. Map of the Wimmera and Glenelg river systems

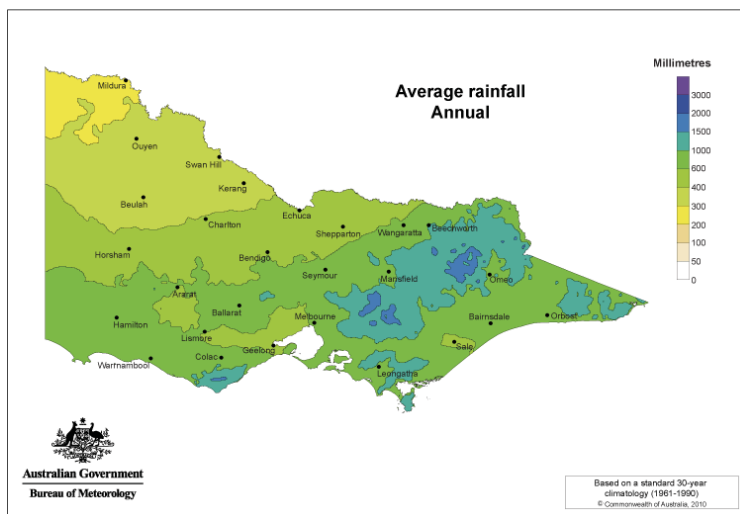


Figure 2. Average annual rainfall of Victoria (Source: (BoM, 2016))

Environmental water management in the western region

River regulation in the western region of Victoria began as early as the 1840s (Anderson & Morison, 1988). The infrastructure of the Wimmera-Mallee headworks connects the ecologically and climatically diverse Wimmera and Glenelg catchments. Water can be harvested from a number of waterways in both catchments, and while water can be transferred north from the Glenelg catchment to the Wimmera catchment, it cannot be transferred in the other direction. Significant harvesting means that since regulation, the hydrology of the Wimmera and Glenelg rivers has been strongly impacted and that both catchments are highly flow stressed (Fletcher & Fennell, 2012; Anderson & Morison, 1988; Westbury, Tiller, & Metzeling, 2007; SKM, 2002; SKM, 2003; Christie, 2007).

There is a long history of environmental water management in the western region of Victoria, formalised through the establishment of the original environmental entitlement - the *Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order 2004* (State of Victoria, 2004) which was replaced by the current entitlement - the *Wimmera and Glenelg Rivers Environmental Entitlement 2010* (State of Victoria, 2014) (the EE). The CEWH also hold an entitlement to regulated water in this system, however it has a lower level of reliability and has not yet been available to use, and therefore is not considered in further discussion.

The EE provides a discretionary entitlement to 40,560 ML (subject to annual allocations), as well as rules based passing flows and spills, to achieve environmental outcomes in the two systems. The water can be used, carried over for use in the next year or traded. It has provided a lifeline for the rivers since 2010, helping both systems to recover after the Millennium Drought and building resilience in the rivers to help the plants and animals recover after the inevitable dry periods. Environmental watering priorities include the Glenelg, Wimmera and MacKenzie rivers, and the Burnt, Mt William and Bungalally creeks (see Figure 1).

The Wimmera CMA manages the Wimmera River catchment and the Glenelg Hopkins CMA manages the Glenelg River catchment. There are knowledgeable and experienced staff managing both systems, informed by environmental flow studies (Alluvium, 2013a; 2013b), which provide a robust scientific basis for environmental watering. The flows studies for both systems were completed in 2013 and describe both the environmental values found in different river reaches, as well as environmental objectives to protect those values and recommended flows to achieve those objectives. The flow recommendations include baseflows for most reaches, as well as freshes of varying magnitude, frequency and duration.

The shared EE means that environmental water can be managed flexibly across the Wimmera and Glenelg systems and from year to year. Depending on environmental conditions and need, water can be prioritised for use across either or both the Wimmera and Glenelg catchments. The VEWH Commission is charged with deciding how the water is shared between the rivers as water becomes available through the year.

The VEWH's annual seasonal watering plan scopes out potential watering actions for each year in each Victorian system that has environmental water holdings, including the Wimmera and Glenelg rivers. A consistent scenario planning approach is used to inform the plan based on the seasonally adaptive approach outlined in the *Northern region sustainable water strategy* (DSE, 2009). The approach is used to guide the development of environmental watering objectives under the full range of potential climatic scenarios and is used to inform adaptive management as conditions change, from drought through to very wet conditions (Figure 4). This includes assessment of how much water might be required to achieve the environmental objectives.

Since the creation of the environmental entitlement, the assessment in the seasonal watering plan has shown that even with the water available under the entitlement, there is a significant shortfall in meeting the volume of water required to meet the environmental objectives in these systems. This shortfall and the shared nature of the entitlement means that there is competition between the two systems for the water available.



Figure 3. The Wimmera River at Dimboola during the Millennium Drought taken in February 2008 (left) and after environmental flow deliveries in April 2015 (right)



Figure 4. Examples of environmental watering objectives under different planning scenarios, illustrative photos are of the Wimmera River at Lochiel (Source: (VEWH, 2015c, p. 3))

Development of water sharing processes

There are some community concerns in the Wimmera and Glenelg catchments around sharing the EE, which are described in the *Western region sustainable water strategy* (DSE, 2011). In response to these concerns and as an action in the *Western region sustainable water strategy*, the VEWB carried out a review of the entitlement to consider the benefits of separating the EE (VEWH, 2013). As a result of the review, it was decided not to separate the EE, but to develop water sharing ‘rules’ to more clearly define how water would be shared between the catchments, improving certainty and transparency for the community and maintaining the flexibility inherent in the shared entitlement.

The ‘rules’ were developed in 2014 (VEWH, 2014), and largely reflect the criteria that the VEWB follow when making watering decisions (accessible in the *Seasonal Water Plan 2015-16* (VEWH, 2015b, p. 16)), outline the principles for management of the entitlement, and establish a collaborative regional advisory group to inform water use decisions - the Western Rivers Advisory Group (WRAG).

A drying climate

While there were 100% allocations after the floods in 2010-11, conditions since then have become increasingly dry. The highly variable nature of rainfall and catchment inflow in these systems means that the

ability to carryover environmental water is extremely important. In wetter years, water has been carried over to increase water availability in drier years.

Streamflow in the upper Wimmera River at Glynwylln in 2015-16 was the lowest on record (Figure 5(A)), and the third lowest on record for the Glenelg River (at Big Cord). Environmental water use and availability since the floods in 2010 is outlined in Figure 5(B), including assessment of the passing flow contributions to the rivers. The regulated volume available is a combination of carryover from the previous year and allocation made in that year. It can be seen in this figure that when unregulated flows were higher (2010-11, 2011-12), regulated deliveries were lower as environmental needs were generally met by the wetter catchment conditions. As more regulated water was accumulated and the catchment dried out, regulated deliveries increased (2013-14), before again reducing as both unregulated water deliveries and regulated water availability reduced (2013-14 and 2014-15).

Deliveries in 2015-16 were firmly aimed at protecting drought refuges. The low water availability and poor outlook meant that very little environmental water was delivered (approximately 7,970 ML), with as much water as possible reserved for limited watering in 2016-17. While reserving this water for carryover presents an opportunity cost, with 15% lost from one year to the next to cover evaporative losses associated with retaining water in storage, the risk of very low allocations in 2016-17 was considered by the WRAG to be higher than the opportunity costs associated with carrying over the water.

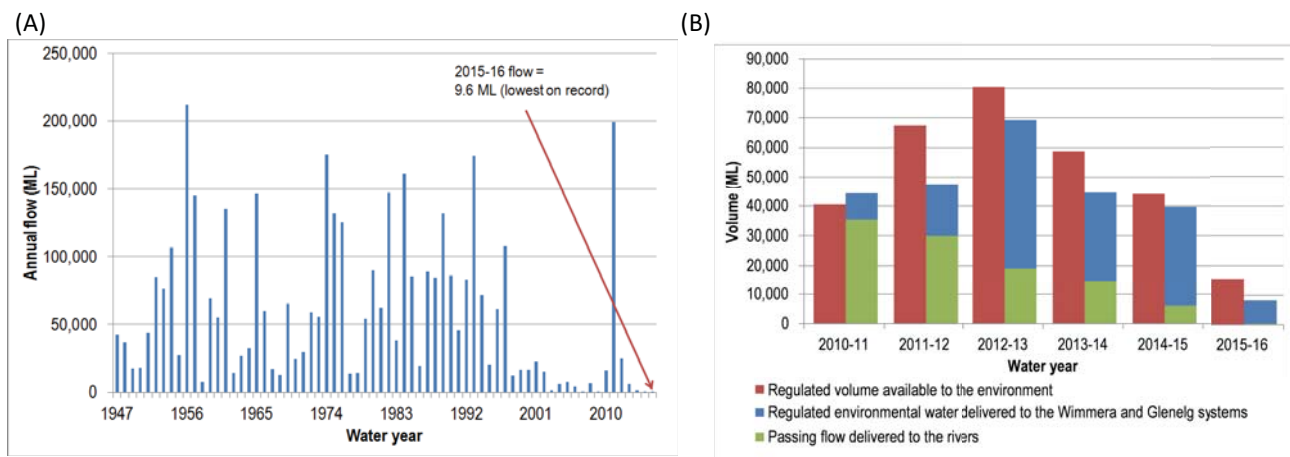


Figure 5. (A) Annual flows in the Wimmera River at Glynwylln (Gauge number 415206, upstream of any regulation and correct at 14 June 2016) and (B) Water availability, passing flow and regulated deliveries for the rivers in the EE

Method

The CMAs prepared seasonal watering proposals (GHCMA, 2015; WCMA, 2015b) outlining the proposed environmental watering actions in 2015-16, under a range of climatic conditions from drought through to wet conditions, based on environmental flow studies (Alluvium, 2013a; 2013b) and environmental water management plans, which at the time were in draft (GHCMA, 2016; WCMA, 2015a). These proposals then formed the basis of the VEWH seasonal watering plan (VEWH, 2015b).

Allocation in 2014-15 and 2015-16 was so low that the volumes available for use were much lower than anticipated through the planning process. As a result, additional prioritisation was required to assist in maximising environmental outcomes and minimising environmental risks such as fish deaths or vegetation dieback as a result of low water availability or poor water quality.

This prioritisation was facilitated through regular meetings of the collaborative, cross-catchment WRAG. A number of water availability scenarios were considered by the WRAG to assist in prioritising environmental water demands. Key considerations and discussions included assessment of the seasonal conditions, reflections on learnings gained from recent watering in each catchment, consideration of carryover requirements to mitigate against future uncertainty, advice on priorities within each catchment, and collective consideration of priorities between the two catchments. The advice gained through this process was used to inform VEWB Commission decisions on water use in each catchment.

Results

Collaborative assessment of priorities in 2015-16

The first shared prioritisation scenario considered by the WRAG in 2015-16 was a 'drought' scenario where a total of 20 GL would be shared between the catchments – which was expected to be the lowest volume of allocation that the environmental entitlement might have available in any one year. However in early 2015, it became clear that due to the dry catchment conditions and low rainfall in the region, allocations were likely to be significantly lower and available water would largely be limited to carryover. As a result, a further assessment was undertaken to prioritise watering actions under an 'extreme dry' 8,000 ML scenario.

The ability to achieve environmental benefits with such a low volume of environmental water was severely limited. The target location of watering in each system was scaled back to the upper reaches, given there was insufficient water to deliver to all priority locations. Objectives for water use were restricted to managing risks to the environment, protecting critical refuges and preventing adverse environmental impacts (such as fish deaths). Prioritised releases were restricted to the higher risk summer period, where water quality impacts were likely to be most severe.

The prioritisation identified trigger based freshes for the Wimmera and Glenelg rivers to improve water quality, baseflows in the MacKenzie River and upper Burnt Creek and a small delivery to a refuge pool on the Upper Mount William Creek at Mokepilly aimed at maintaining habitat for native fish. Due to the low water availability, the flows that were identified were significantly lower than those recommended in the flows studies. As a result, expert scientific input sought in 2014-15 was used to guide and improve confidence in the prioritised watering actions.

Once the peak summer period was over and the majority of deliveries complete, the WRAG reassessed priorities, considered the remaining needs of the systems and carryover requirements for 2016-17. It was considered important by the WRAG to ensure additional water was made available to mitigate potential emergency water quality issues (like a blackwater event or hypersaline conditions), despite the fact that this would potentially reduce carryover and therefore the volume available for use in 2016-17. This volume of water was made available, however as conditions were milder than expected and good rainfalls were experienced in May, the additional water was not required, and instead was carried over to support deliveries in 2016-17.

The WRAG was convened a number of times throughout the year to review and revise priorities and inform adaptive management, considering the conditions in each catchment, ecological risks, water availability and expected outlook.

Environmental outcomes of watering in 2015-16

Water quality in the Glenelg and Wimmera rivers responded well to environmental water deliveries, however there was an overall decrease in water quality throughout the year, especially in locations where environmental flows were limited or unable to be delivered to. Without the environmental water deliveries, it is likely that water quality would have deteriorated much more dramatically.

All of the rivers in the regulated system to some extent became a series of disconnected pools. The Glenelg River at Casterton effectively ceased to flow from November 2015 to May 2016, however refuge pools upstream of Dergholm were mostly maintained. In the absence of tributary inflows, and limited passing flows, environmental releases were even more critical to the Glenelg than in previous years. Deliveries in the Wimmera River only targeted Dimboola, as the volume of water available was too small to target outcomes to Jeparit (WCMA, 2016). As a result of no flow downstream of Dimboola Weir since March 2015, the riparian vegetation along the lower Wimmera River was severely stressed and surface water salinity rose from 2,000 $\mu\text{S}/\text{cm}$ to over 50,000 $\mu\text{S}/\text{cm}$ at depth. Due to virtually no unregulated flows, regulated environmental flows were critical in preventing refuge pools in the MacKenzie River, Burnt Creek, upper Mt William Creek and the Wimmera River from drying out.

Through close planning of the WRAG and conservative use of water by the CMAs, despite low allocations in 2015-16, and an opening allocation of 0 ML in 2016-17, 6,360 ML is available for use as at 1 July 2016. Given the anticipated delayed start to meaningful allocations, this carryover will be critical in supporting environmental watering in 2016-17.

Discussion

The WRAG has provided an effective platform for collaboration between the VEWH and the Wimmera and Glenelg Hopkins CMAs, particularly in the light of the recent drying climate and continued challenges of environmental water management in western Victoria. The process has harnessed the vast local knowledge and expertise of the CMAs, providing sound advice to inform VEWH decision-making.

The WRAG has provided a forum to improve consistency in planning and transparency in decision-making, allowing CMAs to effectively influence and inform water use decisions. Ensuring that a consistent approach is used in planning is particularly important to enable the vastly different values, risk and associated watering actions to be compared using consistent analysis. Trade-offs can then be made between systems, across catchments, and between years more transparently, and enable consideration of feedback and collaborative advice by WRAG members.

As Muro and Jeffery found (2012), participatory management requires a high level of commitment by stakeholders and an extended timeframe to realise the benefits of social learning. The success of collaboration in recent years has strong foundations in the increasing maturity of relationships between stakeholders and the culture of openness and trust that has been fostered through the WRAG process. WRAG interactions are becoming increasingly sophisticated as the group has formed its own social norms and shared understanding. This is consistent with the conclusions of both Cheng and Daniels (2005) and Muro and Jeffery (2012).

In order for this participatory management process to be effective in the long term, the WRAG needs to be able to adapt to changes in personnel and more challenging climatic conditions, while maintaining the collaborative, respectful and open culture that has developed.

There are challenges in using a collaborative prioritisation process when there are competing organisations and communities involved. The fact that the water is shared between the two catchments means that the two CMAs are advocating on behalf of their communities for a 'fair' share of the limited water that is available. The success of the WRAG depends on its members being able to consider prioritisation in a non-partisan way, to the extent possible. To date this has not been a barrier to constructive discussion, however it is in those situations where having an independent decision maker, like the VEWH is important.

Conclusions

The shared EE means that environmental water can be managed flexibly across the Wimmera and Glenelg systems across multiple years. Depending on environmental conditions and need, water can be prioritised for use across either or both the Wimmera and Glenelg catchments, however this brings challenges in comparing between the two systems and deciding on the best use of the water to maximise environmental benefits. The establishment of a collaborative process to inform prioritisation has improved consistency in planning and transparency in decision-making, fostering strong partnerships and promoting continuous improvement in environmental water management in the western region of Victoria.

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8ASM Full Paper

Wiesenfeld et al. – Collaborative processes for prioritisation: a case study from western Victoria

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