Challenges of sustainable management of the surface water resources in the Murray-Darling Basin

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INTRODUCTION

The Murray-Darling Basin (MDB) is the most significant river system in Australia. The basin covers 14% of Australia's mainland, with around 1 million km^2 across large parts of the four States: Queensland, New South Wales, Victoria, South Australia; and all of the Australian Capital Territory. There are 16 wetlands recognised under the Ramsar convention. The basin also supports more than 45 native fish species, over half of which are considered threatened or of conservation significance (Lintermans, 2007). The basin experiences much higher flow variability than any other continent in the world and is under stress as a result of over-allocations of water, prolonged drought, climate variability and emerging climate change. Currently, the total surface water (based on 1895–2006 historical climatic data) that flows into the rivers is around 28 900 GL per year (1 GL = 1 billion litre). Figure 1 shows the dominance of the southern portion in terms of water availability. Over 60% of the total surface water resource of the basin is found in this part of the basin. The Murray-Darling Basin Authority (MDBA) has been given the task of developing a Basin Plan for the integrated and sustainable management of water resources across the whole basin. When the Basin Plan is in place, it will address the wicked water problems or challenges being faced by the basin communities and the environment.

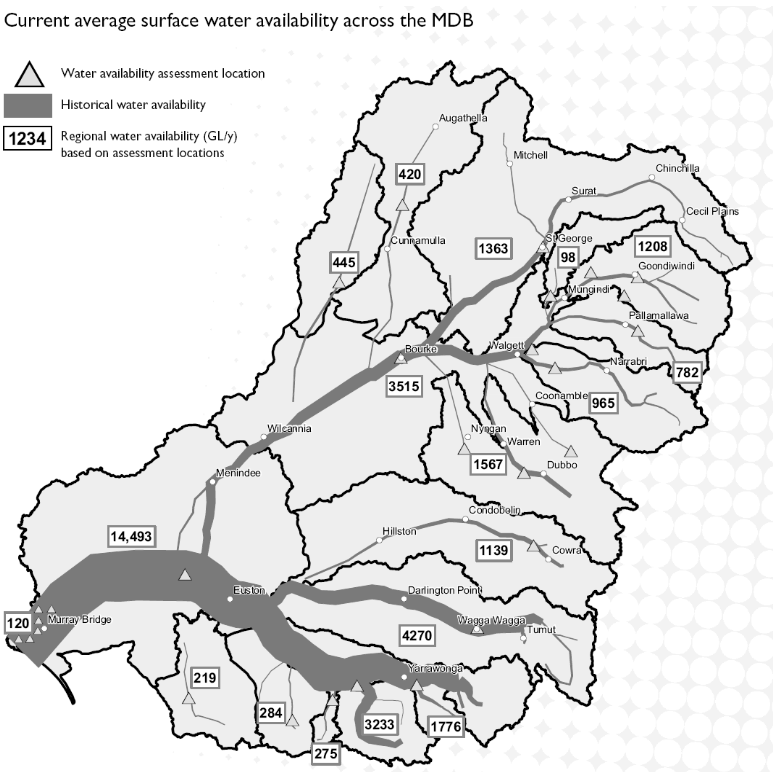

Fig. 1 Annual water availability (CSIRO, 2008).

CHALLENGES

Climate change and climate variability

With the persistent drought in Australia ever since records began (~1895), climate change has significantly contributed to deteriorating health of many of the Australia's waterways. Australia has one of the most highly variable climate regimes on the planet. Small variations in rainfall, temperature and evaporation are amplified when translated into inflows, making multi-year water resource management critical. There is a wide range of climatic conditions in the basin, including a strong east–west rainfall gradient and a strong northwest to southeast temperature gradient.

Water scarcity

Rising temperatures, low rainfall, manifold increase in water demands, and the historical over-allocation of irrigation water have all caused water scarcity. This poses a serious threat to the agricultural activity, regional economies, and the nature of the environmental assets that depend on this water across the basin.

Seasonality of flows

The variability of the flows in the basin ranged from 20% of the average flows (7100 GL) in 2008–2009 to floods (554%) in 1956–1957. Annual streamflow is most variable in the north of the basin and is least variable in the southeast corner of the basin (CSIRO, 2008). The storages to regulate inflows counter the impact of short term variability; however, ample storage cannot counter persistent lower inflow conditions like those experienced over recent years.

Environmental water needs

Enormous strain has been placed on the environment by combination of drought, climate change and past water-allocation decisions. The pattern of irrigation and environmental needs is quite different and can be conflicting. With current infrastructure, the natural flow regimes of rivers are reversed with high flows in summer and low flows in winter in line with irrigation needs. Lack of water and natural flooding are having a great impact on iconic wetlands and other environmental sites such as flood plains, waterways, flora and fauna.

Surface and groundwater connectivity

Surface and groundwater systems are not separate resources, but are components of one system. In strong connected systems, groundwater extraction may directly impact on surface water streamflow, by inducing leakage, or intercepting stream baseflow, over short and long time-frames. There is the challenge of double accounting one resource, and integrated management is critical for meeting the objectives of the Basin Plan.

Water quality

Salinity is arguably the highest-profile threat to water quality in the basin, with risks most pronounced during the extremities of the climatic sequence (MDBA, 2009). Management of salinity across the various landscapes is underpinned by the Basin Salinity Management Strategy (BSMS) that holds jurisdictions accountable for land and water management actions. Management efforts are continuing to reverse the trend of water quality decline in the basin.

THE BASIN PLAN

In accordance with the *Water Act 2007*, the Murray-Darling Basin Authority (MDBA) is preparing a Basin Plan for the management of the basin water resources. The Plan will ensure that future water use is placed on a sustainable footing so that there is enough water for a healthy environment as well as other uses. A mandatory requirement of the Basin Plan is setting of Sustainable

Diversion Limits (SDLs) for surface and groundwater. Most water users in the basin hold a license to take water, referred to as an "entitlement". Water extractions from the Murray River are subject to the Cap on diversions that applies to most rivers in the Murray-Darling Basin. The Cap limits water use to the volume of water that would have been diverted under 1993–1994 levels of development. Based on 1895–2006 scenario analysis, the average consumptive surface water use across the basin is 11 327 GL per year, with irrigation being the biggest user by far. The new arrangements include certain principles for the apportionment of environmental water. The diversions from unregulated watercourses and sections upstream to the storages are unmodelled parts of the SDLs. However, not all surface water resources are included in the Basin Plan modelling framework. Other authorized uses like interception activities from farm dams (stock and domestic rights, and commercial purposes) and commercial plantation forestry are also included in the plan. Levels of use throughout the basin can be represented by the average streamflow changes (shown in Fig. 2) in each region based on 1895–2006 modelling. The draft Basin Plan is underway and will be released by mid 2010.

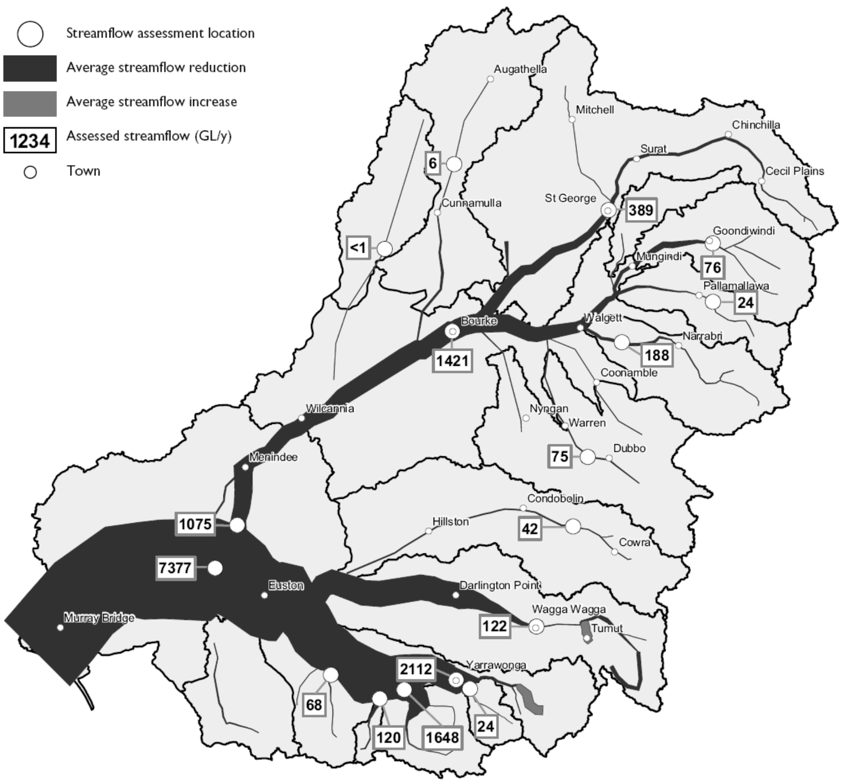

Fig. 2 Changes in average annual streamflow as a result of water resource development (CSIRO, 2008).

Acknowledgements This work is mainly based on the findings from the CSIRO Sustainable Yield Project. The authors greatly acknowledge the support from CSIRO research staff.

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