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Enhancing environmental water management in Source: decoupling spell identification from ordering at environmental flow nodes

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Abstract: Environmental flows are critical to sustaining aquatic ecosystems and supporting biodiversity. Water for the environment is one of the key elements of the Murray-Darling Basin Plan. This has seen water recovered from communities, industries, and irrigators to ensure that there is sufficient water to sustain the natural ecosystems of the basin. As the number of water licences held by environmental water managers increases, how this water is managed needs to be represented in the River System (hydrological) models that underpin long-term planning processes.

eWater Source is Australia's National Hydrological Modelling Platform. It needs continual development to allow users to better represent key aspects of the water balance and water management processes relevant to Australia. In the Murray-Darling Basin, water set aside for the environment falls into two categories: planned and held environmental water. Planned environmental water relates to rules set out in policy documents. These may include things like minimum flow requirements that help describe how to operate the river systems. Planned environmental water is incorporated into Source models using specific nodes, such as minimum flow nodes. In some cases, planned environmental water may be placed into environmental water accounts to be managed alongside other licences held by environmental water managers. The modelling of held environmental water is complex; it requires the model to be able to decide when and where water should be ordered and how much water should be deducted from accounts. Planning timeframes may span several years, rather than the annual timeframe typically used to model demands from industry, town water supplies, and irrigation.

eWater Source uses environmental flow nodes (EFNs) to represent environmental water requirements, and an environmental flow manager (EFM) to determine which of these requirements will be met given water availability. Initial implementation of the EFNs and EFM functionality in Source indicated limitations in ordering, tracking, and debiting environmental water. Ordering and success were tightly linked: spell success was determined by comparing ordered events with observed flows at the EFN location, adjusted for a configured minimum travel time. In practice, accurately predicting travel times from release points to the EFN is challenging. Variability due to attenuation and operational constraints often leads to water arriving too early, too late, or spread over a longer period, resulting in misalignment with target flows in the ordering. This limitation forced users to configure duplicate actions at EFNs to track and order different spell types.

This resulted in eWater working with the Murray-Darling Basin Authority (MDBA) and Basin States to improve environmental flow functionality in Source. Separating the observation of spells from ordering, along with enhancements to event triggering, has allowed users greater flexibility in configuring environmental demands. We use three examples from the Murray, Murrumbidgee, and Loddon River Systems to demonstrate how these enhancements improve the ability to model the use of environmental water portfolios in eWater Source. The Murray example explores how in-stream and overbank requirements at Yarrawonga can be delivered opportunistically or forcefully depending on water availability and system conditions. The functionality also enables recognition of environmental requirements met through unregulated flow or delivery of other operational or consumptive needs. Using the Mid-Murrumbidgee Wetlands, we demonstrate how the spell observer simplifies model configuration by removing the need to duplicate spell-based actions for tracking events. The Loddon example shows how spell observation can be used in conjunction with spell cancellation functionality to model actions requiring multiple spells in a season.

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