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Modelling stormwater harvesting for environmental flows

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Abstract: As the climate changes and population increases, the water industry increasingly needs to explore alternative water sources. Historically, stormwater has been an underutilised water resource which has the potential to improve social, economic, and environmental outcomes.

Industry is still coming to understand the full range of capability and limitations of Australia's National Hydrological Modelling Platform, e-Water Source. Sharing learnings from successful applications of this software, such as this study, is an important part of progressing the field of water resources modelling.

This study focuses on how the Sunbury Stormwater Harvesting Scheme (SSHS) could be operated to improve environmental outcomes in Jacksons Creek at Sunbury. The SSHS is a project in which a 19 km^2 growth area 35 km north-west of Melbourne (Victoria) will be developed to incorporate wetlands and stormwater harvesting ponds as well as a network of pipes to pump stormwater to a 300-420 ML storage basin. In the long term, this stormwater resource may be utilised for potable or non-potable water reuse, however, this may take several decades to come to fruition as Victorian water policy does not currently allow for potable reuse. As an interim plan, the harvested stormwater flows are proposed to be released into Jacksons Creek for environmental benefits.

A catchment-based Source model has been used to estimate the flows in Jacksons Creek under current, 2028 and 2040 hydro-climatic conditions. This involved combining rainfall runoff model-generated streamflow with wetland-generated flows under changing climate and land use, at different stages of the SSHS development. Climate change scenarios assumed an emissions scenario of RCP8.5 and high climate change. The model was calibrated to streamflow gauge data under current conditions, aiming to best match flows between 1 and 300 ML/day as these are most relevant for the stormwater harvesting. The results from the Source model are to be used to inform a strategy for stormwater releases with the aim of improving environmental flow compliance and staging potential augmentations of the storage.

The results of the study indicate that utilizing the SSHS for environmental flow will achieve positive impacts. Table 1 presents the results of the study, showing that compliance with environmental flow requirements will decrease in 2028 and 2040 without the SSHS. With the harvesting scheme, environmental outcomes can be significantly improved, particularly through increasing summer and winter low flows and to a lesser extent through increasing the number of freshes occurring per year. By comparing the results of the. 2028 scenarios with storage of 300ML versus 420 ML, we can determine that increasing the size of the storage from 300ML in 2028 will not result in any significant improvements in environmental outcomes. Therefore, the most cost-effective option is likely to be to build a 300 ML storage by 2028 and upgrade to 420ML by 2040.

Table 1. Environmental flow compliance results for Jacksons Creek under SSHS scenarios

Compliance criteria	Base case	2028 (no SSHS)	2028 + 300 ML storage	2028 + 420 ML storage	2040 (no SSHS)	2040 + 420 ML storage
Summer low flows (% days compliant)	61	64	94	94	62	96
Winter low flows (% days compliant)	28	17	37	38	15	44
Total complying freshes (events / year)	4.6	5.3	8	8	5.1	8

Source is a valuable tool for predicting plausible future streamflows. Stormwater harvesting for environmental flow has the potential to greatly improve waterway health. Combining the joint benefits of environmental flows in the present with the potential for ensuring potable water supply in future is an effective way to balance today's urban growth with future environmental and potable water needs.

Keywords: *E-water Source, stormwater harvesting, water resources modelling, environmental flows*