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Water resources modelling in Melbourne: Current status and future directions

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Abstract: Planning for efficient management of water resources is a key function of Melbourne Water. This planning considers the uncertain future conditions and a mix of water sources ranging from low-cost catchment sources through to higher cost sources including desalinated supply as well as potential future water source options. In undertaking the planning, Melbourne Water as the resource manager for the supply system engages with the water entitlement holders; Melbourne's three retail water companies, regional water companies that receive supply from Melbourne system, the Victorian Environment Water Holder, as well as the Victorian Department of Energy, Environment and Climate Action. The range of stakeholders makes the planning very comprehensive; however it relies on timely information that is easily understandable by a diverse group.

Key information for water resources planning is produced using water resources modelling assessments. These assessments inform planning activities including: (1) water supply strategy development (2) water resource augmentation (3) determination of the volume of water needed from high-cost sources (4) asset transformation options, (5) drought preparedness, (6) routine water storage projections and (7) environmental flow planning.

In informing the above example areas of planning, water resource simulation modelling undertaken using eWater Source modelling platform provides information in various forms including: (1) climate change impacts on future water supply availability (system yield), (2) need for additional water sources under various plausible scenarios, (3) volumes of water required from higher cost sources under various scenarios (4) water resources implications of asset transformation projects, (5) water storage during droughts and the implications of mitigation options, (6) projections of water storage volume considering climate outlooks, and (7) effective ways to provide water for the environment considering available allocations and urban water supply security. In addition to simulation modelling, optimisation modelling is undertaken as required to identify options that provide optimal trades-off between multiple objectives such as cost minimisation and water supply security maximisation.

There are challenges and improvement opportunities in communicating the above information to stakeholders. As an example, the concept of system yield or the potential range of system yield, while clear to technical experts, is not easily understood nor does it provide answers to all the questions raised by stakeholders. Yield estimates are therefore supplemented or sometimes replaced by modelled system behaviour projections that provide additional or alternative information. Another example area is multi objective optimisation which identifies a range of equally good planning solutions that provide optimal trade-offs between objectives. These solutions are based on modelled objectives that often represent a subset of the many complex objectives involved in managing a large water supply system. Additional and easily understandable information is therefore required in such communications. The type of information required may also vary over time, depending on changes in stakeholder needs, which calls for flexibility in modelling processes and tools.

Considering the current and future needs, Melbourne Water has implemented modelling improvements as well as supplementary systems and tools including cloud-based systems for modelling documentation, model/data repository that can be shared with internal and external stakeholders, and model run and output processing/automation tools. Future directions in water resources modelling include the development of functionality to assess water sourcing options covering both centralised and local/urban water supply sources, and further developing the integration and accessibility of models, data, processing/automation tools and outputs through an online stakeholder interface. The latter is driven by the need to further improve information-provision, assist in participatory decision-making processes, and enable Victorian water grid assessments involving multiple water companies through online linkages of the models of various companies as needed.

Key aspects of the status, challenges, and potential improvement opportunities will be presented, and future directions will be elaborated with a view to obtaining feedback on further developing the modelling tools and supplementary systems.

Keywords: *Water Resources Planning, Water Resource Modelling, Water Supply Security, eWater Source*

