

Can real-time control technology deliver environmental flows to protect urban streams?

3 x PhD Opportunities



These three PhD projects, funded by the Australian Research Council's Linkage Program, in conjunction with Melbourne Water, South East Water and Yarra Ranges Council, will test whether a network of real-time controlled (RTC) rainwater tanks ("smart tanks") on public and private land, and on large water storages, can return a more natural flow regime to Monbulk Creek (in Victoria, Australia), with the aim of improving the health of the stream ecosystem, and improving the foraging habitat of a population of platypus. Three PhD studies are available relating to different aspects of this experimental approach to managing urban water: **hydrology**, **ecology** and **sociology**.

PhD1: Assessing the impacts on stream hydrology and hydraulics. Using flow measurements in the stormwater and stream network, you will investigate how the real-time controlled network of water storages affects the stream flow regime, and how that translates into the hydraulic environment (flow velocities, wetted habitat characteristics, etc). You will use the monitoring data to develop hydrologic and hydraulic models and use those to come up with alternative operating rules to govern how and when the storages release water to the stream. This project will also work in collaboration with the ARC Training Centre on Optimisation Technologies, Integrated Methodologies and Applications (OPTIMA: see optima.org.au), in a related project on optimisation algorithms for real-time control of work storages.

PhD2: Understanding the social sustainability of real-time controlled rainwater tanks in households. Installing networked "smart tank" technology on household rainwater tanks creates new possibilities for the ways in which people interact with urban water and with water agencies. Rather than simply being users of water, householders can become producers and co-managers of urban water for public benefit. In this PhD, you will use an exploratory, qualitative social research design to investigate the ways in which this technology transforms, and is transformed by, household practices. The PhD will involve interviews with householders, and novel methods to generate insight into the ways in which householders engage with new technology in the domestic setting. Applicants should have a social science background (sociology, human geography, or a related discipline) and previous experience of qualitative social research.

PhD3: Assessing in-stream ecological responses. In this study, you will investigate changes in a) in-stream habitat (in collaboration with PhD1), b) macroinvertebrate abundance and assemblage composition and c) platypus foraging behaviour in response to implementation of the real-time controlled flow releases. You will develop maps of instream habitat, guided by experts in stream geomorphology and ecology, and then assess the potential for increased wetted habitat to support food sources for platypus. You will validate this with monitoring campaigns to quantify macroinvertebrate abundance and assemblage composition and use novel Radiometry Long-Wave Infrared (LWIR) cameras to track the foraging behaviour of platypus. You will combine this with data from Melbourne Water using live-trapping and eDNA (environmental DNA) to build a complete picture of platypus response to the experiment.

These PhDs will be undertaken within The Waterway Ecosystem Research Group (<http://thewerg.org>), a group of researchers studying interactions between landscapes and running waters. We aim to generate knowledge and tools for achieving healthy streams and rivers in urban and rural landscapes. The group is made up of ecologists, hydrologists, chemists, geomorphologists and social scientists. Combined, these skills allow us to undertake novel interdisciplinary research, as well as fundamental and applied research within each of our own disciplines. We work in close

collaboration with other researchers and research programs from around the world, as well as our local industry partners

The PhD is open to Australian residents, but non-residents may be considered if their academic track-record would qualify them for an international scholarship (note: these are very competitive). Applications will only be considered where they meet the entry requirements for PhDs in the Faculty of Science at the University of Melbourne: <http://science-courses.unimelb.edu.au/study/degrees/doctor-of-philosophy-science/overview>

You must apply before 27th August 2021. To apply, please email tim.fletcher@unimelb.edu.au with a cover letter including your particular interest in and suitability for this project (outlining which of the three PhDs you are interested in) and a detailed curriculum vitae, along with a full academic transcript, and details of two academic referees.

Feel free to contact Tim Fletcher (timf@unimelb.edu.au) in the first instance for further information or to discuss your application.

For information about the research groups in which these PhDs will be held, see <http://thewerg.org>, <http://mwrpp.org> and <https://findanexpert.unimelb.edu.au/profile/23855-stephanie-lavau>