

## A message from the director



One year out from the completion of the Alliance's mandated five-year term in June 2012, the Board commissioned an independent strategic review of the Alliance's research program.

The review, by Dr Gary Bickford (Nestis Consulting) and Rod Lehmann (Water Strategies), found that the existing research program has provided a good return on investment for the

Government, in terms of cost-effectiveness and capacity building.

Its final report states that \$38 million in research dividends has been realised to date, from the \$19 million invested in UWSRA.

Also, the research community has seen a marked boost in its capacity in water research, with the creation of 36 additional full-time research positions, including six PhD candidatures, as a result of the Alliance's program.

The review found that the Alliance's research outcomes are of direct relevance to SEQ policymakers and planners, and have the capacity to be adapted into other jurisdictions.

It concluded that while "the Alliance has played a valuable role in delivering scientific inputs which inform water policy for SEQ, pressing research questions remain and the Alliance could continue to address these issues".

The Board is now exploring this with a view to making a formal approach to the State to extend the Alliance research program for another two to five years. Read more about that in Board News.

The review identified five key areas for additional research:

- **Climate change** and its impacts on water supply options and inflows to dams.
- **Decentralised systems** (including stormwater harvesting, the subject of this newsletter) and optimising rainwater tank systems and cluster-scale systems to produce quality water while reducing cost and energy footprint.
- **Portfolio management of diversified supplies** — optimising the water storage management for water supply security as well as flood mitigation and assessing any impacts on water security. This is also about being able to optimise the water storage management to cater for other water supply options such as desalination, recycled water and stormwater.
- **Economics of future supply options** — A greater focus is needed on the economic costs and benefits of varying supply options.
- **Cities of the future** — Water smart cities are all about looking at the range of options for water supply and total water cycle planning and management, making better use of supply options but also considering other factors such as recreational needs, amenities, green space and how all these things fit in with liveable cities of the future.

The authors said synthesis of findings and knowledge transfer of outcomes to government agencies and water utilities must be a priority to maximise the benefits of the research — these factors are very much guiding our program in its last year.

As well as publishing scientific papers and presenting results at conferences and in journals, we are putting significant effort into bringing research results together under key issues and publishing them in plain-English for planners, government agencies and the water utility sector.

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# Greenfield sites to use modelling

Stormwater should be considered in tandem with all other spatial elements in the process of planning greenfield developments, UWSRA Stormwater Harvesting and Eco-hydrology project leader Dr Brian McIntosh said.

With an initial focus on the Ripley Valley as a case study, the project team has developed a Geographic Information Systems (GIS) and spreadsheet modelling methodology to identify the location and relative characteristics of portions of land for stormwater harvesting and use in greenfield urban developments.

Stormwater is one of the last major untapped sources of water in the urban landscape. The average urban stormwater yield potential for SEQ is about 470 gigalitres per year (GL/yr). With 35 identified greenfield developments planned for South East Queensland (SEQ) by 2031 — resulting in an estimated 754,000 new households — the issue of where to establish stormwater sites for harvesting and use is particularly significant.

“The argument we are testing is that the spatial layout of a development determines the runoff and also the opportunities for using water,” Dr McIntosh, a senior lecturer in integrated water management at the International Water Centre, said.

“So, if you don’t consider the stormwater whilst you are doing the spatial layout, the risk is that you might preclude the opportunity for generating and using a substantial yield of stormwater as a resource.”

Dr McIntosh said the project team was taking a ‘whole of catchment’ approach, rather than simply focussing on the urban development within the catchment, to provide a more accurate calculation of likely runoff volumes.

He said a key outcome of the project would be the production of maps showing the location of harvesting points as well as the sizes, configuration, reliability and cost of supply of non-potable domestic and outdoor irrigation uses which could be supplied from each harvesting point.

The maps will be produced for stormwater harvesting under the current planned development at Ripley and under a densified version of the Ripley structure plan.

Dr McIntosh said the question of whether to harvest stormwater in one single (centralised) harvesting, treatment and storage location within greenfield developments or several, smaller (decentralised) stations — and the cost implications of that choice — were a key focus of the project.

“From an ecological point of view, it makes sense to harvest stormwater close to where the runoff is being generated, otherwise you end up with hydrological stress being exerted on creek ecosystems,” he said.

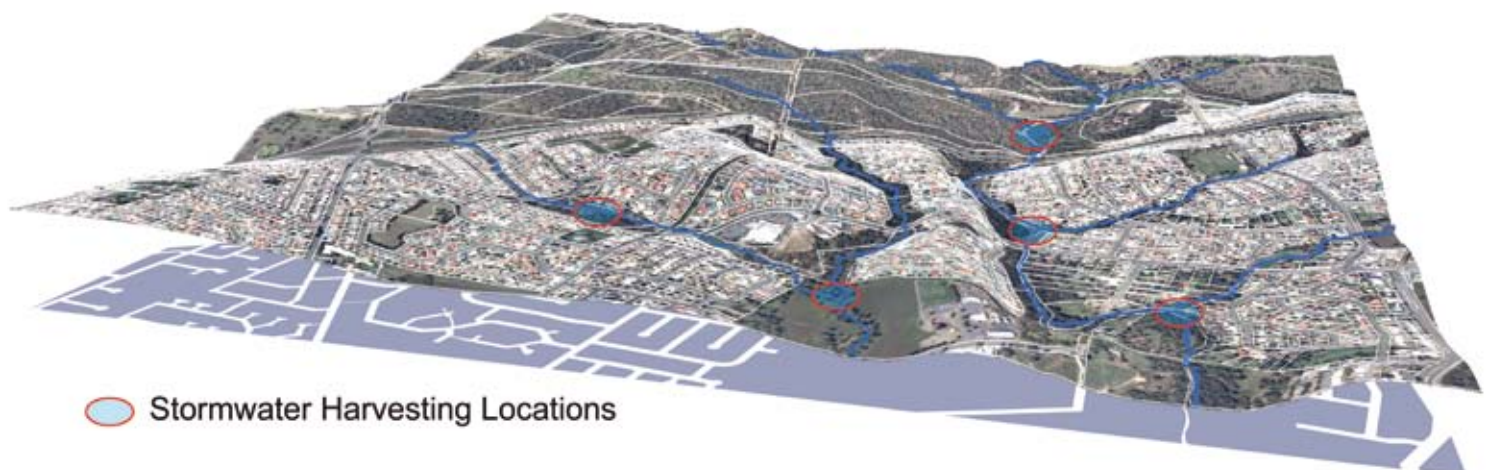
“One big harvesting point won’t do anything to prevent creek ecological degradation, but lots of smaller points will.

“However, harvesting smaller amounts from a number of locations has the potential to cost more in infrastructure terms.

“What we don’t have at the moment is a good sense of the extent to which a number of smaller harvesting points can supply demand, versus one large supply point — and we don’t have a really good sense of the relative difference in costs in a whole of catchment context.”

The project team is completing the storage, yield and reliability analysis of each harvesting scenario, as well as producing a cost assessment of collection, treatment and distribution.

Once the method has been proven for the Ripley case study, Dr McIntosh said it would be available for use in other future greenfield developments in SEQ.



# Research helps measure stormwater harvesting risks

There is a need for greater understanding of the potential health risks associated with stormwater harvesting and use to ensure good public health outcomes, according to the preliminary findings of an Alliance research project.

Dr Simon Toze from CSIRO is leading UWSRA's Health Risk Assessment of Local Source Waters project, one component of which is to investigate the pathogens and chemical components of stormwater at six sites in Brisbane with different land use.

The project team is assessing numbers of microbial contaminants in both base-flow and stormwater runoff samples by measuring faecal indicator bacteria (FIB) and several viral, bacterial and protozoan pathogens.

Dr Toze said preliminary results showed that levels of *E. coli*, enterococci and FIB found in stormwater runoff exceeded guideline values for recreational use of water.

He said these results were not cause for alarm, especially as stormwater in SEQ is only used for non-potable purposes. However, greater monitoring and some degree of treatment were required to ensure health risks were minimised for any potential uses of captured stormwater.

"Different organisms have different ability to cause disease, with some less likely to cause disease than others," Dr Toze said.

"Once we have done further testing and have a better handle on the average numbers of microorganisms in stormwater runoff, we can then look at the different scenarios in which people are exposed to that water.

"That will help us determine the levels of treatment required for different levels of exposure through a range of end uses, such as garden watering or irrigation of public open space.

"If we treat the stormwater to a certain level and people use it with a hand-held hose, for example, we can assess the health risk to the community associated with this level of potential exposure, and inform people about appropriate use of the water."

Dr Toze said a major part of the research was attempting to establish the sources of microbial contaminants.

"We can identify the risks based on potential identified sources. For example, if we see a particular pathogen coming into a catchment after every storm event, then we might be able to suggest there's



a problem with a particular source in that area and it may require correcting," he said.

"Otherwise, if elevated levels of pathogens are found only after certain storm events, then maybe the solution is a public education campaign warning to avoid contact with stormwater without taking proper hygiene measures."

Dr Toze said an important aspect of the study was trying to develop methods to determine whether the sources of contamination are from humans or animals.

"Animal sources are a lot harder to control than human sources as it is more difficult to stop native or domestic animals from defecating near water sources," he said.

"If we can also determine what type of animal it is, that can then help us determine what health risks may be associated with that particular source of bacteria."

Dr Toze said sampling would continue until April 2012 with a final report due from the project team in June 2012.

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We also share the results at targeted workshops, stakeholder events and the annual Science Forum. This year's Science Forum, held in September, was once again very successful. About 270 people attended over the two days of the Forum.



This year, Paul Doherty from SAWater (Adelaide) and Greg Ryan from South East Water (Melbourne) provided very useful perspectives on the approaches to total water cycle management planning in those States.

We also had guest presentations from international experts Dr Rolf Altenberger (Helmholz Centre for Environmental Research, Leipzig, Germany) and Dr Alistair Boxall (University of York, UK) on emerging environmental water quality issues and the use of bioanalytical tools in Europe and North America.

We received some excellent feedback from attendees about the Alliance research presented and the discussions in the panel sessions and throughout the forum.

We will host one more forum to wrap up the Alliance research program at the end of June next year. These fora are a key component of our knowledge transfer strategy and I would encourage readers to visit our website to view the proceedings, papers and posters on each of our research projects.

— Donald Begbie

# Project investigates frequent flow management options

Management objectives designed to minimise the impacts that urbanisation has on South East Queensland's (SEQ) hydrological cycle are achieving mixed results, according to modelling being undertaken as part of UWSRA's Stormwater Harvesting and Eco-hydrology project.

Implementation Guideline No. 7 for Water Sensitive Urban Design provides design objectives for urban stormwater management in SEQ. The frequent flow management objectives (FFMOs) for SEQ contained in the guidelines are designed to mitigate the increase in frequency and magnitude of stormwater flows associated with the urbanisation of catchments.

Researchers are measuring how effective the FFMOs are against a range of different extents of urbanisation in a variety of catchments, focussing initially on the largely non-urban, naturally vegetated Tingalpa Creek in south east Brisbane.

Research project officer Stephanie Ashbolt from CSIRO said the project team had developed a calibrated and validated catchment model representing Tingalpa Creek catchment.

The model has been used to simulate the effect of increasing degrees (or percent) of urbanisation on creek hydrology and to then simulate the impact of applying the FFMOs in reducing the impacts of urbanisation.

"The objective is to see what we can do to restore the creeks to close to pre-urban conditions — and the first step toward that is to see how effective the current frequent flow management guidelines are," Ms Ashbolt said.



"Rather than working with hypothetical catchments with hypothetical parameters we are working with real catchments and real data."

Instruments have been set up in 12 creeks south of the Brisbane River to establish a hydrological monitoring system to collect continuous stream flow data. Using rainfall data for the past 30 years, these catchments can be simulated to characterise their hydrology prior to the impact of urbanisation.

The results indicate that urbanisation increases the amount of runoff, the frequency of high flow events and the total number of days at high flow in local waterways. Higher impervious areas also result in decreasing frequency of low flow spells, but increases in the total duration of those spells.

Current FFMOs recommend the capture and management of the first 10mm of runoff from impervious surfaces (non-porous surfaces such as roofs, driveways and roads) where the total impervious surface is less than 40 percent; or the first 15mm of runoff from impervious surfaces where the total impervious surface is greater than 40 percent.

"The guidelines recommend capturing a certain volume of the flow every day that there is runoff. So, in our modelling, we have tested the kind of scenario that developers might have to follow to see what kind of an impact they make," Ms Ashbolt said.

"We have included both largely undeveloped and more urbanised sites. By including the undeveloped catchments, we are gaining a better idea of what we should be aiming for.

"The FFMOs are showing some good effect, but are less effective in some cases. That's not unexpected — the FFMO rules were set up as a clear and simple guideline and we don't expect a perfect result."

Results for Tingalpa show that the 10mm flow rule was effective at returning creek hydrology to pre-development characteristics, but that the 15mm rule resulted in more mixed outcomes — with high flows reduced to slightly below pre-development levels, and the total duration of both high flow and low flow spells reduced, but not to pre-development levels.

Ms Ashbolt said stormwater harvesting worked well for lower impervious areas (5–20 percent), but not as well for high impervious areas.

The project team will continue to test other catchments and also explore additional harvesting measures in these areas through simulating the effects of specific technologies (eg, bioretention features in combination with and without domestic rainwater tanks) of different sizes.

## 2012 Diary Dates

**21 February, 22 May, 21 August, 21 November** — Board meetings  
**17–18 April** — Research Advisory Committee meetings  
**19–20 June** — UWSRA Annual Science Forum

# Stormwater solutions must consider habitat

In order to preserve ecosystems, planners require a greater understanding of how water flow velocities in urban creeks after storm events affect organisms living in the stream, a UWSRA researcher said.

Dr Fran Sheldon from the Griffith School of Environment and the Australian Rivers Institute is leading a project, as part of UWSRA's Stormwater Harvesting and Eco-hydrology project, that seeks to understand the effects of water flow on three types of stream ecosystem: a natural (forested) catchment; an urbanised catchment; and a site that is designed according to water sensitive principles.

The differences across these three streams relates to the amount of impervious or 'hard surface' (house roofs, roads, footpaths, etc) in their catchments.

Dr Sheldon said previous research had shown that very small amounts of impervious or non-porous area, such as concrete surrounding an urban stream, or the presence of roads and roofs, had quite a significant impact on the diversity and abundance of life in the stream.

"That research was done in a temperate stream and we were interested to see whether the same results held in a subtropical system where we get significant downpours and the organisms living in the stream are used to sudden changes in velocity," she said.



"We surveyed 26 sites and we did find a similar level of decline in the diversity of macroinvertebrates, with only small changes in impervious area.

"We found a decrease in the abundance of sensitive macroinvertebrates, such as mayflies and stoneflies, and an increase in the abundance of worms and snails. Macroinvertebrates are a significant component of streams as they provide food for fish and also birds."

Dr Sheldon said the project team was now looking at three of the 26 sites (one natural, one urban and one water sensitive design), seeking to define the critical thresholds of water flow that would have an impact on creek life.

"We're running flume experiments to determine at what velocity of water flow the macroinvertebrates can no longer hold onto rocks," she said.

"We are also exploring whether it is just the water flow, or the availability of habitat within the stream —

natural streams have abundant riffles (or cascades) and pools, whereas urban streams are often just silty pools filled with shopping trolleys."

Dr Sheldon said the critical thresholds would help planners identify how much stormwater may need to be diverted from entering a stream rapidly, in order not to impact the ecology of the stream.

"In some rivers, planners have actually done habitat modifications where they've put structures back in the stream like logs, rocks and boulders to trap debris and help build the stream back up," she said.

"The difficulty of doing this in urban streams is that anything that contributes to localised flooding isn't going to be seen as an option.

"However, hopefully by understanding more about how flow affects the diversity of animals living in these streams, we can come up with realistic options for their restoration."

## Board News

The second-last meeting for the year was held on 23 August and the Board made the decision to approach the Government to seek an extension on the term of the Alliance for another two to five years.

As the Nestis report confirmed, there is a solid case for continuing the urban water research effort through the Alliance framework.

We have been talking with government and water industry sector stakeholders over the last month in order to better understand the big issues that are likely to drive urban water policy over the next five or so years and the research needed to provide answers for the major emerging issues.

This will then help us develop a proposal for future research

directions and put a formal proposal to the State Government for the establishment of a new urban water research program.

In the meantime, we are focused on wrapping up the current research program by June 2012 and the transfer and adoption of the knowledge generated to government and the water industry.

# Meet the researcher



**Dr Vicki Ross**  
Research fellow  
Smart Water Research Centre  
Griffith University

Vicki Ross is a research fellow at the Smart Water Research Centre, based at Griffith University, Gold Coast. She has a PhD in psychology from the University of Queensland. Her doctoral research involved developing a model for the factors that influence public trust and acceptance of recycled water projects. Vicki has worked in communications for the Queensland Water Commission and is now leading the risk communication component of UWSRA's Bioassays and Risk Communication project.

**Q. Can you tell us a bit about your career path to date?**

A. I started out wanting to have a career as a clinical psychologist but ended up becoming interested in applied social psychology. This looks at group behaviour and processes and can be used across a wide range of social issues. For example, we can apply theories to understand and predict things such as how people make decisions, or what factors might lead people to trust an organisation or not.

**Q. Where did your interest in water come from?**

A. When I was first introduced to recycled water issues I was amazed that we've had the technology available for quite some time to purify wastewater and stormwater to drinking water standards, and yet in many cases public perceptions have prevented these technologies from being taken up. It's quite a fascinating area. This is the same for a lot of new technologies — if there are negative public perceptions around them, it can have a huge impact on implementation. You really can't underestimate the power of public perceptions when introducing a new technology.

**Q. What's been the highlight for you so far working in this area?**

A. It was great to be able to conduct 'real life' Australian case studies for my doctoral research, particularly in Toowoomba, which was just before the plebiscite on recycled water was held.

It was such a salient issue at the time, so it was great to have that opportunity to study people's attitudes to what was such a controversial project.

**Q. What is it like as a social scientist working among scientists from 'harder' science fields?**

A. I think it's quite exciting because there's so much to learn and I'm really fascinated by the challenges that scientists have in getting their work taken up by government and industry. People who write policies and regulations have to have the confidence in the science so that it can be used within the industry. The research around the challenges of translating scientific results into policy and implementation is a really interesting area.

**Q. How will the work you're doing contribute to improving water security in Australia and potentially internationally?**

A. With the Bioassays and Risk Communication project I am evaluating a science communication workshop as an educational tool and looking at the barriers and enablers to communicating science. I would hope the results from this would encourage more science communication initiatives because this will facilitate water policy and regulations that are based on the best available science, hopefully leading to best practice within the water industry.

## Publications

For a list of UWSRA publications including journal articles, reports, conference papers and annual reports, visit: <http://www.urbanwateralliance.org.au/publications>

# Water facts

1. The amount of stormwater runoff in urban SEQ is estimated to be an average of 470 gigalitres per year (GL/yr), ranging from 245 to 750 GL/year, with rainfall variability year to year being a significant source of uncertainty.
2. A 2007 report by PMSEIC estimated stormwater yield potential in SEQ at 375 kL per household per year.
3. New data shows the average mains water savings from households with internally plumbed tanks in 2009 and 2010 was more than 58 kL/household/year across the SEQ region, which is equivalent to about 50 L/person/day or approximately one third of total mains water supplied.
4. Figures supplied by the SEQ Water Grid put current water consumption in the region at 689 megalitres (ML/d) or 154 L/person/day.
5. A study into the influence of the January floods on the decay of selected microbial pathogens in Wivenhoe Dam found no noticeable difference in the decay rates of *E. coli* and *Salmonella* (approximately seven days for a 90 percent reduction).
6. An assessment of the efficiency of wastewater treatment plants at removing 11 key organic micropollutants showed firstly that most compounds were removed by greater than 95 percent and secondly that the aerobic steps were more effective than anaerobic steps at removing the compounds.

## Conference alert

Below is a list of conferences happening around the world in coming months that may be of interest to people involved in water research or industry

*(UWSRA is not necessarily affiliated with these conferences.)*

**First International Conference on Water and Society**  
5–7 December 2011, USA

**7th Annual Water Symposium**  
24 February 2012, Sydney

**6th Annual NSW Water Industry Engineers and Operators Conference and Exhibition**  
28–29 March 2012, Tamworth, NSW

**2012 Global Water Summit**  
30 April–1 May 2012, Italy

**OzWater 2012**  
8–10 May 2012, Sydney

**Global Conference on Oceans, Climate and Security**  
21–23 May 2012, USA

**2012 International Water Conference**  
4–8 November 2012, USA

## About UWSRA

The Urban Water Security Research Alliance (UWSRA) is leading water research and security in South East Queensland (SEQ) through a \$50 million, five-year partnership between the Queensland Government, CSIRO's Water for a Health Country National Research Flagship, The University of Queensland and Griffith University.

UWSRA is addressing SEQ's emerging urban water issues through targeted, multidisciplinary research into water security and recycling.

It is Australia's largest, regionally focused urban water research program, contributing to a national effort to research water solutions for Australia.