CRC for
Water Sensitive Cities

Program C: Future Technologies | Project C1.2 | Project duration: July 2012 – December 2014

Cities as water supply catchments – Risk and health: Understanding stormwater quality hazards

Overview

Harvesting and reuse of stormwater runoff provides ecosystem services and increases water security. Impediments to the implementation of stormwater harvesting systems are mainly related to concerns regarding potential public health risks. Testing stormwater for micropollutants, toxicity and pathogens is costly and time consuming and has not been undertaken on a large scale, particularly for raw or blended stormwater.

The project aims to characterise the chemical, microbial and toxicological quality of raw and blended stormwater in Australian catchments with diverse land use and climatic characteristics. Comprehensive water quality testing and characterisation which includes a broad range of regulated and non-regulated pathogens and micropollutants will be conducted. The project will apply in vitro bioassays (biological assessments of substances to determine their activity and the effect they have on a living organism) to evaluate toxicity to screen for chemical pollutants that cannot be measured. In addition, water quality data will be combined with data from catchment audits to increase knowledge regarding the influence of catchment characteristics on stormwater quality.

Key outcomes

This project addresses the knowledge gaps in understanding the human health risks associated with pathogens and chemicals in untreated stormwater. Information gained in this study will contribute to the improvement of guidelines for stormwater harvesting and the development of stormwater treatment technologies to provide fit-for-purpose water. Methodology recommendations for identifying hazards within a catchment and assessing and characterising catchment-specific risks associated with stormwater quality will also be developed.

Key findings on stormwater quality hazards in urban catchments

Through studies of urban catchments in Victoria, Queensland and New South Wales the project has shown that urban stormwater in some catchments can have characteristics similar to secondary treated wastewater, with remnants of pathogens found. This is an important finding that informs the selection of stormwater treatment technologies to produce fit-for-purpose water supplies.
The studies pinpoint a need for continuing research into the public health implications of pathogens, and recommend interim design and water quality guidelines for the use of stormwater for non-drinking purposes.

Pesticides and pharmaceuticals were found in samples from Victoria, Queensland and New South Wales, however, detection values were well below the human health guideline values outlined in the Australian Guidelines for Water Recycling: Augmentation of Drinking Water Supplies. Heavy metals were frequently detected at concentrations near or above guideline values. Caffeine was the only detected chemical that exceeded guideline levels.

High estrogenicity (female hormones) was found in two sampling events and could be related to sewage overflow; whereas genotoxicity (material that has harmful effects on genetic material), dioxin-like activity and oxidative stress response were found in only three of the samples where the stormwater drain was situated next to a heavy traffic road, confirming that road runoff is a potential source of contamination.

The presence of pharmaceuticals and food ingredients combined with detections of bacteria and viruses specific to humans suggest sewage ingress into stormwater is occurring more frequently than previously anticipated and stormwater will require treatment prior to reuse. The level of treatment required will be guided by risk management guidelines associated with the end use. Factors determining the effect on people's health included: the exposure route (ingestion, inhalation, skin contact); the volumes of water individuals will be exposed to; and the frequency of exposure.

An Australian Government Initiative

CRC AUSTRALIA

Project design

Sampling campaigns were conducted in catchments within Queensland, New South Wales, South Australia, Victoria and Western Australia. Catchments included sub-tropical, moderate or mediterranean-style regions and were classified as residential, commercial or industrial. Rainfall event samples were analysed for a range of chemical, microbial and toxicological parameters. Findings were collated into a water quality database on chemical contamination, pathogens and toxicity. Risk assessments were conducted on identified water quality hazards and priority hazards were identified. A catchment audit tool was developed to gather information on sewer and stormwater infrastructure age and design; land use; share of impervious surfaces; housing and traffic density; roofing materials; active transport modes; domestic pets and wildlife. The findings flowed into the characterisation and prioritisation of risks caused by chemical and microbial hazards in stormwater.

Another component focused on the use of different analytical methods as surrogates for particular risk factors, for example, the use of chemical analysis to qualitatively and quantitatively identify sewage ingress into the stormwater system. This is particularly important, as sewage ingress is currently believed to be one of the biggest risks to the microbial water quality of stormwater.

Outlook

The project is nearly complete with the final recommendations for industry on the risk assessment process being released by the end of 2014. Additional outputs of this project include:

- a water quality database on chemical contamination, pathogen and toxicity
- a characterisation and prioritisation of risks caused by chemical and microbial hazards in stormwater
- recommendations for the usage of chemical surrogates to characterise stormwater quality hazards.

About the Cooperative Research Centre for Water Sensitive Cities

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) brings together interdisciplinary research expertise and thought-leadership from Australia and the world to address current urban water management challenges facing our cities and regions. In collaboration with over 80 research, government and industry partners, it develops and synthesises knowledge into powerful tools and influences key players aiming to achieve sustainable, resilient and liveable water sensitive cities.

Further information

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