



Study establishes methods to assess recycled aquifer water

The Australian Government National Water Commission has funded a study to establish an approach to assess the quality of water treated using managed aquifer recharge.

Researchers at Australia's CSIRO Land and Water set out to determine if the end product would meet standard drinking water guidelines.

At the Parafield Aquifer Storage, Transfer and Recovery research project in South Australia, the team of scientists harvested storm water from an urban environment, treated it in a constructed wetland, stored it in an aquifer, and then recovered the treated water via a well.

The stormwater exceeded the Australian drinking water guidelines prior to treatment. Small amounts of faecal bacteria, elevated concentrations of iron, and other contaminants were found in the water. After undergoing treatment, however, the water collected from the aquifer had dramatically lower levels of all hazards. Further supplemental treatment was needed to remove some hazards, though the process shows potential if improvements are made.

"Overall, results from the assessment showed that the water produced via this process was of near potable quality," said Declan Page of CSIRO Land and Water. "This is the first reported study of a managed aquifer recharge scheme to be assessed following the Australian guidelines for a managed aquifer recharge."

CSIRO Land and Water is continuing research in an effort to develop a sustainable method for recycling water through an aquifer.

Source: American Society of Agronomy

Removing willows saves water

Removing weeping willows growing in the streambed of rivers and streams could return valuable water resources to river systems, CSIRO research has found.

The study into the water use of willows found that potentially more than 5.5 ML/year of water could be saved per hectare if willow canopy were removed where trees stood in-stream with permanent access to water.

"One megalitre is one million litres – the volume of water used by three average households a year. So the evaporative loss of one hectare of willows is enough for about 17 households each year," said project leader Tanya Doody. "A comparative study of native vegetation use lining the same watercourse showed willows could be replaced with native vegetation and the annual water savings would be maintained."

Funded by public company Water for Rivers, the project results have been published in the *Journal of Environmental Management*. According to Water for Rivers Project Director Phil Deamer, an estimated 220 ha of in-stream willows in rivers have been removed. "This removal has returned 1 200 ML/year of water that was previously lost to willows," he said.

Source: CSIRO

Electric nano-filter promises cleaner water for cheaper

American scientists are reporting development and successful initial tests of an inexpensive new filtering technology that kills up to 98% of disease-causing bacteria in water in seconds without clogging.

A report on the technology appears in *Nano Letters*, a monthly American Chemical Society journal.

Dr Yi Cui and colleagues from Stanford University, in California, explain that most water purifiers work by trapping bacteria in tiny pores of filter material. Pushing water through those filters requires electric pumps

and consumes a lot of energy. In addition, the filters can get clogged and must be changed periodically. The new material, in contrast, has relatively huge pores, which allow water to flow through easily. And it kills bacteria outright, rather than just trapping them.

The scientists knew that contact with silver and electricity can destroy bacteria, and decided to combine both approaches. They spread sub-microscopic silver nanowires onto cotton, and then added a coating of carbon nanotubes, which give the filter extra

electrical conductivity.

Tests of the material on *E. coli*-tainted water showed that the silver/electrified cotton killed up to 98% of the bacteria.

The filter material never clogged, and the water flowed through it very quickly without any need for a pump. "Such technology could dramatically lower the cost of a wide array of filtration technologies for water as well as food, air, and pharmaceuticals where the need to frequently replace filters is a large cost and difficult challenge," their reports states.

Source: American Chemical Society



'The pill' not to blame for oestrogen in drinking water – Study

Contrary to popular belief, birth control pills have been found to account for less than 1% of the oestrogens found in the USA's drinking water supplies.

According to scientists of the Programme on Reproductive Health and the Environment at the University of California, San Francisco, this endocrine disrupter enters drinking water supplies mainly from other sources. Amber Wise, Kacie O'Brien and Tracey Woodruff note ongoing concern about possible links between chronic exposure to oestrogens in the water supply and fertility problems and other adverse human health effects. Almost 12 million women of reproductive age in the USA take the pill, and their urine contains the hormone. Hence, the belief that oral contraceptives are the major source of oestrogen in lakes, rivers and streams.

Knowing that sewage treatment plants remove virtually all of the main oestrogen – 17 alpha-athinylestradiol

(EE2) – in oral contraceptives, the scientists decided to pin down the main sources of oestrogen in water supplies. Their analysis found that EE2 has a lower predicted concentration in USA drinking water than natural oestrogens from soy and dairy products and animal waste used untreated as a farm fertiliser. And that all humans (men, women and children, and especially pregnant women) excrete hormones in their urine, not just women taking oral contraceptives.

Some research cited in the report suggests that animal manure accounts for 90% of oestrogens in the environment. Other research estimates that if just 1% of the oestrogens in livestock waste reached waterways, it would comprise 15% of the oestrogens in the world's water supply.

To access the report, 'Are Oral Contraceptives a Significant Contributor to the Estrogenicity of Drinking Water', Visit: http://coe.ucsf.edu/coe/spotlight/env_hlth+wm/contraceptives_water.pdf.

Massive *Daphnia* genome leads to understanding gene-environment interactions

An international team of researchers, the *Daphnia* Genomics Consortium, has described the complete genome of *Daphnia pulex* (the water flea), opening the door to enhanced knowledge of this species and its response to the environment.

The team found that, despite its near-microscopic size, the humble *Daphnia* contains more than 31 000 genes, more than any other animal with a complete gene sequence, including humans. The findings have been detailed in an article in the journal *Science*.

"It's personally a major achievement,"

said W Kelly Thomas, Hubbard Professor in Genomics and Director of the University of New Hampshire's Hubbard Centre for Genome Studies. "This genome gives biologists and ecologists the tools they need to do genomic analysis on this organism from an ecological perspective."

The end product is a better understanding of what genes matter for organisms to cope with environmental stresses like pollutants and global warming and of the technologies necessary to understand how these genes function within an animal that is easily studied in water reservoirs around the globe.

Victory for Kalahari Bushmen as court ruling grants water rights

Botswana's Court of Appeal has squashed a previous ruling that denied the Kalahari Bushmen access to water on their ancestral lands.

With support from international organisation, Survival, the Bushmen appealed a 2010 High Court judgement that prevented them from accessing a well they relied on for water. Among others, the panel of five Appeal Court judges found that the Bushmen have the right to use their old borehole, which the government had banned them from using; that they have the right to sink new boreholes and that the government's conduct towards them amounted to 'degrading treatment'.

In 2002, the Bushmen were forcibly evicted from their ancestral lands in the Central Kalahari Game Reserve by the

Botswana government. They took the government to court and after four years, won a landmark ruling that said they had been evicted illegally and unconstitutionally, and that they have the right to live on their ancestral lands.

However, since then, the government has continued to prevent the Bushmen from returning home, by banning them from accessing a well which it capped during the evictions. Despite the lack of water, many Bushmen have returned to their homes, surviving off rainwater and melons, and making arduous journeys by foot or donkey to fetch water from outside the reserve.

More court action followed and a 2010 ruling was made in favour of the government. This has now been overturned by unanimous decision of five Appeal Court judges.



Arguably, more is known about the ecology and stress biology of the water flea than any other animal. The genome project was conceived with an expectation that many new gene functions would be uncovered when studied in light of the animal's natural environment – not necessarily expecting to discover many more genes.

Yet, *Daphnia's* genome is no ordinary genome, it turns out. "*Daphnia's* high gene number is largely because its genes are multiplying, by creating copies at a

higher rate than other species," explained project leader John Colbourne. "We estimate a rate that is three times greater than those of other invertebrates and 30% greater than that of humans."

According to Colbourne, one theory is that *Daphnia* is so good at adapting to so many environments because it has this huge catalogue of genes to call upon. The researchers note that more than a third of *Daphnia's* genes are undocumented in any other organism – they are completely new to science.



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New urinal valve saves water



The growing precariousness of South Africa's water situation is prompting the need for waterless systems of all kinds, including waterless sewage and urinal disposal systems.

One such system currently being introduced to the market by Sannitree is the Free Flowing Water Free Urinal Valve (patent pending). According to Sannitree founder Mike Mayne (pictured with the company's John Williams), the new valve is a breakthrough invention because it not only drastically reduces the use (and cost) of water, but it is also far more hygienic than conventional systems.

The traditional men's urinal found in today's hotels, restaurants, office complexes and sport clubs has a U-bend below the bowl. This can and does keep within the system the odours and gases that are generated by urine when it is mixed with water impurities. Long experience, however, has shown that the U-bend is by no means 100% effective in this respect. This technology does go out of order, leaving permanent, unpleasant odours and gases in the atmosphere. Furthermore,

traditional urinals are exceptionally wasteful of water – every time they are flushed they use up to two litres of water.

In his search for a solution, Mayne hunted for a local manufacturer that could design and supply a one-way waterless valve for urinals. The final design features an airtight seal and a deodorising dome which, it has been shown, entirely eliminates the need for water while efficiently containing the entrapped odours and gases. The patent for the system is now pending.

Tests have proven that the unit is also capable of dealing with the traditional problems experienced by flushing urinals. These include encrustation and blockages (which can cause flooding). "In an efficient, water-free urinal bacteria cannot thrive because they need moisture to reproduce," notes Mayne.

The new design will fit 95% of all urinals, and can be installed by an unskilled worker. It is also easily cleaned. "The new system can save 1,5 million litres of water every year in a single-rise building," notes Mayne.

SA's largest desal plant supplied in record time



The largest seawater desalination plant in South Africa is now operational.

The 15 Ml/day plant, situated at Mossel Bay, is supplying water to Mossel Bay Municipality and PetroSA. The turnkey project was undertaken by Veolia Water Solutions and Technologies within 6 months.

In an earlier undertaking to alleviate the water crisis, Veolia constructed a municipal wastewater reuse plant for the municipality to supply PetroSA with purified water recovered from domestic sewage. The aim of this plant was to relieve the pressure on the municipal supply. It is one of several emergency projects launched to address the problem of water supply in the district.

The seawater desalination plant, located on PetroSA's logistics site at Voorbaai, is supplied directly by open seawater intake, just off Seal Island, about 600 m out to sea from the bay itself. The seawater is pumped to a pump station, and then into a holding

tank via drum screens, which screen incoming water to 500 microns in an effort to get rid of kelp, sea shells and other impurities.

Next, water passes through six filters before going to the reverse osmosis units for purification. The treated water is fed from the plant into split tanks. A dedicated tank of 5 Ml supplies PetroSA. The 10 Ml of water destined for human use in the other tanks is treated chemically to kill any bacteria and stabilise the pH balance before joining up with the municipal water line.

The project team faced various challenges in terms of ground space. The project also required Veolia to build its largest pressure water filters to date. In addition, time constraints warranted several special logistical arrangements for those parts that had to be imported. Last, but not least, there were environmental considerations to take account of.

The plant became operational at the end of January.

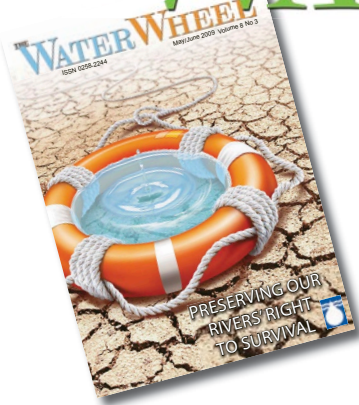


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New from the WRC

Report No: KV 234/09

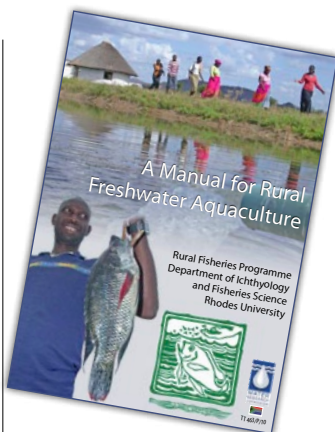
WRC Programme on Endocrine Disrupting Compounds (EDCs) Volume 4: Implementation of the Extended Research Plan on Endocrine Disruptor Chemicals in Water Resources (AEC Burger)

The WRC launched the EDC Research Programme to coordinate local research undertaken on this subject and also to involve other role-players such as government departments, industry and water suppliers in the research. This report is the last of a series, and reports on the implementation of the extended research plan as recommended in a previous volume. It gives an overview of the status of projects from 2006-2010 and recommendations for future research and actions to be taken in the WRC EDC Research Programme. The other reports in this series are: *Volume 1: Strategic Research Plan for EDCs in South African Water Systems (Report No: KV 143/05)*; *Volume 2: Implementation of a Research Programme for Investigating EDCs in South African Water Systems (Report No: 1402/1/08)*; and *Volume 3: Extended Plan for the EDC Research Programme of the WRC 2006-2010 (Report No: KV 228/09)*.

Report No: TT 463/P/10

A Manual for Rural Freshwater Aquaculture (Rhodes University)

In 2004, the Rural Fisheries Programme of the Department of Ichthyology and Fisheries Science, Rhodes University, completed a project on behalf of the WRC to assess the contributions of rural aquaculture to livelihoods. It became apparent that although the current contributions



were low, the potential was significant. To exploit this potential a new project was solicited by the WRC in 2005 and is co-funded by the Department of Agriculture, Forestry and Fisheries (DAFF). This project was formulated to address a number of issues, such as developing provincial aquaculture strategic plans, revitalising State hatcheries, training of extension officers and the development of a manual to complement the training. It is envisaged that this manual will continue to be modified and reviewed as aquaculture in South Africa grows in order to reflect the needs of the extension officers over time. The manual is not only intended for the training of extension officers, but is also resource material to be used in the field when interacting with farmers.

Report No: 1891/1/10

Laboratory and Pilot-scale Development of the Ambient Temperature Ferrite Process (NE Ristow & AR Brauer)

This project was commissioned in response to an opportunity to implement the ambient temperature ferrite process

(ATFP) as part of the CSIR Alkali-Calcium Desalination Process that was to be installed at the East Rand Proprietary Mines (ERPM) site in Germiston, Gauteng, treating 100 M³/day of acid mine drainage. The ATFP was developed previously at pilot scale, but the results were negative in terms of iron removal, and the development was continued at laboratory scale. Once the ERPM opportunity had been identified, it was agreed that the process development should be fast-tracked so that the ATFP could be included as part of the AMD treatment process.

Report No: KV 252/10

Rapid Enzymatic Detection of Organochlorine Pesticides in Water (B Pletschke; I Cockburn; P Adebisi & JS van Dyk)

In recent years, increased public awareness and interest in environmental issues have highlighted the problem and the effects of the high level of accumulated persistent pesticides and other toxins in the environment. The increased concern and attention around this issue has led to an increased need for effective methods of detection of these substances in potentially contaminated areas and systems. The ultimate aim of this work was to develop a rapid enzymatic assay for the detection of organochlorine pesticides.

Report No: 1831/1/10

A Systematic Approach to Sulphidic Waste Rock and Tailings Management to Minimise Acid Rock Drainage Formation (S Harrison; J Broadhurst; R van Hille; O Oyekola; C Bryan; A Hesketh; A Opitz)

Acid rock drainage (ARD) is recognised as a major challenge to South Africa. Re-examination of the manner in which waste materials are disposed from the mineral processing and extractions stages of mineral recovery is required to relieve the environmental burden created and reduce the timeframe of risk. In this study, the approaches to the removal of risk through removal of sulphur species were considered through both a paper-based review of key South African workings and a set of case studies addressing specific mineral wastes. Aspects of disposal of dump rock and tailings from mining operations processing mineral sulphides (especially pyrite) have been addressed, specifically with the focus of reducing capacity to form ARD through removal of the sulphidic component of the waste.

Report No 1670/1/10

Strategic Guidance towards Prioritising Stormwater Management Research in Human Settlements (J Burke & X Meyer)

The WRC identified the need to determine and prioritise stormwater research needs, particularly in the field of stormwater control and management. The objectives of this study were to build on the outcome of a previous project and further identify, characterise and prioritise stormwater management issues requiring attention in South Africa, within the context of human settlements. Among others, findings indicated that resources and support from the political level were limiting factors in proper stormwater management.

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