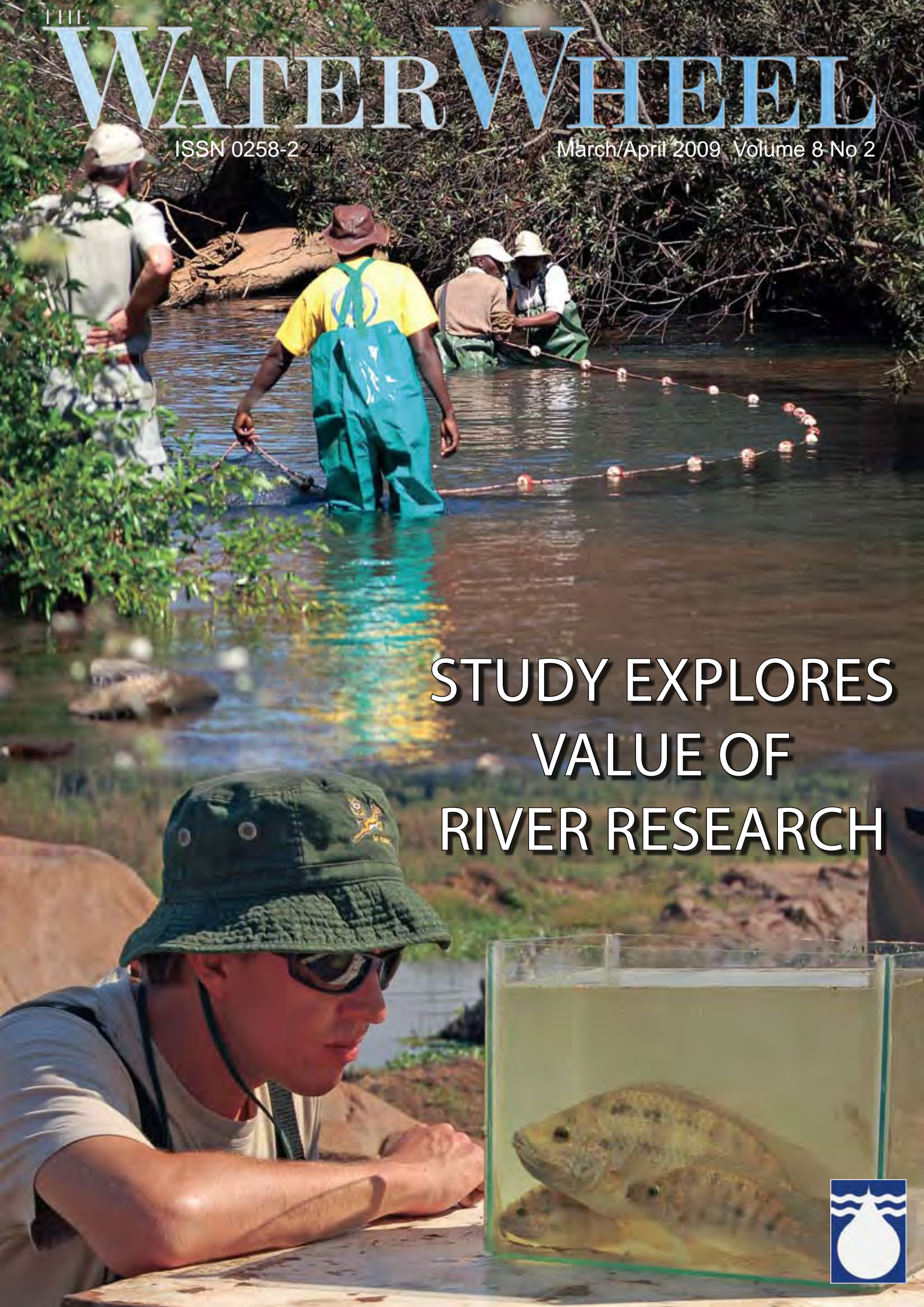


THE WATER WHEEL

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STUDY EXPLORES VALUE OF RIVER RESEARCH



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Mrs LB Hendricks, Minister of Water Affairs and Forestry, Extracted from an Address to the SADC Water Ministers Meeting, Mwanza, United Republic of Tanzania, 6 November 2008

“Cholera is spreading ... We are beginning to see a shift from Zimbabwe to South Africa. The situation is scary.”
Barbara Hogan, Minister of Health, Quoted in The Times Online, 28 January 2009

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- **Trevor Tutu**, Director, **DRIVING SOLUTIONS**
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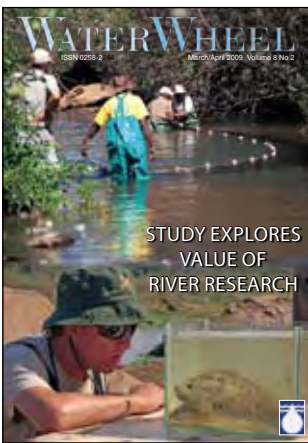


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Cover: A newly-published study highlights the good and the bad of the River Health Project. (See page 16).

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THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

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LETTER TO THE EDITOR

Praise for article on Vaal Barrage

Your article on the Vaal Barrage and Rand Water is an excellent one ('Vaal Barrage, Storing Water for a Thirsty City', the Water Wheel January/February 2009).

It should provide a historical perspective that human kind needs to take a long term perspective, even beyond our own lifetimes.

There is a small typographical error in your box on Johannesburg. The Rand Water Supply Board was constituted by legislation in 1903 not 2003!

**P. Camay (Past Chairperson of Rand Water),
Fordsburg**



Letters must be addressed to The Editor and can be faxed to (012) 331-2565 or E-mailed to laniv@wrc.org.za.

SA wine sector praised internationally for going green

South African wine industry representative, Wines of South Africa (WOSA), featured among the top five on the 2009 Green List published by UK magazine *Drinks Business*.

The list features the 50 most influential drinks companies, individuals and organisations when it comes to having a "strong environmental influence over many consumers." WOSA placed fifth, just behind US President Barack Obama, with multinational retail giants, Tesco, Carrefour and Wal-Mart in the top three positions respectively.

WOSA was praised for its involvement in the Biodiversity and Wine Initiative (BWI), a project managed by the World Wide Fund for Nature (WWF) and the Botanical Society of South Africa. The initiative is a strategic

partnership between the wine industry and the conservation sector, which promotes the adoption of biodiversity guidelines and environmental impact studies.

The BWI has led to protection of significant areas of the Cape Floral Kingdom, where over 95% of South Africa's wines originate. In less than four years, 140 local wine producers have set aside 112 550 ha for long-term conservation. This is more than the total national vineyard footprint of 102 000 ha.

Source: WWF



WATER DIARY

CLIMATE CHANGE

MARCH 3-6

The Department of Environmental Affairs & Tourism is hosting a Climate Change Summit at Gallagher Estate. Visit: <http://www.csummit2009.co.za>

WATER

MARCH 15-22

The Fifth World Water Forum will be held in Istanbul, Turkey. The theme is 'Bridging Divides for Water'. E-mail: m.giard@worldwater-council.org; Visit: www.worldwater-council.org

CLIMATE CHANGE

MARCH 23-26

An international conference, Greenhouse 2009: Climate Change and Resources, will be held in Perth, Australia. The conference is hosted by CSIRO in conjunction with the Australian Climate Change Science Programme. Visit: www.greenhouse2009.com

OXIDATION TECHNOLOGIES

MARCH 30-APRIL 1

The 5th IWA Specialist Conference on Oxidation Technologies for Water and Wastewater Treatment will be held in Berlin, Germany. E-mail: aop5@cutec.de; Visit: www.aspd5.com

Better hygiene could save moms', babies' lives

Simply improving hygiene practices could prevent some of the thousands of maternal and neonatal deaths which occur around the world every year, reports UNICEF.

The organisation launched its *State of the World's Children Report 2009* in Johannesburg in January. This year, the report focuses on maternal and newborn health.

Every year, more than 500 000 women die as a result of pregnancy or childbirth complications. Around 70 000 of these deaths are among girls and young women 15 to 19. A staggering 99% of maternal deaths take place in the developing world

where having a child remains among the most serious health risks for women.

At the same time, every year, some four million newborns die within the first 28 days of life from largely preventable causes. That is about 40% of all under-five deaths per year.

"Most maternal and neonatal deaths can be prevented through proven interventions, including adequate nutrition, improved hygiene practices, antenatal care, skilled health workers assisting at births, emergency obstetric and newborn care and post natal visits for both mothers and newborns," reported UNICEF Executive Director Ann Veneman.

"These interventions should be delivered through a continuum of care linking households to health systems. Research indicates that around 80% of maternal deaths could be prevented if women had access to essential maternity and basic healthcare services."



Partnership formed to preserve African heritage

The University of Pretoria (UP) has partnered with the Kara Heritage Institute (KHI) in order to expand knowledge and preserve the country's African heritage.

"The collaborative relationship between the two parties was born out of two distinct recognitions by both parties, reports Prof Hannes Rautenbach, Head of the UP Department of Geographic, Geoinformatics and Meteorology (GGM). "The first is that the KHI is the custodian of the unique living heritage of ancient and medieval Africa which has been preserved, inter alia, by the Queen Modjadji Dynasty, successor to the Mapungubwe and Great Zimbabwe Dynasties. The second recognition is that the GGM department plays a unique role in world-class research, development and training in

the atmospheric sciences, environmental sciences, geoinformatics and remote sensing, geomorphology and social geosciences in South Africa, the continent and beyond."

According to Prof Rautenbach, the collaboration provides a platform for the two parties to gain from each other's strength for the sake of promoting community engagement through creating awareness, training and research. The partnership has already seen the development of two projects, the first being a heritage education programme drawing around 60 youth from all provinces. A heritage education seminar is also being planned with the Department of Education and National Heritage Council to explore ways of combining heritage and indigenous knowledge systems into the school curricula.

Calling all groundwater specialists

The Geological Society of South Africa's Groundwater Division (Western Cape Branch) has called on groundwater experts to submit papers for the 2009 biennial groundwater conference titled 'Pushing the Limits', to be held from 15 to 18 November in Somerset West, in the Western Cape.

Session themes will range from managing resource limits and debating the limits of acceptable impacts to making decisions with limited data, pushing the limits of science and expanding the limits of understanding. The deadline for abstracts is 15 April.

For more information, go to www.kruger-associates.com/groundwaterconference2009/home/default.asp

State launches phase two of job-creation programme

Government is launching phase two of its Expanded Public Works Programme (EPWP) this month.

According to Public Works Minister Geoff Doidge R5-billion has been allocated over the medium term to scale up the programme, aimed at furthering job creation and abating unemployment. "The aim is to create two million full-time equivalent jobs for poor and unemployed people in South Africa so as to contribute to halving unemployment by 2014, through the delivery of public and community services," he said, speaking in Durban in February.

Phase two will have a fiscal incentive for public bodies to create EPWP employment by providing R50 for every person-day of work created. This will be phased in over the next two years to all sectors, provinces and municipalities.

From 2004 to 2008, phase one of the EPWP created more than 950 000 job opportunities.

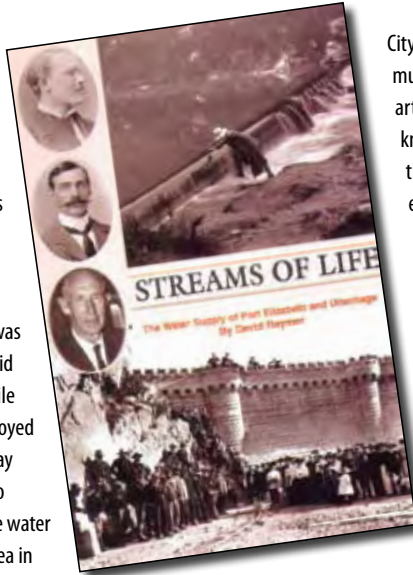
Source: *BuaNews*

History of PE water resource developed unearthed

A new book relating the fascinating history of the development of water supply infrastructure for Port Elizabeth and Uitenhage is now available.

Streams of Life – the Water Supply of Port Elizabeth and Uitenhage was researched by author David Raymer over 14 years while he was an engineer employed by the Nelson Mandela Bay municipality from 1980 to 2007. The book covers the water supply schemes of this area in the Eastern Cape starting with natural springs and communal wells from 1804 to the link with the Orange River Project in 1992.

The history has been compiled from official reports, brochures, files of the Port Elizabeth



City Engineer's Department, municipal archives, newspaper articles and Raymer's personal knowledge. Giving recognition to some of the early engineers and city engineers that made these schemes possible, the book contains more than 400 photographs.

For Raymer this was obviously a labour of love, and his passion for the field can clearly be seen. The book should make for an interesting read by history buffs,

while providing enough technical detail to keep engineers with a penchant for history entertained. To obtain a copy, contact the author at Tel: (041) 373-0180; or E-mail: elraymer@absamail.co.za. Copies are also available from Fogarty's Bookshop in Port Elizabeth (E-mail: fogartyscc@global.co.za).

WATER ON THE WEB

www.dwaf.gov.za/iwqs/rhp/naehmp.htm

The River Health Programme (RHP) Web page has moved. Information on the RHP, which assesses the state of health of rivers across the country according to set criteria, can now be found on the website of the Department of Water Affairs & Forestry.

www.waterfootprint.org

This is the website of the newly-formed Water Footprint Network, a collaboration of global groups aimed at working towards a common approach to water footprint measurement, accounting and reporting. The partners are World Business Council for Sustainable Development at the University of Twente in the Netherlands; WWF; UNESCO-IHE Institute for Water Education; the Water Neutral Foundation; the International Finance Corporation; and the Netherlands Water Partnership.

Tilapia now SA's own bio-indicator of water pollution

Southern African water specialists can now use a local Tilapia species – instead of alien fish species – to test whether water sources are polluted by compounds that can cause hormonal imbalances. Such chemicals, known as endocrine disrupting compounds (EDCs) can subtly mimic the female hormone oestrogen and alter the male testosterone, while others disturb thyroid-hormone functioning.

Researcher Dr Marna Esterhuyse from the Botany and Zoology Department at the University of Stellenbosch recommends the use of the hardy Mozambique tilapia – which is sensitive to water pollution – over that of the alien zebrafish which is currently often used as a bio-monitor. "This work brings South Africa one step closer to its own fish model – similar to that of most developed countries – that can monitor

chemicals in water sources that cause hormonal imbalances," notes Prof Hannes van Wyk, who acted as Dr Esterhuyse's promoter.

During such monitoring, scientists analyse the tissue, study the physiology and look at the changes in the genetic levels of fish species exposed to pol-

luted water and chemicals. "Aquatic animals are good bio-monitors because EDCs are rapidly absorbed through the gills and stored in the body," explains Dr Esterhuyse.

Her toxicogenomic study focuses particularly on the interaction between pollutants and some

of the genes specifically associated with the body's endocrine systems. Due to Dr Esterhuyse's genetic test model, fish exposed to a water sample can now be examined after only a few hours.

"Research on frogs, crocodiles and some fish species shows that endocrine disturbance caused by EDCs in polluted water results in, among others, deviations in the reproductive system and in the malfunctioning of the thyroid gland," she reports. Dr Esterhuyse is now extending these studies with post-doctoral work on genes influenced by thyroid hormones.



All eyes to the sky in successful workshop

A successful workshop has been held on the development and application of global navigational satellite systems (GNSS) methodology for groundwater resource assessment.

The workshop, which attracted around 50 practitioners and featured local and international speakers, took place at the Hermanus Magnetic Observatory. It was organised by earth sciences consultancy Umvoto Africa, in collaboration with the Overstrand Municipality and the Department of Land Affairs with funding from the Water Research Commission and the Department of Science & Technology.

"The workshop introduced new scientific and technological developments in the application of

space geodesy in South Africa," explained Andiswa Mlisa, who heads up Umvoto Africa's GIS and Remote Sensing unit. "Delegates got an overview of the very latest in GNSS, the TrigNet Global Positioning System (GPS) infrastructure in South Africa, the application of GNSS and other space-geodetic techniques for measuring a deforming earth, and their application to understanding the earth's hydrosphere, atmosphere and ionosphere."

"We examined the use of space-based and terrestrial or in-situ observations to understand the qualitative fluxes in the water cycle. In recent years a clear relation has emerged between geodetic signals and mass distribution in the terrestrial hydrosphere," Mlisa explained.



Dr Chris Hartnady, Umvoto technical director (second from right) explains the Overstrand Municipality groundwater project and GPS monitoring system to Ian Hunter of SAWS (far right), Eric Calais of Purdue University (centre) and Mike Smart from DWAF (third from left).

Zimbabwe cholera crisis one of world's worst

About 5% of Zimbabweans who contract cholera die from the disease, according to the World Health Organisation (WHO). The organisation reports 1% as an 'acceptable' mortality rate.

At the time of writing more than 60 000 people in the country had contracted the waterborne disease, with fatalities totalling more than 3 000. Cholera is a diarrhoeal disease caused by infection of the intestine. In 5% to 10% of cases patients develop severe watery diarrhoea and vomiting from six hours to five days after exposure to the bacterium. The loss of large amounts of fluids can rapidly lead to severe dehydration and without proper treatment, death can occur within hours. Those who are malnourished or already have intestinal parasites can be at especially high risk of death.

Zimbabwe's cholera outbreak is one of the world's largest ever recorded and, according to

the WHO, is far from being brought under control. "Unless drastic action is taken by all players in this crisis, more Zimbabweans will succumb to the outbreak, and other countries in the southern African region will face the continued threat of spill over epidemics," reported Dr Eric Laroche, Assistant Director for WHO's Health Action in Crises Cluster in January. The United Nations has released close to US\$8-million from its emergency fund to help fight the spread of the disease. This allocation is being used to buy some of the most essential drugs and materials needed.

Meanwhile, more than 4 000 cases of cholera have been confirmed in Mpumalanga with close to 30 people dying since the outbreak of the disease earlier this year. The areas most affected include Mbombela North, Bushbuckridge, Mbombela south, Nkomazi, Thabachwey and Umjindi.

WATER DIARY (CONTINUED)

WATER

APRIL 1-3

The Water Africa 2009 Sub-Sahara Conference & Exhibition will take place in Accra, Ghana with the theme 'African urban and rural water challenges in the 21st Century'. Enquiries: Tracey Nolan-Shaw (ACE Events); E-mail: tnolan-shaw@btconnect.com; or info@ace-events.com

BIOMONITORING

APRIL 20-22

A course in SASS 5: a rapid method for water quality assessment will be presented by Nepid Consultants at Sabie, Mpumalanga. The course will cover aspects such as site selection, habitat assessment, equipment and safety, sampling procedures, invertebrate identification, data analysis and reporting and the national River Health Programme.

Enquiries: Rob Palmer; Tel: (013) 751-1533; E-mail: rob@nepid.co.za; Visit: www.nepid.co.za

WATER LOSS

APRIL 26-29

An IWA conference on water loss reduction will be held in Cape Town. The conference is the fourth in a series of water loss reduction specialist conferences. Email: organising@waterloss2009.com; Visit: www.waterloss2009.com

DRINKING WATER

MAY 11-13

The Water Institute of Southern Africa is hosting a conference on Drinking Water Quality at the Feather Market Centre in Port Elizabeth.

Enquiries: Dot Zandberg; Tel: (011) 805-3537; E-mail: conference@wisa.org.za

MEMBRANE TECHNOLOGY

MAY 13-15

The WISA Membrane Technology Division in association with the European Membrane Society will be hosting an International Membrane Conference in the Western Cape. Visit: www.soafrica.com/events/Membrane/E01.htm

HYDROLOGY

SEPTEMBER 21-23

The 14th Symposium of the South African National Committee of the International Association of Hydrological Sciences (SANCIHHS) will be held at the University of KwaZulu-Natal, Pietermaritzburg.

Enquiries: Courtney Thompson; Tel: (033) 260-5490; Fax: (033) 260-5818; or Email: thompsc@ukzn.ac.za

Acute food shortages predicted for end of century

Rapidly warming climate is likely to seriously alter crop yields in the tropics and subtropics by the end of this century and, without adaptation, will leave half the world's population facing serious food shortages, new research shows.

"The stresses on global food production from temperature alone are going to be huge, and that doesn't take into account water supplies stressed by the higher temperatures," said David Battisti, a University of Washington atmospheric sciences professor. Battisti is lead author of the study in the 9 January edition of *Science*. He collaborated with Rosamond Naylor, director of Stanford University's Programme on Food Security and the Environment, to examine the impact of climate change on the world's food security.

"This is a compelling reason for us to invest in adaptation, because it is clear that



this is the direction we are going in terms of temperature and it will take decades to develop new food crop varieties that can better withstand a warmer climate," Naylor said. "We are taking the worst of what we've seen historically and saying that in the future it is going to be a lot worse unless there is some kind of adaptation."

By combining direct observations with data from 23 global climate models, Battisti and Naylor determined there is a greater than 90% probability that by 2100 the lowest growing-season temperatures in the tropics and subtropics will be higher than any temperatures recorded there to date. They used the data as a filter to view historic instances of severe food insecurity, and concluded such instances are likely to become more commonplace. Those include severe episodes in France in 2003 and Ukraine in 1972. In the case of the Ukraine, a near-record heat wave reduced wheat fields and contributed to disruptions in the global cereal market that lasted two years.

"I think what startled me the most is that when we looked at our historic examples there were ways to address the problem within a given year. People could always turn somewhere else to find food," Naylor reported. "But in the future there's not going to be any place to turn unless we rethink our food supplies."



Testosterone-blocking chemicals found in UK rivers

New research by Brunel University, the Universities of Exeter and Reading and the Centre for Ecology and Hydrology, shows for the first time how a group of testosterone-blocking chemicals is finding its way into UK rivers, affecting wildlife and potentially humans.

The research was supported by the Natural Environment Research Council and is now published in the journal *Environmental Health Perspectives*.

The study identified a new group of chemicals that act as 'anti-androgens'. This means that they inhibit the function of the male hormone, testosterone, reducing male fertility. Some of these are contained in medicines, including cancer treatments, pharmaceutical treatments, and pesticides used in agriculture. The research suggests that when they get into the water system, these chemicals may play a pivotal role in causing feminising effects in male fish.

Lead author on the research paper, Dr Susan Jobling at Brunel University's Institute for the Environment said: "We have been working intensively in the field for over ten years. The new research findings illustrate the complexities in unravelling chemical causation of adverse health effects in wildlife populations and re-open the possibility of a human-wildlife connection in which effects seen in wild fish and in humans are caused by similar combinations of chemicals."

"We have identified a new group of chemicals in our study on fish, but do not know where they are coming from. A principal aim of our work is now to identify the source of these pollutants and work with regulators and relevant industry to test the effects of a mixture of these chemicals and the already known environmental oestrogens and help protect our environmental health," she said.

Senior author Prof Charles Tyler of the University of Exeter added: "Our research shows that a much wider range of chemicals than we previously thought is leading to hormone disruption in fish. This means that the pollutants causing these problems are likely to be coming from a wide variety of sources."

New publication on managing water conflicts

A new publication, *Managing and Transforming Water Conflicts*, is available from Cambridge University Press.

Authored by Jerome Priscoli and Aaron Wolf, the publication investigates the dynamics of water conflict and conflict resolution, from the local to the international.

They explore the inexorable links between three facets of conflict management and transformation: alternative dispute resolution, public participation and institutional capacity.

For more information, Visit: www.cambridge.org/9780521632164

Australia standardises greywater treatment technologies

CSIRO's Water for a Healthy Country Flagship programme and the Smart Water Fund (a joint initiative of Melbourne's water businesses and the Victorian government) have developed a practical, robust, sustainable method for testing whether greywater treatment technologies meet Australian standards.

CSIRO Land and Water scientist, Melissa Toifl, explains that the protocol is the first

of its kind developed in the country, and could be used to establish a national greywater treatment testing regime. For testing, scientists created a synthetic greywater that contained basic everyday products that people use in the bathroom and laundry.

"We used this synthetic formula and high levels of bacteria, viruses, and protozoa, to test whether a treatment technology under challenged circumstances would produce water that meets the standard described in Australian guidelines for recycled water," reports Toifl.

At present, Australia has no standard national testing method; states and territories each have their own legislation for greywater collection, treatment and use.

"With this protocol we are anticipating a national approach in the way greywater treatment technologies are tested and regulated," says Toifl. "This would simplify the process for manufacturers with the aim of increasing consumer adoption rates."



CSIRO



Discovery vs disgust – the power of the ‘yuck’ factor

People often instinctively reject fearsome or repugnant things, especially when those things are unfamiliar.

However, if shared by masses of people, collective repugnance, or the so-called ‘yuck’ factor, becomes a social force with the power to shape environmental and public policy. For example, numerous wastewater reclamation projects around the world have been derailed following an outcry of disgust among communities. This is despite these technologies being considered a generally safe and cost-effective way to save dwindling water supplies.

According to an article which appeared in international journal *Environmental Health Perspectives* in December 2008, policymakers and scientists need to better understand these gut responses and take them seriously if they are to move certain technologies forward, such as the retreatment of wastewater for drinking and other purposes.

It is argued that, by giving pause to technological progress, the yuck factor opens new opportunities for dialogue between scientists and the public. In some cases, that dialogue might show that a technology's benefits outweigh the repugnance that goes with it. In others, it pushes scientists to make a better case for why a given technology should be pursued at all.

It is important that scientists appeal to this emotion when arguing their case. More often than not this is what determines who wins and loses in science policy debates. To read the article, Visit: www.ehponline.org/members/2008/116-12/EHP116pa524PDF.PDF

New digital map of Africa's soils planned

The International Centre for Tropical Agriculture (CIAT) has launched a new project which hopes to produce the first-ever, detailed digital soil map for all 42 countries of the region.

This project, which is made possible by a US\$18-million financial injection from the Bill & Melinda Gates Foundation, combines the latest soil science and technology with remote satellite imagery and on-the-ground efforts to analyse thousands of soil samples from remote areas across the continent. The effort is expected to especially assist poor farmers, who suffer from chronically low-yielding crops largely because of degraded soils.

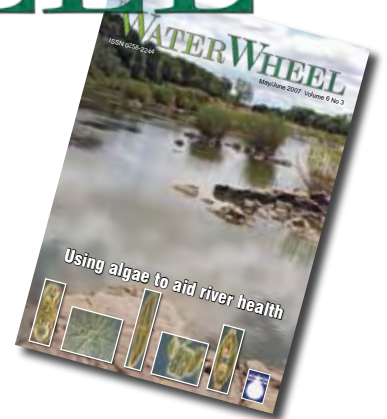
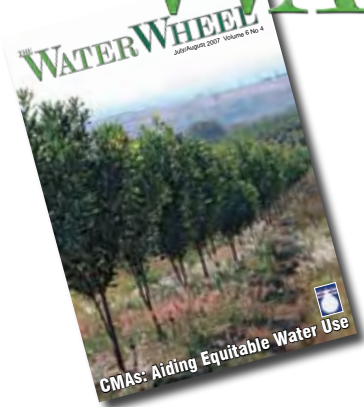
Efforts to improve African soils, which are among the most depleted on earth, have been hampered by a lack of up-to-date,

comprehensive knowledge about current soil conditions. This information is critical to identify the types and amounts of mineral and organic nutrient sources needed to increase crop yields.

"Soil management in sub-Saharan Africa must be improved dramatically if we are to reduce poverty, feed growing populations and cope with the impact of climate change on agriculture," said Dr Nteranya Sanginga of CIAT, which is one of 15 centres supported by the Consultative Group on International Agricultural Research (CGIAR). "Achieving this requires accurate, up-to-date information on the state of Africa's soils."

Innovative remote sensing technology will be used via satellite to create detailed images of large areas indicating nutrients, moisture and organic matter in the soil.

THE WATER WHEEL



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Postal address: Private Bag X03, Gezina, 0031

SSI grows its African portfolio

SSI Engineers and Environmental Consultants has boosted its African portfolio following the award of a multimillion US Dollar water supply project in Zomba, 70 km north of Blantyre, and Mangochi, 170 km north of Zomba, by the Malawian Southern Region Water Board.

The South African company is working in close cooperation with local subconsultant Chapita Consulting Engineers of Lilongwe. According to project director Mike Richardson of SSI, the project will extend the existing water distribution systems to meet increasing demands in both centres.

In Mangochi the project will also improve the quality of potable water being distributed from its source at the south end of Lake Malawi. Water quality in the lake has deteriorated in recent years and the existing technology is no longer able to provide adequate water treatment.

In Zomba the project will involve upgrading of the existing water treatment plant and a booster pump station as well as the design on extensions to the existing distribution system south along the Kamuzu highway towards Blantyre. The latter includes pipelines, a booster pump station and water tank.

SSI's contract includes a socio-economic survey and review of business plans for both towns, as well as an environmental impact assessment for all the works. "Although the technology we will be specifying for this project is pretty standard, logistics will present a big challenge once construction starts," says Richardson. "We have already solved the communications issue by setting up a local wireless Internet connection at the site office."

Utility injects millions into capital projects

Amatola Water is injecting millions of Rands into capital projects designed to meet anticipated future water demands and to improve water quality in the Buffalo City Municipality and Amathole District Municipality.

These projects, which are already underway, will see several water treatment works being upgraded and additional pipelines being laid to extent the water utility's supply zone to other areas outside its present area of supply. This includes the

upgrading of the Laing water treatment works in King William's Town and the Nahoon water treatment works which supplies water to East London and surrounds to a total of R29-million. These projects were anticipated to be completed by the end of last year.

Amatola Water project manager Ronney Mtshana reports that construction on the required additional pipelines would begin early this year. He says there is also the R11-million upgrading of the Masincedane water treatment works in Keiskam-mahoek and laying of additional pipelines to meet future water demand. The works' capacity is being increased from 1,8 Ml/day to 4 Ml/day to serve new low-cost housing and other planned developments in the region.

The Peddie water treatment works, which currently supplies water to the town and surrounding villages, is also undergoing a revamp.

Desalination tender for VWS Envig

VWS Envig has been awarded a tender by the Ndlambe Municipality, in the Eastern Cape, to supply a water treatment plant to provide potable water to the communities of Cannon Rocks and Boknes.

The company will be refurbishing the existing plant, which treats salty groundwater through reverse osmosis (RO) membranes. The new plant will have a capacity of 750 m³/day. The company will supply and integrate a seawater RO skid with pre- and post-treatment for the project. The skid is being manufactured by the company's facility in Paarl.

According to Abrie Wessels, VWS Envig General Manager: Western Cape region, commissioning of the project is scheduled for May. "The company will operate and maintain the plant for 14 months and will also provide operation and maintenance training to municipality staff to ensure the plant's long-term viability."

"The main challenge of the project will be ensuring compatibility between the existing and new plant in terms of infrastructure and equipment," reports Wessels. "However, our experience in completing similar jobs gives us a base of expertise that will ensure the success of the projects."

New alliance for better quality water

Nanotechnology is but one of the new generation technologies that will be explored by Johannesburg Water (JW) under its new Memorandum of Understand-

ing (MoU) with the University of Johannesburg (UJ).

The MoU, signed in January, paves the way for the two entities to collaborate on research and development projects in various areas, including nanotechnologies, water purification, wastewater treatment and innovation in water analyses. It is anticipated that this initiative will assist JW to benchmark its performance and thus ensure the enhancement of its efficiencies and competitiveness through research and development. In turn, the UJ will be afforded the opportunity to further develop research-based approaches to long-term strategic planning linked to economic, social and other areas of development.

"We believe that the key to the successful development of new and novel technologies lies in forging science and technology partnerships and the collective will to increase a skilled workforce to enhance competitiveness in future," reported Jones Mnisi, JW Acting CEO. "Such partnerships are particularly critical if we want to improve business efficiencies, reduce the cost of service delivery and become more responsive to the needs of our customers."

The alliance will also see UJ providing workplace-learning opportunities to JW workers/students and outlines other meaningful interventions that address the shortage of scientists and engineers especially in this service industry. Since JW has accredited water laboratories with state-of-the-art equipment, this presents an opportunity for the training of scientists towards obtaining higher degree at UJ.

While the MoU merely lays the foundation of a relationship between the two organisations, it is important that it is not merely a "paper exercise", said UJ Pro-Vice Chancellor, Prof Derek van der Merwe. He noted that substantial groundwork had already been laid and that he expected hard results by the end of the year.



Johannesburg Water Acting CEO Jones Mnisi and University of Johannesburg Pro-Vice Chancellor Prof Derek van der Merwe toast the new Memorandum of Understanding signed by the two organisations.

New from the WRC



Report No: TT 367/08

Developing a Land Register and a Set of Rules for Application of Infield Rainwater Harvesting in Three Villages in Thaba Nchu: A Pilot Project (S Manona & M Baiphethi)

This project complemented a five-year solicited research projects funded by the WRC in various villages around Thaba Nchu. The investigation revealed the complex nature of land tenure and the total collapse of land administration in the villages concerned, mainly as a result of the lack of a coherent policy and legislative framework since 1994.

Report No: KV 216/08

A Preliminary Exploration of Two Approaches for Documenting 'Mental Models' Held by Stakeholders in the Crocodile Catchment, South Africa (H Biggs; D du Toit; M Etienne; N Jones; A Leitch; T Lynam; S Pollard and S Stone-Jovicich)

Mental models are what people use to understand and interpret phenomena of everyday life. These models are frameworks of concepts and relationships that underpin how people understand, filter and process information and contribute to understanding, reasoning and action. This report reflects an attempt to try understand issues of compliance with the water legislation by eliciting mental models which may underlie much of the intrinsic motivation of stakeholders to take particular collective actions, develop specific practices, and ultimately behave in particular ways.

Report No: 1576/1/08

Real Time Irrigation Advice for Small-Scale Sugarcane Production using a Crop Model (A Singels and M Smith)

The rapid progression of communications technology enables quick transfer of large amounts of data and information, further bolstering the potential usefulness of computerised irrigation decision support systems. In practice, farmers tend to prefer instinct or simple tools over these sophisticated systems. The challenge is to provide simple, practical and useful advice to farmers using state-of-the-art technology and to convince farmers of the benefits of irrigation scheduling. The objectives of this study were to develop and refine an automatic irrigation advice system consisting of automatic weather stations, a Web-based crop model and cellular communication network; implement the system for small-scale farmers and evaluate the suitability of the system for providing useful irrigation advice and to determine likely adoption rates and impacts on water use.

Report No: 989/1/08

The Value of Water as an Economic Resource in the Greater Letaba River Catchment (CJ Williams; GA Veck and MR Bill)

During the past number of years the Water Research Commission has initiated a number of economic research projects aimed at determining the value of water in different sectors of the economy and in different parts of the country. This project explores the value of water as an economic resource in the Groot, Middle and Klein Letaba river catchments, in Limpopo. The need for water is an important issue in every part of the region and the need for effective water management is great. During this study the water balance was determined in the catchment as well as the water demand schedules for the irrigated agriculture, forestry, ecosystems and household sectors. The study used these demand schedules to determine the economic value of water by establishing willingness to pay.

Report No: 1319/1/08

Modelling Vegetation Water Use for General Application in Different

Categories of Vegetation (PJ Dye; C Jarman; D le Maitre; CS Everson; M Gush and A Clulow)

Water yield from catchments may be significantly modified by vegetation management. Since the early 1900s, South Africa has witnessed one of the most hydrologically extreme changes in land use to be found anywhere in the world, which has demonstrated how influential land cover is altering the proportions of 'green water' (water evapotranspired from vegetation) and 'blue water' (water in streams). In the higher rainfall areas of the country, for example, there has been a steady conversion of natural grassland and shrublands to forest plantations. A greater need has been expressed for realistic information on vegetation water use, however, to date accurate data have remained unavailable. The aim of this project was to develop a relatively simple framework of understanding of annual evapotranspiration patterns shown by a wide variety of land covers, and to translate this framework into a user-friendly form permitting predictions of vegetation evapotranspiration by non-researchers.

Report No: 1525/1/08

Assessments and Improvement of Filter Media Cleanliness in Rapid Gravity Sand Filters (J Haarhoff; SJ van Staden; J Geldenhuys; M Sibiya; P Naicker and N Adam)

Rapid sand filtration is an essential unit process in the water purification process. It captures and removes coagulated and flocculated material and other suspended matter not removed during the preceding treatment processes. The pores in the filter bed gradually become clogged and the media progressively collects deposits through the continuous use and life of the filter. Air scour and wash water are applied to clean the filter media. The combined action of air and water should return the media to its original clean state, however, on inspection it is found that filter sand on purification plants is unacceptably dirty and backwash systems are incapable of cleaning the media to its initial state of cleanliness. Often the reasons for the media deterioration remain elusive and the media becomes dirtier the longer it is used. As there was an almost complete

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lack of published or agreed upon procedures to measure the cleanliness of filter media, rudimentary methods for measuring filter media cleanliness and backwash efficiency were developed during this study. Thereafter filter media from full-scale treatment plants were analysed with these methods at regular intervals to establish some benchmarks for these determinants. These methods were also applied during the laboratory and pilot plant phases of the project.

Report No: 1629/1/08

Research into UD/VIDP (Urine Diversion/Ventilated Improved Double Pit) Toilets: Physical and Health-related Characteristics of UD/VIDP Vault Contents (CA Buckley; KM Foxon; N Rodda; CJ Brouckaert; S Mantovanelli; and M Mnguni)

The aims of this project was to provide a scientific basis for the design and operation of urine diversion toilets by eThekweni Municipality; evaluate the effectiveness of these toilets in improving the well-being of the user community and determine the fate of *Ascaris spp.* eggs from urine diversion toilets. The results of the study support the continued rollout of the system. Since the greatest risk of propagating disease centres on emptying a vault and burying its contents, the physical design of the vaults should be looked at critically to make these operations as easy as possible. Drying and biological degradation of the UD waste appear to be chiefly dependent on contact with air, so the design of the toilets should aim for good air circulation through the vaults.

Report No: 1551/1/08

A Preliminary Decision Support System for the Sustainable Design, Operation and Closure of Metalliferous Mine Residue Disposal Facilities (B Rademeyer; JA Wates; N Bezuidenhout; GA Jones; E Rust; S Lorentz; P van Deventer; W Pulles and J Hattingh)

Mining of South Africa's gold, platinum and base metal resources has given rise to hundreds of mine residue disposal facilities of which the footprints cover large areas of land. It is estimated that about 12 000 ha of land is sterilised by 150 gold mine residue disposal facilities within Gauteng alone. Mine residue usually contains sulphide minerals, which upon weathering give rise to a range of potential pollutants. Where there is insufficient neutralising potential in the mine residue, acid mine drainage occurs with its associated low pH values, high salt loads, and high concentrations of metals. The legacy of the impacts associated with

these facilities has given rise to an increasingly complex regulatory regime. Approvals for upgrading old facilities, for development of new facilities, and for closure plans are difficult to obtain owing to the lack of a suitable framework within which to make decisions. It is imperative to develop a coherent process to facilitate transparent and effective regulatory decision making. This research project was intended to be the first of three phases, stretching over five to ten years. The first phase, the preliminary decision-support system, will be followed by a second phase, addressing some of the key knowledge gaps identified during the first phase. The third phase will involve the development of a final decision support system.

Report No: 1420/1/07

Review of the Selection of Acceptable Flood Capacity for Dams in South Africa in the Context of Dam Safety (J Cullis; A Görgens and S Lyons)

This report is intended to be used as a tool to assist the dam safety practitioner in the selection of acceptable flood capacity (AFC) for dams in South Africa. The primary focus of this report is a review of the *SANCOLD Guidelines on Dam Safety in Relation to Floods*, which outlines the currently recommended approach for the selection of AFC for dams in South Africa. This review was compiled on the basis of a literature survey, key stakeholder interviews, responses to a questionnaire of dam safety professionals and two workshops of dam safety professionals. Specific areas of the *Guidelines* that are considered include the general approach to dam safety assessment, the classification of dams, and the recommended minimum standards for generalised and site-specific dam safety assessments.

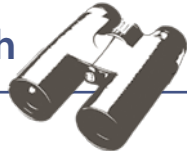
Report No: 1596/1/08

Guidelines for the Selection and Effective Use of Ozone in Water Treatment (R Rajagopaul; NW Mbonga and C Nadan)

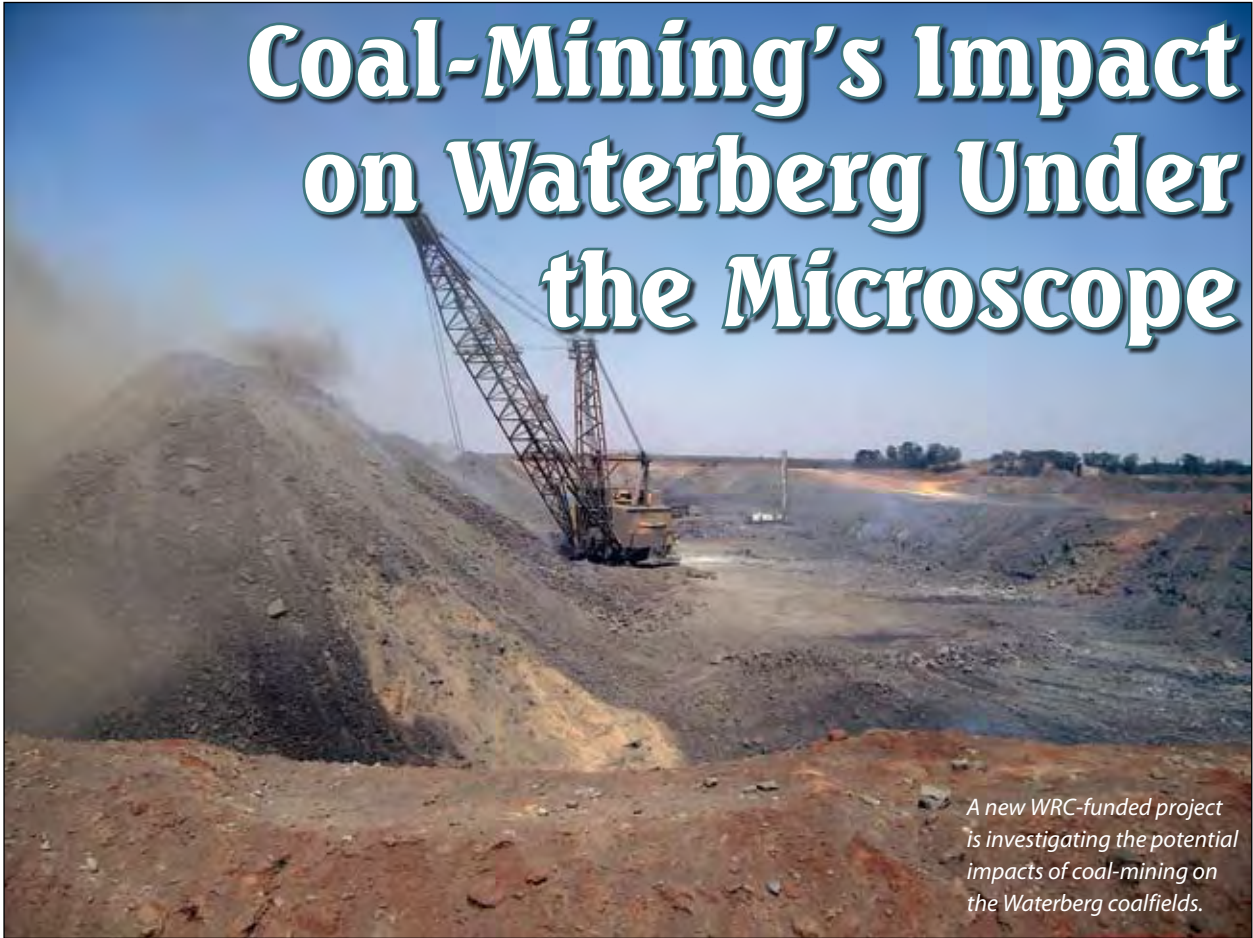
The use of ozone as a pre-oxidant for water treatment is gaining momentum in South Africa. However, ozonation is generally associated with high energy costs. The main aim of this project was to develop a simple guideline for the cost-effective use of ozone in water treatment application. The guidelines serve as an ozone checklist for water treatment practitioners faced with the prospect of specifying a suitable oxidant for either the pre-treatment or intermediate stage in the water treatment train.

WATER BY NUMBERS

- 58%** – The estimated percentage of the African population that has access to safe drinking water.
- 15-billion m³** – South Africa's storage capacity which is currently in use, according to the Department of Water Affairs.
- 898 300 Mℓ** – The total storage capacity of all the supply dams serving Cape Town, the largest of which is Theewaterskloof with a capacity of 480 000 Mℓ.
- 25 700 ℓ** – The water required to grow a day's food for a family of four.
- 1 million** – The estimated number of people across southern Africa who have suffered as a result of floods, cyclones and heavy rains during the annual wet season, according to United Nations relief officials.
- 2%** – The percentage of South Africa's water used by the power generation sector.
- 2025** – The year by which Gauteng, KwaZulu-Natal and Limpopo will suffer acute water shortages if no further bulk water infrastructure schemes are implemented, according to Department of Water Affairs & Forestry national water resources infrastructure Deputy Director-General Dr Cornelius Ruiters.
- 97%** – The percentage of residents in the Tshwane Metropolitan Municipality which have access to tap water within 200 m of their homes. The municipality had connected more than 43 000 households by December 2008.
- 38** – The number of years ago that the Ramsar Convention on Wetlands was signed. The disappearance of the wetlands, the need to protect them for their values and benefits were the primary goals that led to the establishment of the convention on 2 February 1971.
- 1 billion** – The number of people around the world whose water supplies are under threat from increasing populations, expanding cities, industrialisation, climate change and the rising demand for food, according to the United Nations.
- 9 billion** – The estimated number of people there will be in the world by 2050, increasing competition for scarce water resources.



Coal-Mining's Impact on Waterberg Under the Microscope



Renias Dube

A new WRC-funded project is investigating the potential impacts of coal-mining on the Waterberg coalfields.

Historic mining activity on the Witbank and Highveld coalfields, currently the most important sources of South Africa's mined coal, has left deep scars on the landscape and a legacy of polluted mine-water flowing from an increasing number of closed and defunct mines. Now a new project, funded by the Water Research Commission (WRC), hopes to reduce similar future impacts on the Waterberg. Lani van Vuuren reports.

At present, the Highveld and Witbank coalfields are the source of more than 80% of South Africa's total coal output. However, as these coalfields are nearing depletion all eyes are turning to the Waterberg treasure chest and its significant virgin coal reserves in the north of South Africa. It has been suggested that the coalfield has up to 50 billion tons of coal waiting to be unearthed.

Fuelling development in the area is Eskom announcement that it is looking to construct several new power stations in the area in years to come. The first, Eskom's R80-million Medupi dry-cooled

coal-fired generating plant, is already under construction outside Lephalale. To feed this new electricity-generating giant the power generation company and mining giant Exxaro Resources, owner of Grootegeluk mine (the only colliery operating on the Waterberg Coalfield at present), signed a coal-supply agreement last year.

In terms of the agreement, Grootegeluk will, over the next 40 years, supply an average of 14,6 million tons per year of power station grade coal to the power station. This is over and above the 14,6 million t/y of coal supplied to Matimba, Eskom's other dry-cooled

power station in the area. Meanwhile Exxaro has already started spending millions of Rands on expanding Grootegeluk to meet its obligations to Eskom. Incidentally, Grootegeluk is already the largest openpit colliery in South Africa. Other international mining houses, including AngloCoal, have also started exploration in the area.

The availability of water is a significant inhibiting factor regarding the exploitation of coal in the Waterberg as large volumes of water are needed for mining, beneficiation and processing purposes. However, both surface and groundwater are very scarce in the



region. Environmental impact assessment studies are currently underway to augment water resources in the area. One development being strongly considered at present is the raising of the Mokolo Dam, situated outside Lephalale. This dam is currently being used mainly by the Matimba power station as well as irrigation farmers in the area and the town of Lephalale.

While conventional mining methods can exploit the shallow coal resources, alternative technologies, such as coalbed methane extraction and underground coal gasification are the only currently known technologies that may be able to exploit the deep formation resources. It is these alternative technologies that are the focus of the newly-launched WRC investigation.

While it is known from local and international experience that coal mining has a pronounced impact on surface and groundwater quality and quantity, the fact that new extraction options are being considered in addition to the more traditional mining options, brings additional uncertainties to the fore, reports notes WRC research manager Dr Jo Burgess. "Although several factors in addition to its effects on water resources have to be considered when deciding on a mining method, the long-term nature of the consequences for water quality calls for careful consideration of alternatives. It is desirable that both

Eskom's Matimba power station outside Lephalale will in future be joined by Medupi, currently under construction.



Lani van Vuuren

developers and regulators be aware of the long-term liabilities and costs associated with different mining methods," she tells *the Water Wheel*.

The project is in the form of a scoping level study to consolidate the existing information about the geohydrology and pre-mining water quality of water resources associated with the Waterberg coal reserves, predict how the water resources would be affected by alternative mining methods, and make provisional recommendations on the management of the water resources. The project also hopes to identify further research needs concerning the impact of mining of the

Waterberg coal reserves on water reserves.

The study is being led by the Institute for Groundwater Studies at the University of the Free State's Faculty of Natural and Agricultural Sciences, with participation from several international mining houses, and Eskom. According to Dr Burgess, one of the greatest challenges of the project is the current gaps in existing information as well as the lack of coordination of this information. "We also have a large number of stakeholders in this area, many of whom are as yet unidentified."

The project is expected to be completed in 2010. 

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FIRST ANNOUNCEMENT



Progress and Pitfalls of River Health Research Investment Assessed



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An assessment of the impact of the Water Research Commission's (WRC's) research investment made in support of the national River Health Programme (RHP) reveals the progress made in certain areas while recommending ways to improve others.

The WRC is committed to ensuring that the publicly-funded research under its management provides both research excellence and public benefit. It was with this in mind that the project to assess the WRC's involvement in the RHP was commissioned.

The RHP has a relatively long history (more than a decade) of receiving research investment and providing benefits to public and private organisations in the context of improving river monitoring and management practices. It has developed into a flagship for the water resources monitoring programmes operated by the Department of Water Affairs & Forestry. However, its success is to a large degree as a result of the active involvement of, and strong ownership by, a diverse site of national and sub-national organisations.

The recent assessment, undertaken by Monash University and the CSIR, looked at two main aspects. Research excellence was assessed as a function of two main factors, namely the quality and

pattern of engagement in the scientific peer-review process and the degree to which relevant research was taken up in the wider body of science.

The other aspect assessed was that of research relevance. Eleven indicators were examined here, including the flexibility of management, diversity of participation, international collaboration, continuity over time, knowledge capturing and sharing, improved river health and increased capacity and awareness, among others.

MAIN FINDINGS

An overall outcome is a sense that the WRC and its co-custodians have done extremely well in facilitating the transition from developing technical methods to establishing operational routines. The organisation has played an overwhelmingly positive role in enabling the kind and continuity of research that led to the remarkable adoption by implementation agencies, capacity and awareness creation among diverse audiences, and an impact on water and research activities in

a much broader sphere than that directly related to the RHP. Particularly noteworthy is the level of knowledge capturing and social sharing that took place.

Authors Dr Dirk Roux, Liesl Hill and Wilma Strydom write in the final report: "We believe that this success is to a large degree as a result of the community-of-practice style of participation that prevailed among RHP practitioners. The WRC's flexible management style has also played a significant role in enabling this community formation and maintenance."

However, the assessment does reveal a number of areas where performance could be better. First among these is the overall impact within the body of science. This aspect, according to the authors, has clearly been neglected. Related to this is the low degree of international collaboration that has been achieved, with the impact on policy and actual improvement of river health further disappointing features.

It is explained that the poor performance for research excellence is probably as a

result of the strong emphasis that was placed on understanding and catering for stakeholder needs and to facilitate practical implementation of the RHP. While such a focus is admirable, it should be matched with resources for and efforts to ensure scientific credibility.

Interestingly, the assessment indicated that RHP-related research in general advanced the specified impacts areas of the WRC, notwithstanding the poor performance in the areas of research excellence and international collaboration. A further interesting phenomenon is that the RHP's objectives have largely been advanced, yet there is no evidence that the health of rivers have improved nor has the substantial body of river health information had much influence on water policy.

The likely explanation is that the RHP has largely remained true to its main purpose of being a monitoring programme that generates and disseminates accurate and objective information. This is a sound position for a monitoring programme, but without effective extension into the management and policy domains, there is no guarantee that the information stemming from the programme will be used to the benefit of society.

RECOMMENDATIONS

The value of an impact assessment approach such as this one is to facilitate periodic reflection and to reveal areas in need of more focused research attention. This provides guidance for the strategic allocation of available research funding.

Ideally, an impact assessment of this nature should be undertaken in close collaboration with all key role-players to maximise the potential for social learning and the likelihood of an appropriate response to the findings. While an inclusive assessment process was beyond the scope of this study, the authors recommend that the findings of this assessment be presented to and deliberated within at least the RHP's custodian organisations.

Several recommendations are made related to future research in support of the RHP:

- ◆ **International benchmarking:** During the early years of the RHP, much value was derived from international benchmarking. Much has happened in the field of environmental monitoring and reporting, and it is recommended that a comprehensive benchmarking exercise be undertaken to see where the RHP stands against related international practices.
- ◆ **Embrace the scientific publication process:** It is recommended that peer-reviewed publications and presentation of key topics at international conferences be encouraged and supported.
- ◆ **Extension into management and policy domains:** The influence of the RHP on river health and river management policy should have been much greater and this requires further exploration and investigation.

- ◆ **Long-term research, development and implementation initiatives:** Related to the preceding point, the operational influence and effectiveness of the RHP could improve significantly following careful design of and support for a number of long-term research, development and implementation projects. Such projects should have as an ultimate goal the improvement of river health; team a research partner with implementation agencies; focus on a specific catchment or water management areas; include both developmental and implementation objectives; and run for a period of seven years or longer.

To obtain a copy of the report, *Assessing the Impact of Research Funded by the Water Research Commission in Support of the River Health Programme (Report No: TT 360/08)*, contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; or E-mail: orders@wrc.org.za 

STATE-OF-RIVER REPORTS

The following State-of-river reports are available as part of the River Health Programme:

- ◆ Rivers of the Gouritz Water Management Area 2007
- ◆ The Mokolo River 2006
- ◆ Achievements of the RHP 1994-2004
- ◆ Olifants/Doring and Sandveld Rivers 2006
- ◆ Greater Cape Town's Rivers 2005
- ◆ Crocodile(West) Marico WMA 2005
- ◆ Buffalo River System 2004
- ◆ Berg River System 2004
- ◆ Free State Region 2003
- ◆ Diep, Hout Bay, Lourens and Palmiet River Systems 2003
- ◆ Hartenbos and Klein Brak Rivers 2003
- ◆ uMngeni River 2002
- ◆ Letaba and Luvuvhu Rivers 2001
- ◆ Crocodile Sabie-Sand and Olifants Rivers 2001



Copies of these reports can be obtained from the Department of Water Affairs & Forestry Resource Quality Services, Tel: (012) 808-9552 or Tel: (012) 808-9500. To download digital versions of the reports Visit: www.dwaf.gov.za/iwqs/rhp/index.html



Courtesy Heidi Snyman

Study Confirms Benefits of Sludge Reuse

The latest set of sludge management guidelines, developed with funding from the Water Research Commission (WRC) in collaboration with the Department of Water Affairs & Forestry, can play a significant role in growing the status of wastewater sludge as a valuable resource, a recent investigation has found.

The study, undertaken by Frost & Sullivan, focused on the potential impact of the *Guidelines for the Utilisation and Disposal of Wastewater Sludge*. The first two volumes of this five-volume set of guidelines have already been published while the remaining three are awaiting final government approval. The latest project was aimed at quantifying the potential impact of the guidelines on South African society by analysing current examples of wastewater sludge best practice that are aligned with the new sludge guidelines.

FROM WASTE TO RESOURCE

The management of sludge (the solid, semi-solid or liquid residue generated

during the treatment of domestic sewage in a treatment works) is the responsibility of local authorities. Wastewater sludge management in South Africa has been governed through a series of wastewater sludge guidelines over the past three decades. Each of these guidelines has aimed to assist stakeholders with management aspects of wastewater sludge handling. The latest initiative was launched in 2003, with the first volume of guidelines being published in 2006.

The initiative to develop new guidelines for sludge management was launched after it was found that the previous guidelines were overly restrictive, which impacted negatively on sludge

management practices. The guidelines limited the extent to which wastewater managers could dispose of and manage their sludge. For example, overly restrictive sludge metal limits created the situation where certain wastewater sludge was classified as a hazardous material and needed to be disposed of at a hazardous landfill site, which was both expensive and a waste of valuable landfill space. Since many wastewater treatment plants could not comply with these strict guidelines, sludge ended up either being dumped within the precinct of the treatment facility or on land adjacent to the facility.

Wastewater treatment facilities were historically located on the outskirts of

urban areas. However, with increasing population levels and high urbanisation rates cities and towns have expanded and encroached on these facilities as land has become increasingly scarce. This fact, along with increasing international trends to view sludge as a resource rather than as a waste material, have underlined the importance of finding new, safer ways of managing wastewater sludge sustainably.

Mismanaged wastewater sludge can have a considerable negative impact on the environment and human health. The new guidelines provide guidance on the selection of appropriate disposal options, but also create an understanding of operational and legal requirements for different disposal options. In addition, the guidelines recommend the beneficial use of the sludge where possible and sludge disposal is seen as a last resort.

An important difference between previous sludge guidelines and the present sludge guideline series is the principle of risk management. High pathogen levels within wastewater sludge present definite risks for wastewater sludge managers and end-users. Previous guidelines managed this risk by ensuring that wastewater sludge was treated to a particular specification by wastewater sludge managers. This treated wastewater sludge was then released for reuse by end-users. The challenges with this approach was that if reused sludge was not treated to adequate levels there was no control over the management of this sludge and the potential exposure to its high pathogen levels once reused.

The latest guidelines have adopted an additional line of defence when managing these risks. Not only does wastewater sludge need to be treated to adequate specifications, but the latest guidelines also include specific sludge handling and management practices for when wastewater sludge is being reused, which ensures a barrier is created between the pathogen-containing

sludge and potential receptors. For example, when sludge is used for land application the latest sludge guidelines insist that the sludge is ploughed into and covered with soil immediately to reduce the risk of contact.

SAVING MONEY, CREATING JOBS

To date, there has been limited application of the new sludge management principles by local authorities across South Africa, and little beneficiation is taking place outside the large metropolitan areas. This made identifying impacts that have arisen as a result of applying these guidelines quite challenging. However, closer examination of incidences where this has occurred reveals that the new guidelines show great promise in improving the management of wastewater sludge.

The City of Cape Town is one such South Africa municipality which has adopted wastewater sludge management best practices that are aligned with the new sludge guidelines. The unsustainable method of wastewater sludge landfill disposal coupled with the limited availability of landfill space in the city encouraged the municipality to actively pursue alternative applications for their wastewater sludge.

At present, the city uses its sludge for composting, land application, and pelletisation. In the year during which the study was conducted (June 2003 to July 2004), Cape Town used 26 172 t or 40%

of all produced sludge for useful application. This has resulted in significant cost savings for the city, for example, in Cape Town it costs R680 per dry ton to dispose of wastewater sludge to landfill sites, but only R388 per dry ton to dispose of wastewater sludge through composting.

The application of wastewater sludge to arable land is an effective method to dispose of wastewater sludge, and there are existing examples in South Africa where this is not only proving beneficial to the municipalities concerned, but also to end-users. In the Swartland, in the Western Cape, farmers have struggled to produce profitable yields because of the soil's low nutrient levels. However, the land application of wastewater sludge has significantly improved the nutrient and moisture content of the soils and farmers have been able to realise profitable yields from previously unprofitable areas.

The cost-benefits of using wastewater sludge for brick-making and fertiliser manufacture were also studied. The reuse of sludge in this way could not only have environmental and human health benefits but also assist in the creation of much needed jobs, specifically for semi-skilled people.

The study concluded that wastewater sludge management practices that are aligned with the new sludge guidelines have a significant impact across economic, social and environmental areas of South African society. 



Courtesy Heidi Snyman

The reuse of wastewater sludge for, for example, land application, is encouraged.

Are we ready for a SLUDGE REVOLUTION?



VIP sludge is being buried in trenches at a disused oxidation pond at Umlazi, south of Durban.

Jay Bhagwan



Sludge is collected from households near the site.

Jay Bhagwan



Sludge arrives at the site in Umlazi.



The covered trenches after the first trees have been planted.

Jay Bhagwan



Hans Salisbury of the University of KwaZulu-Natal demonstrates the groundwater monitoring equipment. Groundwater is monitored regularly.

Jay Bhagwan



The first Eucalyptus appearance after

New innovative research being funded by the Water Research Commission (WRC) aims to assemble a much-needed arsenal of knowledge to improve operation and maintenance of ventilated improved pits (VIPs) specifically regarding the management of pit latrine sludge. Lani van Vuuren reports.



Jay Bhagwan



The sludge being buried. The project has created quite a number of jobs for the surrounding community.

Jay Bhagwan



The site's fluctuating water table has been a significant challenge. The water table comes up to the surface after a few days of rain, and then drops down quickly after the rain stops. The municipality has assisted in digging a cut-off drain around the site.

Jay Bhagwan



Acacia saplings have made an impact on the environment.



The soil at the Umlazi site is basically pure river sand and should prove interesting for the tree growth trials, as it is practically devoid of any natural fertility.

Jay Bhagwan

Jay Bhagwan



The sludge is covered with soil immediately after offloading on site to prevent possible odours.

Jay Bhagwan

VIPs have long been viewed as an acceptable minimum level of sanitation, and over a million VIPs have been built around South Africa since 1994. However, sooner or later the toilet pits fill up. The challenge is then what to do with the sludge. If these questions cannot be answered satisfactorily, then all the existing VIP toilets will have to be replaced within about ten years and government's massive investment will have come to nought.

Previous research funded by the WRC found that the disposal of pit sludge to wastewater treatment works is neither acceptable nor economical both from a transport and a waste handling point of view. A simpler, more economical and probably more beneficial option appears to be the burial of pit sludge.

A new WRC project, being undertaken by Partners in Development (PID) in conjunction with the Pollution Research Group at the School of Chemical Engineering of the University of KwaZulu-Natal, with support from eThekweni Municipality and Irish Aid, is investigating the disposal of pit latrine sludge. "In the East, human waste has been used since time immemorial as a form of fertiliser, however, in South Africa, this is not accepted due to the perceived health risk," report project leader David Still of PID. "We believe that if the waste is buried in the ground and used as a form of fertiliser for trees, this health risk is negated, and this is what we are testing currently."

Evidence in the literature shows that sludge from wastewater treatment plants works effectively as a form of slow release fertiliser in conjunction with agroforestry, with timber yields improving by up to 50%. The WRC project is unique in that trials are being carried out with pit latrine sludge (which is less

processed than wastewater sludge) and also because the sludge contains a certain amount of domestic solid waste, which is not encountered in wastewater sludge. Trials have started with Eucalyptus and will soon move onto wattle and then paw-paw trees. The project team is also hoping to try poplar and willow species.

There are three test sites, two for the burial of VIP sludge and one for wastewater sludge. The sites differ in terms of soil type and climate. At each site the sludge is being buried in trenches and trees are being planted either on top or alongside the trenches. Some trenches are being dug and backfilled without the addition of sludge to act as controls.

"The work has generated some employment, which helped to get community acceptance, and there is some interest in how the trial will turn out."




The rate of tree growth will be monitored as well as tree health and wood density. The project team will also observe the root growth and rate of penetration into the sludge. Still reports that groundwater in and around the sites will also be monitored regularly to check for any negative effects from the buried sludge. Finally, the die-off rate of pathogens contained in the sludge will be recorded. "In addition, some 24 trees will be planted in large pots (0,75 in diameter by a metre deep) at the UKZN campus in Durban where they can be monitored more intensely. Some of these trees will be cut up at the end of

the study to investigate the root patterns under different circumstances," Still tells *the Water Wheel*.

The first site is a disused oxidation pond at Umlazi, south of Durban. The sludge being buried is sourced from pit-emptying operations by the eThekweni Metro in the surrounding area. According to Still, the community was at first somewhat concerned that the proposed test site would cause bad odours, however, this fear has proved to be unfounded as the waste is covered with soil immediately after offloading. "The work has generated some employment, which helped to get community acceptance, and there is some interest in how the trial will turn out. "This is the largest site of the project (5 000 m²).

The second site is situated on farmland belonging to the municipality. There is no domestic settlement near the site and eThekweni has given permission for the work to go ahead. Burial of sludge will only start on this site this winter, with tree-planting scheduled for spring. The third site is on a research farm near Curry's Post. Again there is no effect on any nearby settlement. These two sites are both around 1 000 m² in size.

The trees will have to be monitored for two growing seasons before any preliminary conclusions can be reached, notes Still. "Ideally, the trees will be monitored for up to five years to get more complete evidence of the success of the trials. However, it is envisaged that faster-growing trees, such as paw-paws, will also be used to allow for more rapid results."

In the end, the project team hopes to add significantly to the body of knowledge to operate and maintain VIPs successfully. "We hope that instead of pit sludge being viewed as a problem and as a waste product, it may come to be regarded as a useful resource. This will make more funds available for emptying of VIPs," concludes Still. 

The vast majority of environmental problems stem from human actions. Perceptions that Earth and all the life contained within it exist for human comfort alone contribute to the over-exploitation of natural resources. For more than five decades psychologists and socio-psychologists have investigated the human-environment interaction, i.e. relationships between behaviour and various variables, such as demographics, personal values, and how these link with awareness, intentions and attitudes.

Although there are interrelated links between awareness, knowledge, attitude and behaviour, none of these studies have been able to identify the 'magic' link to changing people's behaviour towards the environment. However, it could be reasoned that if people do not see or are unaware of the state of their environment, they will neither be able to observe any changes of degradation, nor foster the desire to take action.

In 2007, an evidence-based study was conducted in the Buffalo, and Hartenbos and Klein Brak River catchments to measure the impact of State-of-River (SoR) reporting on people's awareness and attitudes towards river conservation. (State-of-River reports are graphical, reader-friendly publications produced as part of the government's National River Health programme, which investigates the environmental health of rivers according to a set of environmental indices).

The main driver of this study was the need to know whether SoR reporting added any value towards awareness and knowledge creation among South African society. Unfortunately, this could not be determined as the SoR reports were not being disseminated widely enough. Nevertheless, valuable information regarding people's attitudes and general awareness of water issues were obtained from this study.

SAMPLING AND DATA COLLECTION

A rigorous sampling method ensured the participation of learners and

Spreading the conservation message – ARE WE DOING IT RIGHT?



Respondents filling in questionnaires under a fig tree during the regular community member meeting.

Wilma Strydom

With water becoming an ever scarcer resource it is becoming increasingly important to spread the message of conservation to all communities. Wilma Strydom of CSIR Natural Resources and the Environment takes a critical look at the way in which information is being disseminated and recommends a new way forward.

parents from different cultures and socio-economic backgrounds. A total of 1 144 parents responded by filling in the questionnaires about river conservation which was available in the three main languages spoken in the study areas (Afrikaans, English and isiXhosa).

“If people do not see or are unaware of the state of their environment, they will neither be able to observe any changes of degradation, nor foster the desire to take action.”

Data generated from this study indicated that there was large (82%) consensus among respondents that there existed a need for more information on river systems. Thus, although unanswered, the question stays relevant whether SoR reports would contribute towards this need.

Language representation in the sample group was fairly equal with 29%, 41% and 30% of the responses in English, isiXhosa and Afrikaans, respectively. All age groups were well represented, but the majority of respondents (almost 38%) were aged between 31 and 40. Female respondents dominated (64%), over males (21%), while 15% of the respondents did not indicate their gender. All education levels were fairly well represented.

MAIN RESULTS

From the Buffalo catchment about 30% and from the Hartenbos and Klein Brak catchment 22% of the respondents indicated that they use water very sparingly. While respondents with access to municipal tap water in their homes were more prone to wasting water, this group showed better attitudes and more awareness towards river conservation issues than those which did not have access to municipal tap water.

The study further indicated that respondents from urban areas scored higher in their attitudes towards river conservation than those from rural areas. Urban residents were also more aware of water issues than their rural counterparts. Both the attitude and awareness scores in this study did not correlate with water use behaviour: rural respondents used water more sparingly. Attitude and awareness improved slightly with increased education levels. Respondents that indicated that they would pay more for their water rather than changing their water use behaviour showed the lowest score for attitude towards river conservation.

Given that education has an effect on awareness, attitudes and behaviour, albeit indirectly through people's belief systems, and is negative in some instances, the current formal education system (the syllabus as well as the way in which knowledge is gained) as well as the implication for the conservation of natural resources cannot be ignored and should be investigated further.

KNOWLEDGE DISSEMINATION WITH THE END-USER IN MIND

Distribution of the SoR reports and posters in the two studied catchments was mainly through launch events and did not necessarily reach all the stakeholder groups concerned. One could therefore argue that adequate information dissemination strategies and policies in the organisations and departments responsible for the dissemination were either not in place or were not adhered to. Such an institutional malfunctioning has detrimental effects on both the science-society and the science-policy interfaces.

Organisations and departments should realise and give effect to the fact that the end user is the one for which the communication was intended and subsequently developed for. The value in showcasing communication materials at conferences and seminars is limited to



Wilma Strydom

An interpreter lends a helping hand during the survey.

showing the possibilities and to encourage others to start or continue similar work. If the communication does not eventually reach the target audience, bragging about achievements of part of the communication chain will not help to achieve the desired changes in attitudes and behaviours of society, and the necessary conservation goals will not be reached.

Recommended areas for future research include: addressing language diversity, socio-economic circumstances, cultural differences as drivers of human attitude and behaviour. Childhood experiences and the formal education system (schools) as a vehicle for environmental education should not be neglected.


“If the communication does not eventually reach the target audience, bragging about achievements of part of the communication chain will not help to achieve the desired changes in attitudes and behaviours of society, and the necessary conservation goals will not be reached.”

Difficulties relating to culture when using children as a means to educate their parents, as well as the lack of understanding of adverse impacts on rivers and the general water use culture should be investigated within the South African context.

The River Health Programme should give more attention to the actual dissemination of information to ensure that the information reaches the intended target audiences. It is recommended that dissemination strategies are formulated, implemented and adapted to suit the special needs of the diverse target groups. Such strategies and the execution thereof should be evaluated

and adjusted where necessary; and the impact on awareness, attitude and behaviour changes assessed. It is equally important to apply the learning and knowledge gained from this study in future investigations.

Creating awareness of river conservation issues to change people’s attitudes and behaviour in such a way as to ensure adequate protection of South Africa’s natural water resources is a challenging aspect to ensure river conservation and protection for future generations. Whether this can be achieved if all efforts are concentrated on adults (e.g. resource managers and decision makers) is debatable and intervention is most probably needed at a very early age and throughout children’s formative years.

South Africa’s natural water resources are facing detrimental consequences under the current status quo. It is the responsibility of every citizen to ensure that these resources are used in a responsible and sustainable manner, and every citizen should carry that responsibility to his/her workplace, whether it is in the agriculture, mining, industrial or policy-making arena. 

THE NEED FOR SCIENTIFIC SUPPORT

For the past two decades there has been growing emphasis on the need for scientifically credible environmental information to support decision-making and to inform the public. In South Africa, the National State of Environment and several sectoral reports, including the State-of-Rivers (SoR) reports, have been made freely available and accessible to a wider audience, ranging from politicians and resource managers to riparian communities and the general public. The SoR report is presented in a user-friendly and easy-to-understand format and compliments the technical reporting on river ecosystems. Although the style and content of SoR reports were tested before, the success of dissemination and impact of SoR reporting on people’s attitudes were not previously measured.



Wilma Strydom

Parents gathered at the school where teachers and children could assist when the reading got tough.



Courtesy of Leon Terblance

BUCHUBERG:

Built on the backs of men

Constructed in the 1930s, the Buchuberg Dam was one of the first attempts to tame the lower reaches of the mighty Orange River for irrigation purposes. Lani van Vuuren looks back at the history of this dam surrounded by red dunes and quiver trees where man and beast worked side by side for want of a better life.

The idea of constructing a dam and canal in the lower reaches of the Orange River to irrigate the narrow strip of alluvial soil which lies across the south bank of the river to the west of the Buchuberg range (so named for the Buchu plant – a medicinal herb – which grew wildly there) was considered as far back as 1872, shortly after the discovery of the first diamonds in the Northern Cape. The government owned a series of farms along the river front, which had been reserved for irrigation.

The first definite scheme for the irrigation of any portion of these farms was prepared in 1895. In that year a survey was made and estimates were prepared for a canal 58 km long,

to irrigate 2 800 acres (about 1 133 hectares), in four farms. It was to take off at a point on the Orange River, about eight kilometres above the Buchuberg Range, from above a masonry weir, about 4 m high. The scheme was discussed in the Cape Parliament by Cecil John Rhodes, John X Merriman and Jan Smuts. However, the calculated cost of the scheme at £40 per acre was considered prohibitive and the scheme was placed on the backburner.

During the next decade the scheme would come up in parliamentary discussions often, and various changes were proposed to the original design in efforts to come up with a cheaper solution. MPs expressed their concern over the fact

that the Colony's water resources were allowed to flow "unused into the sea," and pleaded that the waters of the Orange River should rather be used for irrigation.

In 1906, it was proposed that the Buchuberg Irrigation Project be brought back on line. Director of Irrigation, WB Gordon, proposed the construction of a smaller canal to irrigate 1 400 acres (567 hectares) at a cost of about £20 an acre. The canal would be about 27 km long instead of 58 km as originally planned. Gordon suggested that a weir would not be needed because the inlet of the canal would be above the rapids. The entire project would cost £34 000. In his report, laid before Parliament in 1907, Gordon states: "An irrigation scheme is urgently needed for the development of this backward part of the country."

Initial work started on the scheme in September 1906. Interestingly, initial work was carried out by black labourers as white labour was considered "too scarce" in the area. However, on 10 September 1907 it was indicated in Parliament that work on the project had been abandoned due to the unexpectedly high construction costs. Commissioner of Irrigation, Dr Smartt, said that £7 500 had already been spent on the works. He also stated that: "As soon as the financial position of the country improved, it was the intention of the government to resume operations." However, this was not to be for nearly two more decades.

A PROJECT IN AID OF THE POOR

In 1929, as the country was in the grip of its worst drought experienced in living memory, and the Great Depression had the world's economy on its knees, Director of Irrigation, AD Lewis, received sudden instructions to organise and start with construction of irrigation works at Buchuberg. He was told to "start construction as soon as possible to

provide employment for white people who were suffering from the effects of drought." Funds were to be provided by the Department of Labour (which was also in charge of employing labour for the project from its Pretoria headquarters), with construction led by the Department of Irrigation.

"The Orange River will never provide a solution to the problem of water conservation, because large storage facilities will be subjected to siltation."

This was in spite of Lewis' caution against the implementation of large water resource development schemes in the Orange River. He stated that, because of the steep gradient of the river and the magnitude of floods, storage works for the purpose of irrigation would be "very expensive". Lewis wrote in 1929: "The Orange River will never provide a solution to the problem of water conservation, because large storage facilities will be subjected to siltation." These words proved to be prophetic as siltation would significantly reduce Buchuberg Dam's storage capacity in later years.

The Buchuberg Dam and canal would be tackled as two separate construction projects. Resident engineer DF Kokot oversaw works at the dam, and the dam's construction camp was to be sited on the farm Seeikoeibaart. Mr Aslaken was the resident engineer in charge of work on the canal, and this construction camp was at Sternham (later renamed Groblershoop). Work on the dam and construction camp started concurrently in 1929.

The dam wall was constructed to a final height of 0,7 m and is 622 m long.



Courtesy of Leon Terblance

A POEM FOR BUCHUBERG

Canal Construction Engineer W Lingnau wrote the following poem of his experience of building the Buchuberg Canal in August 1933:

Have I Loved These

*Rotton roads and windy days
Flapping tents torn many ways
Dusty plates and gritty food
A rattling car without a hood*

*Sacks for carpets on muddy floors
Vacant spaces where should be doors
A stretcher with a mattress thin
Where warm goes out and cold comes in*

*A stagnant pool the pump does stand
Disinfectant used by liberal hand
Dead donkeys in the river sand
Tasty water to beat the band*

*Yapping dogs and donkeys bray
Troubled callers every day
Tattered clothes in bright array
Does the pay car come this way?*

*Families large and still they grow
Ag sister kom kyk tog na my vrou
Always ready their ails to show
Are they happy for all we know?*

*Here we meet something so rare
Surely not found everywhere
Dust and wind for all to share
Few trees and shrubs but here and there*

*Have I loved these say it not
Rather would I place a dot
For Buchuberg although you're hot
You still remain a lovely spot*

Source: Boegoebergdam se Mense

BLOOD, SWEAT AND TEARS

Mr Willa Cloete was one of the first workers on site in May of that year. He describes the area that greeted these first 18 men as "a wasteland". Cloete told Lökkie van Zyl, author of *Boegoebergdam se Mense*, that there was no cement at the start of the project, and labourers started by collecting sand needed for the concrete. Level areas were chiselled from the mountain to create space for the stone crusher. Tip-trucks were hauled up

the mountain by machine to bring the rock to the bottom. All work was done by hand, with pick, shovel and wheelbarrow, with the assistance of donkeys and mules. Even the holes for the explosives (some as deep as two metres) were drilled by hand. The coffer dams were built on sand bags which the workers carried on their backs. Work was carried out by day under the 40°C heat and at night by oil lamp to tame the mighty Orange River by hand. Tales are told of hardened men reduced to tears at the site of their bleeding hands.

**"Work was carried out by day
under the 40°C heat and at
night by oil lamp to tame the
mighty Orange River by hand."**

An average 350 men worked on the construction of the dam. They came in hordes, from the closed diamond mines and the insolvent farms to earn a meagre 7s-6d a day. Only white men were employed on the project, as was the case with many government infrastructure projects during that time. The only work people of colour could hope for was to cut firewood for a few scraps of food. Children as young as nine worked for a sixpence hauling stone in an effort to help their families put food on the table. It is reported that at one time as many as 30 children between the ages of nine and fourteen were working on the dam site.

Initially, the labourers and engineers stayed together in tents. Kokot had a strict rule: no liquor and no women! However, liquor was easily smuggled in and the workers' wives soon started arriving on site, living in makeshift shelters. Later these shelters were replaced by wooden units with sink roofs and clay floors for the use of families. Unmarried men remained in the tented camp or the so-called 'bachelor's camp'.

Everything, from labourers to equipment, sluices and even the stone crusher was initially transported piece by piece by donkey cart from the nearest train station at Draghoender, more than 60 km away. Such a round trip could not be done in a day. Thus the hotel, the liquor and grocery stores at Draghoender became very popular during the construction of Buchuberg Dam. The donkeys were later replaced by trucks, rented from richer farmers in the region.

In June, 1930, a school was opened (although the pioneer teacher, Koos de Beer, initially taught children under the trees with no books and no desks). Although the camp later boasted a hospital with a medical officer paid for by the Department of Labour, these were tough times, and around 50 people (including 38 children) died during the construction of the dam. In 1933, the river stopped flowing, causing an outbreak of diarrhoea. The camp was also plagued by malaria when the river was in flood.



The dam was initially constructed with 68 sluices designed to allow sediment to pass through the structure. The crane used to open the sluices can be seen in the lower right corner of the photograph.

Courtesy of Leon Terblance

By 1932, construction of the dam had advanced enough for water to flow into the canal for the first time. The dam wall was constructed to a final height of 10,7 m and is 622 m long. The dam was initially equipped with 68 sluices designed to allow sediment to pass through the structure.


The completion of the 121 km canal in 1934 was celebrated with big fanfare. Dignitaries walked ahead of the water in the canal and at the canal's end a prayer of thanks was held.

All present had to pick up a stone along the way which was to be used later to construct a monument in honour of those who constructed the dam. The monument did not materialise until some years later when a rebuilt oxwagon camped at this venue on its way to a commemoration ceremony of the Great Trek. The monument that was erected afterwards served a dual purpose (to commemorate the Great Trek and, with the inclusion of the stone collection, the pioneers of the Buchuberg Dam and canal).

SOURCES

Boegoebergdam se Mense – 'n Flukse Draai van die Wiel by Lokkie van Zyl.
Hydropolitical History of South Africa's International River Basins (WRC Report No: 1220/1/04).
Buchuberg Irrigation Works on Orange River, Prieska. Report on the Proposed Buchuberg Canal from the Orange River by Mr WB Gordon, Director of Irrigation, Cape Town. Department of Water Affairs & Forestry website (www.dwaf.gov.za).
 Thanks to Mr Leon Terblance for photographs.

Although the dam had an initial storage capacity of 40 million m³, this has been halved through the years through sedimentation. The sediment sluices have been closed permanently and the structure is now effectively a concrete weir which supplies water into the canal on the left bank. Today, the Buchuberg canal supplies water to 7 560 hectares of irrigation in the area, most of which is used for field crops and a small portion of fodder crops.

At present, the Buchuberg site is one of several sites being considered for a new larger dam along the lower Orange River to provide additional storage and regulation capacity below the Vanderkloof Dam. It is thought that a new weir will be constructed at a proposed construction site about 1,5 km downstream of Buchuberg Dam, although a final decision is still pending. 

In-field Rainwater Harvesting on Croplands:

Opportunities and Challenges

In-field rainwater harvesting, which has been successfully applied in backyard food gardens in several rural communities of South Africa, is now being upscaled to communal croplands. However, it will take more than technology to cure the country's food security ailments, writes Water Research Commission (WRC) Director: Water Utilisation in Agriculture, Dr Gerhard Backeberg.

Over the last 18 years the WRC has invested in a range of research projects on different aspects of rainwater harvesting. This research began with a sequence of projects by the Agricultural Research Council (ARC) Institute for Soil, Climate and Water, which led to the development and testing of the technique of infield rainwater harvesting and conservation (IRWH&C).

In general terms, IRWH can be classified as a micro-catchment, on-farm method of water harvesting with runoff strips. This new technique is now successfully applied in backyard food gardens by more than 1 000 households in 42 villages at Thaba Nchu, in the Free State.

The potential was identified for upscaling of IRWH to communal croplands.

For this purpose the University of the Free State developed an innovative and cost-effective procedure to delineate soils suitable for cultivation and rainwater harvesting. Experts such as Dr Malcolm Hensley are convinced that with IRWH farmers can e.g. produce enough maize for own consumption and also earn cash with the sale of surpluses.

KEY ISSUES

Observations and anecdotal evidence indicate that communal cropland (i.e. land held as common property) adjacent to these rural villages has mostly not been cultivated for about the last 25 years. This can probably be explained by the low and variable crop yields achieved with conventional ploughing and planting practices.

“Land use planning must be done in participation with plottolders and households in rural villages.”

The contention is, however, that this situation of unutilised land also has to be attributed to institutional failures. This means that land rights, or rules which govern the access to land, have over time broken down. This argument is based on the institutional economic principle that secure property rights are the incentive for productive use of resource. In other words, although higher yields of up to 50% can be expected with IRWH&C, this technological innovation will not be practically applied unless it is preceded by additional institutional innovations.

If this reasoning is correct, the investment by the WRC to promote productive use of soil and rainwater will under present conditions not achieve the fullest possible impact of increased food production and reduced poverty in rural areas.

The WRC therefore initiated a pilot project with the expert inputs by Siyabu Manona of Umhlaba Consulting, to develop a land register of communal cropland for three villages in Thaba Nchu. The findings of this study confirm the near collapse of the prevalent land tenure system, i.e. the entitlements to use communal land for rainfed crop production and the organisational structures to manage the access to the land.

After consultation a participative process was started to establish representative groups in the villages and to formulate rules which are generally accepted. In order to succeed and gain momentum, this process deserves support from a number of role-players. With the knowledge generated by the available research reports it is clear that two related actions are required.

Firstly, further research must be undertaken on access to markets and finance; on institutional arrangements and organisational relationships within the traditional cultures; and on essential farmer support services in order to ensure that IRWH&C is socially acceptable and economically viable. This is being done through WRC solicited research projects by the University of the Free State, University of Fort Hare and the ARC, to enable sustainable food production in household gardens and communal croplands.

Secondly, major contributions can be made by cooperation between public servants in the Department of Water Affairs & Forestry, Agriculture, Land Affairs, Provincial and Local Government for service delivery to farmers, within the existing legal framework and implementation of various departmental strategies. In this regard, four issues should be highlighted:

- ◆ Existing land rights must be explicitly delimited so that each holder gains exclusive access to his or her own plot; that rules are enforced to prevent e.g. damage by livestock or loss through theft; and that use rights can be transferred through e.g. share-cropping or lease agreements.
- ◆ Provision must be made on departmental budgets for fencing of croplands and supporting entrepreneurs who are interested to start new business ventures such as ploughing or transport services.
- ◆ Land use planning must be done in participation with plottolders and households in rural villages.



FOOD SECURITY IN SOUTH AFRICA

Food security remains a priority issue for South Africa despite the country's national 'food secure' status. An estimated 14 million people, or about 35% of the country's population, are estimated to be vulnerable to food insecurity, while the development of as many as 1,5 million children under the age of six is reckoned to have been stunted by malnutrition. The present situation in South Africa shows that food security is not a failure of agriculture to produce sufficient food at the national level, but rather a widespread, complex failure of households to guarantee access to sufficient food. Food insecurity and malnutrition are highest in provinces with large rural populations, such as KwaZulu-Natal, Limpopo, Eastern Cape and the Free State. Overall, poor households seem to have a greater reliance on purchased food as opposed to own-produced food, with most of these poor households being dependent on social grants and/or pensions as their only income. Thus, there is a continued need to strengthen small-scale farming and community food gardening programmes.



A farmer prepares his land for planting using the in-field rainwater harvesting technique.

◆ Demonstration plots of IRWH must be established on communal croplands, together with practical skills training and goal directed extension programmes to reach women and men who are interested to begin with farming enterprises.

A number of related WRC projects are currently ongoing, and an extensive list can be found in the **2007/08 Knowledge Review**. One such project, being undertaken by the ARC, is assessing water harvesting and conservation techniques/practices for

“Although higher yields of up to 50% can be expected with in-field rainwater harvesting and conservation, this technological innovation will not be practically applied unless it is preceded by additional institutional innovations.”

improved rangeland and cropland productivity in communal areas through on-station (controlled) and on-farm (participative) research. The project is investigating the institutional arrangements in these communities and assessing the extent to which production has been historically suppressed as a result of inappropriate working rules and how these can be improved. It is envisaged that a guideline on best management practices for IRWH&C for rangeland and croplands will be produced.



Left: *In-field rainwater harvesting can be used to cultivate a range of crops, in this case carrots.*

Right: *When using the in-field rainwater harvesting technique, runoff water accumulates in basins and percolates beyond the evaporation zone.*



AVAILABLE WRC RESEARCH REPORTS ON IN-FIELD RAINWATER HARVESTING AND CONSERVATION



Report No: 508/1/97
 Modelling the Water Balance on Benchmark Isotopes (Agricultural Research Council – Institute for Soil, Climate and Water)

Report No: 878/1/00
 Optimising Rainfall Use Efficiency for Developing Farmers, with Limited Access to Irrigation Water (ARC – ISCW)

Report No: 1176/1/03
 Water Conservation Techniques on Small Plots in Semi-arid Areas to Enhance Rainfall Use Efficiency, Food Security and Sustainable Crop Production (ARC – ISCW and University of Free State)

Report No: 1267/1/04
 Socio-economic Study on Water Conservation Techniques in Semi-arid Areas (UFS)

Report No: TT 313/07 (Vol 1) and TT 314/07 (Vol 2)

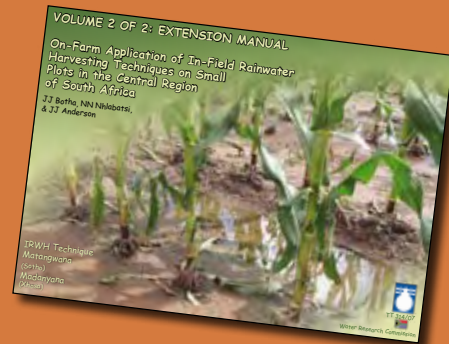
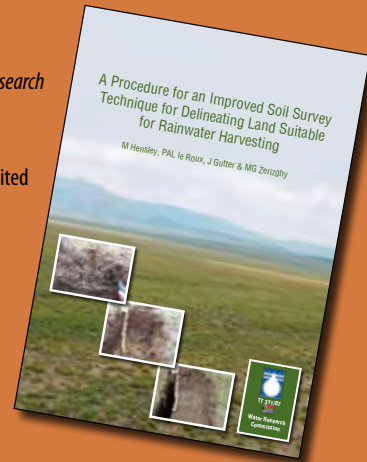
On-farm Application of In-field Rainwater Harvesting Techniques on Small Plots in the Central Region of South Africa (ARC – ISCW and UFS)

Report No: TT 311/07

A Procedure for an Improved Soil Survey Technique for Delineating Land Suitable for Rainwater Harvesting (UFS)

Report No: TT 367/08

Developing a Land Register and a Set of Rules for Application of Infield Rainwater Harvesting in Three Villages in Thaba Nchu: A Pilot Project (Umhlaba Consulting Group)



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Another project is developing a comprehensive learning package for the application of IRWH&C for household food production and poverty alleviation in rural areas. It will identify the existing unit standards for training in rainwater harvesting and fill the gaps in learning material by adopting and adapting available material and developing a comprehensive package, which will be tested in the field with trainers, facilitators and learners. Work is also continuing to assess the social and economic acceptability of rainwater harvesting and conservation practices in selected peri-urban and rural communities.

The results from completed projects are made available through reports (a list which can be found elsewhere on this page). These reports can be ordered and are distributed free of charge as part of the WRC's mandate for knowledge dissemination. The WRC is also willing to

facilitate knowledge exchange sessions, led by the relevant scientists, on how best to use the information contained in the reports.

Although this research work was completed in the semi-arid region of central South Africa, the principles are applicable in different regions of all provinces. The complexities of each particular farming region will obviously have to be taken into consideration and adjustments will accordingly have to be made. Nonetheless, the implementation of these guidelines, procedures and approaches will contribute to higher food security and lower poverty among households in many more rural areas.

Concerted efforts by everyone involved in this initiative will make a difference, improve rural livelihoods and promote growth and development of agricultural production in South Africa.



SA Leads Regional March Towards NANO-ENABLED SOCIETY



Hannelie Coetzee

The sophisticated science of nanotechnology is said to hold unlimited potential for uplifting the poor, for example, through the creation of more cost-effective cement and concrete.

Southern Africa's governments, led by South Africa, are increasingly looking towards science and technology at the nanoscale as a possible solution to some of the region's socio-economic challenges.

Lani van Vuuren reports.

According to South African Minister of Science & Technology Dr Mosibudi Mangena, nanotechnology is one of the key features of a new science, technology and innovation strategy being developed for the Southern African Development Community (SADC) following a meeting of the region's science and technology ministers in December. This follows the adoption of the Protocol on Science, Technology and Innovation in August last year.

Speaking at the NanoAfrica 2009 conference in Pretoria in February, Dr Mangena said as the new Chair of SADC, South Africa would ensure that a platform is

created for regional dialogue in the area of nanotechnology. Nanotechnology is the act, science and engineering for manipulating objects at the nanoscale (one nanometre is about one million times smaller than a millimetre). "The nano-disciplines have emerged from small beginnings to become one of the most enterprising and promising disciplines in the world of science. For South Africa, the most exciting thing of all is the potential that nanotechnology holds to change the lives of the disadvantaged for the better."

Water treatment for rural communities using nanotechnology has already been

tested at pilot scale in South Africa, while there is promise of a more effective tuberculosis treatment due to successes achieved in drug delivery through nanotechnology.

Another potential area in which there has been little local research to date is that of improved production of cost-effective cement and concrete through the application of nano-materials. Delivering a paper at NanoAfrica 2009 Stephen Ekolu of the School of Civil and Environmental Engineering at the University of the Witwatersrand said that the introduction of nano-engineered materials could result in cheaper construction

materials, cheaper and better housing for the poor, durable infrastructure, and improved traditional construction materials. "Materials making up cement can be targeted and manipulated at nanoscale to enhance or generate desirable powerful processes not possible with conventional systems. The real anticipation here is that, ultimately, nano-enabled products will be more efficient, smarter, lighter, faster, stronger and, at the same time, cheaper to produce than conventional products."

The South African government's interest in nanoscience and nanotechnology has been formalised through the National Nanotechnology Strategy, aimed at improving coordination of nanoscale research and development at a national level. South Africa is one of the first countries in the world to have an official nanotechnology strategy.

The implementation plan for the National Nanotechnology Strategy broadly outlines programmes and projects spread over ten years that will contribute to the attainment of the strategy's objectives. They involve the creation of platforms for human capital development, building of infrastructure, and promotion of innovative thinking, ideas and ways of doing things. "In many ways, nanotechnology is already well established and has brought benefits for most during the twentieth century," said Dr Mangena. "Many of its techniques and applications, such as powder metallurgy, catalysis, optical coatings and semiconductor films, have been around for over 50 years."

On top of these there are new materials such as carbon nanotubes, new synthesis methods, such as catalytic and hot-wire chemical vapour deposition and biosynthesis, and new applications for solar cells and thin film transistors. Consolidating old and new, including various academic disciplines, such as chemistry, physics and engineering, under the name 'nanotechnology', opens opportunities for developments in new materials, said Dr Mangena.

Science & Technology Minister Dr Mosibudi Mangena believes nanotechnology could do much to improve the lives of southern Africa's poor.



Lani van Vuuren


Following the adoption of the strategy in 2005, two national nanotechnology innovation centres were opened at CSIR and Mintek. While the CSIR National Centre for Nano-structured Materials focuses on materials and energy research, the centre at Mintek concentrates on water, health, mining and minerals. Dr Mangena expressed his delight with the progress at these centres.

He added that the Department of Science & Technology (DST) also encouraged and supported the local nano-community's involvement in collaborative research through various bilateral agreements with other countries. NanoAfrica 2009, which attracted around 200 delegates from 20 countries, also saw the launch of the India, Brazil, South Africa (IBSA) Nanotechnology Forum. During previous IBSA missions health, water, energy and advanced materials were identified as areas of mutual interest for possible collaboration. "All of these tie in with the South African National Nanotechnology Strategy," noted Dr Mangena.

Various IBSA working groups and ministerial meetings had discussed a number of proposals and initiatives, leading to

the approval of the IBSA Nanotechnology Proposal in 2007. "The mentoring of young scientists and the development of human resources were seen as key priorities and the implementation of the proposal which commences this year starts with the hosting of a nano-school in India in May," reported Dr Mangena. The second nano-school with a focus on health will be hosted in South Africa in November.

DST has also endorsed the newly-established Nanocentre for Africa at iThemba Laboratories for Accelerator Based Sciences (LABS). The centre is the continental platform for nanoscience and nanotechnology. Its aim is to produce solutions to pressing socio-economic problems related to health, water and energy. "Since nanotechnology is a new area of research in Africa, the centre will have to play a critical role in promoting awareness about it," said Dr Mangena.

In the end, said the DST Minister, nanotechnology had to be applied to create a better world for all. "Nanotechnology's highest and best use should be to create a world of abundance where no one is lacking for their basic needs." 

TRANSBOUNDARY WATERS: We all live downstream

Rivers know no boundaries. Their paths have been carved out through valleys and mountains over centuries, without thought of the political systems of the countries through which they flow or the international rules used to manage them.

Around the world, there are more than 260 river and lake systems shared by more than one country. Known as trans-boundary or international river systems, the basins from which these rivers and lakes draw their water are home to about 40% of the world's population. Less is known of the aquifers (under-ground reservoirs of water) shared between countries, however, to date, around 300 transboundary aquifers have been recorded.

While most transboundary rivers systems are shared between just two countries, there are many rivers where this number is much higher. There are 13 river systems worldwide that are shared between five to eight countries. Five river systems, the Congo, Nile, Rhine and Zambezi, are shared between nine to eleven countries. The river that flows through the most countries is the Danube, which passes through the territory of 18 countries.

This is significant because it means that the way we treat our water might also affect the water supplies of our neighbours.

Many people have spoken of so-called 'water wars' – conflicts over limited and shared water supplies – that might occur between countries in future as water resources become scarcer, and such shared waters might well hold potential for conflict. However, history has shown that transboundary waters are more likely to be catalysts of peace rather than conflict. Over the last 60 years, there have been more than 300 international water agreements, compared to less than 40 conflicts over water. We need to continue to nurture the opportunities for cooperation that transboundary water management can provide.

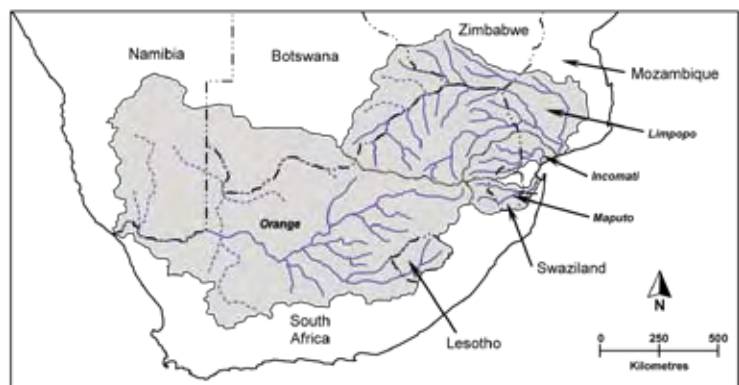
TRANSBOUNDARY WATERS IN AFRICA

In Africa, transboundary river systems provide 93% of the renewable surface water. There are 63 river systems that cross international borders, quite considerable when considering there are only 53 countries in Africa. The continent boasts a number of large river systems shared by quite a number of countries, for

SOUTHERN AFRICAN SHARED RIVER BASINS		
Countries	Area of Basin in Country	
	km ²	%
Incomati		
South Africa	29 200	62,47
Mozambique	14 600	31,20
Swaziland	3 000	6,33
Limpopo		
South Africa	183 500	44,25
Mozambique	87 200	21,02
Botswana	81 500	19,65
Zimbabwe	62 600	15,08
Maputo		
South Africa	18 500	60,31
Swaziland	10 600	34,71
Mozambique	1 500	4,98
Orange		
South Africa	563 900	59,65
Namibia	240 200	25,40
Botswana	121 400	12,85
Lesotho	19 900	2,10

Source: Atlas of International Freshwater Agreements

Right: The positions of the four river basins that South Africa shares with its six neighbours.



FACTS AND FIGURES ABOUT TRANSBOUNDARY WATERS

- Over 90% of people in the world live in countries that share river basins.
- About 40% of the world's people live in river and lake basins that are shared between two or more countries.
- There are about 300 transboundary aquifer systems in the world on which more than two billion people depend for water.
- There are 263 transboundary river and lake basins that cover nearly one half of the Earth's land surface.
- The Danube is the river system shared by most countries (18).
- More than 3 600 treaties have been identified relating to international water resources dating from AD 805 to 1984. The majority of these treaties are concerned with some aspect of navigation.

example, the Nile, which is shared between ten countries (Burundi, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Uganda, Tanzania, and the Democratic Republic of Congo).

South Africa shares four major river systems with neighbouring countries:

- The Orange-Senqu system is shared with Lesotho and Namibia
- The Limpopo River is shared with Botswana, Zimbabwe and Mozambique
- The Incomati system is shared with Swaziland
- The Usutu/Pongola-Maputo system is shared with Mozambique and Swaziland.

South Africa has signed and ratified the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, which promotes the principles of equitable and reasonable utilisation and the obligation not to cause significant harm (to downstream users). It also prescribes to the Southern African Development Community Protocol on Shared River Courses.

The management of internationally shared surface and

WHAT IS TRANSBOUNDARY WATER?

Transboundary water refers to lakes, rivers, and aquifers (groundwater) which are shared between more than one country.

groundwater resources is considered so important to South Africa that it has been taken up in the country's national laws (namely the National Water Act). This Act gives international requirements a priority that is second only to the basic human needs and the Ecological Reserve. This means that no infrastructure may be developed in any transboundary waters without considering the needs (or without the involvement) of the other countries involved.

WORLD WATER DAY

The theme 'Shared Water – Shared Opportunities' has been selected as the theme for this year's World Water Day, which is celebrated on 21 March. Special focus will be placed on transboundary waters. Nurturing the opportunities for cooperation in transboundary water management can help build mutual respect, understanding and trust among countries and promote peace, security and sustainable economic growth. For more information on World Water Day Visit: www.unwater.org/world-waterday/ or for South African National Water Week activities, Visit: www.dwaf.gov.za



Dirnie van Rensburg

The Limpopo River forms the border between South Africa and Botswana.



Dirnie van Rensburg

The Limpopo River flood plains near Xai-Xai in Mozambique and a bridge across the river.



Dirnie van Rensburg

The Platjan border post between South Africa and Botswana.



Dirnie van Rensburg

The Limpopo River mouth in Mozambique.

It's a Beetle ID Parade at Workshop

World aquatic beetle specialist Prof Olof Bistrom took time out from his one-month visit to the Albany Museum in Grahamstown in November to present a workshop on the identification of aquatic beetles. Prof Bistrom's work focuses on the aquatic beetle family *Dystiscidae*. As Volume 10 of the *Guides to the Freshwater Invertebrates of Southern Africa* had recently been published this also

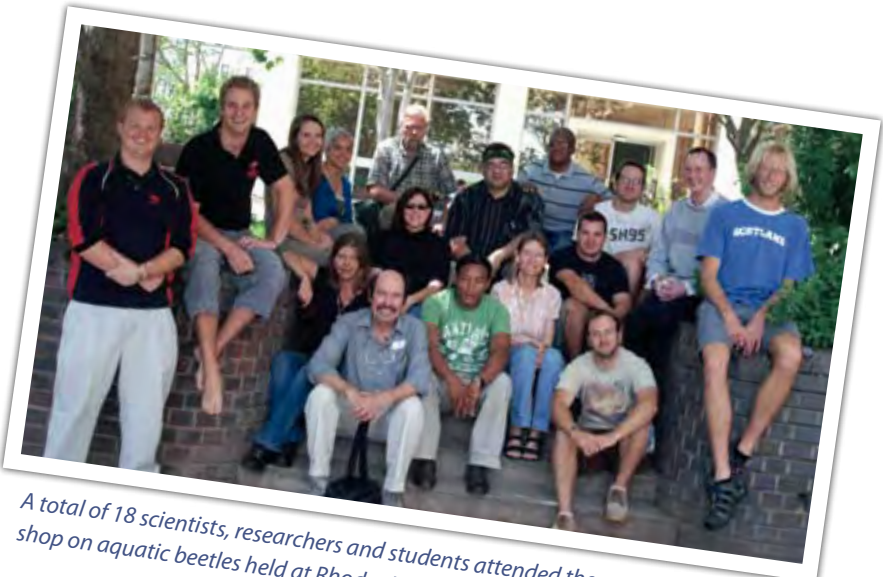
presented an ideal opportunity to test the accuracy and ease of use of such a guide by non-specialist researchers and students of aquatic invertebrates, reports Dr Ferdy de Moor of the Albany Museum. Prof Bistrom and Riaan Stals (scientific editor of this guide) were invited to run the workshop together with Prof Marin Villet from Rhodes University and Dr de Moor. Identification guides

generally make use of 'keys' or a number of discernable characters to enable users to identify species. According to Dr de Moor, the importance of good identification lies in looking at a number of features in a systematic way thereby discovering where there are consistent differences (between species), often in characters not even used for the key that was constructed, and based on the species known at the time.



All photographs courtesy Ferdy de Moor

Prof Olof Bistrom collecting specimens for the workshop, which focused mainly on the two large aquatic beetle families *Dystiscidae* and *Hydrophilidae*.



A total of 18 scientists, researchers and students attended the workshop on aquatic beetles held at Rhodes University in November.



The workshop was presented by (standing) Riaan Stals of the Agricultural Research Council; Prof Olof Bistrom, Director of the Zoological Museum of Helsinki, Finland; Prof Martin Villet of Rhodes University and (seated) Dr Ferdy de Moor of the Albany Museum.



Participants identifying beetles using the latest invertebrate guide. Beetles from the Albany Museum, Transvaal Museum and ARC's collections were provided while delegates also brought in large numbers of beetles they had collected during research projects.

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Aim of the Conference

Water Loss 2009 is intended to present and discuss the latest developments, strategies, techniques and applications of international best practices in water loss assessment, management, leakage reduction and control, and improvement of customer metering.

The conference is the fifth event in a series of IWA Water loss reduction speciality conferences.

Water Loss 2009 is being brought to the African region in order to address the pressing need for improved water utility efficiency in this part of the world.

Programme Themes

- **Feasibility and Benefits** (economic, social, environmental and technical) of undertaking water loss reduction projects.
- **Performance Indicators and Best Practice.** It is important to understand which indicators are required to evaluate feasibility of options.
- **Intervention Techniques** to find leaks and reduce water loss.
- **Sustainability.** Success stories achieving lower sustainable water losses.

Scientific Programme

The draft technical programme will be available on the website from 8 February 2009. Conference Proceedings will officially commence on Tuesday morning 28 April 2009 with an optional half-day workshop on the Basic Concepts of Water Demand Management on Monday 27 April 2009.

Social Programme

The social programme includes:

Welcome Reception on Sunday evening, 26 April 09 incl in reg fee
 Trip to Robben Island, Monday pm 27 April 09 R350.00 pp
 Cocktails in Two Oceans Aquarium, 27 April 09 R350.00 pp
 Conference Dinner on Wednesday evening, 29 April 09 incl in reg fee
 Additional Africa Dinner on Thursday evening R500.00 pp

More information regarding the companions programme and pre- and post conference tours are available on the conference website.

	Early Bird (closes 15 Feb 09)		Normal Registration	
	€	R (incl. VAT)	€	R (incl. VAT)
IWA Member	€ 370	R 5500	€ 420	R 6200
IWA Non-Member	€ 490	R 7250	€ 540	R 8000
IWA Member (low income country)	€ 260	R 3850	€ 300	R 4450
IWA Non-Member (low income country)	€ 320	R 4750	€ 350	R 5200
Companion fee	€ 120	R 1750		

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