

New from the WRC

Report No: TT 267/08

Technology Transfer and Integrated Implementation of Water Management Models in Commercial Farming (A Pott; N Benadé; PS van Heerden; B Grové; JG Annandale and M Steyn)

Commercial irrigation accounts for about 62% of South Africa's total water use. There have been increased calls for the irrigation sector to improve its water use efficiency, and through the years the WRC has funded various research projects to achieve just that. These projects have resulted in the development of several irrigation efficiency models and

programs, including the Agricultural Catchment Research Unit (ACRU) model, Water Administration System (WAS), irrigation scheduling program (SAPWAT), Soil Water Balance (SWB) and Risk Management Simulation Model (RISKMAN), which have all proved to be popular and are used widely. A new technology transfer project involved water user associations and water boards to act as centres of excellence as a means of lesson sharing. A central feature of this project is to capture accurate data in a geographic information system (GIS). The project will assist in providing water resource managers and other stakeholders with valuable information, enabling them to evaluate water management scenarios.

Report No: 1286/1/07

Development and Application of Prokaryotic Biosensor Systems for the Evaluation of Toxicity of Environmental Water Samples (B Pillay and D Pillay)

Pollution of water systems poses a severe threat to human health and is of serious environmental concern. The problem is exacerbated by the fact that detection of pollutants in the environment is currently time-consuming and expensive. The WRC funded a successful study into the evaluation of eco-toxicity testing using bacterial bioluminescence biosensors as an effective and cost-efficient means of detecting pollutants

in water. Detection is based on the production of light in modified bacteria, through the effect bio-available pollutants have on the metabolic activity of cells. The amount of light emitted provides an indication of the presence of toxic substances, and a measure of the toxicity of the pollutants. Several different bacterial biosensors with the ability to emit a readily detectable signal (light) in the presence of a wide range of environmental pollutants were developed. The data generated from the research proved the potential of using biosensors to monitor pollution in water resources.

Report No: 1502/1/08

PCB-based Markers for Detection and Identification of Toxic Cyanobacteria (Anna-Marie Botha-Oberholster and Paul Johan Oberholster)

Toxic cyanobacteria found in eutrophic, municipal and residential water supplies are an increasing environmental hazard in South Africa. The objectives of this study were to determine the genetic diversity and population structures in selected South African water reservoirs; and to determine the potential of using the *mcyB* sequence as a diagnostic tool in raw water to detect the presence of toxin-producing cyanobacterial spp. in South African water reservoirs.

Report No: 1320/1/08

Definition and Upscaling of Key Hydrological Processes for Application in Models (Simon Lorentz; Kevin Bursey; Olufemi Idowu; Cobus Pretorius and Kalala Ngeleka)

The clear definition and quantification of the sources and pathways of components of discharge making up streamflow is becoming increasingly important. This project aimed to define key hydrological processes at a range of scales by observation and experimentation at these scales in order to improve deterministic, physically-based simulation tools so that land-use changes, streamflow reduction activities, surface and groundwater interactions and topological runoff generating mechanisms are linked conceptually and spatially to the responses at each scale.

Report No: 1250/1/08

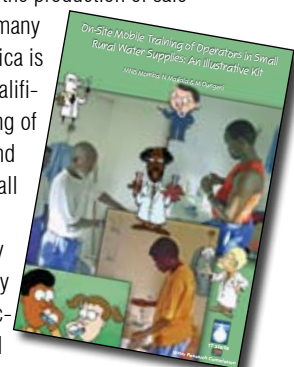
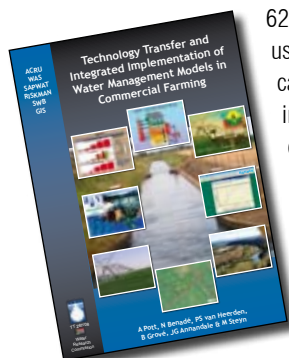
Market Risk, Water Management and the Multiplier Effects of Irrigation Agriculture with Reference to the Northern Cape (DB Louw; HD van Schalkwyk; B Grové and PR Taljaard)

The main objective of this project was to quantify the impact of market risk on the efficient use of irrigation water and to determine the multiplier effects of irrigation accompanied by a shift in production patterns, with reference to the middle and lower Orange River, on the total economy of the Northern Cape. The project also looked at identifying and quantifying risk factors in irrigation agriculture; developing a decision-making framework that farmers can use to reduce their risk; comparing present water-use practices with optimal risk-reducing practices; and developing a policy framework for irrigation agriculture that would reduce risk and improve the financial viability of the individual farmers and of irrigation schemes.

Report No: TT 348/08

On-Site Mobile Training of Operators in Small Rural Water Supplies: An illustrative kit (MNB Momba; N Makala and M Dungeni)

A major barrier to the production of safe drinking water in many areas of South Africa is the inadequate qualifications and training of many operators and supervisors at small treatment plants. This is particularly a problem in newly established municipalities which did not previously have water services. In rural water treatment plants there is a need for more operators to upgrade their training in order to achieve the necessary improvements in performance to produce water that is consistently safe to drink. This illustrative kit follows on the on-site mobile training of 26 operators from seven different small water treatment plans in the Eastern Cape. It emphasises why each step in water treatment is important and how to check the performance at each stage.



Report No: 1507/1/08*Determination of the Impact of Coal Mine Water Irrigation on Groundwater Resources (PD Vermeulen; BH Usher; and GJ van Tonder)*

It is predicted that vast volumes of impacted mine-water will be produced by mining activities in the Mpumalanga coalfields of South Africa. Research over more than a decade has shown that this water can be used successfully for the irrigation of a range of crops. There is, however, continuing concern from local regulators regarding the long-term impact that large-scale mine-water irrigation may have on groundwater quality and quantity. The results from this study into the potential impact of coal mine-water irrigation on groundwater resources indicate that many of the soils have considerable attenuation capacity and that in the period of irrigation, a large proportion of the salts have been contained in the upper portions of the unsaturated zones below each irrigation pivot. The volumes and quality of water leaching through to the aquifers have been quantified at each site. From this, mixing ratios have been calculated to determine the effect of the irrigation water on the underlying aquifers and expected salt load addition from different irrigation options.

Report No: 1411/1/08 & 1411/2/08*The Development of a Hydraulic Model for Determining Bed Disturbance Due to Floods in Cobble and Boulder Bed Rivers (J Cullis; M Gazendam; A Rooseboom; and G Ractliffe) & Flood Disturbance Responses of Invertebrate Assemblages in Two Cobble-Boulder Bed Rivers of the Western Cape (G Ractliffe; J Cullis; and A Rooseboom)*

The first report, referred to as the Hydraulics Report, outlines the development of a mathematical hydraulic model used to predict bed disturbance under particular flood events. A simple empirical model relates the DRIFT flood class to the intensity of movement (i.e. the total percentage of cobbles that move), and a more detailed model that looks at the probability of movement of individual stones in cobble and boulder bed rivers based on a critical Movability Number that represents the ratio of applied power to required power. The second report, referred to as the Ecological

Disturbance Report, considers the relationship between bed disturbance due to flood events and the impact and response of invertebrate assemblages in the two observed cobble and boulder bed rivers in the Western Cape.

Report No: KV210/08*Principles of a Process to Estimate and/or Extrapolate Environmental Flow Requirements (CJ Kleynhans; AL Birkhead; and MD Louw)*

The primary objective of this project was to develop a procedure for extrapolating ecological water requirement (EWR) low-flow results from Reserve sites to additional locations (termed hydro-nodes) that have a degree of ecological similarity. The extrapolation procedure refers to hydrological extrapolation by adjusting default parameters in the Desktop Reserve model, and is the current approach for estimating EWRs for additional river locations.

Report No: 1684/1/08*Towards Improved Estimates in Water Resource Assessments: the Use of Hyperspectral and Multispectral Imagery to Classify and Map Vegetation in Southern Africa (M Govender; V Naiken; K Chetty; and H Bulcock)*

This project aimed to review hyperspectral remote sensing technology and its application in vegetation and water resource studies; measure and characterise the spectral signatures of selected vegetation classes, for example, indigenous, exotic and declared or candidate streamflow reduction activities for southern Africa; map selected and classified vegetation classes from the research site using hyperspectral imagery; and contribute the results towards an envisaged spectral library for vegetation in southern Africa.

Report No: 1582/1/08*Methods and Software for the Real-Time Implementation of the Ecological Reserve – Explanations and User Manual (DA Hughes; SJJ Mallory; and D Louw)*

The project and its results are about real-time water management that includes an allowance for the Reserve as well as water users. In that respect the project has been about

developing methods whereby the analyses that are typically undertaken using a water resource systems yield model can be given effect to in a real-time operational system. The project has generated a number of deliverable reports that contain the full technical details of all methods and software that have been developed, as well as the revisions that occurred as a result of interactions between the project team and potential users.

WATER BY NUMBERS

44 – The age of the June rainfall record that was broken at Paddock weather station along the KwaZulu-Natal coast during recent heavy rains. The weather station recorded 382 mm on June 17, breaking a record which has stood since 1964.

2012 – The year by which the world population will reach 7 billion, according to a US government projection. The world population surpassed 6 billion in 1999, meaning it will only take 13 years to add a billion people.

R5-billion – The funds allocated to Johannesburg Water's project to upgrade and rehabilitate municipal water infrastructure across the city.

11 – The number of dams which provide bulk water to the City of Cape Town and surrounds. The city also has 20 bulk reservoirs and 12 water treatment plants.

115 – The number of municipalities in South Africa where 60% of more households do not have access to water in their dwellings or in their yards. This number is down from 155 in 2007, according to Minister of Provincial and Local Government Sydney Mufamadi.

5 680 ℓ – The volume of water it takes to process one barrel of beer.

September 2008 – The target date for the removal of the remaining 23 083 bucket toilets in the Free State, Northern Cape and Eastern Cape.

950 000 – The number of work opportunities created by the Expanded Public Works Programme between 2004 and 2007. The programme aims to create 1,3 million jobs by 2009.

16 000 – The number of residents in especially informal settlements affected by flooding due to July storms in Cape Town.

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