WATER RESEARCH COMMISSION

HYDROLOGY-RELATED REPORTS

2015 – 2025

SP 188/25

Obtainable from:
Water Research Commission
Private Bag X03
Gezina
0031

SP 188/25

Printed in the Republic of South Africa

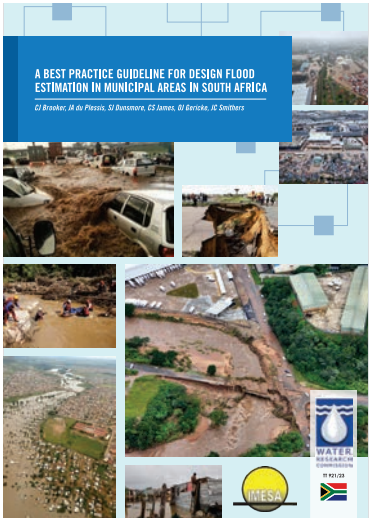
INTRODUCTION

Hydrology-related research is a cornerstone of the South African Water Research Commission's (WRC) mission to secure the country's water future. South Africa is a water-scarce nation, highly vulnerable to climate variability, population growth, rapid urbanisation, and competing demands across agriculture, industry, and households. In this context, understanding the science of water – how it moves through landscapes, interacts with ecosystems, and responds to human use – is critical for ensuring sustainable supply and equitable access. Hydrology provides the knowledge base needed to protect rivers, aquifers, and wetlands, manage flood and drought risks, and plan for long-term water security in an uncertain climate.

The WRC plays a pivotal role in advancing hydrological research that bridges science and practice. By investing in monitoring technologies, modelling tools, and integrated water resource management approaches, the Commission supports evidence-based decision-making for water managers, municipalities, and policymakers. Importantly, hydrology research at the WRC is not limited to theory; it is deeply applied, addressing real-world challenges such as groundwater availability for rural communities, early warning systems for extreme weather, and strategies to enhance ecological resilience. In doing so, the WRC ensures that South Africa's water sector is equipped with the data, innovations, and human capacity needed to meet present and future challenges.

This booklet showcases the latest research available from the WRC on this topic.

CLIMATE AND WEATHER



A BEST PRACTICE GUIDELINE FOR DESIGN FLOOD ESTIMATION IN MUNICIPAL AREAS IN SOUTH AFRICA

WRC report no. TT 921/23

The requirements for design flood estimation in urban areas are changing largely as a result of the pressure placed on flood-prone land by rapidly expanding urban populations. This guideline is aimed at flood risk determination in municipal catchments. It is intended to assist municipal officials in carrying out their flood management and stormwater design responsibilities. Hence, the focus is much wider than flood line determination. The recommended design flood estimation methods are selected from the range of methods in use in South Africa as being the most suitable for urban catchments and Municipal requirements. The selected methods are not ideally suited to large river catchments. Municipalities located on large rivers will need to look at other methods when determining flood lines for these main watercourses. This guideline seeks to set out best practice for design flood estimation at the municipal level. In doing so, it gives emphasis to the responsibilities and, therefore, accountability of the Municipal Manager regarding flood management planning and awareness and the expertise of officials and appointed external practitioners.

Click here to download

OTHER REPORTS

Dynamic system water balance model (DYWABM) enhancements: Climate change and water quality risks using Steve Tshwete Local Municipality as a case study area

A linear approach to solving water-related problems leads to the transfer of risks and costs from one user/sector/place to another, which is not in line with principles of sustainable development and equitable access to water resources. A dynamic system water balance model (DyWaBM) developed on the Kgetlengrivier Local Municipality in the North West Province of South Africa was applied to a more complex water supply system in the Steve Tshwete Local Municipality (STLM) in the Mpumalanga Province of South Africa to enhance its capabilities on water quality and climate change risks. It works with operational time scales, testing interventions that can affect water security on a day-to-day basis. In this study, the basic water system configuration for STLM was developed using baseline data which included land use, water resources, bulk water supply and wastewater infrastructure.

WRC report no. 3144/1/24

Click here to download

Investigating and accounting for non-stationary data in design rainfall and flood estimation: Case study in KwaZulu-Natal, South Africa

Standard methods for frequency analysis of extreme rainfall and flood events assume a stationary climate, i.e. the statistics of the data do not change over time. However, the reported increase in the occurrence of extreme rainfalls leading to catastrophic flood events has raised the question of whether changes in the magnitude and frequency of observed extreme rainfall events are already evident in South Africa. Many observations of global climate trends have raised an increasing concern that the extreme rainfalls, including the Probable Maximum Precipitation (PMP) needed for the design of high-hazard hydraulic infrastructure, will change as a result of the influence of a changing climate. This project aimed to review and refine the updated 1-day PMP estimates; develop and assess the performance of a method to account for the impacts of non-stationary data on PMP estimation; develop and assess the performance of a method to account for the impacts of non-stationary data on design rainfall estimation; and assess the trends in hydrological extremes and investigate the use of regional magnification factors.

WRC report no. 3147/1/24

Click here to download

Development of a regionalised approach to estimate areal reduction factors and catchment response time parameters for improved design flood estimation in South Africa

Event-based deterministic design flood estimation methods are the most commonly used by practitioners in ungauged catchments. Design point rainfall estimates are only applicable to a limited area, and for larger areas, the average areal design rainfall depth is likely to be less than the maximum design point rainfall depths. Areal Reduction Factors (ARFs) are used to describe this relationship between point and areal rainfall. In considering the above status quo in South African flood hydrology, the overall objective of this project is to develop a regionalised approach to estimate ARFs and at-site catchment response time parameters for improved design flood estimation in South Africa.

WRC report no. 2924/1/23

Click here to download

Further development, updating and assessment of the SCS-SA model for design flood estimation in South Africa using a continuous simulation approach

The assessment of flood risk by associating a flood event with the probability of an exceedance or return period is the standard approach to design flood estimation (DFE) in most countries. These design flood estimates are essential for designing hydraulic infrastructure such as dams, bridges, culverts and other drainage structures. A National Flood Studies Programme (NFSP) has been initiated to overhaul DFE procedures used in South Africa. Some of the recommendations in the NFSP include the further development and assessment of a continuous simulation modelling (CSM) approach to DFE in South Africa, and updating and modernising the SCS-SA method. Among others, this project aimed to refine and update the SCS-SA model for design flood estimation to account for antecedent moisture conditions and the joint association of rainfall and runoff using the results and methodology from a CSM system.

WRC report no. 2926/1/22

Click here to download

Impacts of floods and data availability, data quality and data screening on the estimation of design floods

The socio-economic impact of flooding in South Africa needs to be assessed, particularly to highlight the vulnerability of the increasing population living in flood-prone peri-urban areas. These results are needed to highlight the impacts of floods and the importance of flood-related research in South Africa. Among others, this project aimed to synthesise and highlight the socio-economic impacts of floods in South Africa; assess the impact of data screening on the estimation of design flood and rainfall events in South Africa and make recommendations for local adoption of data screening, outlier detection and treatment; and assess and quantify the impacts of the declining hydrological network on the estimation of design floods and rainfall in South Africa.

WRC report no. 2925/1/21

Click here to download

Using land-use change to mitigate impacts of future droughts on water yield in South Africa

An increasing number of studies have highlighted that projected climate change may influence the hydrological cycle and water yield in South African river catchments. Land-use/land-cover (LULC) changes can play a crucial role in influencing the hydrology of a basin. They may have positive or negative impacts on the water cycle and water yield in the basin by influencing processes like evapotranspiration, vegetation interception, and surface infiltration. However, the magnitude and direction of these hydrological impacts depend on the type and extent of the land-use changes. This study aimed to calibrate, evaluate, and apply a hydrological model over three selected river basins in South Africa; to investigate the influence of bias correction of climate simulation datasets on the quality of hydrological simulation over the river basins; project the impacts of future climate change on hydrological droughts in the river basins; and explore and quantify the extent to which LULC changes can reduce the impacts of droughts in these river basins.

WRC report no. 2835/1/21

Click here to download

The impact of the predictability of continental tropical lows on hydrological modelling: Current state and future projections

This report deals with Continental Tropical Low (CTL) pressure systems which occur fairly regularly in late summer over southern Africa. Before the commencement of this research it was known that these weather systems have in the past been responsible for widespread and heavy rainfall over South Africa. In this report the character of CTLs are explored by creating a synoptic climatology and also to quantify the rainfall contributions of these systems to South African rainfall. An objective, repeatable method was developed to identify CTLs over southern Africa. The identification method places strict constrains on the atmospheric circulation in order to eliminate weaker low pressure system such as the Angola Low. The objective method was applied to NCEP reanalysis data from 1979-2018 from December to March in order to create a synoptic climatology of CTLs. This climatology is the first of its kind over southern Africa and advances knowledge of synoptic scale weather systems over South Africa.

WRC report no. 2510/1/21

Click here to download

The development of an integrated system for drought monitoring and prediction in South Africa

Droughts can have a devastating effect on the economy of a country as well as the livelihoods and quality of life of communities, especially those with limited resources or ability to adapt. South Africa is especially prone to drought due to our highly variable rainfall, both seasonally and over longer cycles of above and below average rainfall. An early warning system would allow action to be taken timeously so as to mitigate the effects of drought where possible. The ultimate purpose of this project was to develop such an integrated system to monitor and predict droughts so that action can be taken timeously to manage the impact of droughts.

WRC report no. 2746/1/21

Click here to download

The applicability of the use of radar data to developer areal reduction factors in South Africa

The main objective of this research was to establish if radar data can be used effectively in the hydrological field and specifically for the development of Areal Reduction Factors (ARFs) in South Africa. Radar data was sourced and analysed to derive ARFs and in doing so, the applicability of the use of the radar data was assessed. It is important to note that the aim is not to derive new ARFs, but the process developed in this research to deriving ARFs from radar data, only serves as a means to assess the applicability of radar data.

WRC report no. 2923/1/20

Click here to download

Quantifying rainfall using rain gauges, radar and satellite and real-time techniques to facilitate capacity building

Weather observation is the key to addressing many of the environmental challenges that we face. Severe weather events are recognised as one of the most likely risks, having the biggest impact on the economy. South Africa has a world-class weather observation infrastructure that is used to mitigate these impacts. However, funding constraints have put a massive burden on existing infrastructure. The biggest threat to its sustainability is capacity building. The purpose of this project was to address this concern by reviewing and developing technologies, and by doing so, to build capacity in the field of weather observation.

WRC report no. 2751/1/20

Click here to download

Design flood estimation in urban areas in South Africa: Preliminary results from Tshwane case studies

The international trend in urban hydrological modelling is currently leaning towards models that can better simulate the spatial and temporal distribution of rainfall and consequent urban stormwater runoff. However, many of the software packages currently available are relatively expensive, and require significant amounts of input data which are often not available, especially for consultants working in developing countries. It also becomes more difficult to assess the accuracy of models with increasing complexity in ungauged catchments. The major aims of this project consisted of major objectives related to design flood estimation for urban areas in South Africa, including improving the understanding of hydrological processes in the South African urban and suburban environments, and developing a calibrated design flood estimation method for urban and sub-urban areas, either by updating existing methods, or developing a new method, by focusing on two case studies in urbanised areas of South Africa.

WRC report no. 2747/1/20

Click here to download

Development and assessment of regionalised approaches to design flood estimation in South Africa

There is a need to update and modernise methods used for design flood estimation in South Africa as many of the methods were developed more than 40 years ago and hence there are longer hydrological records to use in the updating of the methods. The original aim of this study was to develop an improved and refined regionalised Probabilistic Rational Method (PRM) for South Africa, and this objective was expanded to include the development of a Regional Index Flood (RIF) method and a comparison of the performance of the two approaches was undertaken.

WRC report no. 2748/1/20

Click here to download

Hydrological modelling of climate change impacts for development of adaptation strategies: The case of Luvuvhu River Catchment, Limpopo, South Africa

Knowledge of existing adaptation options forms the basis upon which practical methods can be identified and developed to protect the communities from the adverse effects of climate change and hence reduce their vulnerability through integration of the indigenous knowledge and new techniques. Events associated with climate change, in most cases, take people by surprise as they are usually caught unaware. There are no systems put in place to predict changes that come with climate change. This study, therefore, addressed this problem by modelling alterations in the hydrological system associated with climate change to enable preparedness through the development of adaptation options. A hydrological modelling system that provides future climate change scenarios and predicts the impacts on water resource availability for agriculture and municipal/domestic use is, thus, essential as it will aid in the generation of long-term climate change adaptation options.

WRC report no. 2771/1/20

Click here to download

Climate change impacts on the safety of concrete arch dams in South Africa

The reality of climate change can no longer be ignored as evidenced by the observed temperature increases. In South Africa the temperature increase is projected to reach more than 3°C, by year 2050. Existing concrete arch dams were not designed anticipating climate change. Therefore the temperature rise coupled with possible dry or wet weather will progressively lead to the deterioration of the structural integrity of concrete dams. This study has shown that concrete arch dams are likely to be overstressed in future leading to cracking and this may compromise their structural integrity. Concrete arch dams impound 39% of South Africa's total volume of water in storage reservoirs. Therefore a 'no regrets' approach is recommended to ensure their safety in the long term. Dam surveillance programmes need to incorporate climate change impacts, to ensure that the onset of possible dam failure is detected and resolved before it becomes catastrophic.

WRC report no. 2749/1/20

Click here to download

EXSMET: A model for soil moisture and evapotranspiration determination in fine detail over the SADC region

This report is about exporting PyTOPKAPI and HYLARSMET over SADC, including South Africa, with extended spatial and computational capacity of soil moisture and evapotranspiration for flood and drought monitoring. Timeous and routine monitoring of the spatial distribution of soil moisture and evapotranspiration over a large region in fine detail has great value for coping with two weather extremes: flash floods and droughts. The current state of soil moisture conditions has a major impact on the runoff response of a catchment to heavy rainfall; and monitoring the wetness of the soil in detail over large regions, without having to laboriously take expensive samples, is a bonus for agricultural managers who need to understand the status of crop growth potential. This is particularly relevant in the southern and central African countries in the SADC region, which contribute importantly to the food basket of Africa.

WRC report no. 2312/1/18

Click here to download

Improving weather radar estimates of rainfall using a high-density rain gauge network

Overall, this project aimed to develop infrastructure and build capacity to improve rainfall estimation from multiple platforms that are accessible to the scientific community. More specifically, the aims were to establish a high-density rain gauge network; establish supporting infrastructure that would provide research data for the scientific community; advance remote sensing estimates of rainfall in South Africa; and to build capacity in rainfall estimation from multiple platforms.

WRC report no. 2062/1/16

Click here to download

New methods of infilling Southern African rain gauge records enhanced by annual, monthly and daily precipitation estimates tagged with uncertainty

The main product of this project is an update of the mean annual precipitation (MAP) maps of observed and repaired rainfall records over South Africa. It also offers Mean Monthly Precipitation (MMP) maps crafted from observed and infilled data. In contrast to previous studies, the project team chose to infill the missing data at the scale of interest (annual or monthly, rather than infilling at daily and accumulating) to exploit the far stronger spatial correlation between gauges in order to provide more robust estimates of the missing values. In addition, the precision of these MAP and MMP maps is indicated by sets of estimates of low and high quantiles of the distributions of the data.

WRC report no. 2241/1/15

Click here to download

Improvement of early preparedness and early warning systems for extreme climatic events – flood warnings

This project endeavoured to enhance the early warning system against flash floods in South Africa, which is based on the South African Flash Flood Guidance (SAFFG) system. The SAFFG system models on an hourly basis the likely hydrological response of small river basins to rainfall as estimated in near real time by information obtained from SAWS weather 2923 systems and the Meteosat weather satellite.

WRC report no. 2068/1/15

Click here to download

Predictability and attribution of the South African seasonal climate

The project had two main goals concerning South African seasonal climate: to characterise the degree to which the predictability of seasonal forecasts varies from year to year, and to identify causes of such variations; and to characterise the degree to which anthropogenic greenhouse gas emissions have altered the chance of extreme months. In addition, the project included a case study extending the predictability and attribution methods to a hydrological case study: the streamflow discharge into the Okavango Delta, Botswana.

WRC report no. 2067/1/15

Click here to download

Dynamics of weather ad climate variability over the all-year rainfall region of South Africa

Climatologically, the Cape south coast is unique in the sense that it lacks the pronounced seasonality observed over the remainder of South Africa. Here, rainfall occurs all-year round, implying that rainfall-producing systems characteristic of both the winter and summer rainfall regions contribute to rainfall over the Cape south coast. However, the relative contributions of different rain-producing weather systems to annual rainfall have not been quantified before this project. This study addresses this issues through objective identification of the prevailing synoptic types of the Cape south coast region, with a subsequent analysis of their interannual variability. The association between synoptic types and streamflow is also investigated.

WRC report no. 2257/1/15

Click here to download

HYDROLOGICAL MODELS

Critical catchment model – Intercomparison and model use guidance development

Catchment hydrological modelling has become a central component of water resources management in South Africa. Models are regularly used for a range of applications, including predicting inflows to supply reservoirs, helping to delineate flood lines, and assessing the probable impacts of land cover and climate change. A plethora of modelling tools are available, each with differing approaches to representing hydrological processes. This project aimed to contribute to this field by producing accessible information and guidance that can assist modellers in the process of selecting and applying modelling tools for typical use cases. This was informed by reviewing the structural differences across several commonly used modelling tools in South Africa and exploring the implications of these differences in various settings.

WRC report no. 2927/1/22

Click here to download

The validation of the variables (evaporation and soil water) in hydrometeorological models: Phase II – Application of cosmic ray probes for soil water measurement

The purpose of this project was to improve the accuracy and validation of soil water and evaporation measurements in South Africa, which are essential for water management, agriculture, disaster preparedness, and climate modelling. Building on earlier WRC initiatives, the project tested the use of innovative Cosmic Ray Probes (CRPs) to measure soil water over large areas and compared these results with satellite-based and modelled estimates. By doing so, it aimed to evaluate the suitability of CRPs for catchment-scale monitoring, strengthen soil water modelling systems, and enhance the reliability of hydrometeorological models used in flood forecasting, irrigation planning, and drought management.

WRC report no. 2323/1/17

Click here to download

Developing methods for converting digitised rivers into a hydrological drainage network

In this study, techniques were investigated to create a South African river network that is repeatable and applicable to all the water catchments in South Africa. The methodology was implemented on two selected catchments and aimed to produce a network that will contain rivers similar to the 1:250 000 scale topographic maps at an accuracy that is equivalent to

the 1:50 000 scale. Spatial databases of drainage networks are invaluable in many fields, for example, spatial analysis and hydrological modelling. River lines in a hydrological network must be seamlessly connected and must have flow direction. Hydrological modelling is an essential component of water resource management, and the importance of river network databases is evident in the extensive efforts that have been undertaken to date in attempting to develop standard river network datasets for South Africa.

WRC report no. 2164/1/15

Click here to download

The validation of the variables (evaporation and soil moisture) in hydrometeorological models

Water resources management, crop modelling, and irrigation scheduling all require accurate, spatially distributed, daily estimates of soil moisture (SM) and total evaporation (ET) from catchment to national scale. This project aimed to provide data for the continued support of soil moisture modelling of South Africa using a hydrologically consistent Land Surface Model; provide accurate field and satellite estimates of ET and SM for the calibration of hydrometeorological models; and evaluate the spatial variability of SM at catchment scale.

WRC report no. 2066/1/13

Click here to download

REMOTE SENSING

Monitoring hydrological dynamics and connectivity in non-perennial rivers using remote sensing

This report reports on the use of remote sensing technology in the collection of hydrological data, and the collection and processing of in situ data during the two hydrological years of the project. It also describes the citizens' science methodology used to collect data both on the ground and the results obtained in the two study catchments (Molototsi in Limpopo and Touws River in the Western Cape) and conclusions drawn from these two years of hydrological data collection.

WRC report no. 2936/1/23

Click here to download

The use of GIS and remote sensing techniques to evaluate the impact of land use and land cover change on the hydrology of Luvuvhu River Catchment in Limpopo Province

The Luvuvhu River Catchment is one of the regions in South Africa which is undergoing rapid land cover and land use change. Land use and land cover changes in a catchment can impact water supply by altering hydrological processes such as infiltration, groundwater recharge, base-flow and runoff. Studies that link anthropogenic factors and land cover to hydrology and water resources have not been widely conducted in the catchment. This study was therefore conducted to evaluate the impact of land cover and land use change on the hydrology of Luvuvhu River catchment.

WRC report no. 2246/1/15

Click here to download

Review of the use of earth observations and remote sensing in water resource management in South Africa

The use of modern technologies, such as Earth observation (EO) and remote sensing (RS), further contributes to the efficient and integrated management of water, a limited resource. However, the need to ensure that full use is made of these technologies requires investigation so that gaps can be identified and research agendas adapted. The main aim of this study was to assess the use of EO and RS technologies in the efficient and integrated management of water resources in South Africa and to identify research gaps that constrain the full use of these technologies.

WRC report no. KV 329/15

Click here to download

WATER RESOURCE ASSESSMENT

Towards a hydrological soil map of South Africa (Hydrosoil) – Developing a methodology and showcasing its uses

On 20 February 2020, just before the outbreak of the Covid-19 pandemic, the Department of Water and Sanitation hosted a workshop titled 'Towards a detailed hydrological soil map for South Africa' in Pretoria. The workshop identified an urgent need for a detailed hydrological soil map for South Africa, and that this map should be parameterised with hydrological soil property data, which will require pedotransfer functions for ease of predictions. This project was duly initiated to commence the fulfilment of the needs expressed at the workshop shortly afterwards. Among others, this project developed the methodology by which a national hydrological soil map (HYDROSOIL) could be created with digital soil mapping methods; compiled a legacy soil point and hydrological properties database through data rescue of largely paper-based data sources; and create a HYDROSOIL map for each of the priority areas within six economically and/or ecologically important catchments of South Africa.

WRC report no. 3145/1/24

Click here to download

Participatory hydrological modelling for collective exploration of catchment management in the Western Algoa Water Supply Area

The Baviaanskloof, Kouga and Kromme (BKK) catchments provide over 70% of the current water supply to the Algoa Water Supply System, which includes the city of Port Elizabeth in the Nelson Mandela Bay Municipality (NMBM). Growing water demands and increasing water scarcity have led to a policy focus on water use and allocation in these upstream catchment areas. This project aimed to foster social learning and group decision-making about catchment management in the BKK by using a participatory process to develop models of local hydrology. The focus was not only on the accuracy and applicability of the models, but also the process of model building as a dialogue facilitation and learning tool for the participants. Through this project, the partnering stakeholders identified potential land and water management scenarios and used understanding of hydrological processes to explore and evaluate likely hydrological and socio-economic outcomes.

WRC report no. 2527/1/22

Click here to download

Towards the quantification of the historical and future water resources of the Limpopo River basin

The aim of this project was to improve the estimation of available water resources in the Limpopo River Basin by examining the upstream-downstream hydrological linkages at the basin scale – using improved scientific approaches that address the paucity of the requisite data as well as the uncertainty related to the resource's quantification. To this end, this study established the following four broad objectives for the basin: Develop a more homogeneous set of hydrologic data that facilitates the broader and more consistent application of water-resources modelling approaches across the whole of the basin; identify, establish, and quantify the upstream-downstream hydrological linkages in the basin; estimate the water resources potential of the basin, based on simulated historical natural flows that incorporate prediction uncertainty; and estimate the impact of climate change on the water resources potential, based on existing modelled future projections.

WRC report no. 2439/1/21

Click here to download

Identification, delineation and importance of the strategic water source areas of South Africa, Lesotho and Swaziland for surface water and groundwater

Strategic Water Source Areas (SWSAs) are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. They include transboundary Water Source Areas that extend into Lesotho and Swaziland. Among others, this project reviewed and refined the understanding of the hydrological processes that lead to the generation of runoff and groundwater recharge in South Africa's water source areas, and especially in groundwater systems; and developed an integrated method to identify and delineate water source areas that include run-off generation and groundwater recharge (i.e. surface water and groundwater).

WRC report no. TT 754/1/18 (main report) and TT 754/2/18 (Vol 2: Management framework and implementation guidelines for planners and managers)

Click here to download (Vol 1)

Click here to download (Vol2)

Finding 'new' water to address conflicting and competing water demands in the Nuwejaars Catchment, Cape Agulhas

The Heuningnes Catchment, which is 1 401 km^2, is located in Cape Agulhas and is not covered by the networks of river flow and groundwater monitoring stations of the South African Department of Water and Sanitation. Consequently, there are uncertainties regarding the potential and limitations of the available water resources. It is managed by the Breede-Gouritz Catchment Management Agency (BGCMA). The Institute for Water Studies at the University of the Western Cape and the BGCMA agreed to collaborate in improving information about water resources in the Heuningnes Catchment so as to contribute towards sustainable water resources management.

WRC report no. 2324/1/18

Click here to download

The Mzimvubu Water Project: Baseline indicators for long-term impact monitoring

The Mzimvubu River is the largest undeveloped river in South Africa, despite having high potential for development. In recognition of this, the South African government announced plans to build two multipurpose storage dams in Tsitsa River, one of the largest tributaries to the Mzimvubu. The Ntabelanga dam will largely be used for irrigation (2 686 ha) and potable water whilst the smaller Laleni dam, 20 km downstream of Ntabelanga, will predominantly be used for generation of hydroelectricity. The overall aim of this interdisciplinary project was to construct a baseline of environmental, agricultural and socio-economic intersections associated with the Mzimvubu Water Project.

WRC report no. 2433/1/18

Click here to download

Palmiet wetland sustainability: A hydrological and geomorphological perspective on system functioning

Palmiet wetlands in the Eastern and Western Cape are particularly threatened wetlands. This situation has potentially serious consequences for water security in many towns in their catchments, including cities such as Port Elizabeth. Despite large investments by the State in wetland restoration, serious knowledge gaps in our understanding of wetland structure and function remain, particularly regarding the hydrological functioning of these systems. This lack of understanding means that many restoration initiatives might be designed poorly, are not efficient, or may even be harmful. This study aimed to reduce uncertainty around palmiet systems by improving the understanding of the hydrological and geomorphological functioning of these wetlands.

WRC report no. 2548/1/18

Click here to download

Quantifying the water use of dominant land uses in the Maputuland Coastal Plain

In this study the ModFlow regional groundwater model and SWAT surface water model were used and evaluated as a tool to study the impact of vegetation systems and species on the groundwater dynamics. The models were used to predict the impact of various agroforestry

systems on shallow aquifers and dependent aquatic environments in primary aquifers. The research into the groundwater flows was used to clarify the understanding of the geohydrology in this region and contribute to the broader knowledge and management of environmental resources such as the health of Lakes Sibaya, Mgobezeleni, Shazibe, Bhangazi North and the Kosi Lake which are an important component of the iSimangaliso Wetland Park.

WRC report no. TT 781/18

Click here to download

Parched Prospects 3: Using the International Futures model to forecast water supply and withdrawals in South Africa

South Africa is over-exploiting its freshwater resources and the national level and water could be a major constrain on development going forward. This project improved the water model of the International Futures (IFs) forecasting system, and uses IFs to forecast water demand and supply for South Africa at a national level to 2035, the time horizon for the national water strategy. The research finds that the gap between demand and supply persists over time, and that the solutions proposed by the Departments of Water and Sanitation (DWS) (and previously the Department of Water Affairs) will be insufficient to reconcile that gap. This report offers a comprehensive picture of the state of South Africa's water system, a dynamic representation of how the water sector might unfold over time, and provides a sense of how water interacts with other key aspects of human, social and economic development.

WRC report no. TT 741/17

Click here to download

Mgobezeleni – The linkages between hydrological and ecological drivers

The ecological dependencies on the hydrological system of coastal environments, with its many feedbacks are highly complex and not well understood. The terrestrial environment controls the hydrological system. To investigate the linkages between the hydrological and ecological drivers in this project, the hydrological system was quantitatively analysed using field measurements and numerical modelling techniques.

WRC report no. 2259/1/16

Click here to download

Establishment of and demonstration of the potential of the Cathedral Peak research catchments as a living laboratory

This project built on the South African Environmental Observation Node's (SAEON) initiative to resurrect streamflow and climatic monitoring in the Cathedral Peak research catchments. The long history, the wealth of data collected, and knowledge that exists surrounding the Cathedral Peak research catchments make them an ideal site for long-term monitoring to understand environmental change, as well as providing an opportunity for capacity building.

WRC report no. 2236/1/16

Click here to download

Water resources of South Africa (WR2012)

This is one of a series of reports which contain the results of a revised appraisal of the Water Resources of South Africa. This is the sixth such water resources appraisal; the first was completed in 1952. With every appraisal, significant improvements are made in the methodology, use of the latest computer technology, level of catchment detail and resulting accuracy in the results. There are, however, some data deterioration and data access issues which are beyond the control of the study team, which are proving to be big challenges to anyone in the water resources field. In this WR2012 study, there is a website which contains all the deliverables (www.waterresourceswr2012.co.za).

WRC Report no. TT 683/16 (Executive Summary)

Click here to download

ALSO AVAILABLE:

WR2012 User Guide (WRC Report No. TT 684/16),
Click here to download

WR2012 Book of Maps (WRC Report No. TT 685/16),
Click here to download

WR2012 Calibration Accuracy (WRC Report No TT 686/16),
Click here to download

WR2012 SAMI Groundwater module: Verification Studies, Default Parameters and Calibration Guide (WRC Report No. TT 687/16),
Click here to download

WR2012 SALMOD: Salinity Modelling of the Upper Vaal, Middle Vaal and Lower Vaal sub-Water Management Areas (new Vaal Water Management Area) (WRC Report No. TT 688/16),
Click here to download

WRSM/Pitman User Manual (WRC Report No. TT 689/16) WRSM/Pitman Theory Manual (WRC Report No. TT 689/16),
Click here to download

WRSM/Pitman theory manual (WRC report no. TT 690/16),
Click here to download

WRSM/Pitman Programmer's Code Manual (WRC Report No. TT 691/16),
Click here to download

Assessing sediment connectivity at the hillslope, channel and catchment scale

Connectivity is being embraced increasingly by hydrologists, geomorphologists and ecologists as a concept that allows integration of landscape structure and function at a number of time and space scales. Connectivity allows the free flow of energy and materials through the system and, as a result, mutual adjustment between system components. The research was conducted in the catchment of Thina River (Tertiary catchment 34), lying in the headwaters of the Mzimvubu catchment, located in the former homeland of the Transkei where subsistence farming has been practiced for many years.

WRC report no. 2260/1/15

Click here to download

HOSASH (Hydrology of South African soils and hillslopes)

The project aimed to develop a hydrologically based classification system of South African soils and hillslopes. The hydrology of SA soils and hillslopes (HOSASH) aims to assist in hydrological modelling, especially in ungauged basins. The project further aimed to develop techniques suitable for studying the hydrology of South African soils and hillslopes. This includes an improved understanding of soil water regime, permeability and near saturation water flow in all directions; distribution and role of characteristic hillslopes of South Africa and the possible impact of a hydrological classification of soils and hillslopes on hydrological modelling.

WRC report no. 2121/1/15

Click here to download

Sediment yield modelling in the Mzimvubu River Catchment

This study modelled the major soil erosion processes in the Mzimvubu River Catchment, as well as the sediment yield contribution from sheet-rill and gully erosion for the whole study area. The thinking was that understanding these processes would enable area-specific management intervention and erosion control measures that are currently planned for the future dam site at Ntabelanga on the Tsitsa River. Thus, the study would aid in the allocation of scarce conservation resources.

WRC report no. 2243/1/15

Click here to download

WATER RESEARCH COMMISSION

VISIT US:
www.wrc.org.za