TERMS OF REFERENCE FOR A SOLICITED WRC-MANAGED RESEARCH PROJECT

THRUST	**Big Data Analytics; Building regional scenarios; Policy support; Research support**
PROGRAMME	**Transboundary Water Collaboration**
TITLE	**Imagining solutions for extracting further value from existing datasets on surface and groundwater resources in Southern Africa**

BACKGROUND TO THE SPECIAL CALL FOR PROPOSALS AND CRITERIA

This Terms of Reference (ToR) document is part of a suite of research calls that link to an initiative called "Big Data Analytics and Transboundary Water Collaboration in Southern Africa". This initiative is funded by USAID, the South African Department of Science and Technology (DST), and the SADC Groundwater Management Institute (GMI), managed primarily by the Water Research Commission (WRC), and with technical support from the US Geological Survey (USGS) and the IBM Research Africa Lab in South Africa.

This programme includes 3 main components: 1) a series of research calls on transboundary ground and surface water with a focus on big data potential and value for improving the management of the region's water resources, the creation of scenarios for the region and the support to regional strategies and policies; 2) the creation of a Community of Practise (CoP) related to transboundary water, including the potential contributions of big data analytics to transboundary water management; 3) a series of workshops and training opportunities for individuals involved in the projects and the CoP.

The overarching goals of this programme are to:

- *Deepen* water-related big data skills and capabilities for Southern African researchers and their students through research activities, training and engaging in a CoP;
- *Enhance* current understanding of shared groundwater resources and how they can contribute to management and delivery of sustainable drinking water and other productive uses;
- *Improve* transboundary ground/surface water management and collaboration.

This initiative has grown out of a series of USAID and partner-driven initiatives in the Southern African region over a number of years. The need for this program was cemented in a regional workshop that took place at the IBM Africa technology hub in Johannesburg in April 2017. At its core, this program acknowledges the importance of robust, sufficiently detailed and locally relevant data to inform local and regional decision-making in transboundary basins.

The program thus explores how enhanced big data capabilities can potentially improve the robustness of data, analysis and decision making in the context of transboundary ground and surface water decision-making.

This is part of a set of 4 separate calls for proposals to advance the goals of the programme:

Theme 1	Consolidation of data and application of big data tools to enhance national and transboundary data sets in Southern Africa that support decision-making for security of water resources;
Theme 2	Imagining solutions for extracting further value from existing datasets on surface and groundwater resources in Southern Africa;
Theme 3	Localizing transboundary data sets in Southern Africa: A case study approach;
Theme 4	Groundwater secure transboundary systems

Under this call, we seek proposals that **address the consolidation of data and application of big data tools to enhance national and transboundary data sets in Southern Africa that support water resources security decision-making.**

APPLICATION ELIGIBILITY

- Any organization based in the SADC region can apply to the call as project leader;
- The lead organization can partner with any institution globally to carry out the activities proposed;
- All documents requested in the application form and online process must be submitted for the proposal.

OVERARCHING GUIDELINES FOR RESEARCH PROPOSALS

- All proposals need to have a **transboundary dimension** (i.e. Any case/application must include two or more countries in SADC);
- Preference will be given to:
  - proposals related to **groundwater systems**;
  - proposals by consortia showing clear evidence of **big data capabilities**, as well as strong **water sector technical experience**;
  - proposals that show a strong **commitment to student development**.
- The proposals should be **creative and include novel elements** in their theoretical and practical approaches, while aiming at supporting the wider goals of the programme (see above). Submissions should also specifically address how the proposed activity will:

  - Identify and/or address gaps in knowledge, management and use of ground and surface water data;
  - Advance the use of data to address transboundary issues in water management and use, especially in water supply system for drinking water;
  - Have broader impact on the sustainable management of water resources, including the sustainable management of drinking water supply systems.

Please note the following:

The consortium of organisations, which is selected for funding, will be expected to engage in activities and events related to the **Community of Practice** and should budget for attendance at the programme's **three technical workshops**.

The opportunity will be provided for one data-focussed individual within the consortium to take part in an **internship programme with the IBM Research Africa Facility in Johannesburg** (Braamfontein), which includes comprehensive training in the latest methods in big data analytics, including classical and deep machine learning.

RATIONALE

Big data and emerging computational capabilities have the potential to change the way that water managers in national and shared basins collaboratively manage shared water resources. Tasks that even in recent years were being accomplished through guesswork, and trial and error, are now being transformed by the existence of robust, verifiable, mutually agreed upon data sets. This data-driven approach has already begun to transform the way in which shared water resources are managed, but there continues to be large gaps in data for surface and ground water, and also limited capability and understanding of big data opportunities.

In exploring how such approaches can be applied within Southern Africa, in order to improve the quality of planning and decision-making, it has been noted that numerous datasets relating to surface and ground water resources exist within the region. There are however a host of challenges around data compatibility, accessibility, quality, completeness and keeping data sets up to date. These datasets have also not been integrated in a way that enables their full combined potential to be unlocked. The lack of data and lack of platforms to link data directly to decision-making hinders sustainable management of water for drinking and other productive uses, and undermines environmental quality, especially as pressures on transboundary water resources increase. The potential of big data and analytics to resolve some of the challenges with existing datasets, and to identify novel ways in which previously unimagined value can be derived from them, remains largely unexplored.

Research under this call for proposals will therefore focus on exploring the opportunities that a changing data analytics landscape presents, in terms of novel ways of tackling persistent problems and trends with water-related data in Southern Africa and enhancing the use of existing data more than ever before. It will also examine what has to be done to prepare for these opportunities (e.g. data governance, capacity, institutional synergies and coordination, areas for investment, emerging research questions and opportunities).

OBJECTIVES

General:

The programme seeks to support projects that identify opportunities that current and emerging data analytics technology present for tackling persistent problems and trends with water-related data in Southern Africa and enhancing the use of such data.

Specific:

- Identify smart solutions, using the opportunities provided by big data and advanced analytics, for filling identified data gaps, especially in relation to transboundary water resources in the region.
- Unpack the unexplored possibilities that a big data approach opens up for extracting further value from existing data to enable more effective surface and groundwater management, including activities like improved planning systems for water service providers, scenario building, early warning systems and disaster management. This includes imagining the types of data, and data presentation, that would be of value for water managers and other decision-makers who have an influence on water. There is a particular interest in linking data to enhanced, sustainable management of drinking water systems.
- Outline the prerequisites that need to be in place in order to actualize the identified opportunities (e.g. data governance, capacity, institutional synergies and coordination, areas for investment, emerging research questions and opportunities, transboundary infrastructure scalability and integration).
- Determine the potential for big data solutions to maximise the value of data coming from 'non-official sources' (social technologies/citizen science) and to contribute to overcoming long-standing obstacles to the integration of such data into formal national-scale databases and tools for decision-makers.

DELIVERABLES

1. Workshops with key stakeholders to understand the status quo, train on tools applied and follow-up on implementation, at a minimum, and reporting thereof;
2. Report and policy support documents, covering aspects researched as per specific objectives, including:
    a. Identification of existing data gaps in the region that could be addressed by smart solutions;
    b. Identification and elaboration of specific opportunities at regional and country levels for big data analytics to fill gaps and extract further value from existing data (including case study or studies and work directly with water managers and service providers, where appropriate);
    c. Situational Analysis on the prerequisites for identified opportunities
3. Solutions scenarios based on both desktop research and stakeholder engagement;
4. A print-ready integrated final report, including lessons learnt.

Please, take note that deliverables are not entirely prescriptive and may change depending on the research and workplan proposed.

TIME FRAME

18 months

TOTAL FUNDS AVAILABLE

R1 410 000