Academy of Science of South Africa (ASSAf)

Statement on Water Security in South Africa

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This Statement is issued by the Academy of Science of South Africa (ASSAf) in partnership with various institutions to highlight the current undesirable water security status in South Africa and to propose solutions to reduce associated risks. The Statement is solution-oriented and is aimed at the water sector holistically; however, the recommendations seek to support the Department of Water and Sanitation (DWS) as the leader and custodian of water resources in South Africa and its role in policy development and implementation. The framing of the Statement is aligned with the discussion themes of the United Nations 2023 Water Conference.

Like much of the rest of Africa, South Africa is experiencing rising spatio-temporal variable water stress which contributes to the derailment in achieving the goals of SDG 6 (clean water and sanitation for all) and the Africa Water Vision 2025[1]. South Africa battles with substantial water security challenges. Major drivers include poor water and sanitation infrastructure maintenance and investment, inequitable access to water, poor water quality, and unsustainable water demand. Recently, water and sanitation service disruptions have become a common occurrence due to flooding and drought disasters and poor infrastructure planning and maintenance. The situation is undesirable not only for the country's developmental goals (of which water is a central pillar), but also when considering South Africa's leading socio-economic role in the Southern African Development Community (SADC) region and the continent at large.

THEME 1: Water for Health

Recent estimates by the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) indicate that, globally, 2 billion and 1.7 billion people respectively do not have access to piped potable water supply and safely managed sanitation services, with the majority residing in low- and middle-income countries (LMICs). This situation is crucial as the availability of adequate, safe and accessible water supply and sanitation resources has a direct and positive impact on the economy and public health of those countries and is thus identified as a priority by governmental organisations worldwide.

In South Africa, approximately 3 million and 14 million do not have access to potable water supply and safe sanitation respectively, informal urban settlements and rural areas commonly experience inadequate services due to various constraints. To monitor the performance of water supply and wastewater treatment services, South Africa has introduced incentive-based regulatory schemes, namely, the Blue Drop and Green Drop certification schemes, based on minimum standard requirements for water supply and wastewater treatment systems respectively. As such, municipalities that underperform in water and sanitation functions are identified and corrective measures are effected, based on cumulative risk assessment. Additionally, the schemes reward excellence. The approach has enabled nationwide identification of critical risk areas, predominantly being in semi-urban and rural areas. The 2022 Blue Drop report stated that only 40% and 23% of systems, respectively, met the microbiological and chemical water quality legal requirements. Overall, less than half (48%) of the country's water treatment systems were determined to be "low risk". At the same time, the remainder failed or barely passed the Blue Drop risk quality tests for excellence in water quality management. Of these, nearly

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a quarter (23%) were ranked at critical risk, a further 11% at "high risk", and 18% at "medium risk". A similar scenario is painted in the Green Drop report, as the majority of wastewater treatment works do not comply with national minimum standards. The net result is chronic pollution of many water resources, which reduces the water's fitness-for-use in various sectors. Failure by the relevant water sector authorities to meet the requirements of the Blue Drop and Green Drop systems could negatively impact the health of communities.

Recommendations

- To alleviate water supply challenges requires utilising a range of water resource measures to reconcile supply and demand; these include enhanced sustainable groundwater use, wastewater reuse, and desalination. In principle, South Africa has adopted the approach to widen the water supply mix, however, implementation remains poor and the heavy reliance on surface water persists.
- Improving access to water and sanitation infrastructure in impoverished and rural communities should be prioritised. As financial, environmental, and logistic constraints may limit the expansion and implementation of conventional centralised drinking water and sanitation infrastructure in these regions, cost-effective decentralised treatment systems should be implemented in combination with Water, Sanitation, and Hygiene (WASH) education strategies and Water Safety Plans (WSP). The implementation of WASH strategies may then not only improve public health, but may also lead to the improvement of a range of socio-economic benefits, including gender equality, quality education, and economic growth.

THEME 2: Water for Development

South Africa's historical mining and industrialisation resulted in settlement rushes into locations without large river systems, and hence water supply schemes, storage reservoirs (dams) and inter-basin transfer schemes became common to support urban developments. Such water engineering schemes substantially improved the water supply for strategic uses, thus becoming key national socio-economic development assets without which most urban and industrial developments would be impossible. South Africa consumes almost 20 billion m^3/annum predominantly from surface water through agriculture (55%), industry (18%), municipal (17%), afforestation (5%), mining (5%) and power generation (2%) activities, with all these sectors being the backbone of the South African economy and development.

A 20–25 year horison is commonly applied in planning for future water requirements, factoring in natural, population growth and socio-economic dynamics. Currently, almost 100% of available water resources have been allocated, including provisions for the Ecological Reserve, which should be determined for significant water bodies to inform water use licenses. However, the implementation of the Reserve has generally been poor, thus compromising future water sustainability during mega developmental projects.

Water supply and wastewater treatment are driven by the supply of electrical energy through pumps, thus creating a water-energy nexus. In South Africa, this nexus is a priority as electricity is predominantly generated from 15 water-cooled power plants, each operating at more than 3 ℓ of water per unit sent out, i.e. 1 kWh, and consuming in excess of 100 Mℓ/day. Furthermore, South African policy embraces recycling, reusing and regeneration as core concepts to water conservation, each requiring notable energy input.

The chronic electricity shortage has notable implications for the water-energy-food nexus and South Africa's overall development goals, as evident in the recent water supply and wastewater treatment disruptions. The combination of poor electricity supply and lagging investment in water infrastructure are key constraints to water for growth and development.

Whilst the South African government has responded by committing much-needed investments (*vis* R115 billion until 2024) in water and sanitation infrastructure, inefficient implementation of projects persists, with that extent rising.

Recommendations

- A vast amounts of wastewater is generated from various water uses and is commonly disposed of without proper treatment, exacerbating the extent of water pollution and restricting extended water use and re-use. There is an opportunity to strengthen the circular-economy approach in the water value chain as enshrined the South African Water Re-use Strategy, and as such the implementation of the strategy requires prioritisation. Initially, particular attention can be dedicated to enhancing sector-wide educational and information sharing initiatives concerning circular economy and value that can be harvested for the country's developmental objectives.
- South Africa needs to increase its Human Development Index (HDI) through investments to enhance development and mitigate climate change-linked degradation of water security. Dedicating adequate investment on SDG 6.3, 6.4 and 6.5 (enhancing water sector competitiveness), South Africa can begin to alleviate some of the risks posed by diminished water resources as a consequence of industrialisation, urbanisation and climate change, for instance, improving quality of education and life for all citizens are key foundation pillars in this regard.

THEME 3: Water for Climate, Resilience and Environment

There is now high certainty that climate change is influencing most aspects of the biosphere. The 2022 Intergovernmental Panel on Climate Change reported a 1.2° Celsius increase in the mean annual earth surface temperatures relative to the pre-industrial period. The World Meteorology Organization 2021 State of Climate in Africa report highlighted a continuum of more frequent and intense hydro-climatic extremes in the continent, with southern Africa being a hotspot for flood, drought, and heatwave events. From 2015 to date, South Africa has experienced severe drought and flood events, and the country is already water insecure before long-term climate change influence is considered. The influence of climate change on the hydrological cycle in South Africa is a priority socio-economic threat, especially considering that over 80% of the climate adaptation strategies tabled at COP27 were water-related.

Biodiversity and water are intimately linked and provide a range of ecosystem services such as food and water supply to sustain human livelihoods, with these additionally forming an important base in the South Africa's tourism sector. Ecological infrastructure, which implies healthy functioning ecosystems that render services to people, includes mountain catchments, rivers, wetlands and coastal dunes; it is the nature-based equivalent of engineered infrastructure such as dams and distribution pipes. Ecological infrastructure is an essential resource for tackling water security challenges as it plays a role in water purification and flow, amongst other roles. The source-to-sea management approach of catchments enables the integrated strategic management of land and

water activities for socio-ecological-economic objectives; and this presents an opportunity for South Africa to improve its water security and to inform climate adaptation policy.

Recommendations:

Nature-based solutions: South Africa needs to prioritise the management and maintenance of ecological infrastructure to aid in adaptation to climate change. For example, wetland conservation and rehabilitation are essential to unlock water yield by slowing siltation rates in dams, by attenuating floods and water purification. On the other hand, engineered systems alone are not a complete solution to climate change linked hydrological extremes that are becoming a common occurrence locally. Additionally, the maintenance of functional riparian zones needs to be crafted into disaster planning in anticipation of recurring hydrological extremes, and this can be achieved largely through zonal removal of alien vegetation and limiting human settlements in riparian zones. At the forefront of climate change adaptation is disaster planning, and hence optimisation of ecological infrastructure functioning to maintain the hydrological integrity of catchments must be prioritised.

Resilience in Agriculture and Forestry: In South Africa, dryland agriculture and commercial forestry are particularly vulnerable to soil water stress, not only for productivity but also for associated employment as a social issue; hence adaptation to climate change is necessary, especially regarding water availability planning. For commercial crop farming especially, standard farm practices need to factor in improved irrigation management using precision agriculture approaches. Broadly, for both crop and livestock sectors, increased genetic diversification is recommended to improve resilience under water stress and erratic weather patterns. Additionally, these sectors can play an important role in maintaining ecological infrastructure from which they can draw numerous services.

Wastewater Management: Poor management of municipal wastewater is a national priority which cannot be addressed by DWS alone. A dedicated multi-sectoral war room type of formulation and platform is urgently needed; additionally, the platform will require the highest level of leadership/hosting (e.g., at the Presidential or Ministerial level) to enable rapid decision-making and unlocking of investments. Immediate remediation measures include proper infrastructure maintenance and repair, coupled with efficient human settlement planning as most wastewater treatment plants (WWTPs) are operating beyond their design capacity owing to population growth. For small WWTPs (< 5 Mℓ/d), green technology solutions need to be prioritised in semi-rural settings due to the relative cost-effectiveness of such systems. Additionally, South Africa needs to enhance wastewater reuse efforts not only for water demand management and conservation goals, but also to reduce pollution loads. This can be strategically targeted at industrial operations due to relative ease of acceptance and bulk water use. The source-to-sea approach is ideal to facilitate an integrated effort rather than having isolated and uncoordinated interventions. Water Resources Classification is already operational in South Africa, however, implementation and monitoring need to be strengthened as this approach integrates socio-economic and ecological goals.

Widening Water Supply: Concerning specifically droughts, it has been evident that South Africa needs to enhance its groundwater use since this option has generally been poorly utilised except in towns in naturally arid and rural areas. Updating a national aquifer atlas

(including geophysics and recharge assessment) can inform the state of groundwater water availability and support conservation measures, as groundwater over-abstraction (in absence of proper assessment and management) during recent droughts has been a concern raised in regard to sustainability. Whilst groundwater utilisation requires prioritisation, such processes need to balance protection and use to ensure that the resource remains sustainable to support consistent and *ad hoc* crisis demands. A key component to expanding the water supply is the urgent reduction of non-revenue water losses in existing distribution networks, which exceeds 50% in some instances.

THEME 4: Water for Cooperation

Few regions in the world offer as much contrast in the field of international waters as Southern Africa. A persistent view, often propagated by the media, suggests water as a likely cause of wars in the 21st century. At least 15 international basins in the Southern African Development Community (SADC) are often named as potential points of tension, typically compared to international basins in the arid and hostile Middle East. However, the reality is very different here, because the region now has more experience in negotiating water treaties and implementing joint management bodies than any other region on earth, except the European Union. So much so, the SADC Water Protocol can be compared to the original founding documents of the European Union, centred on cooperation over steel production and energy. The SADC Water Protocol is a robust foundation for regional integration that enshrines the desire to cooperate rather than compete. Furthermore, South Africa's National Water Act legally prescribes obligations under international agreements, with that being a unique cutting-edge approach.

In this respect, it is gratifying to note that leaders worldwide increasingly recognise that no country can exist in isolation, and that there can be no sustainable development of the world's economies without international cooperation. Nowhere is this more evident than in the current war between Russia and Ukraine. The value of cross-border collaboration in trade, politics, diplomacy, arts and culture, as well as in environmental management, is now established beyond doubt in regional economic integration as a basis for economic globalization. The basic principle of the participatory management of water resources is that stakeholders, such as water users, should have a say in decision-making that affect their lives. This trend is likely to continue as the climate crisis plays itself out.

Requirements for the establishment of water markets: Tradeable water rights can therefore be an important tool for river basin management, but are only effective if a number of conditions are met, *viz.*:

- the basic water demands of citizens and ecosystems are safeguarded.
- the rights are defined and agreed upon by water users;
- the execution of these rights is physically possible;
- monopolies can be prevented; and
- an international agreement on the issue is concluded in the case of water regarding international river basins.

Concluding remarks

The inclusive and cooperative approach adopted by South Africa in international and transboundary water management is commendable and must be maintained and further enhanced. The approach is not only geared to sustaining national water security, but it furthermore facilitates regional peace and socio-economic goals.

THEME 5: Water Action Decade

Aligned with the principles of South Africa's constitution, SDG 6 calls for universal access to safe and affordable drinking water, sanitation and hygiene, and the ending of open defecation. In 2018, the United Nations General Assembly declared 2018–2028 as the International Decade for Action "Water for Sustainable Development", commencing in March 2018 and ending with World Water Day in March 2028. In response to the lagging access to safe water and sanitation for all, South Africa developed the National Water and Sanitation Master Plan (NW&SMP), which identified 12 areas for reform and action to ensure water access, safe sanitation, water conservation and management. The NW&SMP aims to be inclusive in calling for action by government, civil society, the private sector, researchers and innovators, the international community and ordinary South Africans to contribute to the principles of the National Water Act, which is aligned with SDG 6.

The NW&SMP recognises the need to align policies to the National Development Plan and SDGs as significant work is still required for South Africa to achieve the 2030 Agenda within the Decade of Action. National hinderances to progress on the SDG 6 are linked to gaps in knowledge and understanding of interlinkages across the goals and the financial gap to achieve the goals. Mapping of SDGs' interactions provides evidence of possible trade-offs between goals, and opportunities among goals, which could accelerate progress and support improved programmatic planning, implementation and monitoring. For example, indicators of SDG 3 (good health and wellbeing), SDG 8 (economic growth), SDG 9 (industry, innovation and infrastructure), SDG 12 (responsible consumption and production), SDG 13 (climate action) and SDG 16 (peace, justice and strong institutions) contain the most synergies. Indicators of SDG 1 (no poverty), SDG 2 (zero hunger) and SDG 9 (industry, innovation and infrastructure) contain the most trade-offs. Thus sectors covered by these goals are of significant importance for coordinated partnership and interdisciplinary planning towards achieving SDG 6. Furthermore, linkages shared between the indicators of SDG 6 and SDG 16 (peace, justice and strong institutions) and SDG 17 (partnership for the goals) can be considered synergistic. Therefore, government and associated entities (the custodians of SDG 6, SDG 16 and SDG 17) must concentrate their efforts to inspire and effect change in South Africa's water sector and contribute to the decade of action.

A funding gap of R121 billion and R131 billion per annum (equivalent to 2.3% to 2.7% of GDP) has been identified for water and sanitation in South Africa (World Bank and DWS, 2021). Linked to this, the 2022 Water Services Improvement Plan calls for enhanced private sector investment and further highlights long term policy and legislative aspects needed for greater accountability for the implementation of services. There is a need for innovative and disruptive next generation sanitation technologies that are affordable, integrate sustainable built and ecological infrastructure development for managing water resources and water security. Smart solutions can strengthen resilience and water use efficiency in industry, communities and agriculture. For government authorities, progressive action can be achieved by integrating water and sanitation knowledge and solutions into the District Development Model (DDM) as a strategic government vehicle for service planning and delivery.

Recommendations for the Advancement of Water and Sanitation Actions

- Advancing progress in SDG 6 requires priority intervention in addressing the inadequate management of existing water and sanitation infrastructure as identified through the Blue Drop and Green Drop reports.
- The current funding gap in water and sanitation services is a major hindrance to progress in SDG 6 and it is unlikely that adequate mega investment will be unlocked in the short-medium term. However, short-term actions that can assist in alleviating the pressure include:

    1. Enforcing Water Conservation and Demand Management approaches;
    2. Better coordination of water and sanitation planning by utilising the DDM platforms considering local municipality level is the focal service delivery point;
    3. Incentivise proper integrated asset management and operations as well as maintenance through innovative public-private partnerships;
    4. Ensure appropriate service level choices to avoid wasteful and irregular expenditure; and
    5. Prioritise urgent water supply options as part of public-private partnerships to manage water security and water access goals

1 UN Water/Africa, The Africa Water Vision for 2025: Equitable and Sustainable Use of Water for Socioeconomic Development

Statement Writing Panel:
Prof Eugene Cloete: ASSAf Member, Cape Higher Education Consortium
Prof Thokozani Majozi: ASSAf Member, University of the Witwatersrand
Prof Paul Oberholster: ASSAf Member, University of the Free State
Dr Valerie Naidoo: Water Research Commission
Prof Wesaal Khan: Stellenbosch University
Mr Neil Macleod: South African Academy of Engineering (SAAE)
Prof Emma Archer: University of Pretoria
Prof Anthony Turton: University of the Free State
Mr John Dini: Water Research Commission
Prof Benjamin Havenga: Stellenbosch University
Mr Martin Ginster: Sasol
Dr Vhahangwele Masindi: South African Young Academy of Science, Magalies Water
Prof Stanley Liphadzi: Water Research Commission
Dr Brandon Reyneke: Stellenbosch University
Prof Craig Sheridan: University of the Witwatersrand
Dr Avela Majavu: South African Young Academy of Science, Sibanye Stillwater
Dr Rembu Magoba: Council for Scientific and Industrial Research
Dr Pearl Gola: South African National Biodiversity Institute (SANBI)
Dr Harrison Pienaar: Council for Scientific and Industrial Research
Dr Christina Botai: South African Weather Service

Review Panel:

1. Prof Roland Schulze: ASSAf Member (retired)
2. Prof Faizal Bux: ASSAf Member, Durban University of Technology (SARChI Chair: Water and Wastewater Technology)
3. Prof Philiswa Nomngongo: University of Johannesburg (SARChI Chair: Nanotechnology for Water)

Enquiries: ASSAf Secretariat
Dr Melusi Thwala: Science Advisory and Strategic Partnerships, melusi@assaf.org.za
Mrs Henriette Wagener: Media and Communications, communications@assaf.org.za