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Drought relief and bulk water distribution strategies for South Africa

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Summary

- Introduction
- Background
- Literature
- Methodology
- Results
- Conclusion



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Introduction

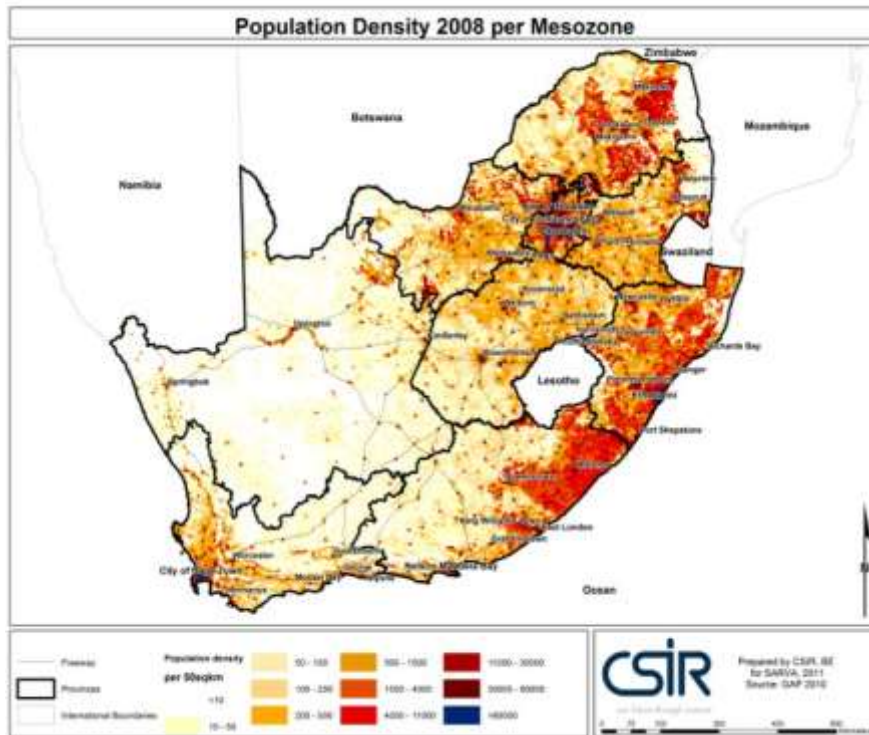
- Amidst a drought spanning from 2014 to 2015, water supply and distribution in South Africa is heavily constrained.
- The pressing drought also highlights possible future supply risk pertaining to growing demand and unique socio-economic circumstances in the arid South African environment, presenting a short, medium and long term threat.
- The combination of risks requires sound water supply, distribution and demand intervention strategies.
- The South African Water Research Commission (WRC) has called for risk mitigation and preparedness plans for constrained water supply and distribution.
- This study compares and evaluates different strategies for risk and drought mitigation to improve future water supply and distribution during drought occurrence as a precursor to demand growth.



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Background



- As a result of the climate and the population density, the water demand consumes available water at one of the highest rates globally.

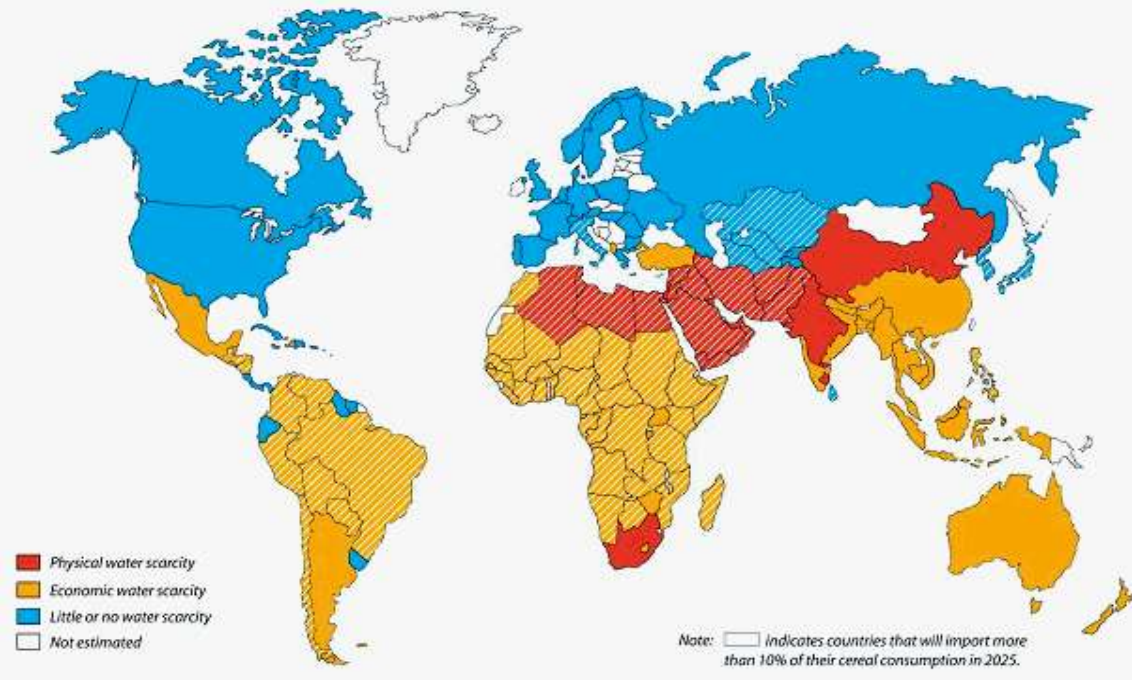


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Background

Projected Water Scarcity in 2025



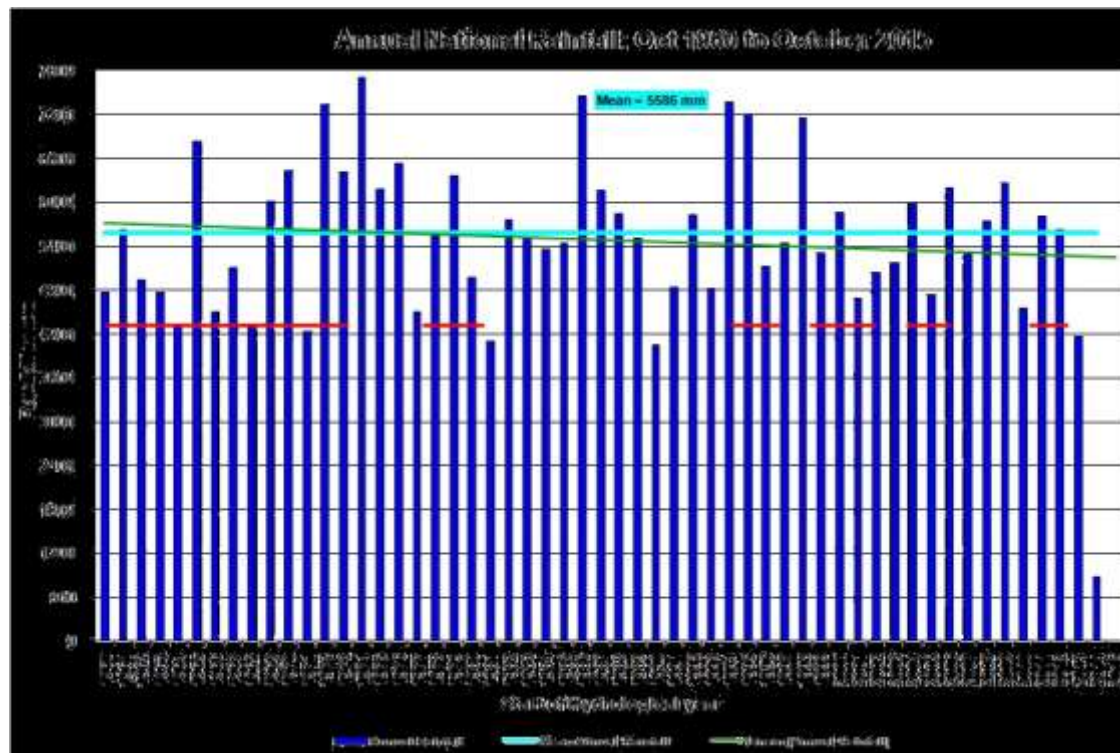
- Water scarcity is said to grow dramatically over the next ten years.
- South Africa is predicted to be one of the most physically water scarce countries in the world by 2025.



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Background



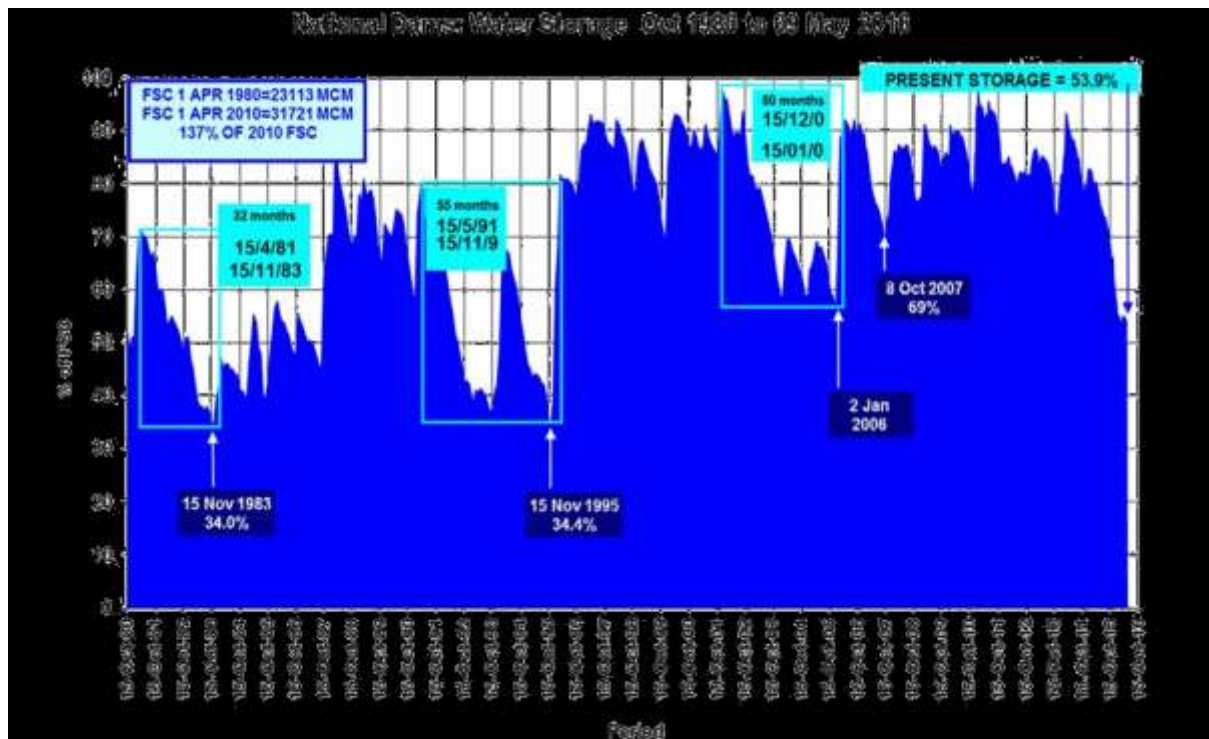
- During the 2013/2014, 2014/2015 and 2015/2016 seasons, South Africa experienced a lower than average rainfall.
- During the 2014/2015 season, the lower rainfall trends reached a maximum and pulled South Africa into severe drought.



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Background



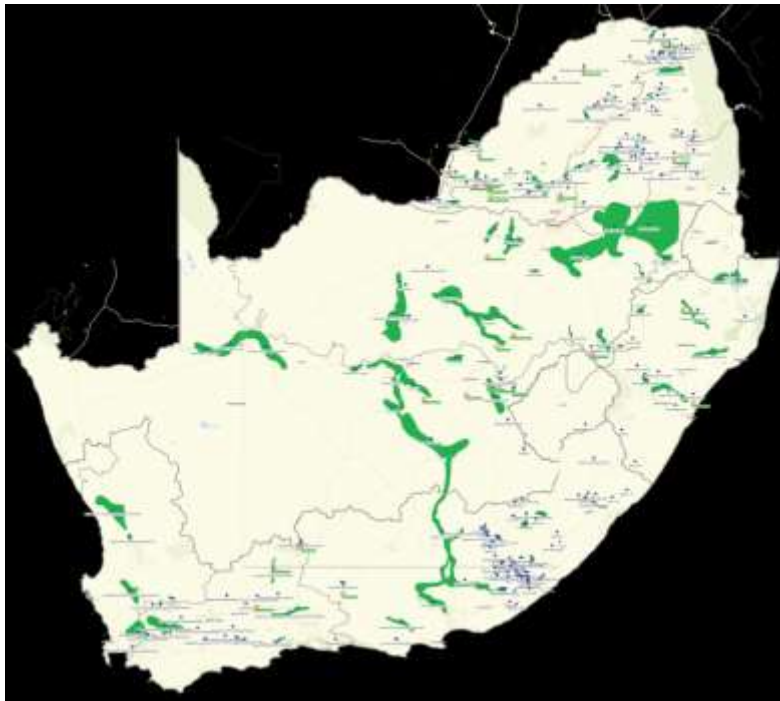
- As a result of the year on year reduced rainfall and drought, the South African river flows, ground water supply and in turn the dam storage levels dropped dramatically.
- The effect of this drought can be noted from the national dam storage drop to it's lowest levels since the previous sever drought occurring between 1991 and 1995.



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Literature



- South Africa water distribution consists of large bulk water transfer schemes that feed large industry, dense urban areas and power generation.
- Bulk water transfer schemes mostly consist of catchment dams, transfer pump stations, pipelines, tunnels, canals and storage reservoirs/dams.
- These dams are filled by the transfer schemes from areas with higher rainfall and natural water catchment and are artificially controlled.

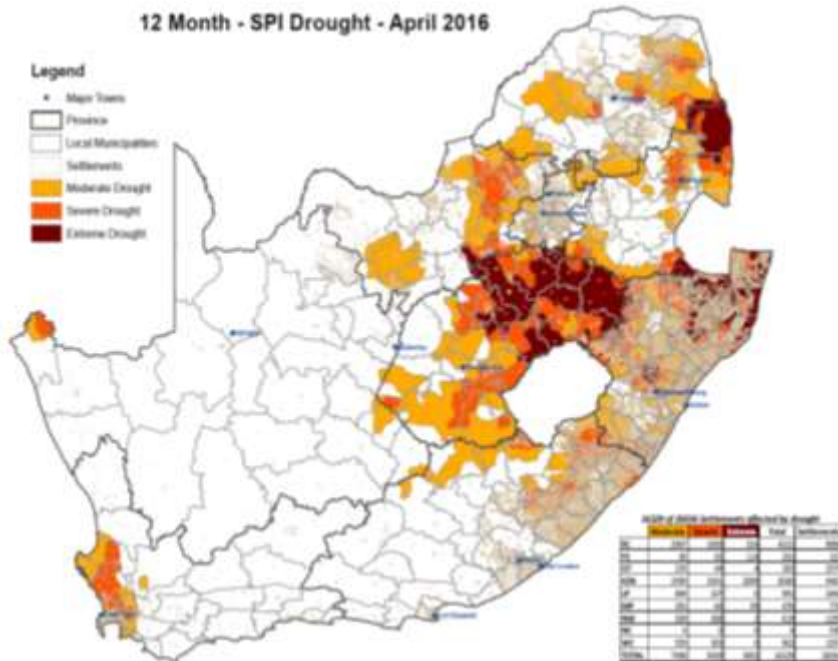


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Literature

- The impact of the drought on ground water and water availability in specific areas cannot be clearly identified from the dam levels.
- Primarily rural and agricultural areas, experienced severe to extreme drought.
- These areas consist of commercial and subsistence farming, rural “carried bucket” water supply and locally produced produce.
- The result was that the people, livestock and food supply was severely affected by the drought.

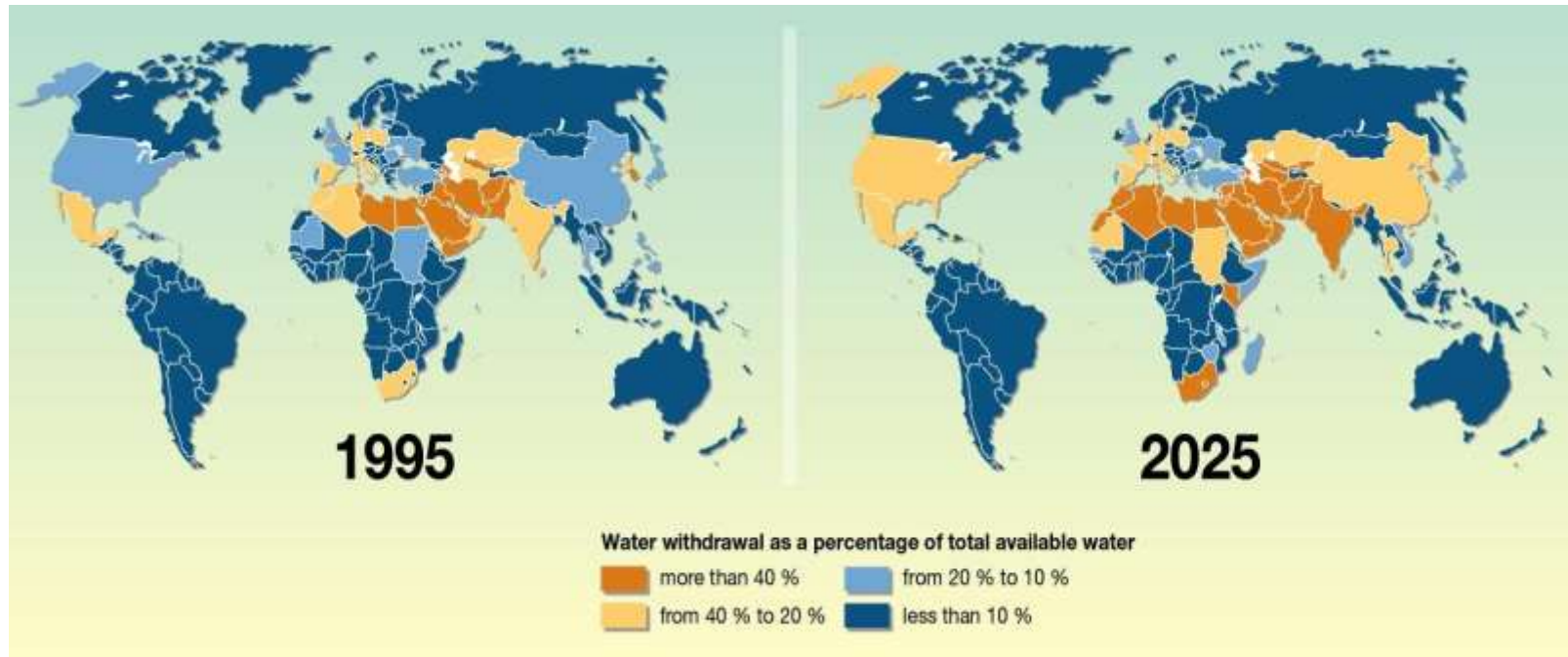




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Background



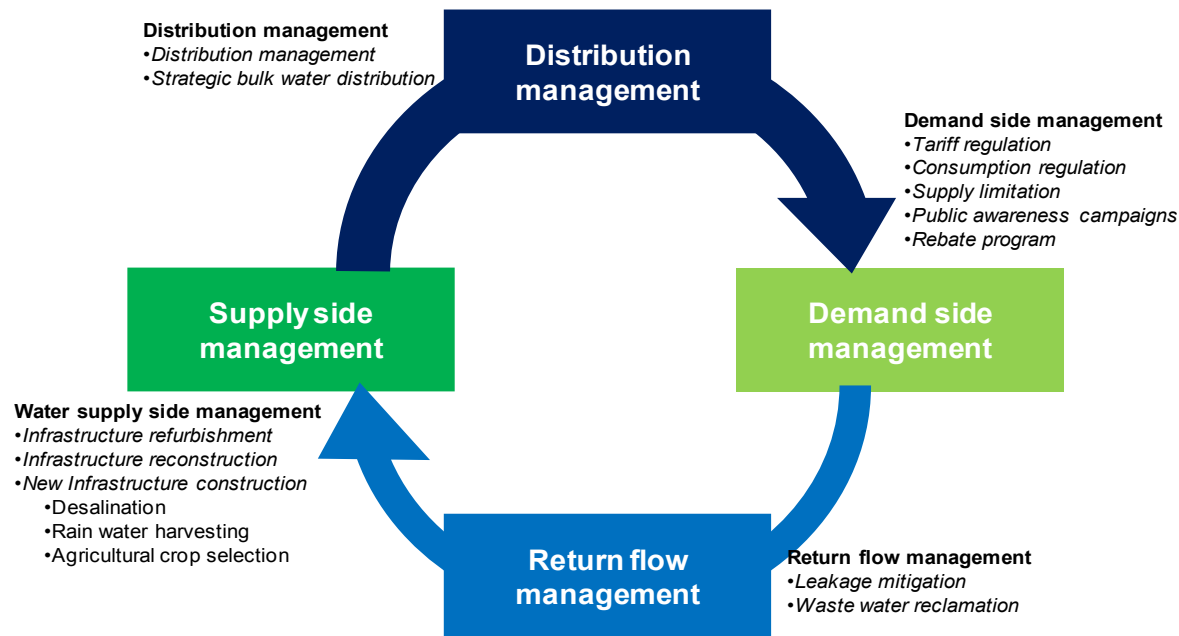
- The drought experienced in South Africa has highlighted concerning medium and long term risks.
- With climate change, rapid population growth, rural upliftment and aging bulk water infrastructure, the possible future shortfalls and affected areas is a major threat.
- By 2025, South Africa will become one of the world's most water scarce countries and the water scarcity will impact mainly on rural and agricultural areas.



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Methodology



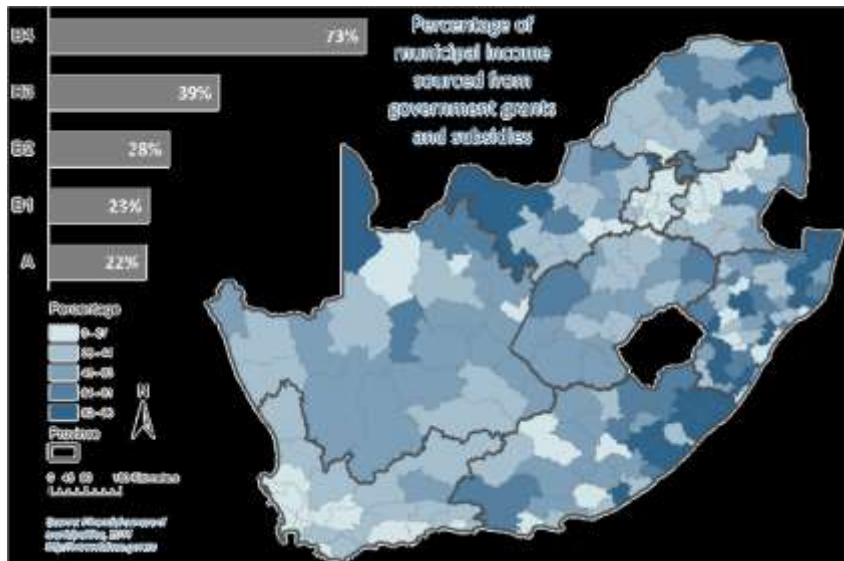
- Various short, medium and long term water risk mitigation strategies are identified in literature and further developed.
- The mitigation strategies are divided into four focus areas:
Water supply side; -distribution; -demand side and; return flows.



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Methodology



- Regional data including economic, social and hydrological circumstances are used to evaluate the feasibility of the different strategies for the different areas of South Africa.
- Common pitfalls, including water restriction enforcement and supply interruptions in the South African context are also emphasized and used as a further strategic evaluation.



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Methodology



- The criteria for infrastructure evaluation is mapped using a geographical approach, in turn identifying regions and technologies that could be implemented to mitigate the possible supply short falls and alleviate the adverse impacts of drought.



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Results

- Water demand management by means of price regulation will not be an effective solution for short to medium term drought mitigation as 36% of national users, primarily located in crisis areas do not pay for water.
- Water consumption regulation will also show limited results due to lack of enforcement.
- Wide spread public awareness champagnes have proven effective.
- Water supply limitation will prove most effective but generates public dissatisfaction.
- Rebate programs will also be effective in reducing household reliance on supplied water and in so doing reduce demand.



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Results

- Medium term mitigation in distribution and return flow by means of distribution management, strategic bulk water transfer between schemes and leakage mitigation will also prove to be very effective.
- Growing demand will consume created virtual excess supply capacity leading to persisting long term supply constraints.
- Medium term interventions will generate excess capacity which will allow an accelerated bulk supply and distribution infrastructure construction and aging infrastructure refurbishment and reconstruction campaign to alleviate long term supply constraints.
- Infrastructure that is developed must, however, be re-evaluated to apply emerging, better suited technologies that reduce reliance on a heavily constrained energy/electricity supply and local availability of fresh water (including energy independent desalination and rainwater harvesting).



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Conclusion

- The present drought in South Africa has strained the water sector and highlighted possible future supply shortfalls.
- Short, medium and long term strategies are compiled and evaluated for specific application effectiveness in the South African context.
- The different strategies are combined to compile an action plan for the alleviation of possible supply shortfall risk and improve possible future development of bulk water infrastructure.
- It is recommended that present water conservation and development strategies be augmented with the present findings and the results be monitored continuously to re-evaluate intervention effectiveness on frequent basis.