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Potential of "marginal waters" in the Orange-Senqu Basin

BACKGROUND

Scarcity of water in semi-arid and impoundment-restricted regions of the world has necessitated the development of strategies to optimise the use of available water resources. One of the most widely adopted measures is the augmentation of the water supply through the use of unconventional or "marginal" water sources. Marginal water has been defined as water that can be recycled, reused or reclaimed, including naturally occurring un-potable water, such as sea water, brackish water, saline and sodic water, un-potable groundwater, rainwater and fog harvesting.

The Orange–Senqu River Commission (ORASECOM) undertook a study entitled "Assessment of potential for the development and use of 'marginal waters' ", funded by the French Global Environment Facility (FGEF).

PROJECT OBJECTIVES

The primary objective of the project was to determine the present use of "marginal waters" within the Orange-Senqu River Basin and to collect examples of such uses from the rest of the world. The study then identified opportunities and potential projects for using "marginal waters", which would result in increased social and economic benefits from the available water resources and existing potable supplies.

PROJECT DESCRIPTION

Using the following definitions for recycle, reuse and reclaim, a desktop study was conducted of examples of the use of marginal waters within the basin, in the rest of Africa and in the rest of the world.

- **Recycle**. This is when water is used in a process and then reused in the *same* process with or without any purification/treatment or improvement of the water quality.
- **Reuse.** This is when water is used and is then used again for *another* purpose, with or without purification to some acceptable level (not yet potable).
- **Reclaim.** This is when water that was previously used for potable or any other purpose is treated up to potable quality standards so that it can be used again for potable purposes.

EXAMPLES OF THE USE OF MARGINAL WATERS IN THE WORLD

The trends in the rest of the world were identified from best practice guidelines, environmental practices and many technological examples. These included:

- In the US, California residents reuse on average 656 million m^3 of municipal waste water annually, the majority of which is reused for irrigation purposes, as well as meeting environmental flows.
- In Japan, approximately 150 million m^3 of waste water is reused annually. Since 1997, 163 publicly owned waste water treatment works (WWTW) have provided treated waste water to 192 water-use areas. Individual and block-wide water-treatment systems provide toilet flushing water in 1 475 commercial buildings and apartments, as well as water for landscaping. The Tokyo Metropolitan Government produced a set of guidelines for the reuse of treated "miscellaneous use" water in 1984. Based on these guidelines, Tokyo directs the operators of large-scale buildings with a floor area of more than 30 000 m^2, or that use a daily total volume of 100 m^3 of water for non-drinking water purposes, to reuse water.
- The latest water recycling development in Melbourne, Australia, is a portable "sewer mining" plant. The plant uses membrane technologies (ultra filtration and reverse osmosis) to produce Class A reclaimed water from Melbourne's sewage mains. The unit, mounted in a 12 m shipping container, has no significant environmental impacts and is suitable for taking

advantage of on-site water reclamation opportunities to irrigate Melbourne's parklands. The sewer mining unit plugs directly into a sewer via a manhole, and waste products are returned to the sewer.

- In Oman, Petroleum Development Oman (PDO) produces nearly five barrels of water for every barrel of oil. The water is found in the oil and gas deposits and brought to the surface during production. The water, which contains small amounts of salts and oil, is often pumped back into the well. PDO is in the process of researching reed fields to absorb the contaminants from the water before making it available to the local communities. During the reed-bed process, the water becomes saltier due to evaporation but it can be used to grow salt-resistant crops and for stock watering. The use of the reed-beds has reduced the costs to PDO of pumping the water back into the wells, as well as reducing the CO_2 emissions.

MARGINAL WATER USE IN THE ORANGE-SENQU RIVER BASIN

In Lesotho, examples of water recycling were found in the mining industry, where water is recycled and reused for the cooling of blades in a sand quarry, for the washing of product and for process water. In the textile industry, industrial process water is reused. There are also examples of rain water harvesting in Lesotho.

In South Africa, several examples of reuse and recycling of industrial water were identified, mainly outside the Orange-Senqu Basin, but there are some examples within the basin too. Many of these cases can be attributed to corporate social responsibility and provide a good example or precedent for other industries.

- SAB Miller, at its Appletiser plant and other plants, reuses backwash water for cleaning purposes such as crate washing. Biogas, a by-product of waste water treatment, is being used as an energy source at many SAB Miller plants.
- Durban Water Recycling (a company) treats sewage from the City of Durban to almost potable standards. This water is then reused in the paper and pulp production process. The plant processes 40 000 m^3 per day of this water. The Sappi Stanger plant has a potable water treatment plant that reclaims water for drinking purposes.
- The Shell SAPREF refinery also has an agreement with Durban Water Recycling to reuse water from households to meet part of the refinery's fresh water needs (307 m^3 of the daily 11 000 m^3) and reduce the demand on drinking supplies. The water is reused for process cooling and to make steam.
- The eMalahleni plant at Witbank, an initiative of Anglo Coal and BHP Billiton, reclaims acid mine drainage (AMD) to potable standards to supply the town with drinking water. A portion of this reclaimed water is also used to meet environmental flow requirements in the rivers. The eMalahleni plant produces 25 000 m^3 per day and is to be expanded to produce up to 75 000 m^3 per day. Although it is not located within the basin, this is an example of the potential of AMD reclamation. AMD reclamation also provides an environmental benefit: the water that is released into the receiving environment as environmental flows is of a better quality than it would otherwise be. Currently, Western Utilities Corporation is busy planning a similar project within the Orange-Senqu Basin. In this project AMD will also be reclaimed to potable standards, but different technology will be used.
- The Northern Waste Water Treatment Works in Johannesburg pipes treated sewage effluent to the Kelvin Power Station on a daily basis. The water is then reused in the cooling processes at the power station.
- Treated effluent is indirectly reused and reclaimed in South Africa. Treated effluent in Gauteng is released into the Vaal River where it is abstracted further downstream for purification for potable use.

In the Orange-Senqu Basin, the industrial examples from South Africa dominate individual or corporate initiatives.

In Botswana, the mines, especially the Debswana mines, provide many good examples of recycling and reuse of marginal waters. The mines recycle water in the washing processes, as well as reusing the treated effluent from the mine village to water the gardens and sports areas. The mines, as well as local schools and others, also

1 Mobile treatment works, Melbourne
2 Direct reuse of water from the handbasin to the toilet cistern for flushing

conduct rainwater harvesting. On the small business scale, many car wash operations in Gabarone buy their water from the local waste water treatment works. Botswana also utilises saline groundwater for stock watering.

In Namibia, the best known example is the reclamation of treated effluent water, via impoundment and repurification, to potable standards to augment Windhoek's supply of drinking water. Namibia also practises aquifer recharge and utilises saline groundwater for stock watering. In addition, Windhoek has implemented an industrial zone with dual reticulation. The second water supply is treated effluent from the local waste water treatment works; this is used for non-potable purposes. Within the Basin, Namibia provided very good examples of government-driven initiatives.

The research identified world trends regarding marginal waters, and proposed several potential future projects for the Basin. Of these, six priority projects were agreed on for further investigation. These are:

1. Feasibility study into the use of treated sewage effluent for the irrigation of sports fields in Maseru (Lesotho)
2. Development and implementation of an awareness strategy to promote water reuse in Botswana
3. Feasibility study into the use of treated sewage effluent for the irrigation of sports fields and urban agriculture in the larger Namibian towns
4. Preparation of guidelines for implementing dual reticulation systems in new developments in Gauteng
5. Compiling best practice guidelines for industries for recycling, reusing and reclaiming marginal waters
6. Review of the institutions, policy and legislation in the Orange-Senqu Basin States to assess the current situation in each country with respect to using marginal waters

CONCLUSION

The examples identified in the rest of the world of the development and use of marginal waters have been well tried and tested. There are also a few very good examples within the Orange-Senqu Basin. However, more can and needs to be done. As the country's water requirements continue to increase, now is the time to start changing our mindsets and to make water recycling and reuse a daily practice so that we can make optimum use of our finite water resources.

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PROJECT TEAM

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