Rainwater harvesting to retain and recharge groundwater

Besides facing the situation of supplying a large amount of people in densely populated areas, cities and built up areas also face the challenge of dealing with runoff and developing appropriate drainage and sewerage systems. Intense rainfall can quickly cause flooding and overflowing sewerage systems in urban areas. To avoid flooding and tremendous pressure on wastewater treatment plants during intense downpours, the Water Boards and Municipalities in The Netherlands are actively promoting harvesting rainwater. Their main effort is to have owners of homes and buildings disconnect their rainwater pipes from wastewater pipes and construct infiltration areas to replenish groundwater in a natural way. The City of Nijmegen for example gives home owners the opportunity either to link their rooftop to recharge designated piping or gives subsidies if water is retained within someone's property. The latter can be achieved through surface infiltration at a subsidy rate of 10€ / m² of roofing; or through sub-surface infiltration at a rate of 5€ / m² of roofing.

Rooftop water storage

Have you ever been to New York and gazed the skyline? It is certainly one of the most impressive collection of skyscrapers in the world.
However you must have ever noticed the vast amount of water tanks on top of all these buildings. Even residents might not be aware that their drinking water is lifted and stored in water tanks located on the roof of the building. Whereas drinking water is siphoned off the top part of the tanks, the bulk of the stored water serves eventual fire-fighting purposes.

3R Approach and 3R Water Secretariat

Since 2009, several organizations joined forces in their attempts to contribute in climate change adaptation and pro poor development aid and developed the 3R approach. The 3R approach of recharge, retention and reuse of water, aims to promote sustainable management of water buffers, tackling both increasing uncertainty in water availability, distribution and land degradation. Within this decade, the mission is:

- to promote 3R globally, within the framework of integrated water resource management (IWRM), at local, national and international level;
- to increase co-funding for implementation, research and capacity building
- to integrate 3R practices into policies, strategies, budgets and plans of national and local governments;
- demonstrate and advocate the added value of buffer management in securing water for rural (and urban) livelihood throughout the year, today and in future.

A 3R Water secretariat has been set up recently to act as a focal point, where partners meet and greet, where smart alliances are constructed, where knowledge and information on 3R solutions are shared and disseminated among the large network of 3R enthusiasts. The secretariat consists of a front office (for matchmaking and project development) and a support office (for data and information management and support services to 3R members)

We like to invite you to join our efforts and connect to our expanding network, share your ideas through this free quarterly publication and explore collaboration in new or ongoing projects. More information can be found on: www.bebuffered.com

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3R Water Secretariat, 2011. 3R Solutions in Urban Areas. The Netherlands.

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Upcoming publications:

- Transforming Landscapes, Transforming Lives -The Business of Sustainable Water Buffer Management, September 2011.
- Valuation of Water Buffering: Business case for Upscaling, Book launch at 6th WWF in Marseille, March 2012.

MANAGING THE WATER BUFFER

Title of issue: 3R Water Solutions in Urban Areas

Published by 3R Water Secretariat

This brochure is published by the 3R Water Secretariat and relates water Recharge, Retention and Reuse (3R) interventions to water in urban areas. For 3R, safeguarding water quantity and quality is an essential issue to extend the chain of water uses. Moreover, making better use of the water buffers makes it possible to provide water of acceptable quality in urban areas, where this is difficult otherwise – because of poor infrastructure, strained sources or absence of storage capacity. The cases presented in this publication demonstrate how in different circumstances better management of local water buffers and water reuse can make a large contribution to the availability of safe water, for domestic needs as well as for agricultural and industrial use in urban environments.

FINANCING A WATER BUFFER FOR WINDHOEK
Namibia

As part of the Central Area of Namibia (CAN), which is highly prone to droughts, the city of Windhoek (capital of Namibia) faces the challenge to supply water to the increasing population and the per capita demand. Having stretched the potential of local and regional water resources the Department of Water Affairs (DWAF) has had to evaluate water supply augmentation options to the CAN.
One of the options would involve taking water from three reservoirs when there is surplus water available, purifying it and injecting it into the Windhoek Aquifer via the boreholes. Besides the fact that subsurface storage would disallow any unnecessary evaporation of water and overflow losses from surface reservoirs, it proved that using the surplus water of the surface reservoirs in the CAN would also allow a downsizing of the planned 'Grootfontein Okavango River pipeline'.

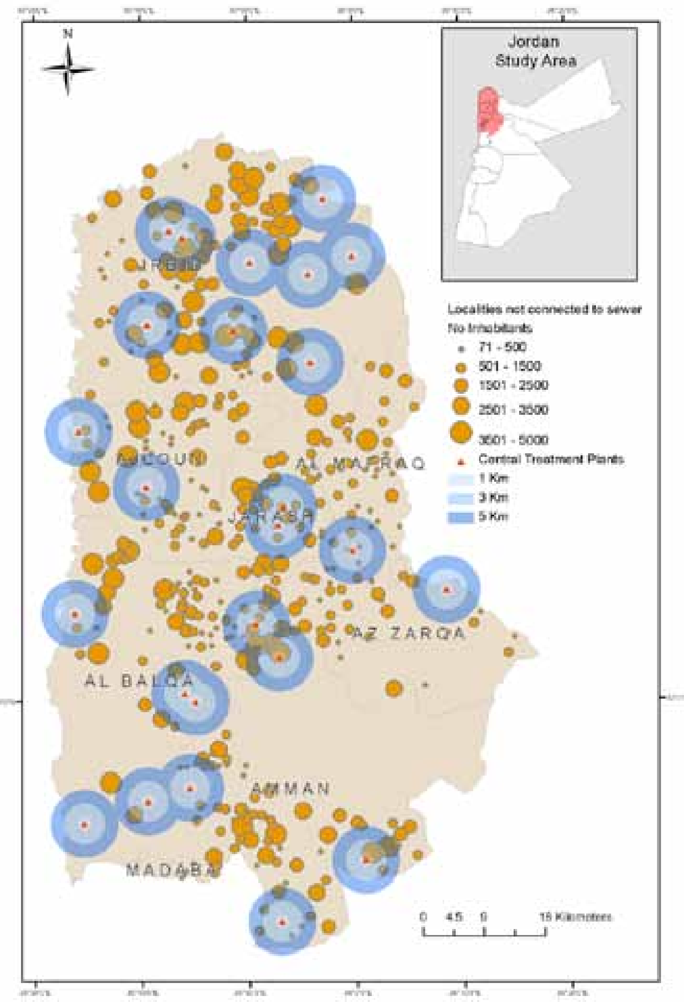
The evaluation of different augmentation options in the NamWater study in 2004 led to interesting results. The artificial recharge scheme amounted to a total cost of 38 million USD whereas that of piped supply from the Okavango River Scheme would cost 280 million USD.
Besides the difference in investment costs the unit reference value was also compiled whereby the recharge scheme proved almost twenty times cheaper per m^3 as that of the river pipeline scheme (1.5 USD/m^3 versus 32.5 USD/m^3). Based on subsequent financial and economic cost benefit analyses that have been carried out of the recharge scheme, it is interesting to note however that financially the investments would not be viable without real tariff increases (tariff increase required of 65% in 14 years) but economically - relating to the benefit of the scheme to the economy of Namibia - it would. In other words, the tariffs would need to rise (estimated at 0.65 USD/m^3 in 2004 and 1.07 USD/m^3 in 2018) to cover the investment, operation and maintenance, depreciation costs; however the economic losses, in case of water shortage, would be catastrophic to the economy of Namibia.

In 'Managing the water Buffer' further information on the context and technologies is available.

URBANISATION AND DECENTRALISED WASTE WATER TREATMENT DEVELOPMENT FOR REUSE
Jordan

Due to urbanisation and conglomeration of rural villages takes place, existing water and sewerage utilities face the challenge of having to increase coverage, whilst being hindered by lack in urban planning and financing to appropriately cover the underdeveloped or backward parts of cities. In many waste water infrastructure projects, the size and complexity often discourages investors and lenders to finance these projects, whereby the uncertainties around cost recovery of construction as well as that of operation and maintenance play an important role. In Jordan a regional implementation approach in order to overcome these concerns was developed, as part of the 'sustainable management of available water resources with innovative technologies programme (SMART). Research in to the most appropriate decentralised waste water treatment technologies (DWWST) is underway to find the most appropriate technology; both in terms of cost effectiveness as well as its treatment level and capacity. The different technologies, including the MBR (membrane bio reactor), SBR (sequencing batch reactor) and constructed wetlands can be built to accommodate various waste water capacities as well as quality levels of effluent water, so that water can be reused either for irrigated agriculture or recharging aquifers.
The project furthermore also consisted of a GIS tool that aims at defining the most suitable regions, locations and sizes of clusters that seem appropriate for a DWWST. The tool allows comparison of costs of by connecting un-serviced areas to existing central waste water treatment plants (WWTP) or connecting these areas through DWWST. By using the tool and clustering of DWWST technologies in urban and peri-urban areas, it allows the definition of a critical mass, both for international investments as well as for identifying economically feasible operation and maintenance services for decentralised infrastructure.

Cluster 3D-Model of collection systems for decentralized wastewater treatment solutions in a sub-urban area of Al-Salt, Jordan



Map showing Jordanian communities with a potential for implementing decentralized wastewater treatment solutions. (Community size < 5000 inhabitants, not connected, no future plants for central treatment plants.)

More info on SMART project

GREYWATER REUSE
Jordan

Besides decentralised systems of treating waste water, reusing grey water is a remunerative option for hotels, schools and homes in Jordan to reduce 'blue water' consumption and related service-provision costs.
Low cost technologies such as constructed wetlands; with either vertical flow planted filters (requiring pumps for distribution) or horizontal flow planted filters can be used to irrigate greenhouses, gardens and tree crops. Various pilot projects in Jordan at a Mosque and schools have allowed successful irrigation of date palm and olive farms. Both students and Mosque visitors are now aware of the value of conserving and reusing water.
More advanced methods of treating grey water will allow in-house reuse: for flushing toilets, cleaning floors and in washing machines. A pilot project carried out at the Dead Sea Spa Hotel, running since May 2009, has demonstrated the potential to reduce water use by 17%. Given the high water service prices, the payback period is estimated to be only 7 years. Guests at the hotel are appreciative of the hotel's efforts to recycle water. As water is scarce; reuse is considered a good option, as long as there is not any loss in comfort.

Constructin grey water reuse application at student dormitory

RAINWATER HARVESTING TANKS TO SERVE DOMESTIC NEEDS IN URBAN AREAS
Bangladesh and Ethiopia

In the urban areas of Ethiopia and Bangladesh similar problems are faced in supplying sufficient water, both in space (peri-urban and slum areas) as well as in time due to prolonged periods of drought and diminishing clean water sources. In Bangladesh due to a groundwater overdraft and high pollution loads in rivers, Dhaka's water utility had to look for alternative sources and started with rainwater harvesting, coupled with recharging groundwater and reusing rainwater. In Bangladesh, WaterAid (In collaboration with a number of public organizations), decided to implement rainwater harvesting demonstration projects at three public building and an local NGO office. By constructing RWH systems, the aim is to create a positive impact among the mass people, through 'seeing is believing' an example and encouragement for others to implement the same. In Ethiopia the lagging development of appropriate water capture schemes and piping in poor areas has made both water utility and users start thinking of other ways for providing water. Therefore they start establishing rainwater harvesting pilot projects at public buildings (schools, government buildings, hospitals and health posts) to convince a critical mass of people to become involved. Next to this the media contributed, through allowing media to catch and cover RWH demonstration projects on national and regional radios, the press and TV.