



Wastewater reuse in the Middle East and North Africa

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Wastewater reuse is particularly critical in arid and semi-arid countries. Although unregulated irrigation with wastewater does persist in some countries of this region, especially nearer smaller urban centres, the trend is towards regulated reuse of treated wastewater – as far as available capital resources allow.

In many arid or semi-arid countries, including those in the Middle East and North Africa, reclaimed water, i.e. effectively treated wastewater, is already the only practically affordable source for further development of agriculture, industry and non-potable municipal uses.¹ This is particularly true where the renewable freshwater resources per capita are very low.

As elsewhere, the key reasons cited for systematic management of wastewater reuse are increasing demands for water, drought mitigation, environmental protection and enhancement, socio-economics including health, and public health.² In the wealthier countries, including the oil-rich states of the Middle East, the initial reason for such interventions was environmental protection. With increasing demands for water, the reclaimed water has become a

valuable resource and has to be considered in the context of the overall water balance, as has been the case in Israel.

In the middle-income and poorer countries a major reason for intervention in wastewater reuse, usually in the form of regulation against the practice, has been for health protection. Now, in countries where competition for water resources is increasing, and financing is available for wastewater treatment, water reuse is viewed as a component of water resources management and is reducing the pressure on freshwater resources (e.g. in Jordan and Tunisia).

Unregulated wastewater reuse in the region

Irrigating raw-eaten vegetables was blamed for the 1981 cholera outbreak in Amman, Jordan.³ Although now

illegal in most if not all countries in the region, enforcement of the ban is variable, and this use of wastewater is still practised in such places as the Kedron Valley, West Bank, and in smaller towns in Iran and Morocco.

In Yemen, the majority of the treated wastewater, which is of varying quality, is used for unregulated irrigation in the highlands and along the wadi⁴ as well as for landscaping in the coastal cities and dune stabilization. Unregulated irrigation is used to produce fodder and a range of fruits and vegetables, including those that will be eaten raw.

The majority of Moroccan towns have sewage collection systems, but few have treatment facilities and many of those do not work adequately. The sewage systems collect both domestic and industrial waste. In the inland areas, most of the wastewater is used indirectly for irrigating a variety of crops, although the irrigation of raw-eaten crops is prohibited. Driven by a relatively high incidence of water-borne illnesses, Morocco recognizes the need to enhance the management of water reuse.

As early as 1900, wastewater was used to irrigate orchards near Cairo, and today there is an estimated 42 000 ha of land irrigated with some portion of wastewater that, according to the 1984 martial law, should be treated.

Farmers in Iran consider wastewater as a viable source of irrigation water, and treated wastewater is being used to grow fodder and grain crops near major cities. However, as with other countries in the Middle East, despite laws to the contrary, there are locations where untreated wastewater is used for



A community member lays locally manufactured colour-coded drip-lines for a pilot project in Wadi Musa, Jordan, providing reclaimed water for irrigation of tree crops, ornamentals and fodder.

wastewater reuse in agriculture and aquaculture

irrigation, particularly in cities without wastewater treatment facilities.

Using reclaimed wastewater

The use of reclaimed water, (i.e. treated wastewater) on a relatively large scale is increasingly common in a number of countries in the region, including Israel, Jordan, Kuwait, Oman, Saudi Arabia, Tunisia and UAE. Some, including Israel, Jordan and Tunisia, have incorporated reuse into their overall water resources management plans.

Kuwait is almost entirely urban, produces most of its domestic water supply from desalination, and treats all of its wastewater. Agriculture and landscape irrigation consumes 60 per cent of the water resources, with most of this (61 per cent) coming from groundwater and the remainder from reclaimed water. As with other oil-producing nations in the region, the management of reclaimed water is tightly regulated.

In Israel, with its acute water shortage, water reuse is an important component of the national integrated water management system using treated domestic wastewater from the medium to large centres for agricultural irrigation. The system is already relatively sophisticated, meeting 10 per cent of the national demand for water, and with surface and groundwater storage capacity of more than 150M m³ to keep the reclaimed water for the peak demands. Israel plans to capture and treat all of its wastewater by 2015, which would supply 20 per cent of the national demand for water.

Tunisia's increasing demand for water is reaching the limits of sustainable supply. Reclaimed water is meeting some of the agricultural and recreational (golf courses and lawns) demands.³ As is the case elsewhere, the seasonality of water demand creates the need for carry-over storage or alternative discharges for the reclaimed water during the periods when it is not needed.

Since the early 1980s, the Government of Jordan has sought to treat wastewater, and either discharges it to the environment to mix with freshwater flows for use in agriculture downstream, or, to a lesser extent, uses the effluent directly under restricted conditions with limited economic return. With chronic water shortages, effluent is a major



Irrigating fodder crops with reclaimed water at Wadi Musa, Jordan

component of the overall water balance, and is already meeting 25 per cent of the demand from irrigated agriculture.⁵ The approach now being pursued by Jordan is that of major reconstruction and expansion of wastewater treatment facilities to overcome overloading of a number of the treatment plants and of exploring options for direct water reuse to replace freshwater sources in agriculture, industry and landscaping.⁶

The Aqaba Special Economic Zone Authority (ASEZA) is seeking to use reclaimed water to meet industrial and landscape needs, in addition to existing agricultural use. However, the expected supply of reclaimed water has already been overtaken by projected demands, and ASEZA recognizes the need to develop an integrated water management plan that includes reclaimed water.

With recent major investments in wastewater treatment, Egypt has begun to develop more comprehensive guidelines for managing reclaimed water, focusing specifically on restricting cropping patterns.

Conclusions

The overriding concern with water reuse is the impact on the health of the general public and field workers. The impact on crop productivity and on produce export markets as well as the environmental impact on soil and water are also major concerns.

The characteristics of the wastewater management and water reuse systems are unique for each country and, to some extent, are shaped by the prevail-

ing economic conditions. Systems vary from the highly treated wastewater used to irrigate urban landscapes in some of the Gulf States, to a combination of treatment and regulation in Tunisia and Jordan, to the varying systems of enforcement of regulation modelled on the WHO wastewater guidelines in regions where farmers are irrigating with untreated wastewater.

Countries in this region need to develop their wastewater treatment capacity. This involves significant capital costs often beyond the reach of smaller communities and even some of the countries. The wastewater management systems need to be developed with eventual water reuse in mind, including the need to separate industrial wastewater from domestic wastewater to ensure that contaminants do not reach the end-user, usually a farmer.

Sensitivities. Despite the 1978 fatwa³ which allows the use of appropriately treated wastewater for all purposes including *wudu* (ablutions performed before prayer), water reuse remains a sensitive issue in this region. Present-day technology can treat wastewater to drinking water standards, yet using it as a source for potable water is not likely to be an option in the foreseeable future due to public acceptance considerations.⁷ Farmers who have access to freshwater are reluctant to use reclaimed water because of its widespread negative image. However, those farmers who are already irrigating with wastewater tend to view it as a reliable source.

Quality of treated wastewater. Even with treatment, elevated levels of salts in some of the reclaimed waters further restrict the crops farmers can grow, which limits the financial viability of the irrigated agriculture enterprise.⁵ Trace elements are also of concern, and require a combination of separation of industrial and domestic wastewater streams, pre-treatment of industrial wastes and management of the constituents at sources, such as the case in the Amman-Zarqa basin in Jordan.⁵

Persistence of unregulated irrigation. Irrigation with untreated wastewater for raw-eaten crops is illegal throughout the region and, unsurprisingly, likely to remain so despite being practised in a number of countries. In most cases the use of adequately treated wastewater for irrigation

is acceptable, as long as raw-eaten crops are not included in the cropping pattern.

Contribution to the water balance.

Most countries in the Middle East and North Africa now recognize the increasing significance of wastewater in the overall water balance and as a practical intervention in improving water management. A number of countries have already incorporated the effective management of wastewater in their policies and already have or are making investments to implement these policies. Other countries are also moving in this direction. In doing this, it is important to consider the water rights of those downstream who may in the past have used discharged wastewater, treated or not. Efforts to implement direct water reuse would transfer water from these existing users.

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webwatch

Wastewater reuse

There is plenty on the web covering not only the use of wastewater in agriculture (the subject of this theme issue) but also the domestic reuse of water.

WATER FOR PRODUCTION

■ **Sanitation Connection: wastewater reuse**

This topic node of the Sanitation Connection website provides an introduction to agricultural and aquacultural reuse, treatment technology and environmental benefits. Additional resources are a list of key publications available electronically, and relevant websites and mailing lists. www.sanicon.net/titles/topicintro.php3?topicId=3

■ **World Health Organization (WHO) Regional Centre for Environmental Health Activities (CEHA)**

This is a web-based 'Information Clearinghouse' providing speedy access to screened and topic-specific information, highlighting regional innovations. It provides useful information such as: documents, project reports, project information, success stories, web links and resources, and a directory of contact addresses. The clearinghouse covers water demand management, drinking water quality, sanitation/wastewater management for small communities and wastewater reuse. www.emro.who.int/ceha/clearingh_waterdemand/

WATER FOR PEOPLE

■ **Centre for Alternative Technology (CAT): rainwater and wastewater (greywater)**

CAT publishes a *Water Supply, Treatment and Sanitation Resource Guide*, which is a comprehensive directory of useful contacts, and tipsheets – 'Water conservation in the home' and 'Making use of greywater'. The Factsheet 'Future Homes' gives details of a house where filtered rainwater is the only water source. www.cat.org.uk/information/

■ **International Water Association (IWA) Specialist Group on Water Reuse**

The overall aims of this international group include: promoting water reuse and recycling; policy development; establishing international guidelines; evaluating projects and identifying best practice; developing planning, economic analysis, and financing systems and other resources. Members receive newsletters and can take part in discussion. www.iawq.org.uk/

■ **Tropical Public Health Engineering at Leeds University**

Links to online publications on wastewater reuse compiled by the Tropical Public Health Engineering research group. www.leeds.ac.uk/civil/cehi/cehi-home.html

■ **The School of Water Sciences, Cranfield University**

Water Sciences at Cranfield is a leading research institution in the sector working with leading companies and government agencies. The website includes a guide to the school's research activities and a useful list of the department's publications. www.cranfield.ac.uk/sims/water/

ELECTRONIC DISCUSSION LISTS

■ **GARNET wastewater management e-discussion list**

This Global Applied Research Network electronic discussion list focuses on all aspects of sustainable wastewater management. Resources include: archived discussions from September 1998 and the potential to use the list to raise issues and questions for discussion by other sector professionals. www.jiscmail.ac.uk/lists/WASTEWATER-MANAGEMENT.html

■ **Water-recycling e-discussion list**

WATER-RECYCLING list is a fully moderated forum intended to facilitate communication about issues relating to the reuse of water and wastewater effluents. Typical areas of reuse include urban (e.g. direct and indirect potable, greywater, parks and gardens, etc), industrial, agricultural, stormwater and aquifer recharge. www.nrme.qld.gov.au/cgi-bin/lwgate/WATER-RECYCLING

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