Thematic consultation on wastewater management and water quality

Short non-technical brief

Impact of wastewater on Oceans- the Nitrogen and phosphorous challenge

Wastewater and Water quality are global issues

People are dependent on the coasts and oceans and the resources they provide for their survival and well-being, yet these environments are under growing pressure as the bulk of the world's population lives in coastal areas, and there is a continuing trend towards its concentration in these regions: 38 per cent of the global human population live along a narrow fringe of coastal land which constitutes only 7.6 per cent of the earth's total land area; 70 per cent of mega-cities with populations over 8 million are located on the coast. Also, the health, well-being and, in some cases, the very survival of coastal populations depend upon the health and well-being of coastal systems - estuaries and wetlands -as well as their associated watersheds. Ultimately, sustainable patterns of human activity in coastal areas depend upon a healthy marine environment, and vice versa.

However, the coastal and marine environment is being degraded due to human activities on land. Indeed, the major threats to the health and productivity and biodiversity of the marine environment result from human activities on land -in coastal areas and further inland. With the ever increasing global population and increased human productive activities, the amount of wastewater is also increasing. Also, direct discharge of wastewater into surface and groundwater systems with little or no treatment is one of the most serious threats to water resources. According to the *Sick Water* report *'The central role of wastewater management in sustainable development'* (UNEP & UN-Habitat, 2010), up to 90 % of wastewater flows untreated into densely populated coastal areas, resulting in the receiving water bodies (rivers, lakes, groundwater and coastal waters) having excessive nutrient and organic materials as well as other contaminants such as persistent organic pollutants and heavy metals.

Most developing countries and countries in transition have yet to reach full-capacity wastewater treatment. Currently, most of the wastewater infrastructure in many of the fastest growing cities is lacking or outdated, not designed to meet local conditions, poorly maintained and entirely unable to keep pace with rising urban populations. Further, policies and regulatory measures that encourage wastewater treatment and reuse of treated wastewater are lacking.

Multiple and greater impacts

Unregulated discharge of wastewater undermines biological diversity, natural resilience and the capacity of the planet to provide fundamental ecosystem services, impacting both rural and urban populations and affecting sectors from health to industry, agriculture, fisheries and tourism.

Run-off from wastewater irrigation systems drains into surface water, particularly small confined lakes and water bodies and the remains of nutrients may cause **eutrophication**[1], particularly if phosphates in the orthophosphate form are present. Imbalances in the plant microbiological communities of water bodies may in turn affect other higher forms of aquatic life and reduce biodiversity. If these water bodies serve local communities the ecological impacts can be translated into economic impacts, which should be considered. Global loss of ecosystem services due to eutrophication is estimated to be USD 200 billion/year. In the north east of Australia, run-off of agricultural herbicides caused the loss of 30 km^2 of mangrove between 1999 and 2002. In the Black Sea, eutrophication resulted in an annual decline of USD 360 million/year of tourism revenue (Ibrahim Thiaw, pers. Communication, UNSGAB meeting 2012).

The **climate** is also being impacted by wastewater discharge. In fact, healthy coastal ecosystems decrease vulnerability to climate change effects and extreme events, and save e.g. infrastructure related costs. Healthy mangroves, sea grass beds and salt marshes are globally important Carbon sinks, but become sources of emissions when degraded. Wastewater-related emissions of methane *(CH4)*, a powerful global warming gas, and another called nitrous oxide *(N_2O)* could rise by 50 per cent and 25 per cent respectively between 1990 and 2020.

The contents and significance of wastewater vary greatly between and even within regions. In developing countries, it is the impact on people's **health** that is the major factor. It is estimated that, over half of the world's hospital beds are filled with people suffering from water related diseases while some 2.2 million people die each year from diarrhoeal conditions: 1.8 million of them are children under 5 years old.

In developed countries the input of nutrients into the coastal waters reduces productivity and contributes to the rapid growth of de-oxygenated **dead zones** in the world's seas and oceans. Such discharges are part of the reason why de-oxygenated dead zones are growing rapidly in the seas and oceans and are now a global concern. In 1960 there were 9 documented hypoxic zones. The number of **hypoxic areas** has doubled every decade since then. In 2007, a panel of experts convened under the auspices of the World Resources Institute identified 415 eutrophic and hypoxic coastal systems covering more than 245,000 km^2 of water area worldwide (Diaz and Rosenberg, 2008), with impacts on **fisheries**, **livelihood**s and the **food chain**. Healthy coral reefs can produce up to 35 tons of fish per square kilometer each year and around 275 million people depend directly on coral reefs for livelihoods and sustenance. There is a catch reduction of 67 tons for every square kilometer of clear-cut mangrove forest.

High cost of no action

The costs related to the pollution of coastal waters can be significant. Undermining coastal ecosystems providing services are estimated to be worth more than 25 000 billion USD every year (Martinez et al, 2007). The millennium ecosystem assessment report

[1] Eutrophication: "The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the process." - Art, 1993

suggests these to be $16 billion annually, and much of this is due to impacts on human health.[2] While pollution is costly, the same report suggests that the economic value of the goods and services delivered by healthy coasts and oceans are worth trillions of dollars: 61 per cent of the world's total economic output of approximately $44 trillion comes from areas within 100 kilometres of the coastline. If the pollution of coastal waters can be linked to impacts on human health and could result in a decline in the economic value derived from the coasts and oceans, the deterioration of coastal and marine environments must also contribute to rising poverty levels. The situation is likely to get worse unless there is urgent action to manage wastewater better. The world's coastal population is increasing and by 2030, close to five billion people will live in towns and cities, many within 60 kilometers of the coast; and by 2050 the global population will exceed nine billion. Some of these trends are inevitable, but the world can still choose the quantity and quality of discharges to rivers and seas if a sustainable link is made from cities, rural areas and farms, to the ecosystem services surrounding them. Investment in improved sanitation and water treatment technologies will pay multiple dividends. Similarly, investment in rehabilitating and restoring nature's own water purification systems—such as wetlands and mangroves— will be cost effective.

Inadequate treatment and a lack of ecosystem-based and resource-recycling approaches to wastewater management, not only impacts the environmental conditions and ecosystem services of receiving water bodies, but also lead to lost opportunities to reuse and recycle nutrients, water and other materials for agricultural production and water supply. Also, a series of demonstration activities to utilize organic materials found in wastewater to produce biogas for energy and heat generation clear exhibited climate change related benefits connected with the climate change related funding mechanisms. It was confirmed that a number of approaches, such as dry toilets and industrial water use efficiency improvement, can reduce water used in wastewater systems. All in all, wastewater is an important resource to be wisely used for economic benefits of concerned populations.

The Challenge can be tackled

Reducing unregulated discharge of wastewater and securing safe water are among the most important interventions for improving global public health and achieving sustainable development. The knowledge and the technology exist. The key to success must blend immediate action and long term thinking, and bring wastewater into the dialogue of wider planning and management. Solutions must be innovative, bringing together partnerships between private and public sectors. Successful and sustained wastewater management will need an entirely new dimension of investments, to start now.

Experiences have shown that **appropriate investments done in the right manner can provide the required returns**. However, it will require not only investments, but careful and comprehensive integrated water and wastewater planning and management at national and municipal levels. This must transcend the entire water supply and disposal chain involving ecosystem management (including coastal waters), agricultural efficiency and production and treatment of wastewater and a stronger focus on urban planning

[2] The Millennium Ecosystem Assessment. Synthesis report Ecosystems and Human Wellbeing. page 52-53

Meeting the wastewater challenge is not a luxury but a prudent, practical and transformative act, able to boost public health, secure the sustainability of natural resource and trigger employment in better, more intelligent water management.