

PART III

POLICY RECOMMENDATIONS

A TACKLE IMMEDIATE CONSEQUENCES

1 Countries must adopt a multi-sectoral approach to wastewater management as a matter of urgency, incorporating principles of ecosystem-based management from the watersheds into the sea, connecting sectors that will reap immediate benefits from better wastewater management.

On its journey through the hydrological cycle, water is used and reused an infinite number of times by various industries, communities and ecosystems. With 70–90 per cent of the water being used and some 50 per cent of the nutrient loading added before water even enters urban areas, wastewater management must address not only urban but also rural water management through improved forestry, agriculture and ecosystem management. This requires national plans and organization as it cannot be dealt with solely by municipalities or single ministries.

Eventually water reaches the coastal plains, estuaries, ports and harbors where communities, agriculture and industry are burgeoning. More wastewater is generated and finally it is discharged to the sea, frequently with little or no treatment, contaminating seafood, polluting critical ecosystems and threatening biodiversity. Wastewater management should reflect the community and ecological needs of each downstream ecosystem and user. Improved ecosystem management, including integrated forestry, livestock, agriculture, wetland and riparian management, will reduce and mitigate the effects of wastewater entering rivers, lakes and coastal environments. The best option is to close the nutrient loop and harness the potential of wastewater for re-use in agriculture, or to generate biogas, thus turning the nutrients contained therein into resources.

2 Successful and sustainable management of wastewater requires a cocktail of innovative approaches that engage the public and private sector at local, national and transboundary scales. Planning processes should provide an enabling environment for innovation, including at the community level.

To succeed in the face of some of the largest threats to human health, productivity and environmental degradation, it is not sufficient to address only one source of contamination. Governance frameworks should clarify and link the roles of central and local authorities and communities, including rural areas; promote public responsibility; and where appropriate, facilitate private investment and involvement in wastewater management. The use of technology in wastewater management should also be multi-faceted and should reflect the needs and capacity of local communities. Incentives should encourage innovative, adaptable approaches to reduce the production of wastewater and potency of its contaminants. The use of green technologies and ecosystem management practices should be used more actively and encouraged, including in rural areas with regard to both water supply and wastewater management.

Whilst experience has shown that privatizing water management as a means to gain more investments rarely results in positive results, the private sector has demonstrated improvements in operational efficiency and service quality. Hence, rather than outsourcing management, integrated partnership models where the private sector is given responsibility not for the full water management, but mainly for certain operational segments, can work best

B THINKING TO THE LONG TERM

3 Innovative financing of appropriate wastewater infrastructure should incorporate design, construction, operation, maintenance, upgrading and/or decommissioning. Financing should take account of the fact that there are important livelihood opportunities in improving wastewater treatment processes.

Investment, including ODA, in wastewater infrastructure must reflect the full lifecycle of the facility, not just capital project costs. This should not just be about new financing, but also making current investments more effective and sustainable. Full life-cycle financing may involve linking the cost of wastewater treatment with water supply – while many contend that access to safe water is a human right, the act of polluting water is not, and water users should bear the cost of returning water at a quality as close as possible to its natural state.

The valuation of non-market dividends, e.g. public amenity, ecosystem services such as carbon sequestration, nutrient and waste assimilation, must be further developed to enable more comprehensive cost benefit analysis of the potential returns from wastewater management and for the development of effective market based incentives, such as pollution cap and trade schemes.

4 In light of rapid global change, communities should plan wastewater management against future scenarios, not current situations.

Wastewater management and urban planning lag far behind advancing population growth, urbanization and climate change. With forward thinking, and innovative planning, effective wastewater management can contribute to the challenges of water scarcity while building ecosystem resilience, thus enabling ecosystem-based adaptation and increased opportunities for solutions to the challenges of current global-change scenarios.

Population growth and climate change are not uniform in time or space, and so regionally specific planning is essential. Wastewater management must be integrated as part of the solution in existing agreements and actions.

5 Solutions for smart wastewater management must be socially and culturally appropriate, as well as economically and environmentally viable into the future.

Different approaches to wastewater management are required for different areas, rural and urban, with different population sizes, levels of economic development, technical capacity and systems of governance. Approaches can also vary depending on the quality standard required for end users or end point disposal. The sanitation ladder provides a useful instrument to assess the local status of sanitation in a community, municipality or region, pointing to optimal wastewater management strategies.

It is important that wastewater management approaches form part of the planning and development process, reflecting regional realities and cultural differences as well as externalities such as exposure to natural hazards or extreme conditions. Incremental approaches to wastewater management can contribute to long-term success.

6 Education and awareness must play a central role in wastewater management and in reducing overall volumes and harmful content of wastewater produced, so that solutions are sustainable.

Wastewater is everyone's concern in the home and at work. Education and awareness can influence behaviours to reduce wastewater discharge and also to see the opportunities of managing wastewater in an environmentally friendly and financially sustainable way as part of the solution. Increased understanding of the links between wastewater and health, ecosystem functioning, food production and the potential benefits of wastewater reuse in contributing to development and improved wellbeing can increase uptake of initiatives.

It is vital that education and training in wastewater management and systematic engagement of stakeholders in all sectors throughout the entire project cycle is culturally specific and exemplifies or suggests solutions that can be modified to suit different settings. Education, awareness, advocacy and stewardship should be addressed at multiple levels, including the development of professional skills for improved inter-sectoral collaboration and multi-year financial planning.

GLOSSARY

Aquifer

Huge storehouses of water comprising the saturated zone beneath the water table (USGS 2009 <http://ga.water.usgs.gov/edu/earthgwaquifer.html>)

Carbon sequestration

The removal of atmospheric carbon dioxide, either through biological processes (for example, photosynthesis in plants and trees), or geological processes (for example, storage of carbon dioxide in underground reservoirs) (Department of Climate Change 2008)

Dead zone

Hypoxic (low-oxygen) areas in the world's oceans (Science Daily undated [http://www.sciencedaily.com/articles/d/dead_zone_\(ecology\).htm](http://www.sciencedaily.com/articles/d/dead_zone_(ecology).htm))

Desalination

Any mechanical procedure or process where some or all of the salt is removed from water (EMWIS 2010 http://www.semide.net/portal_thesaurus/search_html)

Downstream ecosystem

Ecosystem of a lower watercourse (WaterWiki 2009 http://waterwiki.net/index.php/Downstream_ecosystem)

Economic instruments

Fiscal and other economic incentives and disincentives to incorporate environmental costs and benefits into the budgets of households and enterprises. The objective is to encourage environmentally sound and efficient production and consumption through full-cost pricing. Economic instruments include effluent taxes or charges on pollutants and waste, deposit-refund systems and tradable pollution permits (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=738>)

Economic valuation

The assessment, evaluation, or appraisal of business performance in matters involving ecology and finances (Oxford English Dictionary, quoted in KPV http://kpv.arso.gov.si/kpv/Gemet_search/Gemet_report/report_gemet_term?ID_CONCEPT=2938&LI=94&L2=94)

Ecosystem-based management

An integrative and holistic approach to management based on the idea of systems in contrast to the traditional procedure of managing sectoral activities like fishing, shipping, or oil and gas development. This approach is intended not only to draw attention to linkages among the various components of complex systems but also to consider the non-linear dynamics of socio-ecological systems (Arctic Governance 2010 <http://www.arcticgovernance.org/ecosystem-based-management-ebm.4668250-142904.html>)

Ecosystem services

The processes by which the environment produces resources that we often take for granted such as safe water, timber, and habitat for fisheries, and pollination of native and agricultural plants (Ecological Society of America undated <http://www.esa.org/ecoservices/comm/body.comm.fact.ecos.html>)

Equity

The quality of being fair or impartial (Dictionary.com 2010 <http://dictionary.reference.com/browse/equity>). A core proposition is that future generations have a right to an inheritance (capital bequest) sufficient to allow them to generate a level of wellbeing no less than that of the current generation (European Community 2005 http://biodiversity-chm.eea.europa.eu/ny-glossary_terms/I/intergenerational_equity)

Eutrophication

A process of pollution that occurs when a lake or stream becomes over-rich in plant nutrient; as a consequence it becomes

overgrown in algae and other aquatic plants. The plants die and decompose. In decomposing the plants rob the water of oxygen and the lake, river or stream becomes lifeless. Nitrate fertilizers which drain from the fields, nutrients from animal wastes and human sewage are the primary causes of eutrophication. They have high biological oxygen demand (BOD) (EMWIS 2010 http://www.semide.net/portal_thesaurus/search_html)

Food security

When all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (WHO 2010 <http://www.who.int/trade/glossary/story028/en/>)

Green city

Today, many city mayors are working to get their cities focused on the environmental movement. For many of those mayors, their goal is to convert their city into a green city. By thriving to achieve green city status, leaders are acting to improve the quality of the air, lower the use of non-renewable resources, encourage the building of green homes, offices, and other structures, reserve more green space, support environmentally-friendly methods of transportation, and offer recycling programmes (WisegEEK.com undated <http://www.wisegEEK.com/what-is-a-green-city.htm>)

Green technology

A continuously evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products. The goals that inform developments in this rapidly growing field include sustainability, “cradle-to-cradle” design, source reduction, innovation, viability, energy, green building, environmentally preferred purchasing, green chemistry, and green nanotechnology (Green Technology 2006 <http://www.green-technology.org/what.htm>)

Groundwater

Freshwater beneath the earth’s surface (usually in aquifers)

supplying wells and springs. Because groundwater is a major source of drinking water, there is a growing concern over leaching of agricultural and industrial pollutants or substances from underground storage tanks (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=586>)

Irrigation

Artificial application of water to land to assist in the growing of crops and pastures. It is carried out by spraying water under pressure (spray irrigation) or by pumping water onto the land (flood irrigation) (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=685>)

Marine pollution

Direct or indirect introduction by humans of substances or energy into the marine environment (including estuaries), resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water and reduction of amenities (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=738>)

Market and non-market values

Most environmental goods and services, such as clean air and water, and healthy fish and wildlife populations, are not traded in markets. Their economic value -how much people would be willing to pay for them- is not revealed in market prices. The only option for assigning monetary values to them is to rely on non-market valuation methods. Without these value estimates, these resources may be implicitly undervalued and decisions regarding their use and stewardship may not accurately reflect their true value to society (GreenFacts 2009 <http://www.greenfacts.org/glossary/mno/non-market-value.htm>)

Megacity

Massive migration out of the country and into the city has led to the rise of the megacity, a term typically used to describe a city with a population of over 10 000 000 inhabitants (Wisegeek.com undated <http://www.wisegeek.com/what-is-a-megacity.htm>)

Peri-urban

Peri-urban areas are the transition zone, or interaction zone, where urban and rural activities are juxtaposed, and landscape features are subject to rapid modifications, induced by human activities (Scientific Committee on Problems of the Environment 2008 <http://www.icsu-scope.org/projects/cluster1/puech.htm>)

Polluter Pays Principle

Principle according to which the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environment/gl/gesform.asp?getitem=902>)

Population connected to urban wastewater collection system

Percentage of the resident population connected to the wastewater collecting systems (sewerage). Wastewater collecting systems may deliver wastewater to treatment plants or may discharge it without treatment to the environment (United Nations Statistics Division 2009 <http://unstats.un.org/unsd/ENVIRONMENT/wastewater.htm>)

Population connected to urban wastewater treatment

Percentage of the resident population whose wastewater is treated at wastewater treatment plants (United Nations Statistics Division 2009 <http://unstats.un.org/unsd/ENVIRONMENT/wastewater.htm>)

Private sector

That part of an economy in which goods and services are produced by individuals and companies as opposed to the government, which controls the public sector (Dictionary.com 2010 <http://dictionary.reference.com/browse/private%20sector>)

Public sector

That part of the economy controlled by the government (Dictionary.com 2010 <http://dictionary.reference.com/browse/public+sector>)

Resilience

Ecological resilience can be defined in two ways. The first is a measure of the magnitude of disturbance that can be absorbed before the (eco)system changes its structure by changing the variables and processes that control behaviour. The second, a more traditional meaning, is as a measure of resistance to disturbance and the speed of return to the equilibrium state of an ecosystem. http://biodiversity-chm.eea.europa.eu/nyglosary_terms/E/ecological_or_ecosystem_resilience

Saprogenic

Formed by putrefaction, for example by bacteria <http://dictionary.reference.com/browse/saprogenic>

Sanitation

A range of interventions designed to reduce health hazards in the environment and environmental receptivity to health risks, including management of excreta, sewage, drainage and solid waste, and environmental management interventions for disease vector control.

Adapted from: http://www.who.int/water_sanitation_health/hygiene/sanhygpromotoc.pdf

Slums

Areas of older housing that are deteriorating in the sense of their being under-serviced, overcrowded and dilapidated (Unit-

ed Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=1046>)

Tailings

Wastes separated out during the processing of crops and mineral ores, including residues of raw materials (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=1119>)

Transboundary

Crossing or existing across national boundaries (Encarta World English Dictionary 2009 http://encarta.msn.com/dictionary_1861721403/transboundary.html)

Urban wastewater collection system

A system of conduits which collect and conduct urban wastewater. Collecting systems are often operated by public authorities or semi-public associations (United Nations Statistics Division 2009 <http://unstats.un.org/unsd/ENVIRONMENT/wastewater.htm>)

Urban wastewater treatment

All treatment of wastewater in urban wastewater treatment plants (UWWTP's). UWWTP's are usually operated by public authorities or by private companies working by order of public authorities. Includes wastewater delivered to treatment plants by trucks (United Nations Statistics Division 2009 <http://unstats.un.org/unsd/ENVIRONMENT/wastewater.htm>)

Waste assimilation

Both forests and wetlands provide a natural buffer between human activities and water supplies, filtering out pathogens such as Giardia or Escherichia, nutrients such as nitrogen and phosphorus, as well as metals and sediments. This benefits humans in the form of safe drinking water, and plants and animals by reducing harmful algae blooms, reduction of dissolved oxygen and excessive sediment in water (The University of Vermont

2004 http://ecovalue.uvm.edu/evp/modules/nz/evp_es_definitions.asp)

Water stressed

A country is water stressed if the available freshwater supply relative to water withdrawals acts as an important constraint on development (WHO, WMO and UNEP 2003 <http://www.who.int/globalchange/publications/cchhbook/en/index.html>)

Water table

Level below which water-saturated soil is encountered. It is also known as groundwater surface (United Nations Statistics Division 2006 <http://unstats.un.org/unsd/environmentgl/gesform.asp?getitem=1205>)

White elephant

Something costly to maintain; an expensive and often rare or valuable possession whose upkeep is a considerable financial burden (Encarta World English Dictionary 2009 <http://encarta.msn.com/encnet/features/dictionary/DictionaryResults.aspx?lextype=3&search=white%20elephant>)

Willingness to charge

There is growing evidence that many urban and rural communities are willing to pay more than the prevailing rates for water and sanitation, to ensure a better or more reliable service. However, governments seem unwilling to match this with a willingness to charge consumers for these services and the result is a continuing cycle of low revenues, high costs, unsatisfactory services and financial crisis (UNDP-World Bank 1999 <http://124.30.164.71/asciweb/kwa/site/Content%20Resources/Financial%20Aspects/National/Willingness%20to%20Pay%20Dehradun.pdf>)

Willingness to pay

The amount an individual is willing to pay to acquire some good or service. This may be elicited from stated or revealed preference approaches (UNEP 1995)

ACRONYMS

AMD	Acid Mine Drainage	ONAS	National Company of Sanitation
BFI	Browning Ferris Industries	P	Phosphorus
BOD	Biological Oxygen Demand	PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
COD	Chemical Oxygen Demand	POPs	Persistent Organic Pollutants
CREPA	Le Centre Régional pour l'Eau Potable et l'Assainissement à faible coût	PPP	Polluter Pays Principal
DALY	Disability-Adjusted Life Year	SIDS	Small Island Developing States
DFID	UK Department for International Development	SOPAC	Pacific Islands Applied Geoscience Commission
DSDP	Dempasar Sewerage Development Project	SS	Suspended Solids
€	Euro	UN	United Nations
EF	Environment Fund	UN CESC	UN Committee on Economic, Social and Cultural Rights
EI	Economic Instruments	UN-HABITAT	United Nations Human Settlements Programme
EU	European Union	UNDESA	United Nations Department of Economic and Social Affairs
FAO	Food and Agriculture Organization of the United Nations	UNDP	United Nations Development Programme
GDP	Gross Domestic Product	UNEP	United Nations Environment Programme
GEF	Global Environment Facility	UNESCO	United Nations Educational, Scientific and Cultural Organization
GHG	Green House Gas	UNFPA	United Nations Population Fund
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities	UNGA	United Nations General Assembly
Ha	Hectare	UNICEF	United Nations Children's Fund
HAPPC	Hazard Analysis of Critical Control Points	UNSGAB	UN Secretary General's Advisory Board on Water and Sanitation
ICPR	International Commission for the Protection of the Rhine	USA	United States of America
ICZM	Integrated Coastal Zone Management	US\$	US Dollar
IPCC	Intergovernmental Panel on Climate Change	WFD	EU Water Framework Directive
IWRM	Integrated Water Resource Management	WHO	World Health Organization
JBIC	Japan Bank for International Cooperation	WIO-LaB	Addressing Land Based Activities in the Western Indian Ocean
JMP	Joint Monitoring Programme	WSP	Water and Sanitation Programme
Km²	Square Kilometres	WWAP	World Water Assessment Programme
MA	Millennium Ecosystem Assessment	WWM	Wastewater Management
MDG	Millennium Development Goal	WWTP	Wastewater Treatment Plant
Mg	Milligramme	XOF	Central African Franc
N	Nitrogen	Yr	Year
NPV	Net Present Value		
ODA	Overseas Development Assistance		

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LAYOUT

GRID-Arendal

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