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IMPLEMENTATION OF THE MILLENNIUM DEVELOPMENT GOALS AND WATER QUALITY MANAGEMENT IN THE ESCWA REGION

WATER QUALITY MANAGEMENT

Summary

This paper is based on an ESCWA report assessing water quality management in the ESCWA region, published in 2007, which addresses such key topics as the major sources of water pollution, the impact of limited water resources, water quality laws and policies in the countries of the ESCWA region, anti-pollution mechanisms, monitoring systems, the integration of water quality management in national strategies, and an assessment of the progress achieved in implementing the Millennium Development Goals (MDGs) related to water resources.

The study included a presentation of water quality management practices in three ESCWA member countries: Egypt, Jordan and Yemen. It concluded with a set of recommendations to help define priorities in the area of water quality management with the aim of formulating appropriate policies and strategies and taking the measures needed to treat the problem of deteriorating water quality in all its aspects.

This paper presents in summary form the highlights of the ESCWA report and the recommendations reached.

CONTENTS

Introduction

1. Water is pivotal to sustainable development and the preservation of its quality one of the cornerstones of Integrated Water Resources Management (IWRM). Over the last few decades the countries of the Economic and Social Commission for Western Asia (ESCWA) region have witnessed a large increase in demand for water leading in turn to growing pressure on water-related environmental elements and on the imperatives of sustainable development. Increased demand for water, on the one hand, and its scarcity, on the other, is contributing to the exacerbation of environmental problems, notably the degradation of water quality. The discharging of domestic, industrial and agricultural effluent into waterways constitutes the most significant factor in water quality degradation. Most water quality oversight systems are ineffective either because of insufficient water quality data in the monitoring system and the specific measurement standards for it or because the data available are inaccurate or discontinuous, making it difficult to analyse or make use of them. Added to this are the challenges arising from the dearth of legislative and legal tools – or the difficulty of employing them and their resultant ineffectiveness – and from the reluctance to employ economic tools in water quality protection programmes.

2. Many countries of the region have faced up to the problem of deteriorating water quality, recognizing its full dimensions and the importance of finding sustainable solutions to it. This is taking place in the context of attaining the Millennium Development Goals (MDGs), especially MDG 7 as it relates to providing safe drinking water and basic sanitation services in the context of ensuring environmental sustainability. Governments have taken measures to protect their water resources and halt water pollution. They have endeavoured to secure technical and financial assistance from local sources, donor bodies and countries, and international organizations, with the aim of defining priorities and conferring on water degradation issues. These priorities include planning public water quality management policies and putting in place the laws needed to conserve and protect water resources. They also include determining the bodies responsible for water quality management and defining their roles while strengthening cooperation and coordination channels between them and providing technical and informational support. The measures taken in accordance with these priorities are essential both to preserve and to improve the quality of the region's limited water resources. These measures should be taken in the context of the water quality management process that should be an integral part of national IWRM and development plans.

3. ESCWA published in 2007 a study[1] on water quality management in the ESCWA region which identifies the main sources of pollution, provides a survey of water quality management practices and lays out tools and measures that would make it possible both to prevent pollution and control the practices causing it. Also shown in the publication are the results of a case study of three selected countries in the ESCWA region: Egypt, Jordan and Yemen. The study introduces a set of guidelines and proposals for policies and measures for improving water quality, and for protecting and ensuring the sustainability of water resources on both the national and regional levels, within the framework of comprehensive strategies embracing the principles of IWRM.

4. The comprehensive water quality management strategy includes the following: (a) mechanisms for managing the water system given water scarcity; (b) tools for increasing the efficiency of water use in various activities; (c) standards for ordering priorities in line with public policy and development plans; (d) water resource protection and pollution-control measures and mechanisms for providing the investment needed to put them into effect; and (e) sufficient investment in the water and sanitation sectors and sustainable funding sources.

5. This paper, presented to the Water Committee at its eighth session to be held in Beirut on 17-19 December 2008, is based on the above-mentioned study and presents a summary of its main points.

[1] Water quality management in the ESCWA region (Arabic only), (E/ESCWA/SDPD/2007/2).

I. MAIN SOURCES OF POLLUTION AND THEIR IMPACT ON WATER QUALITY

A. SEWAGE

6. Water pollution from sewage is one of the most significant problems facing the countries of the region, one whose treatment requires enormous investment in sanitation networks. Domestic and municipal wastewater in the ESCWA region was estimated in 2002 to be some eight billion cubic metres of which only 2.8 billion were subject to either primary or secondary treatment.[2] The rest is discharged either directly into the sea or into open waterways. Some countries of the region channel partially-treated sewage into underground reservoirs or into the irrigation of public parks and green spaces. Other countries use partially-treated wastewater in agriculture which leads to the contamination of both agricultural produce and shallow aquifers. Most people living in villages still rely on ground cisterns which they build for storing wastewater which they then siphon off for reuse. However, high costs and weak Government supervision in rural areas compel residents to channel wastewater directly into waterways or onto surrounding land which has a decided impact on the groundwater supply.

B. AGRICULTURAL RUNOFF

7. Agriculture represents one of the main sources of water pollution. The large quantities of water consumed by agriculture deplete both groundwater and surface water and the disequilibrium leads to degraded water quality. Likewise, the excessive use of agricultural chemicals and fertilizers leads to high groundwater salinity levels and is a continuing source of water pollution. Agricultural runoff in the ESCWA region contains a high level of untreated domestic and industrial wastewater which leads to the degradation of water quality to the point of toxic pollution with heavy metals or bacteria.

C. INDUSTRIAL EFFLUENT

8. The degree of pollution arising from industrial activities in the ESCWA region varies with the magnitude and character of these activities and with their location in relation to waterways. The problem of water pollution worsens where untreated or partially-treated industrial residues are discharged into surface waterways or onto open ground. This affects both the groundwater supply and the surrounding environment. Industrial effluent may affect water quality on a number of levels, including altering the water temperature which results from changes in the water's chemical and biological composition or a reduction in the oxygen ratio following which the aquatic ecosystem is damaged or even destroyed. Industrial runoff carrying heavy metals, in addition to organic content, constitutes a serious hazard, especially when these pollutants precipitate in the rivers and become a permanent source of pollution. This is because the water flow and any change in the physiochemical support system can lead to a high level of dissolution of these metals.

D. SOLID WASTE

9. Solid waste poses a major problem in both urban and rural areas in ESCWA member countries. Solid waste includes: household, agricultural and medical refuse; demolition and construction debris; refuse from clearing surface waterways; and the residual sludge from wastewater treatment. Notwithstanding various rubbish collection projects in the major cities of the ESCWA region, the efficiency of their management ranges from good to seriously poor. Likewise, there are not enough proper landfills and those that exist are not up to specification and lack organized management. Moreover, rural areas still lack such landfills altogether. Pollution from industrial solid waste is reaching dangerous proportions whereby, when exposed to atmospheric factors such as rain and temperature changes, and to multiple chemical reactions, it turns into chemical compounds not easy to eliminate over time, nor by natural means. The treatment required to turn

[2] Compendium of Environment Statistics in the ESCWA Region, pp. 34-36 and 40 (E/ESCWA/SCU/2007/2).

water polluted by various forms of solid waste into a safe source of drinking water meeting international standards is exorbitantly expensive (because in this case it would be a matter of tertiary treatment). Given the poor technical and economic tools at their disposal and the lack of funding, this will be difficult for administrative authorities and municipalities to achieve.

E. SEAWATER INFILTRATION

10. The high salinity of groundwater represents a major problem for the countries of the ESCWA region in general, due to the scarcity of surface water to begin with, and to the fact that the region borders seas and oceans. Saltwater from these seas seeps into fresh aquifers near coastal regions, increasing their salinity. The danger to groundwater is increased by its arbitrary withdrawal, low average rainfall, the fact that most of it evaporates and the impossibility of storing it. These factors eventually upset the saltwater/freshwater balance. This is the state of affairs in terms of water degradation in the Gulf Cooperation Council (GCC) countries which indeed produce fully half the world's desalinated water in order to bridge the gap between water demand and supply.

F. CONFLICT

11. The ESCWA region has also suffered over the past four decades from a large number of wars on both the national and regional stages. These have exposed the environment and natural resources to dangerous defilement.[3] For example, Kuwait was exposed in the 1991 war to environmental disasters arising from oil infiltration and ground pollution. Efforts are being made to rehabilitate these oil-saturated regions.[4] Oil infiltration has not only affected the groundwater supply but also the marine environment and a large number of desalination stations all along the coast of the Arabian Peninsula.[5] Similarly, the World Health Organization (WHO) has cited the 2006 Israeli war on Lebanon and the physical damage it caused to Lebanon's water and sanitation infrastructure, endangering public health through water-borne diseases such as typhoid fever and dysentery.[6] In Iraq, the war raging since 2003 has caused direct damage to water pipelines, sanitation facilities and water treatment plants as well as to both surface water and groundwater exposing them to toxic waste and infiltration by chemical pollutants. Likewise, the war has hampered the process of rebuilding and rehabilitating the sector.[7]

G. TRANSBOUNDARY POLLUTION

12. There are many rivers shared by states in the ESCWA region, whether originating inside or outside the region. Any pollution affecting the shared water supply has an impact not just on one country but rather crosses borders into other countries, threatening in turn the environment and public health in all the countries through which it flows. Solid waste and agricultural and industrial runoff in any one country, if not eliminated properly, represent major sources of pollution of shared rivers and reservoirs. It is worth noting that there are no regional or international agreements for regulating the management of shared water resources in the ESCWA region.[8]

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[3] The environment in a transboundary context in the ESCWA region: the current situation and proposed recommendations (E/ESCWA/SDPD/2005/5).

[4] An environmental assessment of Kuwait: Seven years after the Gulf War, 1998. See http://www.gci.ch.

[5] Environmental impacts of the war on Iraq, 2004. See http://www.escwa.org.lb/divisions/sdpd/iraq/environment.html.

[6] Communicable disease risk assessment and interventions. Middle East crisis: Lebanon, July 2006 (WHO/CDS/NTD/DCE/2006.5).

[7] Environment in Iraq: UNEP progress report. See http://postconflirct.unep.ch/publications/Iraq_PR.pdf.

[8] See footnote 3.

II. IMPACT OF WATER SCARCITY ON WATER QUALITY

13. The countries of the ESCWA region face rapid population growth with their total population predicted to grow from 191 million in 2005 to nearly 381.2 million by 2050.[9] Water exploitation has reached its maximum in many of these countries to the point where the Arab countries, including countries of the ESCWA region, have been classed as having among the poorest freshwater resources in the world. Increased demand for water, on the one hand, and its scarcity, on the other, is helping to compound water quality management problems in the region.

A. DAMS AND RESERVOIRS

14. To bridge the gap between water demand and water availability, the countries of the region have taken measures such as building dams and reservoirs with a view to storing water in order to better exploit it and to control flooding. However, by holding back the flow of rivers that are acting to break up the pollutants, the very dams, barriers and surface reservoirs which contribute so well to water resource management have led in some cases to an accumulation of these pollutants in the waterways.[10]

B. NON-TRADITIONAL RESOURCES

1. *Reuse of wastewater*

15. ESCWA member countries have recognized the importance of reusing treated wastewater as a major resource, especially for countries suffering from water scarcity. Treated wastewater is reused either directly to irrigate agricultural land, green spaces and parks, or indirectly in the artificial recharging of groundwater supplies. Despite water scarcity in the ESCWA region and the great potential offered by wastewater treatment to helping redress the water shortage, the volume of water treated in the region remains very limited. Likewise, the absence in some countries of mechanisms to monitor and control treated water quality constitutes a danger to public health and the environment. Among the reasons for the limited reuse of wastewater as a non-traditional source of supply in the ESCWA region is the reluctance of the masses of consumers and farmers to use it, especially in agricultural production. The constraints on broadening the scope of wastewater treatment projects include: the high cost of treating, managing and controlling this water, lack of affordable technology, the absence of clear laws, overlapping institutional roles and poor technical skills.

16. With the growing reliance on artificially recharging aquifers with reclaimed water, whether to stabilize their levels, prevent seawater infiltration in coastal areas, or store as much water as possible when it is abundantly available, groundwater quality is being affected by the quality of the treated water used in the recharging operation if it is not up to international treated-water standards.[11]

2. *Desalination*

17. The GCC countries lead the world in the use of advanced desalination technologies and are home to nearly 80 per cent of all the desalination plants in the world. More than 75 per cent of all the water used in the GCC countries is desalinated seawater.[12] As concerns the quality of the desalinated water, however, it is estimated that 1.2 billion barrels of oil are spilled annually and refined crude oil contains a large number of

[9] Compendium of environmental statistics in the ESCWA region (E/ESCWA/SCU/2007/2).

[10] Water sector policy review and strategy formation: a general framework, 1995. See http://www.fao.org/docrep/v7890c/V7890E0a.htm.

[11] Health risks in aquifer recharge using reclaimed water: State of the art report. See http://www.who.int/water_sanitation_health/wastewater/wsh0308.

[12] Jamil Hamdawi, Water in the Arab world (Arabic only), Majalat al-Miyaah (Water Magazine), 10 June 2006.

toxins which could, by polluting the seawater, reach the desalination plants and have a negatively impact on the quality of the desalinated water.[13]

III. IMPACT OF WATER QUALITY ON DEVELOPMENT

A. IMPACT OF WATER QUALITY ON ECONOMIC DEVELOPMENT

18. According to a 2004 World Bank report on the subject, the average cost of environmental degradation in four ESCWA member countries, namely, Egypt, Jordan, Lebanon and the Syrian Arab Republic, is 4.45 per cent of the gross national product (GNP). The World Bank report came in the context of the Mediterranean Environmental Technical Assistance Programme (METAP) and includes estimates of the cost of environmental damage as a tool for incorporating the environment issue in economic and social development.[14] Despite the fact that a number of countries in the region are witnessing major economic shifts and some development in institutional restructuring, water policies in the ESCWA region still need to take into better consideration public health and the environment.

19. The quality of irrigation water is linked to the quality of crops and agricultural produce which affects in turn exports from the countries of the region to the outside world. There is a need to compile all data related to the quality of produce and its conformity with environmental stipulations on water quality and use of environment-friendly fertilizers and pesticides. Water quality also affects economic development in terms of the high cost of treating drinking water and the additional burden thereby placed on the population. As for the cost of providing water from non-traditional sources, the biggest challenge may be in making desalination, which calls for substantial investment, a basic source of safe drinking water in the ESCWA region. These high costs are not confined to the initial financing needed to build, equip and power desalination plants, but include the funding needed to operate and maintain them and to transport the water to users.

20. The pollution of sea and estuary water by domestic, industrial and agricultural effluent, by banned fishing methods, including the use of dynamite, and by landfill operations, is a factor affecting economic development through its impact on the quality of fishing grounds and the marine environment, on tourism and on industrial and commercial activity.

B. IMPACT OF WATER QUALITY ON PUBLIC HEALTH

21. Poor-quality water threatens public health directly as society is exposed to it in all its uses, from drinking water and domestic use to touristic and other uses. Likewise, the use of polluted water for irrigation constitutes a danger since pollutants are passed on to humans through consumption of agricultural produce, in addition to directly exposing agricultural workers. Also, the increasing reliance on polluted groundwater poses a fundamental danger to public health. Nearly 50 per cent of the population of Sana'a, for example, relies on private wells for their water, most of which are uncontrolled in terms of the quantity and quality of water withdrawn.[15]

[13] United Nations Environment Programme, Regional Office for Western Asia (UNEP/ROWA), *Desalination*. See http://www.unep.org.bh/Programmes/water/Desalination/default.asp.

[14] Centre for International Trade and Sustainable Development (ICTSD), International Institute for Sustainable Development (IISD), Regional and International Networking Group (RING).

[15] WHO, Water pollution control: A guide to the use of water quality management principles, 1997. Helmer and Hespanhol. Editors.

IV. LAWS AND POLICIES REGULATING WATER QUALITY MANAGEMENT IN THE ESCWA REGION

22. Many countries in the ESCWA region have issued laws and regulatory bylaws aimed at preserving water quality. In the Syrian Arab Republic, for example, Law No. 16 of 1982 regulates water use and quality control, and a water law is currently being drafted to include articles specific to the protection of the public water supply from pollution and defining penalties and fines for infringement This comes in addition to Environment Law No. 50 of 2002. In Lebanon Legislative Decree No. 25/1, on the regulation and protection of groundwater based on standards and indicators for water quality and effluent discharge, was issued in July 1996 and then reissued after review by the Ministry of the Environment in the form of Decree No. 1/8 in January 2001.

23. In the GCC countries, given water scarcity and the extensive reliance on saltwater desalination processes, it is a different matter from both the legislative and institutional standpoints. In Saudi Arabia, for example, Decree No. 225 of 1978 regulates ways of protecting the water infrastructure; Decree No. 62 of 1978 includes measures for protecting water from various sources of pollution and defines penalties; Decree No. 1409 of 1982 defines the environmental standards for protecting air and water quality, and Decree No. 114 of 1988 regulates ways to conserve groundwater. In Oman, authorities have focused on incorporating water issues into the State's economic plans. Among the Sultanate's most significant achievements is the Law for the Protection of the Water Heritage issued in Decree No. 29/2000, two executive orders regulating wells, discharging and the use of desalination units, and Sultan's Decree No. 115/2001 to protect drinking water sources from pollution.

24. However, the absence of a quantitatively and qualitatively comprehensive water resource management law in most countries of the ESCWA region is hindering the development and efficient management of water resources. Existing laws focus on developing water resources and not on their integrated management. In light of their dwindling supply, it has become imperative to develop these resources in order to meet the growing demand for water.

25. On the regional level, incorporating shared transboundary watercourses into the legal system covering international rivers is a relatively new issue in international water law. The only exception is the Convention on the Protection of Transboundary Watercourses and International Lakes.[16] Despite the efforts made in the ESCWA region over the years culminating in the signing of some agreements on managing shared water resources preserving water quality, examples being the Nile Basin Initiative and the Syrian-Lebanese agreement on the Al-Janoubi Al-Kabeer River, these agreements remain partial and are still undergoing institutional and legal development.

26. On the institutional side, multiple bodies are working on water quality management in the countries of the ESCWA region, including the ministries of water resources, health, the environment and population, the municipalities, and numerous research centres and laboratories. This is leading to an overlapping of tasks and responsibilities, especially when these efforts are poorly coordinated and lack clearly defined roles and responsibilities in the areas of water distribution and the discharge and treatment of effluent.[17]

[16] The environment in the transboundary context in the ESCWA region: situation and recommendations (E/ESCWA/SDPD/2005/5).

[17] El-Fadel, M., Zeinati, M. and Jamali, D., 2001, *Water resources management in Lebanon: institutional capacity and policy options*, in *Water Policy*. Vol. 3, 2001, pp. 425-448.

V. ANTI-POLLUTION MECHANISMS AND WATER QUALITY MONITORING SYSTEMS

A. TECHNICAL TOOLS AND SYSTEMS FOR MONITORING WATER QUALITY

27. The monitoring and control systems and the technical capabilities available in the region are inadequate to the magnitude and type of pollutants threatening water quality. The industrial sectors in particular lack automatic control systems, due to the lack of trained technicians and to the absence of oversight bodies to control industrial pollution. Another reason is that water quality management is simply not given enough attention. One of the most effective techniques in this area is to isolate the polluting activities and industries in locations far from water resources so that their hazardous discharges can be controlled. Identifying industrial residues and treating them centrally in also one of the most cost-effective solutions.

28. To properly manage water quality in the ESCWA region integrated databases need to be compiled, including water quality data and indicators sufficient to support enlightened decision-making. Achieving this will take specialized expertise in monitoring systems and database management. Also needed will be arrangements for the collection of the necessary information from users, networks to record the data used and laboratories to measure, analyse and certify the data.

B. DATA ANALYSIS AND EXCHANGE

29. The most important components of an integrated water quality monitoring system are: analysing data, checking them for accuracy and for continuity in their collection, updating the data, and checking the quality of the measurements taken. These will depend in turn on how the oversight network is designed and how effective it is in obtaining exact measurements from the monitoring sites. Although geographical information systems (GIS) and some advanced databases are available in many countries in the ESCWA region, their use is limited in many cases to the preparation of tables, maps and charts and does not extend to data analysis and water quality assessment. To better take advantage of these techniques accurate information must be produced and analytical studies prepared that can support planners, decision makers and policymakers. From another angle, many countries of the region are suffering from a multiplicity of monitoring and oversight bodies within the same ministry or between ministries. These countries lack the mechanisms for the exchange of information between various sectors and Government agencies, meaning that effort is wasted along with the limited resources available. Hence, developing an oversight system for the various types of pollution calls for one basic integrated structure, and the development of consistent analytical capabilities throughout. The data used must be monitored through a dedicated oversight network in order to ensure continuity and sustainability.

C. MECHANISMS FOR MANAGING POLLUTION-RELATED HAZARDS

30. Dealing with pollution hazards is one of the cornerstones of water quality management. Managing pollution hazards means, in the first instance, finding a mechanism for breathing new life into anti-pollution and water quality preservation laws and statutes, and revitalizing the relevant law enforcement authorities (such as Egypt's Water Surface Police and the Environment Police soon to be established in Jordan). These authorities are authorized to carry out spot inspections of establishments that discharge residues into the waterways and to take samples for later analysis either by the oversight body concerned or by some other body such as the health or environment ministry. The second alternative proposed to prevent pollution at source is the provision of special units in factories to treat industrial waste *in situ*.

31. A number of anti-pollution measures have been taken by way of setting up disaster management systems for industrial pollution, especially in the Gulf countries, Egypt, and the Syrian Arab Republic. These measures include controlling the average concentration of hazardous materials at the source, operational and economic measures to prevent pollution, issuing licences – and enforcing compliance - to

discharge waste in appropriate amounts in permitted area, and the enforcement of water quality protection laws.

VI. INTEGRATING WATER QUALITY MANAGEMENT IN NATIONAL STRATEGIES AND ACHIEVING THE MDGS

32. According to a study prepared by ESCWA in 2005[18] on national IWRM strategies in the countries of the ESCWA region, that a small number of countries have finalized these strategies and incorporated them into their socio-economic plans for achieving sustainable development, while a limited number of other countries from this group are still assessing the implementation in principle of IWRM. The study concludes with the observation that some progress has indeed been achieved even at a time when many of these countries are facing difficulties creating partnerships, recovering their costs, building capacity, clarifying roles, and getting the local private sector to invest in water quality management projects. Measures likely to give traction to water quality management systems are as follows:

A. DEVELOPING THE TECHNICAL CAPACITY TO DEAL WITH MODERN TECHNOLOGY

33. Water quality management entails building the technical capacity needed to keep pace with modern technological developments and enabling those working in this sphere to use the modern laboratory and field monitoring devices that have been introduced as well as apparatuses for measuring changes in water quality. These devices are capable of assimilating huge quantities of data, indicators and other elements requiring analysis. Without advanced information management programmes it is no longer possible to enter and collate such volumes of information, prepare statistical reports and reproduce the data in different ways. In addition, the use of quality-control programmes has become a prerequisite for ensuring data quality and for taking best advantage of the investment allocated to establishing a successful water quality management programme. Among the priorities of integrated water quality monitoring programmes are the sustainability of financial resources, upgrading staff competence, and continuous training programmes on the use of modern technologies.

B. PROVIDING THE INSTITUTIONAL SET-UP

34. A water quality monitoring system calls for an effective institutional set-up with a minimum of administrative and financial red tape. Despite efforts to develop a structure for the water resource management sector in the ESCWA region, there remains the challenge of defining jurisdictions and providing the relevant Government bodies with the technical, material and human resources they need. The lack of modern, comprehensive water statutes combined with poor enforcement mechanisms means that existing laws are unable to keep pace with the shifting environmental exigencies brought on by the mounting pressure on water resources, their continuing degradation and the failure to make efficient use of non-traditional water sources. Defining the institutional responsibilities and roles of the various Government agencies concerned with water quality management is one of the basic prerequisites for setting an effective system in motion.

C. PUTTING IN PLACE STATUTES AND LAWS

35. If an effective water quality management system is to be achieved, it must be backed up by a set of statutes and laws. The aim of oversight and monitoring is basically to measure and determine water quality and to set these measures against the legal standards in force. Based on these measures, the volume of effluent is determined along with its impact on water resources and the extent to which it constitutes a hazard, so that it can be dealt with in such a way as not to degrade the water supply. Moreover, these statutes must be flexible enough to allow for regular adjustments.

[18] Developing frameworks for the implementation of national strategies towards integrated water resource management in the ESCWA member States (Arabic only) (EESCWA/SDPD/2005/20).

36. Furthermore, these statutes, bylaws and various standards should not be created in isolation from the socio-economic and cultural circumstances prevailing in society. In certain cases, overzealous application in developing countries of statutes and related penalties for infringements based on those in force in the most economically, technologically and culturally advanced countries, has led to a breakdown in the law. This is the result of the unrealistic nature of the statutes and the inability both of state authorities to enforce them and of citizens to comply with them.

D. SPREADING ENVIRONMENTAL AWARENESS

37. The degree of public awareness of pollution hazards is the most important factor in the success of any water quality preservation system. Given economic, cultural and social deterioration and the lack of knowledge about the environment, it is hard to prevent environmental damage generally and water degradation in particular. It is also difficult to attain the aims set out for a water quality monitoring system given the conditions prevailing in the ESCWA region from which the majority of its citizens are suffering, especially those living in rural areas and in informal settlements. These conditions are characterized by declining standards of living and a shortage and in some cases complete absence of safe drinking water and basic sanitation.

38. Water quality monitoring in the ESCWA region calls for integrated databases containing all the water quality data and indicators that could help support enlightened decision-making in this area. For that to be achieved, specialized expertise on monitoring system and database management must be made available. Also, arrangements must be made to permit data collection from users, networks set up to record the data and laboratories established to measure, analyse, and certify them.

VII. CASE STUDIES OF SELECTED COUNTRIES IN THE ESCWA REGION

A. EGYPT

39. There are numerous water resources in Egypt, including the Nile River and groundwater reservoirs, in addition to the meagre rainfall in the coastal areas and flood plains. However, these resources are exposed to the pressures of an expanding population and the attendant depletion and declining quality of available resources. Steady growth has meant the expansion of agricultural lands and of housing, industrial and tourism projects which have taken their toll on the factors making for a clean environment and water quality.

40. Despite the building of 220 wastewater treatment plants over the past two decades, Egypt is still suffering from pollution of its surface waterways, especially in the Nile Delta with its high population density and lack of sufficient sanitation services.[19] Haphazard population growth around the big cities has contributed to a decline in the capacity of treatment facilities to absorb large volumes of wastewater. This has compelled the plants to carry out partial treatment or to dispose of effluent in agricultural ditches without treating it at all. As for groundwater reservoirs, the results of the study indicate a high ratio of nitrates in some wells as a result of the overuse of chemical fertilizers, rendering some of these wells unsafe.

41. The cornerstone of environmental protection in Egypt is Anti-Pollution Law No. 48 of 1982 and its executive bylaw. This law contains a number of important provisions, including a prohibition against discharging waste into waterways all along their length and breadth. Likewise, the executive bylaw contains mandatory articles defining the indicators and standards that all bodies and establishments must comply with before being permitted to dump into waterways, as well as articles that make thorough treatment processes mandatory for waste resulting from various activities. The Ministry of Water Resources and Irrigation (MWRI) is the body in Egypt legally responsible, in cooperation with the other ministries concerned, for managing various water resources and protecting them from pollution. This ministry includes various sub-

[19] Mediterranian environmental technical assistance program (METAP), *Water quality management: country profile – Egypt*.

sectors and sub-administrations at the regional and governorate levels to follow up on programme and policy implementation. The ministry rests its water resource management policy on three principal pillars: developing existing water resources; increasing the efficiency of water use; and protecting public health and the environment. This last pillar relies on a formula for treating and controlling pollutants as follows: (a) a ban on pollutants (despite the effectiveness of this mechanism, it is extremely difficult to apply under the current circumstances); (b) treatment of pollutants where their discharge into the waterways cannot be banned; (c) and control pollutants in the event that they can be neither banned nor treated.

42. In 2000 Egypt adopted a national strategy for integrated solid waste management that focused on the principle of a gradual privatization of the sector. Under this strategy, some private companies have, since 2003, been assuming responsibility for solid waste management operations in the governorates of Alexandria, Giza, Qalubia, and Cairo. These experiments have created a new scope for private sector participation.[20] Pollution from seawater infiltration into freshwater is confined to those regions adjacent to the coasts. According to the information available, the salinity of the main groundwater reservoirs is below the internationally-permitted level. Likewise, the long course and fast currents of the Nile River constitute the major mitigants of pollution, especially that arising from industrial activities. By the same token, the impact of salinification and waterlogging in agricultural areas has been held in check since the establishment of modern drainage systems and networks of covered drainage canals which has led to the reduction of highly saline agricultural lands, from about 1.2 million hectares in 1972 to 250 thousand hectares in 2005.[21] The practice of wastewater reclamation goes back to the beginning of the 20th century. Egyptian law limits the reuse in irrigation of treated domestic and municipal wastewater to non-fruit-bearing trees, forests and greenbelts.[22]

43. The National Groundwater Quality Monitoring Network in Egypt is one of the principal mechanisms for driving forward water quality preservation policies in the country. The MWRI has relied on water quality monitoring programmes established by different sectors both within the ministry and within research institutes attached to the National Water Research Center. Despite the multiplicity of these programmes, they have sometimes lacked accurate information and have not been linked up so as to cover a wider scope comprising all water resources. These lacunae notwithstanding, central laboratories have been set up within the framework of the National Water Research Center with the ability to produce accurate, precise, high-quality analytical data on water quality in Egypt. To ensure the quality of results, these laboratories have contracted with the Canadian Association for Environmental Analytical Laboratories (CAEAL) to obtain internationally-recognized quality credentials. To complete the system, a water quality unit has been established, which gathers together water quality data from all sections of both the MWRI and other ministries (e.g., health, industry, agriculture and population) in order to have a comprehensive picture of the overall water quality situation. A substantial water quality database has also been designed linking all data whether it relates to fresh surface water, groundwater or sewage. The database currently contains more than 40 indicators and components, boasting a high degree of accuracy and covering more than 435 sites.[23]

44. Consolidated reports have been prepared, in cooperation with the other ministries concerned, on the state of water quality in Egypt, and information on Egypt's water quality oversight programme is circulated through annual reports issued by various agencies. As an example, the Central Water Quality Unit publishes a report on the state of Egypt's water quality which includes the National Water Quality Monitoring Program, while specialized bodies (such as the Drainage Research Institute, the Research Institute for

[20] *Solid waste management center: Egypt country data*. See http://www.metap-solidwaste.org/index.php?id=54.

[21] Information system on water and agriculture (AQUASTAT), 2005, Egypt. See http://www.fao.org/ag/agl/aglw/aquastat/countries/egypt.

[22] M. Bazza, *Wastewater reuse in the Near East region: experience and issues*. FAO Regional Office for the Near East, Regional Symposium on Water Recycling in the Mediterranean Region, Greece, 26-29 September 2002, p. 5.

[23] Egyptian Ministry of Water Resources and Irrigation, Agricultural Residues in the Nile Delta, 2000-2001 Yearbook, Technical Report No. 71, October 2004.

Groundwater and the Nile Research Institute) publish separate reports. Public reports on water quality in Egypt are based on three main indicators: salt concentration; chemical oxygen demand (COD); and dissolved oxygen concentration.

45. Egypt has prepared a National Water Resources Plan in conformity with IWRM principles and also a National Environmental Action Plan up to 2017 in order to effect the changes needed in water resources management and to improve potable water and sanitation services. It has also been striving since 2004 to begin privatizing the water sector by applying new pricing for drinking water accounting for it according to bands based on the quantity consumed. The National Authority for Potable Water and Sewage has carried out a number of feasibility studies to arrive at a suitable rate for the cost of one cubic metre of water, including the costs of water purification and network maintenance. They have also undertaken studies on reducing the amount of water lost to leakage from the network as a result of pipeline fatigue in some areas.

B. JORDAN

46. Jordan has one of the most serious water scarcity situations in the world, whereby the per-capita rate of freshwater supply was around 168 cubic metres in 1997.[24] By now it is much closer to the water poverty limit defined as 1,000 cubic metres per year. Surface water is the greatest source of water in Jordan with the major surface waterways being the Yarmouk and Jordan Rivers and the King Abdullah Canal, though the mountainous plateaux and arid regions rely on groundwater as their main water source. Surface and groundwater sources in Jordan are largely dependent on rainfall.

47. Population increases in Jordan, both from natural growth and also from the influx of migrants and refugees escaping still more conflicts in the Middle East, have led to increased pressure on limited water resources and to the depletion of groundwater. This has led in turn to a higher rate of salt intrusion in the water. Population growth has also compounded the problems of sanitation and pollution. Treatment plants cover most of the large cities and offer services to some two million inhabitants, or about half the population of Jordan. However, the capacity of these plants is no match for the pressures arising from population expansion, rendering them incapable of offering suitable treatment.

48. As in most other countries, water pollution in Jordan is generated by industrial activities from which effluent seeps into the waterways and water basins, such as the industrial residues that leach into the Zarqa River and pour into King Talal Dam. Jordan, with its scarce water resources, has registered the highest score in the ESCWA region on the index of toxic industrial effluent per unit of water availability: 1,392 as compared with 551 for the Syrian Arab Republic and 100 for Egypt.[25] Despite a law regulating industrial drainage operations by requiring an official license (issued by the Water Authority of Jordan which also oversees the law's implementation) to discharge wastewater, the rate of violators remains high at around 50 per cent.[26] By the same token, groundwater quality has deteriorated due to unregulated pumping, excessive underground cisterns and saltwater seepage into them. As a result of salt intrusion in wells, much agricultural land is no longer fit for cultivation, which has led to deteriorating socio-economic conditions in these regions and accelerated migration from rural to urban habitats.

49. By the year 2000, Jordan had 13 traditional and six non-traditional wastewater treatment plants. Wastewater treatment capacity in Jordan reached 82 million cubic metres per year in 2005 and is expected to reach 188 million cubic metres by approximately 2015.[27] In general, most sanitation wastewater in Amman

[24] Application of sustainable development indicators in ESCWA member countries: Analysis of results (E/ESCWA/ED/2000/4), p. 22.

[25] *Jordan country report on water quality and potential METAP interventions*, September 2002, p. 4. See http://www.metap.org/files/Water%20Reports/country%20report/JordanWaterQualityCountryReport.pdf.

[26] Ibid, p. 5.

[27] Compendium of environmental statistics in the ESCWA region (E/ESCWA/SCU/2007/2), p. 44.

is discharged into the Zarqa River where it is stored in King Talal Dam and mixed with floodwater, then discharged into the Jordan Valley. This leads to water degradation as a result of the inefficiency of treatment processes. Excessive consumption of spring water has led to the drying-up of waterways as the flow is replaced by partially-treated sewage due to the low handling capacity of most treatment plants. Agricultural chemicals and fertilizers add to surface water pollution due to their unregulated use and poor oversight.

50. In the context of applying water demand management policies and rationalizing consumption, Jordan has undertaken pioneering experiments in instigating the reuse of domestic wastewater in residential gardens and parks. However, these experiments are still limited, are undertaken within a narrow framework and call for good oversight and the education of society in order to be accepted. Unlike the GCC countries, Jordan does not possess the water resources necessary for desalination. However, despite the difficulties of funding and conveyance, and meagre capabilities, desalinated water production in Jordan rose from ten to 40 million cubic metres between 2000 and 2003.[28]

51. Responsibility for water quality management in Jordan falls to three bodies: the Ministry of Water and Irrigation (from which stem two executive agencies: The Jordan Valley Authority and the Water Authority in Jordan), the Ministry of the Environment, created in 2003, and the Ministry of Health. As for technical tools and water quality monitoring systems, the National Project on Water Quality was established several years ago through cooperation between the Ministry of the Environment and the Royal Scientific Society. The action plan for the project up to 2003 was confined to gathering samples in order to oversee the quality of drinking water. In 2004, the number of sites overseen was increased from five to 103.[29] There is also in Jordan a programme to oversee water, air and environmental quality in cooperation with the Japanese Agency for International Cooperation. This programme, still in its initial stages, aims to provide industrial tools in the monitoring areas and to modernize some of the treatment plants run by the Ministry of Water and Irrigation.

52. There are no laws dedicated specifically to water management and protection from pollution in Jordan which relies on recommendations issued by WHO (JS 286/2001). Water standards in Jordan include those for using treated sludge resulting from wastewater treatment plants in agriculture (standards 1145 of 1996), recommendations for drinking water quality (standards 286 of 2001), standards for wastewater treatment (standards 893/1995, updated in 2002), and recommendations for bottled water (standards 1214 of 2002).[30]

53. With regard to achieving the MDG calling for the halving of the proportion of people without access to safe drinking water and sanitation by 2015, the proportion of people in Jordan having access to safe drinking water reached, in 2004, 99 per cent in urban areas and 91 per cent in rural areas. The proportion of people benefiting from sanitation services had by that year risen to 93 per cent in urban areas and 87 per cent in rural areas. However, despite this progress, because of environmental degradation, more effort is still needed in the legislative and oversight areas and in the provision of sustainable funding sources. Water quality management also calls for more educational programmes to ensure broader popular participation.

54. As a result of the severe water shortage and the problems arising from surface and groundwater pollution, it has become necessary to turn to wastewater reclamation since it is no longer possible to regard wastewater as useless. On the contrary, what is needed is highly efficient treatment to produce water that meets the measurement recommendations in order to be able to use it for agricultural and residential purposes and to recharge the groundwater reservoir. The main constraint to implementing future water quality management strategies in Jordan may be garnering the financial investment needed to build sanitation networks, develop the necessary infrastructure, put in place oversight tools and rethink the division of

[28] Ibid.

[29] Information drawn from a meeting with Adnan Al-Zawahira, director of water protection in Jordan's Ministry of the Environment, 2006.

[30] Jordanian Ministry of Water and Irrigation. See http://www.mwi.gov.jo/mwi/Standard.aspx.

responsibilities. The latter is needed where water quality management suffers from overlap between the jurisdictions of various bodies, hindering both the efficient implementation of oversight works and the effective application of pollution monitoring programmes.

C. YEMEN

55. Yemen suffers from a water shortage, as there are no permanent rivers, and basically relies on the groundwater reservoir, which includes most of the renewable water supply, and some dams and reservoirs for collecting floodwater and rainwater. Average rainfall in Yemen in 2003 was about 88,171 million cubic metres, but due to the country's topography and the fact that the bulk of the rain falls during the summer, most of it is used directly in agriculture and the rest evaporates, with not more than 10 per cent being stored.[31]

56. Population growth in Yemen has registered a sharp increase in the past few years and is expected to exceed a rate of 4.7 per cent between 2005 and 2009.[32] This has naturally led to an increase in water consumption such that the pumping of water from the groundwater reservoir, the principal source of water in Yemen, has reached twice the average natural recharge rate of the water table. Water supply and sanitation services are utmost priorities in Yemen, in urban as much as in rural areas. As existing networks are poorly maintained, water treatment plants are limited in number and the capacity of these plants does not allow for complete wastewater treatment, there is often no alternative to the direct dumping of untreated wastewater, with its attendant impact on water quality. Experts warn of the risks of pollution resulting from salt intrusion in wells due to the drop in the groundwater level and its infiltration by saltwater. Yemen's capacity to make use of alternative water sources is limited. The water shortage problem is expected to become more serious in Yemen as a result of the lack of water quality monitoring programmes, its weak infrastructure and the lack of the technical expertise needed.

57. Law No. 33 of 2002 was enacted in order to regulate and rationalize water exploitation, to protect water from depletion and pollution and to increase the efficiency of water conveyance, distribution, maintenance and operations. In addition, the law is meant to bring the beneficiaries into partnership in the water development, investment and protection stages. This law, however, is still in need of an executive bylaw. In this regard, a survey has been published on the standards intended to be used in the executive bylaw. These standards covered the quality of irrigation water, bottled drinking water, the drinking water supply, industrial effluent, and domestic and municipal wastewater. However, it is feared that the laws will be difficult to apply due to a serious overlapping of jurisdictions and responsibilities among Government bodies and the lack of sufficient coordination with the private sector and civil society in the administration of the water system. Added to that is the lack of expertise and of the funding sources and investment needed to create oversight systems and set up an infrastructure that will make water quality management possible.

58. Given prevailing conditions in Yemen, there is an urgent need to set down a clear strategy linking water quality management and the World Summit on the Information Society (WSIS), and including a clear policy defining the responsibility of each agency concerned with water quality management and the tools that will enable each party to carry out its role.

59. Efforts by the Yemeni Government to lay down the foundations needed to manage the water sector resulted in 1995 in the incorporation of water resource management functions into a single structure, namely, the National Water Resources Authority. A legislative framework was created to support its functions. In 2003 the Ministry of Water and the Environment was established and put in charge of water quality management. This included other organizations concerned with water and its management, namely, the

[31] Ministry of Water and the Environment, National Strategy and Investment Program for the Water Sector 2005-2009: Our Way Forward, pp. 8, 13, 23 and 28.

[32] United Nations Economic and Social Council, Population Division, *World Population Prospects: the 2004 revision*.

Agricultural Research and Extension Authority, the National Water and Sanitation Authority and the National Water Resources Authority. There has been a reliance on decentralized administration in water resource management and in the implementation of related projects. Local councils currently prepare and manage water development projects. All this reflects the significant role of political decisions in the development of institutional capacity to face the present water challenges.

VIII. RECOMMENDATIONS

60. The recommendations that should be followed in order to strengthen ways of protecting water resources from degradation in the countries of the ESCWA region can be summarized in the following steps, realizing that a comprehensive presentation of water quality management recommendations is contained in the report published by ESCWA on this subject:[33]

(a) Optimize the development and application of national IWRM strategies based on a comprehensive assessment and put in place the appropriate solutions;

(b) Harmonize and coordinate efforts, capacities and information between the ministries and agencies concerned in order to contribute to efficiently revitalizing water quality management; divide up authority among existing institutions so as not to hinder the implementation of effective oversight programmes; put in place a solid institutional structure to coordinate among the numerous agencies and institutions concerned with the collection, treatment and reuse of wastewater;

(c) Find tools to ensure sustainable financing and investment, including cost-reduction and cost-recovery measures and ways of increasing the incorporation of the non-traditional solutions; support opportunities for private sector participation in the provision of water resources and investment in water quality management, such as modernization, drinking water and sanitation network management; modernize and increase the handling capacity of existing treatment plants; train management staff to be able to assimilate modern technologies; and expand the creation of proper hazardous waste landfills;

(d) Create and develop a water quality monitoring system at the national level, define the roles of the agencies concerned with overseeing water quality; develop the tools needed for oversight, including standards, licences, law-enforcement tools and empower them to stop pollution;

(e) Develop statutes and put in place executive bylaws with well-defined standards based on the water quality management strategy; such as carrying out well-digging and pumping operations; putting in place effective oversight tools; revitalizing the laws governing water treatment, water reclamation and solid waste management, among others; develop monitoring guidelines and water quality management suitable to the local environment and the socio-economic situation;

(f) Increase the exchange of information on water quality both within individual organizations and between organizations responsible for water quality management; foster cooperation with regional and international agencies for the exchange of expertise on various topics such as desalination, the use of saltwater in agriculture, the search for economical ways to treat and desalinate water; expand the creation of mobile treatment plants and link them with a central network;

(g) Revitalize the role of citizens and NGOs and civil associations, incorporate women and marginal groups and promote their role in the protection of water quality; put in place an effective programme for raising awareness of water quality management, especially in remote and rural areas.

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[33] Report on water quality management in the ESCWA region (E/ESCWA/SDPD/2007/2).