WASTEWATER MANAGEMENT POLICY

Background

The Hashemite Kingdom of Jordan is an arid to semi-arid country, with a land area of approximately 90,000 km2. Its topographic features are variable. A mountain range runs from the north to the south of the country. Land slopes gently to the east of this range to form the eastern deserts, but to the west the ground slopes steeply towards the Rift Valley, which extends from Lake Tiberias in the north, at an elevation of -220 m below see level, to the Red Sea at Aqaba.

The growth of its population has not been natural over the past few decades. The more recent average population growth rate stands today at about 3.5% due to natural and non-voluntary migration. Although population growth rates are declining, the expanding population will continue to place enormous pressures on water resources. About 78 percent of the population is located in urban areas concentrated in four Govemorates: Amman, Balqa, Zarqa, and Irbid. The influx of waves of refugees and displaced persons has resulted largely in fast and almost uncontrolled urbanization.

Jordan has been experiencing an imbalance in the population - water resources equation. Its per capita share of renewable water resources is among the lowest in the world, and is declining with time. It is projected to fall from 180 m3/capita/year at present to 90 m3/capita/year by 2025.

Water resources consist primarily of surface and ground-water resources, with treated wastewater being used on an increasing scale for irrigation, mostly in the Jordan Valley. Renewable fresh water resources are estimated at about 850 million cubic meters (MCM) per year, including water added by the Peace Treaty. About 125 MCM/ year is expected to be available from fossil aquifers and through desalination by the year 2005, making the annual freshwater stock about 975 MCM per year.

Treated wastewater generated at sixteen existing wastewater treatment plants is an important component of Jordan's water resources. Due to the terrain and the concentration of the urban population above the Jordan Valley escarpment, the majority of treated wastewater is discharged into various watercourses and flows to the Jordan Valley where it is used for irrigation. About 60 MCM per year of treated wastewater are effectively discharged today into the watercourses or are used directly in irrigation.

Wastewater quantity is increasing with the increase of population, increase in water use and the development of sewerage systems. Thus, by the year 2020 when the population is projected to be about 9.9 million and when the percentage of the population with sewerage service will have increased from the current 50 percent today to percentages that will cover most of the townships and cities of the country, about 240 MCM per year of wastewater are expected to be generated.

Development and Status of Wastewater Sector

Wastewater collection has been practiced in Jordan in a limited way since 1930 in the town of Salt. Some treatment was achieved by utilizing primitive physical processes. Mostly, however, septic tanks and cesspits were used with gray water often discharged to gardens. This practice resulted in major environmental problems, especially groundwater pollution. The pollution problems were complicated by the rapid urban growth. The population in the capital city of Amman, for example, increased from 50,000 in 1940 to 800,000 in 1985.

Modern technology to collect and treat wastewater was introduced in the late 1960s when the first collection system and treatment plant was built at Ain Ghazal utilizing the conventional activated sludge

process. The system consisted of a sewage network that runs by gravity to the lowest point in Amman, where the treatment plant was located and built. The treatment plant was designed to handle an average flow of 60,000 m3/d with a BOD5 loading of 18,000 kg/d, for a population of 300,000. The design effluent standard was BOD5 20 mg/1. The treated effluent was discharged to Sell Zarqa.

However, due to the high strength of the raw sewage (i.e. the BOD5 of the incoming sewage was greater than 600 mg/1) the effectiveness of the activated sludge process was drastically reduced. Nevertheless, AGTP continued to operate under high organic overloading conditions, which resulted in major operational and environmental problems. As a result, AGTP produced odors that were a source of public nuisance to the surrounding areas. The quality of the effluent of AGTP deteriorated the quality of surface, ground and irrigation water in the region.

Since the year 1980 and during the International Drinking Water and Sanitation Decade (1980-1990), the Government of Jordan carried out significant and comprehensive plans with regard to the different issues of wastewater management primarily related to the improvement of sanitation. About 75% of the urban population and 52% of the total population (at that time) gained access to wastewater collection and treatment systems. This has raised the sanitation level, improved public health, and strengthened pollution control of surface and groundwater in the areas served by wastewater facilities. Presently, there are 16 treatment plants serving most of the major cities and towns in the country. Ten facilities are conventional mechanical treatment plants and six employ waste stabilization ponds. Another two treatment plants are under construction. About 2 million people (nearly 50% of the population) are served by sewerage systems and the effluent quantity is estimated at about 60 million cubic meters per year.

The characteristics of wastewater in Jordan are somewhat different from other countries. The average salinity of municipal water supply is 580 ppm of TDS, and the average domestic water consumption is low (around 70 1/c/d country wide). This results in very high organic loads and in a higher than normal salinity in wastewater. This is particularly applicable to wastewater treated in waste stabilization ponds (85% of the total generated wastewater), where part of the water is lost through evaporation, thus increasing salinity levels in the effluents. In addition, high organic loads impose operational problems where the plants become biologically overloaded with only a portion of their hydraulic loads.

Given the low level of industrial discharges to sewage treatment plants, wastewater in Jordan is comparatively low in toxic pollutants such as heavy metals and toxic organic compounds. It is estimated that 10% of the biological load comes from industrial discharges.

The major receiving streams for wastewater have very low flow with wastewater comprising a significant portion of stream flow. These streams are not used for bathing or fishing. Much of Amman's wastewater treated effluent is discharged in the Zarqa River and is impounded by the King Talal Dam where it gets blended with fresh flood water and is subsequently released for irrigation use in the Jordan Valley.

It is worth mentioning that the increased supply of water to Jordan's cities came about at the expense of spring flows discharging into such streams as the Zarqa River, Wadi Shueib, Wadi Karak, Wadi Kufrinja and Wadi Arab. The flow of freshwater in these streams dried up as a result of increased pumping from the aquifers, and the flow was replaced with the effluent of treatment plants, a process that transformed the ecological balance over time.

Varieties of crops are grown using irrigated wastewater including citrus, vegetables, field crops and bananas. Soil characteristics vary widely from sand to clay. Principal concerns in the use of wastewater for irrigation include its salinity, chloride concentrations, and the presence of fecal coliforms and nematode eggs. Concern about heavy metal, has not been substantiated but is an area of public concern warranting monitoring.

The Jordanian standards and regulations which specify the quality of the treated effluents allowed to be discharged into wadis or destined for reuse in agriculture, require a secondary level of treatment. Quality specifications follow the WHO guidelines for the safe use of treated effluent in irrigation.

In order to develop a Wastewater Management Policy, the following represent the key issues under consideration:

1. Provision of adequate wastewater collection and treatment facilities for all the major cities and towns in Jordan.

2. Protection of the environment and public health in the areas affected by the proposed systems, especially, surface waters and ground waters.

3. Consideration of treated effluents as a source for irrigation reuse.

4. Improvement of the socioeconomic conditions in the areas to be served by the proposed systems.

The Policy

On Resource Development

1. Wastewater is a perennial water source and shall form an integral part of renewable water resources and the national water budget.

2. Collection and treatment of wastewater is a necessity to circumvent hazards to the public health and the environment. It becomes imperative when contamination of freshwater resources with wastewater is immineat.

3. Collection and treatment of wastewater becomes mandatory to protect public health against water borne diseases, and where epidemics become a threat otherwise.

4. Existing levels of wastewater services shall be maintained and upgraded where necessary to enhance public health and the environment.

5. Treatment of wastewater shall be targeted towards producing an effluent fit for reuse in irrigation in accordance with WHO and FAO guidelines as a minimum. Reuse of treated wastewater in other purposes shall be subject to appropriate specifications.

6. Coordination shall be maintained with the official bodies in charge of urban development to account for the treatment and disposal of their liquid wastes. Central treatment plants shall be built to serve semi-urban and rural comunities, and collection of wastewater can be made initially through trucking until collection systems are justified.

7. Specifications and minimum standards shall be issued by the competent authorities for the use of septic tanks in rural areas. Particular attention shall be paid to the protection of underlying aquifers.

On Resource Management

8. It is highly imperative that a section in the Water Authority be responsible for the development and management of wastewater systems as well as the treatment and reuse of the effluent.

9. A basin management approach shall be adopted where possible. 'Ihe use of treated wastewater in irrigation shall be given the highest priority and shall be pursued with care.

10. Effluent quality standards shall be defined based on the best attainable treatment technologies, and calibrated to support or improve ambient receiving conditions, and to meet public health standards for end users. Key factors will include the location of the discharge, its proximity to wells, the type of receiving water, and the nature and extent of end uses. Wastewater intended for irrigated agriculture will be regulated based on the soil characteristics of the irrigated land, the type of crops grown, the irrigation schedule and methods, and whether other waters are mixed with the treated wastewater.

11. Industries shall be encouraged to recycle part of its wastewater and to treat the remainder to meet standards set for ultimate wastewater reuse or to meet the regulations set for its disposal through the collection systems and/or into the receiving environment.

12. Wastewater from industries with significant pollution should be treated separately to standards allowing its reuse for purposes other than irrigation or to allow its safe disposal.

13. Consideration shall be given to isolating treated wastewater from surface and ground waters used for drinking purposes, and to the blending of treated effluent with relatively fresher water for suitable reuse.

On Wastewater Collection and Treatment

14. The existing level of services shall be sustained and promoted. Where it is necessary to meet public health and environmental objectives, treatment shall be improved. Wastewater shall be collected and treated in accordance with WHO and FAO Guidelines as the basis for effluent quality requirements for reuse in irrigation. However, final reuse options, type of crops to be irrigated, location of the reuse and the treatment plant location shall govern the level of treatment (effluent parameters), and the treatment technology to be adopted.

15. Priority shall be given to protecting public health and water resources from chemical and microbiological pollutants.

16. Where possible, gravity flow shall command the collection and conveyance lines.

17. Treatment plants shall be located away from any potential population growth. Location selection shall be coordinated and approved with the concerned governmental agencies. Due consideration shall be given to interact with landowners and adjacent communities.

18. The transfer of advanced wastewater treatment technologies shall be endorsed and encouraged. However, appropriate wastewater treatment technologies shall be selected with due consideration to operation and maintenance costs and energy savings, in addition to their efficiency in attaining and sustaining quality standards.

19. Innovative approaches to wastewater treatment, particularly for the small municipal systems have to be considered. Design criteria, performance specifications and guidelines for such systems shall be adopted and generalized.

20. Design and performance specifications of wastewater treatment plants shall be studied and standardized. Sufficient room in tendering for the construction of new plants shall be provided for competition to take place in both technologies and costs. However, deviations from standard designs shall be minimized and justified.

21. Septage from unserved areas shall be treated either in municipal or in well monitored and maintained facilities designed to receive septage.

On Reuse of Treated Effluent and Sludge

22. Treated wastewater effluent is considered a water resource and is added to the water stock for reuse. This is warranted and deemed feasible in light of the semi arid climate, the modest per capita share of freshwater resources, the high demand for municipal water, the per capita share of the deficit in the trade of food commodities, and of the marginal cost of resource development.

23. Priority shall be given to agricultural reuse of treated effluent for unrestricted irrigation. Blending of treated wastewater with fresh water shall be made to improve quality where possible. Crops to be irrigated by the treated effluent or blend thereof with freshwater resources shall be selected to suit the irrigation water, soil type and chemistry, and the economics of the reuse operations.

24. Crop nutrient requirements shall be determined taking into consideration the prevailing effluent quality. Overuse of nutrients shall be avoided.

25. Accumulation of heavy metals and salinity shall be monitored, managed and mitigated. Leaching of soils shall be advocated by the irrigation authorities.

26. Farmers shall be encouraged to determine the rate of water application needed for different crops, taking into consideration the value of nutrients in the treated water and other parameters.

27. Farmers shall be encouraged to use modern and efficient irrigation technologies. Protection of on-farm workers and of crops against pollution with wastewater shall be ensured.

28. Treated effluent quality should be monitored and users alerted to any emergency causing deterioration of the quality so that they will not use such water unless corrective measures are taken.

29. Studies should be conducted and projects designed and implemented to store the excess treated wastewater in surface reservoirs or in groundwater reservoirs through artificial recharge techniques. Due attention shall be given to the quality of treated and groundwater and the characteristics of the strata.

30. Plans and studies for power generation from sludge, if proven technically, economically and financially feasible, shall be made with due attention to environment impacts.

31. Sludge produced from the treatment process would be processed so it may be used as fertilizer and soil conditioner. Care shall be taken to conform to the regulations of public health and environment protection norms.

32. Whenever possible, other end uses of treated effluents; such as recycling, cooling, power generation, etc ... shall be considered.

On Pricing

33. In view of increasing marginal cost of wastewater collection and treatment, wastewater charges, connection fees, sewerage taxes and treatment fees shall be set to cover at least the operation and maintenance costs. It is also highly desirable that part of the capital cost of the services shall be recovered. The ultimate aim is for a full cost recovery.

34. Appropriate criteria in order to apply the "polluter pays" principle shall be established.

35. Different charges for different areas may be applied. This shall be assessed for each geographical area as a function of end uses and effluent quality and will be subject to economic and social considerations.

36. Treated effluent shall be priced and sold to end users at a price covering at least the operation and maintenance costs of delivery.

On Selected Priority Issues

37. To the extent that design capacities of wastewater treatment plants permit, priority of collection and house connections shall be accorded to expansion of urban areas served by treatment facilities. Users willing to contribute to the cost of the services in addition to fees and charges set by laws and regulations shall also be given priority.

38. Where design capacities of treatment facilities and of conveyance systems are approached or exceeded, priority shall be given to the expansion of such capacities.

39. Priority shall be accorded to situations and locations where waste-water disposal practices threaten the environmental integrity of freshwater resources, and where performance of cesspools and percolation pits pollute underground water aquifers.

On Standards, Regulations and Quality Assurance

40. Jordanian Standards JS893/95, JS202/91, JS 1145/96, WAJ's regulations for the quality of industrial wastewater to be connected to the collection system and WAJ's specifications for sewerage works, have been, thus far, the benchmarks against which plans and specifications of treatment plants and wastewater reuse were evaluated. They were established to bring about relative uniformity throughout the country. Periodically, these standards and regulations should be reviewed and modified to reflect special ambient conditions or end uses. Other aspects shall also be considered, e.g. economic socio-cultural, environmental and regional aspects.

41. Particular attention shall be focused on adopting and enforcing effluent and sludge standards for municipal and industrial wastewater treatment plants and for discharges from industries, laboratories, hospitals, slaughterhouses and other businesses.

42. Extensive and comprehensive monitoring programs shall be developed. Influent to and effluent from the plants and throughout watercourses shall be measured and monitored against all appropriate parameters to ensure that public health objectives and treatment efficiency goals are attained.

43. All crops irrigated with treated or mixed waters shall be analyzed and monitored periodically.

44. Observation wells shall be installed near the treatment plants to monitor groundwater quality where necessary, and to mitigate adverse impacts where and when needed.

45. Data collected from the monitoring process shall be entered and stored, processed and analyzed through computer software, and results published periodically.

46. Roof and storm water connections to public sewers shall be prohibited. Collection of storm water shall be done separately and will be the subject of water harvesting.

47. Effluent and sludge standards for the disposal of hazardous liquid wastes shall be defined to ensure the safe disposal of such wastes.

48. Laboratories shall be maintained and properly equipped to provide services and reliable data needed to ensure enforcement of and adherence to standards and regulations.

On Legislation and Institutional Arrangements

49. Legislation and institutional arrangements for the development and management of wastewater shall be periodically reviewed. Gaps shall be filled, and updating of the institutional arrangements with parallel legislation shall be made periodically to cope with varying circumstances.

50. The role of the Government shall be fine-tuned and its involvement reduced to be regulatory and supervisory. Involvement of the stakeholders in wastewater management and support shall be introduced and expanded.

On Financing and Investment

51. Because of the limited financial resources available to Jordan, setting investment priorities in wastewater will be compatible with government investment plans.

52. Criteria for prioritizing investments in the wastewater sector shall take into account the current and future needs of the country, needs to expand wastewater systems in urban areas and to provide wastewater systems to smaller towns and villages that are not yet served.

53. Priorities of wastewater projects shall not be disconnected from water supply projects and urbanization in general. Decisions will be made concerning them to attain optimum solutions to the need for services, availability of finance and availability of trained manpower.

On Public Awareness

54. The public shall be educated through various means about the risks associated with the exposure to untreated wastewater and the value of treated effluents for the different end uses.

55. Programs on public and farmer's awareness shall be designed and conducted to promote the reuse of treated wastewater, methods of irrigation, handling of produce. Such programs shall concentrate on methods of protection of farmers health, animal and bird health and the environment.

56. Public awareness campaigns shall also be waged to educate the public on the importance of domestic hygiene, wastewater collection, treatment and disposal.

On the Role of Private Sector

57. It is the intention of the Government, through private sector participation, to transfer management of infrastructure and services from the public to the private sector, in order to improve performance and upgrade the level of service.

58. The role of the private sector will expand with management contracts, concessions and other forms of private sector participation in wastewater management.

59. The concepts of BOO/BOT shall be entertained, and the impact of such concepts on the consumers shall be continually addressed and negative impacts mitigated.

60. The private sector role in reuse of treated effluent shall be encouraged and expanded.

On the Human Resources Development

61. Capabilities of human resources in the management of wastewater shall be enhanced through training and continuous education. Work environment shall be improved and incentives provided.

62. The existing National Water Training Center shall be enhanced. It will be accorded adequate attention and provided with space, furniture and the necessary support in order to identify needs, promote and conduct human resources development activities and training needs.

63. Human resources performance will be continually appraised in order to upgrade capabilities, sustain excellence and provide job security and incentives to qualified individuals with excellent performance.

On Research and Development

64. Applied research on relevant wastewater management topics shall be adopted and promoted. Topics such as the transfer of wastewater treatment technologies, low cost wastewater treatment technologies, reduction of energy consumption and others will receive adequate support.

65. Cooperation with specialized centers in the country and abroad shall be advanced, and raising of funds for this purpose shall be supported.

66. Transfer of appropriate technology suited for local conditions will be a primary target for the development activities and for adaptive research.

67. Emphasis will be placed on liaison with international institutions to keep abreast with modern technological advances and to facilitate technology transfer and adaptation