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Wastewater Disposal in the Caribbean: Status and Strategies

The International Drinking Water Supply and Sanitation Decade (1981-1990), proclaimed by the United Nations in November 1980, has done much to stimulate the efforts of countries throughout the world to provide running water to communities previously deprived of that resource. One of the foremost improvements in the standard of living in the Caribbean countries has been the introduction of running water into many homes or, where physical or economic obstacles remain to supplying individual homes, its provision nearby through such means as standpipes. Estimates from 1985 indicate that 52% of the population of the CARICOM countries is served by house connections, another 35% has easy access to water, and 12% remains unserved.

The increase in supply of running water has brought with it an increase in wastewater. The term "wastewater" encompasses much more than water that contains human bodily wastes. It is the by-product of a variety of uses of water, from cooking and laundering to industrial production. In general, an estimated 70% to 80% of water supplied to homes becomes wastewater; in the sugar industry, between 3 and 8 m³ of effluent is created for every ton of sugar produced.

Sanitary wastewater (sewage) can contain disease-causing microorganisms such as those responsible for typhoid fever, gastroenteritis, cholera, and leptospirosis.

In addition, increasing amounts of toxic substances are included in wastewater and municipal sewerage systems because of the widespread use of chemical agents for washing and cleaning and in industrial processes.

Little attention has been given to ways of disposing of water wasted in domestic, commercial, and industrial activities. Despite increases in water supply coverage, provision of sewerage service has lagged behind. As of 1985, only 9% of the population in the CARICOM countries lived in homes connected to a sewerage system; 40% depended on septic tanks and another 40% on privy pits; and 11% had no disposal facilities. The results of neglect in this area are the danger of disease and the deterioration of environmental conditions stemming from random disposal of untreated or only partially treated wastewater.

WASTEWATER DISPOSAL PROBLEMS

The methods of treatment and disposal of wastewater in the Caribbean countries, and particularly in the Eastern Caribbean, are few and somewhat basic. The septic tank is the most used method, with disposal of effluent into wells, soakaways, tile fields, rivers, streams, or the sea. The efficiency and safety, in terms of public health, of disposing of wastewater in this way depend on the physical characteristics and absorptive capacity of the soil in the soakaways, wells, or tile fields. The hard volcanic soils found in many parts of the Windward Islands and the almost impervious clays of St. John's, Antigua, have minimal absorptive capacity. While the sandy soil in coastal areas

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of the Bahamas, Barbados, and Saint Lucia is absorbent, the volume of wastewater effluent in these more densely populated and developed areas, together with high groundwater levels, results in absorption failures. Ponds of unabsorbed wastewater can form, posing a threat to public health and damage to the aesthetic and environmental quality of the coastal areas.

Destruction of Coastal and Near-Shore Ecosystems

In many of the Caribbean countries, untreated and partially treated sewage is contributing to the destruction of coastal and marine ecosystems, such as mangrove forests, sea-grass communities, and coral reefs. The destruction of coral reefs would have broad environmental ramifications. The reefs serve as a natural barrier that dissipates the force of waves, protecting beaches and coastal property; they add calcium carbonate sand to the beaches through natural bioerosion; and they are home to vast numbers of fish. In addition, coral reefs are a popular tourist attraction.

In recent years, studies carried out in several Caribbean countries have implicated coastal wastewater disposal from point sources (such as pipelines) and nonpoint sources (such as land run-off) and from subsurface infiltration as major contributors to the deterioration of marine water quality, with consequences for public health, the environment, and the economy. Knowledge of the results of these studies appears to have influenced governments to place higher priority on wastewater collection, treatment, and disposal.

The Impact of Tourism

The progressive increase in tourism, particularly over the past 15 years, has

led to large-scale development in some coastal areas and thus to an increase in wastewater that needs disposal. The use of septic tanks and subsurface or marine disposal has proved inadequate for the large flow of wastewater from hotels, apartment buildings, and government buildings in urban-coastal areas. Package sewage treatment plants with marine outfalls, the alternative often used at large coastal hotels, have been far from satisfactory, as the majority of them are poorly operated and maintained, often remaining broken down for long periods of time because of a lack of spare parts or trained repair personnel. The shortcomings of both septic tanks and package plants pose a threat to the tourist industry and ultimately to the foreign exchange earnings on which many Caribbean countries depend for infrastructural development. For this reason, tourism is exerting a positive influence on efforts to adequately dispose of wastewater, particularly in coastal and urban-coastal areas. The awareness exists that good environmental conditions are necessary in order to attract and keep tourists.

SEWERAGE SYSTEMS

Sewerage systems are seen as the most suitable way to effectively collect, treat, and dispose of wastewater. Such systems are not new in the Caribbean. The first sewer system was constructed in the city of Port of Spain, Trinidad, in 1861, and other major systems were installed in Trinidad in 1902, 1935–1937, and the largest in 1962–1965. Sewerage systems were constructed in Kingston, Jamaica, in the early years of this century; in Grenada, Saint Lucia, and Dominica during the 1940s; and in Barbados and St. Vincent in the 1970s and 1982, respectively.

A water authority is usually established to manage a country's water resources and the distribution system. Water au-

thorities are now appropriately being given the responsibility to manage, operate, and maintain sewerage systems. The Trinidad and Tobago Water and Sewerage Authority, perhaps the most advanced in the Eastern Caribbean, has a well-structured and staffed wastewater section with the authority and expertise to pursue the country's plans for extending sewerage systems in the densely developed areas of Port of Spain and San Fernando. The Bahamas also has a comparatively long-standing Water and Sewerage Authority, and Barbados gave the responsibility for sewerage to its Water Authority when it was created in 1980. Saint Lucia and St. Vincent established authorities within the last five years, while Grenada has organized the Central Water Commission to take over functions related to water supply, and is expected to expand its statutory responsibility to include provision of sewerage services. These governmental actions are encouraging, since they show that the sewerage sector is now being given high priority, for reasons of public health and economics. They are also signs to donor agencies that sewerage figures prominently in the countries' development plans.

External Financial Assistance

Sewerage systems are costly to construct. In view of the economic crisis affecting the Region, governments will generally not be able to generate sufficient funds on their own, and financial assistance from international donor agencies will be needed in order to plan, design, and construct sewerage systems in the Caribbean. To attract such assistance, governments will need to make some specific preparations:

- Demonstrate that construction, operation, and maintenance of a sewerage system for a specific area is a high priority.

- Establish an appropriate institution to manage, operate, and maintain the system (as noted above, this action has already been taken in some cases).

- Prepare a tariff structure that will meet the requirements of managing, operating, and maintaining the system, as well as compensate for plant depreciation. (The sewerage sector almost always has to be heavily subsidized by the water sector because sewer tariffs are not adjusted as operation costs increase and plants depreciate.)

- Have available experienced and competent technicians, and provide specific training to selected personnel on system operation and maintenance.

- Pass and enforce appropriate legislation to achieve total or maximum possible property connections, which in the past have often not been mandatory, and ensure timely collection of tariff revenues.

Due to the stringent economic conditions facing several of the Caribbean countries, the subregion as a whole or a group of the countries may wish to consider jointly seeking financial and technical assistance. While this plan would entail substantial negotiation and resolute action at the political level, there is precedent for its success. Sixteen countries of the Mediterranean area joined together under the "Barcelona Treaty" to obtain financial and technical assistance from several international donor agencies to rid the Mediterranean Sea of untreated and partially treated wastewater and industrial effluents, which were leading that body of water and the adjoining land areas to environmental and economic disaster.

Appropriate Technology

While the highest population densities in the Caribbean are found in the coastal urban areas, a considerable portion of the population resides in small towns, vil-

lages, and rural settings. Given the cost of conventional sewerage systems, their construction in such areas would be unlikely to attract or justify external financing. Thus, study should be made of more appropriate technology to collect, treat, and dispose of wastewater.

Such a technology is the small bore sewer system, in which the sewer pipelines receive only the liquid portion of household wastewater for off-site treatment and disposal. Solids are separated from the wastewater flow in interceptor tanks installed on each property, upstream from the sewer connection. The accumulated solids are removed periodically for disposal. The advantages of this system are that less water is required to transport solids since they do not flow through the pipelines; excavation costs of the pipelines are reduced since fewer gra-

dients are needed for transport of wastewater without solids; material costs are reduced because pipelines are smaller and fewer manholes are needed; and screening and sedimentation are done mostly in the interceptor tanks, so large-scale structural and mechanical facilities are not required. The disadvantages or constraints are that the solids in the interceptor tanks must be disposed of periodically; the tanks must be maintained and monitored by an efficiently managed operating agency (this task is not the responsibility of the property owner); and a wastewater treatment system must be developed. Experience with this system is scarce so far, and mixed results have been obtained, but it is one option to be explored in tackling a problem of increasing importance.