CEP Technical Report: 55

PROFILES OF WASTEWATER MANAGEMENT IN WCR COUNTRIES

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List of Acronyms

AyA	Costa Rican Institute for Water and Wastewater
BEST	Bahamas Environment, Science and Technology
BOD	Biochemical Oxygen Demand
CARICOM	Caribbean Community
CARSEA	Caribbean Sea Ecosystem Assessment
CBH	Central Board of Health
CBO	Community-Based Organisation
CEHI	Caribbean Environmental Health Institute
CEP	Caribbean Environment Programme
CONAGUA	National Commission of Coordination for Water Resources
CReW	Caribbean Regional Fund for Wastewater Management
CTO	Caribbean Tourism Organization
CZM	Coastal Zone Management
CZMU	Coastal Zone Management Unit
DEHS	Department of Environmental Health Services
EIA	Environmental Impact Assessment
ENT	Ear, Nose, Throat
EPA	Environmental Protection Agency
FUNDAPAT	Foundation Water for Everybody
GEF	Global Environmental Facility
GPA	Global Plan of Action
gpd	gallons per day
GWI	Guyana Water Incorporated
IDAAN	Institute of National Aqueducts and Sewers
IDB	Inter-American Development Bank
INFOM	National Institute for Municipal Development
IWCAM	Integrating Watershed and Coastal Area Management project
IWRM	Integrated Water Resource Management
JANEAP	Jamaica National Environmental Action Plan
LBS	Land-Based Sources
MARN	Ministry of Environment and Natural Resources
MDG	Millennium Development Goal(s)
MINSA	Ministry of Health
MLD	Million Litres per Day
NAWASA	National Water and Sewerage Authority
NBSAP	National Biodiversity Strategy and Action Plan
NCA	National Conservation Authority
NEAP	National Environmental Action Plan
NEMS	National Environmental Management Strategy
NEPA	National Environment and Planning Agency
NIMOS	National Institute for Environment and Development

NRCA	Natural Resources Conservation Authority
NWC	National Water Commission
OECS	Organization of Eastern Caribbean States
PAHO	Pan American Health Organization
ppm	parts per million
SANAA	National Autonomous Water and Sewerage Service
SIA	Social Impact Assessment
SIDS	Small Island Developing States
SS	Suspended Solids
STP	Sewage Treatment Plant
SVG	St. Vincent and the Grenadines
UNEPAR	Executive Unit of the Rural Aqueduct Program
UNICEF	United Nations
USVI	United States Virgin Islands
WASA	Water and Sewerage Authority
WC	Water closet
WCR	Wider Caribbean Region
WHO	World Health Organization
WSC	Water and Sewerage Corporation

Introduction

The United Nations Environment Programme Caribbean Environment Programme has partnered with the Inter-American Development Bank (IDB) and the Global Environmental Facility (GEF) to develop a Prototype Caribbean Regional Fund for Wastewater Management (known as CReW) which will provide sustainable financing for environmentally sound and cost-effective wastewater management projects in the Wider Caribbean Region.

The objectives of this project is to improve the capacity of States in the region to fulfil the obligations of the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (also known as the Cartagena Convention) and the Protocol on the Control of Pollution from Land-Based Sources and Activities (LBS Protocol), regional agreements governing the management and control of polluting substances in the waters of the Wider Caribbean.

This document is extracted from the report, "Regional Sectoral Overview of Wastewater Management in the Wider Caribbean Region. Situational Analysis" prepared by UNEP-CEP/RCU in 2010. It presents profiles of wastewater management in the 15 countries in the Wider Caribbean Region (WCR) that have agreed to participate in CReW. For each country, the following information is provided:

- Current issues and challenges
- Wastewater technologies in use
- Existing policy framework
- Existing legislative framework
- Existing institutional framework

Information presented is from the references cited as well as from personal communication and review of the draft Situational Analysis report by key stakeholders in the wastewater sector from each country.

Antigua and Barbuda

Current Issues and Challenges

- Among the main concerns with respect to wastewater management in Antigua and Barbuda are: lack of adequate domestic handling and holding facilities within the St. John township; lack of treatment facilities prior to discharge; and inappropriate waste disposal mechanisms for septic tank sludge (CEP, 1998b).

- Antigua and Barbuda currently lacks a central sewer system. However, several types of individual systems are used - the bucket system (night soil system); pit privy; septic tank and soak-a-way; sewerage packaging plants (CEP, 1998b).

- Wastewater in Antigua and Barbuda is mainly generated form septic tanks systems, sewage plants and to a lesser extent some small industries such as paint production, distillery and brewery. Water quality test results, on samples taken mainly from recreational beaches, indicate that the source of pollution tends to be livestock or poultry (CEP, 1998b).

- The unsanitary conditions which result from this situation are linked to the incidence of communicable/ infectious diseases, namely typhoid and infant gastroenteritis. According to a 1985 Pan American Health Organisation (PAHO) workshop report, 60 percent of the annual gastroenteritis cases were reported from the St. John's population, where poorly functioning and inappropriate sewage systems are found (CEP, 1998b).

- The ineffective and inefficient sewage disposal systems and methods used on the island are major contributors to marine pollution and pose a great risk to human health. Coupled with the growing standard of living and increased industrialization, including tourism, which has resulted in increased wastewater generation, the matter of wastewater management is of key environmental and developmental concern.

- The country has no national sanitation policy and there is a lack of policies governing wastewater discharge and no proper enforcement system for ensuring compliance with any standards (UNEP-CEP, 2009b).

Wastewater Technologies in Use

- The septic tank system is used by approximately 65 percent of the resident and commercial sector in the country. Within the city of St. John's the predominant soil structure is clay and land space for building construction (residential and commercial) is very limited. This

situation has caused the average septic tank to be undersized in relation to the number of actual load. In addition, very little attention is being paid to the permeability of the soil in the design and construction of these systems. As a result, there has been a proliferation of effluent flowing from one building to the next, creating several wastewater nuisances across the country. To alleviate some of these nuisances the wastewater is channelled to the street drains en route to the sea (NSBAP, 2002).

- The majority of the hotels and some business places employ the use of sewage packaging plants on the islands and in 1998, there are 34 such plants. A survey in 1994 by the Pan American Health Organisation (PAHO) revealed that 88 percent of these plants are not functioning properly, operating above national effluent limitations for Biochemical Oxygen Demand (BOD) of 30 mg/l and Suspended Solids (SS) of 30 mg/l. Further, the survey revealed that the operation of 12 percent of the plants could be classified as good, 35 percent as moderate, 24 percent as poor and the remaining 24 percent of the plants were not operational. The effluent at twelve of the plants is chlorinated before disposal. At few of the plants, chlorine tablets are placed in the clarifier overflow to treat the effluent. However, this is a very ineffective means of disinfection. The effluent from these plants is disposed of directly into the marine environment, salt water lagoons, and into street drains. In some instances it is recycled for irrigation (CEP, 1998).

- The Central Board of Health, a division in the Ministry of Health presently operates the Bucket System for a very small percentage of the population. Human excrement is stored in pails/buckets and collected from the residents during the period of 10:00 p.m. to 5:00 a.m. The waste is transported to the dumpsite where it is buried in shallow trenches, two feet deep. There are over two hundred residents using this system, which from time to time experience some difficulties in its regular and efficient management. Thus, illegal collection and disposal methods result in raw excrement being disposed on in the marine environment and open drainage (CEP, 1998b).

- There are plans to construct a central sewer system in the capital to treat the amount of liquid waste entering the receiving waters of the city (UNEP-CEP, 2009b).

- The Government was successful in securing GEF funds for two demonstration projects which are currently underway in the country: (i) “Mitigation of Groundwater and Coastal Impacts from Sewage Discharges from St. John” which involves the construction of appropriate central sewage system for St. John; and (ii) “Promoting best practices in waste water disposal water conservation and re-use in the North West tourism zone Antigua”, another project aimed at promoting voluntary adoption of best environmental

management practices, particularly within the tourism sector. Both these demonstration projects are consistent with the priorities identified within Principle X of the NEMs.

Existing Policy Framework

- There is no single policy regulating the environment in Antigua and Barbuda, but several programmes are utilised to facilitate monitoring, management and protection. Both the National Biodiversity Strategy and Action Plan and the National Environmental Management Strategy (NEMS), developed as commitment to the OECS St. Georges Declaration, have identified sewage waste as a priority pollutant and the inappropriate disposal of liquid waste as a key environmental concern.

- There is no national policy which specifically addresses the issue of wastewater management. However, St. John's was nominated by the Government of Antigua and Barbuda and adopted as a Hotspot within the Caribbean using the UNEP/ GEF Global International Waters Assessment based Hotspot Selection Mechanism. This selection mechanism identifies St. John's harbour as a primary pollution area, with particular concerns related to microbiological pollution and eutrophication resulting from inadequate sewage treatment.

- One of the expected outputs of the GEF IWCAM Sewage Mitigation Project for the parish of St. John's is the development of a "National Sewage and Wastewater Management Strategy."

- The enabling environment for innovation is weak. There are no/ inadequate system of incentives to promote investment of cleaner/ appropriate technologies and best environmental practices.

Existing Legislative Framework

- Inadequate legislative control and lack of capacity for enforcement are among the main barriers for better control and management of sewage handling, treatment and discharges in Antigua and Barbuda. Other contributing factors include limited incentives/disincentives for construction and use of effective septic tanks; and inadequate monitoring of water quality to guide policy-makers and legislators.

- The Public Health Act is the principal statute governing the disposal and treatment of liquid waste.

- A draft Environmental Health Act and a draft Environmental Protection Management Bill have been prepared. However, conflicts exist between these two instruments particularly as it regards pollution control (GEF-IWCAM, 2009).

- The Central Board of Health (CBH) has been monitoring the near shore water quality status since 1989 in conjunction with the Caribbean Environmental Heath Institute (CEHI, 1998b). The faecal coliform/ faecal streptococcus ratio is used as indicators of the level of pollution.

Existing Institutional Framework

- The Central Board of Health (CBH) of Antigua and Barbuda is responsible for regulating all matters concerning public health in Antigua and Barbuda, and is established as a body corporate under The Public Health Act (1955). The institutional powers for marine areas management are established in the outdated Public Health Act which limits the scope of responsibility to the abatement of nuisances (GEF-IWCAM, 2000).

- A Draft Environmental Health Act established a governance structure for pollution control in the CBH. The Draft Act has been proposed for some time and is itself in need of revision to focus on integrated wastewater management and the obligations of the LBS Protocol.

- Although the Environmental Division is not yet established in law, it shares some enforcement capacity with the CBH.

- The CBH reviews all plans for new developments in the island in conjunction with the Development Control Authority.

- The institutional capacity for monitoring of effluent standards appears to be a weakness. The installation of a new central sewage treatment system will create additional demands on existing organisations with responsibility for wastewater treatment, public health and pollution control. Enhanced institutional capacity is needed in the following areas: management, operation and maintenance of a central sewage system; establishment/ amendment of sewage regulations which set effluent standards; water quality monitoring; enforcement of sewage effluent standards; public education; compliance management.

Bahamas

Current Issues and Challenges

- In the Bahamas, 15.6 percent of the population has access to sewage collection services and 44 percent of sewage treatment plants are in poor condition (UNEP/CEP 1998). New Providence is 15% sewered; remainder use septic tanks (UNEP-CEP, 2009a).

- As in many other countries, wastewater is given low focus compared with water. The focus is on providing the population with water then deal with sewage.

- The system for septage handling needs to be strengthened. The country's septage and sludge facility has become a generic liquid waste facility, thereby becoming overwhelmed. Rates for septage disposal are low - $11 per truck – and therefore there is no profit in managing septage leading to low focus on providing the service. Also knowledge of proper septage handling is limited (UNEP-CEP, 2009a).

- Sewer rates are artificially low and based on fixtures, not flows and are therefore not equitable or appropriate.

- Health authorities have advised Bahamian citizens to avoid the consumption of the marine gastropod Queen conch (*Strombus gigas*), at certain times of the year due to the presence of a Vibrio pathogen in these organisms. Consumption of conch infected with this pathogen has resulted in serious illness and one recorded human mortality (CEP, 2010).

Wastewater Technologies in Use

- The sewerage infrastructure in certain areas of the islands of The Commonwealth of the Bahamas is in poor condition. The government, through the Water and Sewerage Corporation (WSC) has committed to replace old sewerage infrastructure, particularly concrete sewer laid as far back as the 1920s, and to refurbish and expand all wastewater treatment plants which have exceeded their capacity.

- Throughout the country, the principal types of wastewater collection and disposal systems are septic tanks and pit latrines systems (90 percent). The remaining 10 percent are on a centralised sewerage collection systems, which including the islands of Grand Bahama and Abaco.

- In New Providence approximately 65 percent of the total population resides on the island and only 15 percent of the households are on a centralised collection system and the remainder on septic tank and pit latrines.

- Generally, sewerage installations are conventional gravity sewer conduits in bedded trenches which run through the centre of roadways with manholes at intervals not exceeding four hundred feet (400 ft.). The sewer lines are constructed of concrete, vitrified clay and PVC pipes ranging in size from 4" to 21" in diameter. All pumping or lift stations are standardised with Flygt submersible pumps and equipment.

- There are six (6) main independent drainage areas in which treatment processes range from primary to secondary treatment. The six areas and the type of treatment are listed below:
    - Malcom Park - Primary treatment
    - Yellow Elder Gardens - Secondary
    - Eastern District – Fox Hill - Secondary
    - Pinewood Gardens - Secondary but not operational
    - Flamingo Gardens - Secondary but not operational
    - Nassau International Airport - Secondary but privately owned

- All centralised wastewater collected is predominantly domestic in nature with an average influent concentration of 200 mg/l BOD and suspended solids. The efficiency of the treatment process is to conform to the national standard of 35 mg/l BOD and 30 mg/l suspended solids for disposal. Also, the final effluent is to be chlorinated to a minimum of 0.5 ppm. Final effluent disposal embraces deep well injection into wells cased to salt water (which range in depth from 250 ft. to 740ft.), or controlled recharge/recycling via drain field, lagoon or sand filter techniques.

- While there is no practice of wastewater disposal into surface water bodies, provision for the employment of tertiary treatment against any water contamination can be permitted on a case and facility design/performance certification basis.

- All sludge from a treatment process is dried via sludge drying beds and later land filled. There is a centralised septage receiving site with both anaerobic and facultative lagoons from which the final effluent is discharged into a 250 feet deep disposal well. This lagoon system is fairly new to the Bahamas having been commissioned in June 1996.

Existing Policy Framework

- The specific requirements governing the need for sewerage collection and treatment facilities are outlined in the Bahamas Building Code and emanating policy for subdivisions.

The Building Code requires a treatment plant installation at developments with a wastewater flow greater than 6,000 US gallons per day, which prompted the twenty-four (24) lot subdivision policy requiring developers to install a sewerage collection and treatment plant system.

- To efficiently accomplish the task of sewage development, the government's policy for infrastructure development is enunciated in its Manifesto, which advocates environmental conservation and preservation through adequate waste management, including expanded sewerage collection and treatment facilities

- Nationally, it is envisioned that sub-division development will help to accelerate the elimination of septic tank systems. This is being achieved by the current practice of installing septic tanks at property roadside frontages, to readily accommodate connection to a future centralise sewerage system once this becomes available.

- The Government has acquired assistance from the Inter-American Development Bank (IDB) under the Water and Sanitation Initiative, to assist the Bahamas in the preparation of a Water and Sanitation Sector Plan. This will include a tariff study to update the WSC's financial modelling, and assistance to prepare a Corporate Business Plan.

Existing Legislative Framework

- The Ministry of Health and the Environment is entrusted with the administration of the Environmental Health Act and the Health Services Act which regulates and monitors among other things, the discharge of wastewater to ensure that water resources and public health and well-being are preserved.

- The Environmental Monitoring and Risk Assessment, formerly the Public Analyst, Laboratory attached to the Department of Environmental Health Services (DEHS) has the responsibility for monitoring water quality in conjunction with the Water and Sewerage Corporation.

- Several new legislative instruments have been drafted to bolster the framework for management of wastewater. In 2000, a new Environmental Planning and Protection Act and various guidelines were promulgated to enhance the conservation and protection of the environment of The Bahamas.

- The Pollution Control and Waste Management Regulations of 2000 were promulgated under the Environmental Planning and Protection Act of 2000. Part 3 establishes the

ambient water quality criteria for The Bahamas. Permitting requirements for water quality discharges are specified in Part 4.

- Water quality laws and regulations are enforced by the DEHS and the WSC. The Draft Environmental Protection (Effluent Limitations) Regulations, 1995 address primarily effluent discharges from sewage and industrial sources. Effluent discharges include sewage or industrial effluent and exclude storm-water. The limits also apply to discharges to inland waters, including any part of the sea that is within the most seaward (5.5 m or 18 ft) depth contour line offshore from the island.

- Discharges into coastal waters up to the 5.5 m depth contour are subject to specific effluent discharge limits established by DEHS. The Effluent Limitations Regulations strictly forbid the discharge of any flammable liquids, tar or other related liquids into inland areas or into the marine environment.

- A hepatitis scare a few years ago resulted in regulations being promulgated governing the water supply for preschools.

Existing Institutional Framework

- The Bahamas has a sufficiently mature institutional framework.

- The Water and Sewerage Corporation is a quasi government organisation established under the Water and Sewerage Corporation Act (1976) with responsibility for the provision of water and sewerage services in the Bahamas. The WSC's mandate includes the development and implementation of a National Water and Wastewater Plan that reinforces Integrated Water Resource Management (IWRM) to enable good quality and expanded services, operation and maintenance of all facilities for the collection, treatment and disposal of wastewater, including opportunities for wastewater reuse, and to achieve the transfer of appropriate technology. There is presently a move to separate the regulatory function from the service provision/utility function (UNEP-CEP, 2009a).

- The WSC is responsible for the development and implementation of industry standards, policies, procedures, manpower training, and corporate business initiatives involving the wastewater sector. The present scope of its activities encompasses water and sewerage service in New Providence and water services in several of the more populated Family Islands. All engineering designs of the systems, including lift stations, and material selection, are to be approved by the Water and Sewerage Corporation. All designs in part are based on an average daily flow of 50/gal/person/day.

- When private developer's complete the installation of the infrastructure, the WSC ensures that sewers are lamp tested to ensure alignment and infiltration to confirm the existence of proper gradient and pipe jointing of all individual property connection risers. It should also be noted that where there is an existing collection system, properties under new construction within 600 feet of the system are legally bound to connect to the system. These practices and requirements are expected to ensure that as the rate of developments progress there would be a significant reduction of septic tanks which would also retard the rate of groundwater pollution. The subdivision and design policies are to foster and facilitate the provision of water and sewerage facilities to new subdivisions and private developments, which will be standardised and compatible with the public collection, treatment and disposal system both present and in future.

- The Department of Environmental Health Services (DEHS) is the foremost regulatory agency governing the provision and performance of treatment facilities within the country. The Department has responsibility and authority to spontaneously monitor all facilities, and to act as an enforcement agent for the Water and Sewerage Corporation. The DEHS has a lengthy experience with the regulation, monitoring and control of pollution and has performed functions within the entire ambit of marine pollution control. It issues discharge permits.

- The Bahamas Environment, Science and Technology (BEST) Commission has responsibility for formulating policy and providing technical advice towards the protection, conservation and responsible management of the environmental resources of The Bahamas. BEST has no regulatory powers, but is responsible for the administration of the Environmental Impact Assessment (EIA) process.

Barbados

Current Issues and Challenges

- Like most other countries, pit latrines were utilised in Barbados for centuries as the appropriate means for the final disposal of human faeces, gray (kitchen and bath) water and storm water. A national zoning policy for the protection of the island's ground water reserves and the control of domestic and industrial wastewater was instituted in 1963 and is still being used today. Based on this policy, sewage disposal in Barbados varies depending on locality, type of structure and in which water protection zone the premises are situated. The Marine Pollution Control Act was proclaimed in 2000 and this new legal instrument requires all discharges to comply with new discharge limits as outline on the draft Marine Pollution Control (Discharge) Regulation.

- Challenges within the wastewater management sector include inadequate treatment of domestic wastewater; inadequate financing for maintenance of wastewater treatment systems, in concert with high costs of installation of wastewater systems due to the spatial distribution of development; and limited human capacity (numbers and technical skills) for monitoring and maintenance (UNEP-CEP, 2009b).

- The result of inadequate treatment of domestic, commercial and industrial wastewater is having adverse negative impacts on the quality of marine water. This includes increase turbidity, turf algae on coral species, reduction in diversity of coral reef systems and rare breaches in recreational marine water standards (CEP, 1998).

Wastewater Technologies in Use

- Government-operated sewage treatment plants cater to the central Bridgetown and south coast areas. Some hotels have privately-operated sewage treatment plants on the west coast. Generally, preliminary treatment methods which separate solids from liquid are employed for wastewater originating from residential and commercial properties. Final disposal methods vary from dry pit latrines to water borne facilities which utilise a combination or separate treatment systems of septic tank, filter bed and subsequent disposal to the subsurface via to suck well. All wastewater is disposed to the subsurface with the exception of the municipal wastewater treatment systems which discharge effluent to submarine outfalls (UNEP/IETC, 1997).

- Present capacity to treat or recycle waste water (public sewerage scheme) is limited. There were 27 package plants at various hotels and other commercial establishments during the

2005 survey. Some are treating the wastewater and reusing it for irrigation. Effluent discharges were categorised as average to good which indicates an improvement in the treatment of effluent over previous surveys. Seventy percent (70%) of the plants surveyed met the discharge standards proposed under the Marine Pollution Control Act, 1998 (UNEP/IETC, 1997).

- Variance between the discharge standards and effluent quality is expected as most existing plants were designed prior to the adoption of the discharge standard. However, some difficulties still exist in the overall management of treatment plants. These mainly include: a high probability that some operators are not fully trained to operate existing sewage treatment systems; operators are not totally aware of the proposed discharge requirements; wastewater treatment is not viewed as a priority by most hoteliers and hence, maintenance of most plants are secondary; and the employee turn-over rate is suspected to be high. Persons originally trained to operate the plant after it was installed are no longer employed by the establishment.

- In 1997/ 1998, Barbados commenced construction of a 44 km sewer system capturing wastewater flows (11,300 m^3/day) within the 6 m contour on the south coast for treatment at the recently completed Graeme Hall primary treatment plant. The South Coast Sewerage system was commissioned in 2002. The Bridgetown Sewerage System has been in operation since 1982 and serves Bridgetown the capital. However, connections to the sewers were not mandatory so some communities in Bridgetown are not connected to the system. This system discharges approximately two million gallons per day of treated wastewater to the marine environment through a ocean outfall.

- Significant on-going investment in sewage disposal facilities with the objective of stemming contamination of coastal water, preventing contamination of groundwater and generally improving the sanitary conditions on the island is taking place. With this system, sewage is piped from a 12km strip of the southern coastline extending about 500 metres inland, undergoing primary treatment before being discharged 1.1 km out to sea. The West Coast Sewerage has not been constructed and is still at the planning stage.

- The Government of Barbados recently secured an agreement with the Inter-American Development Bank to fund the Water and Wastewater System Upgrade Project. The objective of this project is to upgrade the water and wastewater system in Barbados. The project will include the reorganization and modernization of the Barbados Water Authority (BWA); rehabilitation of potable water supply; and development of a wastewater treatment action plan. The total cost of the project is estimated at US$ 30 million.

- Wastewater recycling is a practice which is becoming increasingly popular amongst developers. The water is mainly used for irrigation purposes in drip irrigation systems on golf courses and flower garden. No standards have been adopted for wastewater reuse but standards were developed and proposed in 2006 in a draft Wastewater Reuse Act and Regulation.

Existing Policy Framework

- Barbados has developed its National Strategic Plan 2005-2025 that includes national development objectives to maintain access to quality education, health care and sanitation (UNDP, 2007). Wastewater management is captured under goal 4 of the Plan which speaks to the preservation of the environment.

- The Barbados Sustainable Development Policy, developed in 2002, also speaks to the improvement of wastewater treatment and improvement of the environmental quality and the quality of life for all Barbadians. The policy is implemented through the Barbados Sustainable Development Action Plan.

- Sustainable development principles have also been integrated into the Physical Development Plan, which ensures that land usage would be managed in such a way that land and natural resources are protected and conserved.

- The Government is developing a draft Green Economy Policy Framework to support its sustainable development policies, which includes strategies to improve the quality of life (protect water resources; solid waste management; reduce pollution); conservation of natural resources and economic efficiency, equity, and participation (UNDP, 2007; GOB, 2010[1]).

- The National Zoning Policy (1963) is administered and enforced by the Town and Country Development Planning Office, Environmental Protection Department and the Barbados Water Authority. The policy establishes a zone rule for private sewage and industrial discharges to soakaways. The zone rule regulates the disposition of wastes depending on the water zone in which the site is located. Water zone 1 is the most sensitive and protected and zone 5 the least sensitive (CEP, 1998b).

- The principal features of the Development Control Zones provide development restrictions for domestic and industrial wastewater control. As this was aimed at protecting the island's groundwater supply, there was little consideration given to protection of the marine

[1] Green Economy Policy Framework In Train 18-FEB-2010 http://www.gov.bb/portal/page/portal/GISMEDIA%20CENTRENEWS%20MANAGEMENT/News%20Composer%20Page/Green%20Economy%20Policy%20Framework%20In%20Train

environment. The entire coastal strip is designated as control zone 5 and there are no set limits for the maximum depth for soak-aways. Additionally, there are no requirements for an approved septic tank design. Most tourism related developments and activities occur in this zone. However, this Policy is under review and most discharges must comply with the Marine Pollution Control discharge standards.

- Consideration has been given to requirements for operators to perform mandatory analyses for key performance indicators and report to the Environmental Protection Department on plant's performance, as well as requirements for operator to obtain certification from a recognized academic institution accredited by the Ministry of Environment, Water Resources and Drainage.

- A policy review of the existing groundwater protection policy is scheduled to be completed at the end of 2009. The old policy which is still in place regulates the discharge of pollutants from development. The Marine Pollution Control Act, 1998 stipulates discharge standards for new development above 3500 gal/day and there is a planned west Coast sewerage Project. Government is looking to raise funds to finance the west coast sewerage project.

Existing Legislative Framework

- The Marine Pollution Control Act, 1998 has been enacted to control the release of pollutants to the environment and provides the government with the mandate to investigate sources of pollution and to require monitoring by the discharger, and with the framework for establishing regulations prescribing environmental standards such as effluent criteria.

- The Act makes it an offence to release any pollutant in violation of the applicable standards and requirements. Discharged pollutants will be required to be registered, and measures implemented to reduce the pollutant level whenever a violation of the standards exists.

- New wastewater standards are proposed under the Marine Pollution Control Act. The standards are designed in two sections: (a) ambient standards and (b) discharge standards. The current policy is that where a parameter is not in the discharge standards list then the ambient standards will be the maximum discharge level unless the applicant can show that there are no adverse effects from the discharge. Discharge standards depend on whether they occur within the coastal management area's outer limit (defined as Class 1 waters which will include all land based discharges), or outside that boundary (Class 2 waters). The sewage discharge from new facilities is expected to meet the Domestic End of Pipe Standards, which correlate with the prescribed effluent limitations in Annex III of the LBS Protocol.

- The Health Services Act makes the Minister "responsible for the promotion and preservation of the health of the inhabitants of Barbados." His functions include: the

preservation, treatment, limitation and suppression of disease, including the conduct of investigations and enquiries thereof; and the abatement of nuisances and the removal or correction of any condition that may be injurious to the public health (Amec, 2006).

Existing Institutional Framework

- The Barbados Water Authority Act, one of the legislative instruments which governs wastewater treatment, treatment facilities and effluent disposal, was drafted with the understanding that the enforcement agency would have been the Barbados Water Authority (BWA). However, the Environmental Protection Department (EPD) has adopted the regulatory role for private and public wastewater treatment systems. The Division operates on the basis of limited legislative authority embodied in the Health Service Act, 1969 and the Marine Pollution Control Act, 1998. There are two main legislative tools, the Health Services (Disposal of Offensive Matter) Regulation, 1969 and the Health Services (Nuisance) Regulation, 1969, which are generally used by the EPD to regulate private and public wastewater treatment facilities (Amec,2006).

- The Environmental Protection Department, Barbados Water Authority and the Environmental Health Department coordinate activities for the monitoring of the potable water supply system.

Belize

Current Issues and Challenges

- Belize has a total population of approximately 240,000 people of various ethnic backgrounds of which a great proportion live in coastal areas. The Belize economy is highly dependent on industries based on environmental resources: tourism, agriculture, and fisheries.

- Since 1998, cruise tourism has experienced an unprecedented and probably unsustainable growth from 14,183 visitors in 1998, 575,196 in 2003, to approximately 800,000 in 2007. Cruise ship tourism requires destinations not further than two (2) hours away from Belize City. Marine Reserves such as Hol Chan, Caye Caulker, Goff's Caye and Swallow Caye Wildlife Sanctuary and terrestrial protected areas along the Western Highway, by extension the Belize River, are the most visited. The necessary infrastructure to host this type of visitation to Belize is currently not in place to accommodate liquid and solid waste being produced. Belize City can therefore be considered as the most critical area with high risks of marine pollution. Land-based tourism is also contributing to the generation of wastewater as more resorts are being built in coastal and off-shore sites.

- The Mexican city of Chetumal and Belize's Corozal Town are a combined non-point source of sewage pollution to the Corozal Bay and Bahia de Chetumal. In 2000, Chetumal's population was 121,602. By 2007 it is estimated that this population has increased significantly, especially its surrounding suburbs, yet they do not have an adequate sewage treatment facility (www.nationsencylopedia.com). In addition, the City of Chetumal sewage treatment plant discharges primary treated sewage into the Bahia de Chetumal. The Corozal Bay is the eastern boundary for Corozal town, a municipality of 8,800 residents with no sewage treatment plant. All sewage from the estimated 1100 households is treated in pit - latrines, septic tanks and soak-aways. The underlying limestone geology allows the sewage to leach into the Corozal Bay.

- Domestic wastewater contaminates surface water by direct discharge into rivers through canals or by emptying buckets into streams, effluents from septic tanks and non-functional sewage treatment plants. Sewage outfall or leachates can lead to high current driven Escherichia coli concentrations contaminating the waters and beaches. Poor water quality can lead to high viral content and infectious diseases, causing problems such as gastroenteritis, cholera and other waterborne illnesses. A review of Environmental Impact Assessments (EIAs) for Blackadore Caye, Stake Bank and Ara Macao indicated the presence of E. coli. The EIA results indicated that all samples were above the levels for drinking water

and the area of southern Belize around Placencia was the only site that has above the standard for recreational purposes. A report from the Public Health Department indicate that they have had to declare Belize Beach as a no swimming area as there has been cases of skin problems by people swimming in these waters.

- Currently, there is no monitoring program for sewage in the marine ecosystem. However, there is investigative evidence that indicate that sewage in the form of Escherichia coli has been detected within the Bahia de Chetumal, Corozal Bay, near Blackadore Caye in the lagoon system, north of Belize City, and on the beaches of Dangriga Town and Placencia. Such water borne and beach evidence was found in these areas but its eastward extent is not known. These levels of E. coli can lead to temporary eutrophication of the water, reducing the transparency of the water. This reduction in transparency can lead to reduction of available sunlight for coral reef and reducing reef growth.

- In addition to the health risk and ecological damage that can result from sewage, pollution is a substantial threat to Belize's tourism industry. The health of Belize's marine ecosystem's flora and fauna and tourism development are integral to the tourist industry on San Pedro Ambergris Caye, Caye Caulker, Belize City, Dangriga, Placencia and Punta Gorda Town.

Wastewater Technologies in Use

- The Belize Water Services Limited contends that its treatment facility is operated significantly below capacity and outfalls are within acceptable standards. Potential source of sewage pollution is from the remaining 50 percent of dwellings that are not connected to the treatment facility.

- The Sewage Ponds located on the southern shores of Belize City, are a potential point source for sewage pollution to the Belizean marine ecosystem. This sewage treatment facility was constructed in 1981 to treat 2.2 million gallons of sewage daily for a projected 50,000 residents. Since its construction, its capacity has not been increased. Despite this, the city's urban area has expanded to the extent that less than 50 percent of the population of over 80,000 residents are now connected to this treatment system.

- Sewage treatment ponds are designed to filter out floating and suspended sediment in the primary treatment. The secondary treatment facilitates the biological degradation of faeces and urine and other similar material to minimize the discharge of putrefying matter to the receiving water; and disinfection destroys infectious organisms. None of these processes treats toxic material contained in household wastes. The Belize Water Services, despite results from sampling conducted that shows otherwise, contends that outfall from the city's

Sewage Treatment Facility is within accepted standard. This issue has been exacerbated by the planned construction of the Carnival Cruise Terminal and Free Zone in the area between the lagoons and the sea, where once there was a healthy stand of mangrove that polished the effluent from these sewage treatment ponds.

- Today, this outfall empties directly into the sea. The sewage system in Belmopan is comprised of sewer draining into two pumping stations, then pumped into a treatment plant (Country Environmental Profile 2006). Unfortunately, this system is not functional resulting in direct release of raw sewage into Mount Pleasant Creek leading into the Belize River, which serves various social and ecological functions, including the water source for Belize City.

- In Belize City, approximately 6,665 households (60 percent of Belize City households) were connected to the sewer system at its beginning, compared to 307 households in San Pedro Town, and 879 households in Belmopan (CSO, 2005). Wastewater being generated from these three systems is 3,039.355, 248.674 and 227.951 million litres/year respectively. As can be noted San Pedro has approximately 35 percent of the households compared to Belmopan and generates approximately the same amount of wastewater, this being attributed to the tourism activities.

- The island township of San Pedro has a population of 8,400 residents and is Belize's premier tourist attraction. The island has a coral foundation covered with coarse sand. Within the coarse sand cover is a thin freshwater (now brackish) lens. Prior the completion of the sewage treatment facility in the mid 1990's all sewage disposals were via septic tanks and soak-aways. The island is currently serviced by a sewage treatment facility that has a daily capacity to treat 600,000 gallons of sewage. Currently, it has 307 dwellings, representing 50% of all dwellings on the island, connected to its treatment facility.

- In southern Belize, land-based non-point source of sewage pollution of the Belizean marine ecosystem exists on the shores of the municipality of Dangriga Town. This municipality of 10,800 residents has no sewage treatment facility. The number of households is estimated at 300 with 40 percent with septic tank sewage treatment. The remaining 60 percent of households use pit latrines and/or dispose of sewage directly into the waterways or sea. In addition to the 60 percent of the households that use pit latrine the shrimp, citrus, banana and other industries attract many from Belize's labour force who remain for extended periods working in the area. What increases the risk of sewage pollution to the marine environment in this area is the soil type. The general area is of course sand, highly porous, which can lead to leaching.

- The Belize City Water System currently includes a 3.0 million U.S. gallons per day facultative lagoon water treatment plant on the Belize River. The sewerage system in Belize City serves about 40 percent of the population of Belize City. Treated effluent is discharged into Sibun Bight through a canal that runs through the mangrove wetland in which the lagoons are located.

- San Pedro Ambergris Caye sewage treatment system consists of three facultative lagoons. It has a capacity of 600,000 gpd. After treatment, the unchlorinated effluent is discharged into the surrounding mangroves for polishing before entering the surrounding water. There are plans to expand the service area and treatment capacity, in the near future, in areas that are not serviced by the sewer system.

- The technology currently being advocated for sewage management for small islands is toilets fitted with composting or biogas tanks. There is considerable experience with biogas tanks which are being tested and promoted by the Biogas Unit of the Ministry of Agriculture. Local testing has shown that the biogas plant works better in preventing contamination than a septic tank. Construction costs were also lower for the biogas plant than the traditional septic tanks.

- Biogas plants have also been used successfully in Belize to treat pig and cattle manure. Currently, there are a total of 31 biogas plants in Belize. However, these plants have all been constructed on the mainland where the water table is high. The success on the islands has not been tested. However, there are plans to test the effectiveness in preventing pollution on the islands. Permission has been granted, through the EIA process, to establish the biogas system to be used at a resort in Nicholas Caye, a small island in southern Belize.

- The Alternating Intermittent Recirculating Reactor system is an innovative alternative for the conventional drain field. It is designed to treat effluent in areas where percolation is limited or non-existent so the land can still be used for homes or business. This system employs the use of different types of bacteria to remove pathogens and to clean effluent water, which is then reused in above ground irrigation discharge into waterways or to drain underground. This system is presently being used in Hunting Caye, the largest of the six cayes of the Sapodilla Cayes located in the south and has approximate area of six hectares. This system is also recommended for other islands especially those with high tourism potential.

- Apart from the traditional two or three chamber concrete septic tanks, the use of fiberglass septic tanks is becoming more widely used in the country. The fiberglass septic tanks are

much stronger and more rigid than non-laminated plastics. It is believed to be 100% water tight, corrosion resistant, lightweight and excellent for high ground water application. These tanks are currently being encouraged for karst topography areas such as the northern areas and low lying area of Belize where the water table is high.

- Only one resort, located on the southern coastal area of Belize is using the Wetland Wastewater Treatment facility. This system is considered to be an ecological wastewater treatment system. It is believed to be a 100% ecological anaerobic - aerobic system. Some of the benefits using this system include: low cost, low energy or no energy process requiring minimal operation attention; reliable and cost effective treatment; high level of effective treatment and contaminant removal; lack of odours, mosquitoes and other insect vectors; minimal cost of operation and maintenance system; ornamental function by the addition of flowers and plants, green areas and integration in the landscape.

- Currently, the above mentioned wastewater treatment systems are presently being utilized in Belize for a variety of domestic, commercial and industrial effluent treatment. With the enactment of the Environmental Protection Act and its subsequent regulations - the Effluent Limitation Regulations and the EIA Regulations all new and existing industries must employ environmentally sound systems to treat their waste water in order to protect the public's health and to ensure a safer, cleaner and healthier environment.

- The department implementing the Rural Water Supply and Sanitation Programme initially set up within the Ministry of Health, was transferred to the Ministry of Natural Resources in 1987. The mandate of the programme is to provide potable water and sanitation services to all rural communities in Belize. In some communities, potable water is provided through strategically located hand pumps, while in others, rudimentary water systems are used to deliver water to the households. The aim is to achieve coverage to World Health standards by the year 2000. WASA provides significant technical support to the Rural Water Supply and Sanitation Programme. The strategy consists of providing piped water to communities with populations of more than 250 people. As a result, new rudimentary water systems are continually being established under WASA's supervision. Over the last year and a half, there have been significant reductions in donor support for water and sanitation programmes, including the Rural Water Supply and Sanitation Programme.

Existing Policy Framework

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- The Government recently instituted a policy that requires coastal and island developments to use package treatment plants for sewage treatment (UNEP-CEP, 2009a).

Existing Legislative Framework

- The Environmental Protection Act (1992, revised 2000) covers control and regulate the use of natural resources and is administered by the Department of the Environment. Requires certain development projects conduct Environmental Impact Assessments prior to project implementation, regulates the prevention and control of environmental pollution, establishes prohibitions on dumping, and outlines the investigation, procedures and General Penalties for offences. It also established the Department of the Environment to carry out the act and conduct a broad range of activities related. Subsidiary legislation passed under this Act are:
    - Environmental Impact Assessment Regulations, 1995
    - Effluent Limitation Regulations, 1996,
    - Pollution Regulations, 1996
    - Environmental Impact Assessment (Amendment) Regulations, 2007

- Chapter 329 of the Coastal Zone Management Act (1998, revised 2000) establishes the Coastal Zone Management Authority, an autonomous institution with the power to acquire, hold and dispose of property and do all things necessary for the fulfilment of its objectives. The Authority may exercise any of the functions entrusted to it by or in accordance with the provisions of this Act or any regulations made there under and may exercise any other duties incidental or ancillary to, or consequential upon, the performance of its functions. The functions of the Authority shall be to advise the Minister of Agriculture and Fisheries in relation to the development and utilization of the resources of the coastal zone in an orderly and sustainable fashion.

- The Water Industry Act (revised 2000, 2003) covers national water services and is the responsibility of the Public Utilities Commission and Belize Water Services Limited. The Act addresses the regulation and provision of water and sewerage services, water abstraction and use, licenses, water pollution control, permits for discharge, and offenses and penalties.

- The Land Utilization Act (revised 2000 and 2003) is the primary legislative instrument for land registration, subdivision, and utilization. The Act establishes the Land Utilisation Authority, which controls the sub-division of any public or private land in Belize. It establishes the Lands Utilization Authority which makes recommendations on subdivision applications. It also establishes Special Development Areas which limit the types of development permissible within these zones. The Act is administered by Ministry of Natural Resources, through the Lands Utilization Authority.

- Belize has relatively good Effluent Regulations categorized by type of industry. The effluent licence system requires monthly reporting on effluent quality. Effluent Limitation Regulations were recently amended based on the LBS Protocol to address domestic sewage (UNEP-CEP, 2009a).

Existing Institutional Framework

- Responsibility for natural resources and freshwater and coastal resources in Belize is primarily concentrated at a national level. The Department of the Environment, under the Ministry of Natural Resources and the Environment, is responsible for inter-ministerial cooperation and coordination on the use and management of Belize's natural resources and control of pollution of the natural environment. The Forest Department, under the Ministry of Natural Resources, administers the Forest Act, National Parks Systems Act and Wildlife Protection Act. The Lands & Survey Department is responsible for land use planning and allocation through implementation of the National Lands Act and Lands Utilization Act.

- Other government institutions that have some responsibility for natural resources primarily in the area of monitoring and permit granting for land and resource use are the Lands & Survey Department and the Department of Geology and Petroleum (under the Ministry of Natural Resources), the Fisheries Department and Pesticide Control Board (under the Ministry of Agriculture and Fisheries). The Ministry of Health's Environmental Health Program conducts some water quality monitoring related to public health, and the National Service of Meteorology (under the Ministry of Natural Resources and the Environment) is responsible for monitoring water level, and quantity of surface water, brackish water and freshwater in Belize.

- Other government ministries and departments with responsibility for management and provision of water and sanitation services at the sectoral level are: Ministry of Tourism and Environment, and the Ministry of Energy, Science, Technology, and Transport. In addition, the Ministry of Agriculture and Fisheries, the Ministry of Works, and the Ministry of Housing are indirectly involved.

- Before January 1995, the Ministry of Natural Resources was responsible for the activities of one quasi-governmental institution and two departments directly involved in the management and supply of water. These are the Water and Sewerage Authority (WASA) and the Rural Water Supply and Sanitation Programme (RWSSP).

- The Water and Sewerage Authority (WASA), a quasi-governmental institution, was established by the Water and Sewerage Ordinance, Chap. 185 of 1971. Under the Water and Sewerage Act, water supply and sewerage services are regulated by WASA. WASA performs water supply functions within water supply areas so declared by order of the Minister of Natural Resources. Such declaration entails the vesting in WASA of all land and property rights related to the facilities, liabilities, and obligations relating to water supply and sewage disposal, and the exclusivity to supply such service. No person or entity other than WASA may carry out water supply functions within water supply areas without WASA's authorization. To date, only one company has been authorized by WASA to act as a water “purveyor” to carry out desalination of water for San Pedro on Ambergris Caye.

- WASA is responsible in any sewage disposal area for maintaining and developing the existing sewerage system and related property, for constructing and developing such other sewerage works as it considers necessary or expedient, for administering the sewerage system so established, and for providing sewerage services. It is assumed that the sewerage system and sewerage works is also taken to include any works for the treatment and disposal of sewage.

- The Ministry of Tourism and Environment is responsible for the activities of four departments, but only one, the Department of the Environment, is directly involved in the water resources sector.

- The Department of the Environment was created in 1989 and legally established by the Environmental Protection Act of 1992. It is headed by a chief environmental officer and is responsible for monitoring the implementation of the Environmental Protection Act and the regulations made under it, and for taking necessary action to enforce its provisions. The Act provides for the appointment by the Public Service Commission of environment officers,

inspectors, and other staff necessary to carry out the provisions of the act and any regulations made under it. The act specifies 27 areas of responsibility under the heading of powers, duties, and functions of the department. Those related to various aspects of water resources management are: assessment of natural resources; development control; land use planning; control of waste discharges; pollution control; pollution monitoring; enforcement; use of natural resources; policy formulation; cooperation; and public education.

- The Ministry of Health is undergoing significant reform. The Health Sector Reform Project, a three-year activity funded by the Inter-American Development Bank is being implemented. The National Health Plan for the period 1996 - 2000 supported by PAHO/WHO was completed in 1995 and its implementation was begun shortly thereafter. Between these two activities, significant change in the management approach of the Ministry of Health is expected. Presently, the Public Health Bureau and the Health Education and Community Participation Bureau are the departments within the Ministry of Health that are directly involved in the water and sanitation sector.

- The Public Health Ordinance, Chapter 31, and its amendment of 1985 give the Ministry of Health, through the Public Health Bureau, the regulatory powers for various health related concerns. These include: monitoring water quality; investigation of public health and related complaints; monitoring of sewage, solid waste, and liquid waste management; pollution prevention; monitoring the use of chemicals, pesticides, herbicides, insecticides, and industrial waste; and prosecution of public health offenders.

- The Health Education and Community Participation Bureau was set up to support social mobilization, health education, and community participation activities. As part of the community-based strategy, the Bureau intends to reorient its health education strategy to incorporate the behavioural approach accepted internationally as standard within hygiene education for water and sanitation projects. Using this framework, the Bureau is developing district and community capacities to identify those health practices of villages which put them at risk for contracting diseases and to develop and effectively communicate relevant hygiene messages aimed at changing risk behaviours and practices. Within the Ministry of Health, health education is also provided by the Office for Primary Health Care.

- The Fisheries Department of the Ministry of Agriculture and Fisheries was established on January 1, 1965, and is concerned with the conservation and protection of both inland and marine fisheries, and in ensuring that fishing is conducted in a sustainable manner. In March

1990, the Coastal Zone Management Unit was set up with the particular responsibility of coastal zone planning and the protection of coastal ecosystems.

- The Ministry of Works is entrusted with bridge construction and maintenance, land reclamation and drainage, and road construction and maintenance. The ministry also has budgetary allocations for activities related to the drains of Belize City and other main towns and villages, drainage of several roads, and river bank maintenance. In addition, the ministry is involved in the maintenance, improvement, and cleaning of navigable waterways and canals and the construction of piers and jetties. The ministry operates a septic tank emptying service for a fee.

- The Hydrology Department is responsible for implementing the stated policy relating to collection and analysis of data on quantity, quality, and variability of water resources; hydrological investigations for engineering and water resources projects; and publication and dissemination of information. The department works closely with the National Meteorology Service and advises the government on watershed and environmental management, and natural disasters such as droughts, floods, and water pollution.

- The Ministry of Economic Development is responsible for the efficient allocation of resources for economic and social development. This responsibility is expressed through the coordination of national development planning, management of external cooperation activities and technical assistance, management of the Public Sector Investment Programme, the promotion and monitoring of selected private sector investments for both export and domestic production, and the preparation of annual analyses of the country's economic and social performances. As stated earlier, there is a relation between the water supply and sanitation sector and other sectors such as health, tourism, mining, environment, and housing. The laws that regulate such sectors also regulate their use of water resources. As a result, there is an overlap in competence and functions among different institutions, creating conflicts that foster fragmentation of the water resource sector with a corresponding lack of coordination. This has resulted in some activities being performed by more than one agency and others that are not carried out by any. Nonetheless, there are inter-sectoral coordination efforts that merit mention.

- Since 1993, the Ministry of Health and the Ministry of Natural Resources have participated in an inter-sectoral "Community Based Environmental Health Programme" to coordinate the delivery of community based services. Introduced under the auspices of the AID-funded Improved Productivity Through Better Health Project (IPTBH), this strategy calls for coordinated planning with the Ministry of Health through the development of inter-sectoral

community-based environmental teams to address environmental problems common to both ministries. A major accomplishment of this program has been the formation of institutional linkages between the Ministry of Health and the Ministry of Natural Resources, using primary health care as a vehicle for this effort.

- The functional organizational structure for these linkages consist of inter-sectoral teams at different ministerial levels: a Senior Inter-sectoral Executive Committee (senior decision-makers including the chief executive officer of WASA), a Central Management Team (technical staff), and at the district level, an Environmental Health Subcommittee of the District Health Team. The lines of communication between these teams are both vertical and horizontal in nature. This approach has proved effective in coordinating service delivery at the community level resulting in a more effective utilization of scarce resources within both ministries. It has also provided a means for decentralizing services.

- The Land Utilization Authority is provided for in the Land Utilization Act of 1993. It repeals the former act of 1981. The authority is comprised of the Commissioner of Lands and Survey as Chair, the Chief Engineer of the Ministry of Works, the Chief Agricultural Officer, the Chief Environmental Officer, a representative of the Ministry of Economic Development, the Director of Social Development, the Physical Planner, a representative of the Ministry of Natural Resources, the Senior Planning Officer of the Department of Housing and Planning, and two persons from the private sector. The authority considers all applications for the subdivision of land, and may require that the applicant submit verification that the application conforms to the standards established by WASA regarding waterworks, the Director-General of Electricity Supply, and the Principal Public Health Inspector. An Environmental Impact Assessment approved by the Department of the Environment may be required and the Authority may consult the local authorities concerned and any statutory planning authority. A prescribed fee is required with each application. The authority will also demarcate specific areas as Special Development Areas for which development plans shall be prepared.

- There is very little authority for resource management at a municipal or village level. In 2000, legal recognition was given to village water boards for management of community rudimentary water systems, but decision-making and enforcement power still lies with the central government.

- There are a number of international and indigenous nongovernmental organizations working in Belize on matters related to the environment and public health. The local NGOs are important in facilitating the expression of community views and promoting grassroots

participation. The more prominent national NGOs concerned with water-related issues are the Belize Centre for Environmental Studies, the Belize Audubon Society, and the Belize Enterprise for Sustainable Technology.

- The NGOs also play a large role in the management of natural resources through the administration of specific protected areas and community coordination. While responsibility for protected areas falls under the mandate of the Forest Department, other departments (i.e., the Fisheries Department and Archaeology Department) and NGOs do manage a large number of them. Examples of these organizations include the Belize Audubon Society (management of some protected areas both inland and on the Halfmoon Atoll), Programme for Belize (management of the Rio Bravo Conservation Area along the New River), SATIIM (management and monitoring of the Temash-Sarstoon National Park), and the Belize River Keeper (previously worked on the Belize River, especially near the Guatemalan border).

Costa Rica

Current Issues and Challenges

- There has been significant progress made by Costa Rica in increasing access to water for human consumption and improved sanitation. In 2007, 99 per cent of the urban population and 96 per cent of the rural population had access to an improved source of water, while 82 per cent of the national population had access to safe drinking water. Approximately 98 per cent of the urban and rural population had access to a source of improved sanitation. The results achieved place Costa Rica among the most advanced countries in the Latin American and Caribbean region (UNHRC, 2009).

- However, there are serious disparities existing in some provinces and districts of Costa Rica with regard to access to safe drinking water and sanitation. An estimated 18 per cent of the population still does not have access to potable water owing to lack of maintenance of existing infrastructures, inefficient management and operation of aqueducts, and the absence of programmes to monitor water quality. 63 per cent of human excreta and wastewater is directly disposed of in rivers and other water streams, and that only 3.5 per cent of wastewater is actually being discharged into the natural environment. Indigenous peoples and persons belonging to other marginalized and vulnerable groups, including persons living in poverty, Afro-descendants and migrant workers, often have limited or no access to potable water and adequate sanitation (UNHRC, 2009).

- For many years the Government has directed all their efforts to expanding the coverage of water supply while neglecting the development of wastewater infrastructure. Large investments are now being made to improve sanitation in the country.

- The main problems faced by the water and sanitation sector in Costa Rica are: an outdated centralized sector model and inadequate sector policy framework; lack of leadership and accountability for sector development; unsatisfactory performance of service providers and low quality of provided services; large backlog in sanitation infrastructure; high investment needs in the sector; low tariffs and poor cost recovery; and lengthy and inefficient procurement procedures.

- Costa Rica has a population of just fewer than 4 million inhabitants, of which about 60 percent are located in urban areas. Although Costa Rica has seen increases in sanitation coverage countrywide within the last decade, there are shortcomings in the quality of service. Wastewater disposal services provided by in situ solutions such as septic tanks or

latrines, while only a small portion of the urban population is connected to a sewerage network.

- It is estimated that 96 percent of Costa Rica's wastewater that is collected goes untreated, and is discharged into rivers and receiving bodies without any treatment, generating public health risks and water resources contamination problems. Sewage disposal via sanitary sewerage lines is 26 percent, while only 3.5 percent of Costa Rica's wastewater is treated before being discharged into the country's rivers.

- Approximately 98 percent of the urban population of about 2.25 million were either connected to public sewerage or had individual septic tanks in 2000. However, in reality, sewerage network coverage is low, reaching only 21 percent. Rural coverage is lower with about 97 percent connected to sanitation services, mostly through the use of septic tanks.

- The untreated wastewater is mainly found in the greater metropolitan area of capital San Jose, in the Grande Tarcoles and Reventazon water basins. Costa Rica has only five operating wastewater treatment plants, which can only serve one-third of the population. The San Isidro treatment plant, in Choluteca municipality, has collapsed while Limón province only has a sea outfall pipe.

Wastewater Technologies in Use

- Virtually all urban population has access to sanitation, about 30 per cent with sewerage, including 70 per cent in the capital, San José. There are only 8 wastewater treatment plants, treating an estimated 10 per cent of wastewater (PAHO, 1997).

- Starting in 2010, the state water utility AyA will invest US$270m to start treating the 2,800l/s of wastewater currently produced in the greater metropolitan area in and around capital San José. The project involves the rehabilitation and reconstruction of the sewerage networks in nine municipalities in San José and one in Cartago province. A total of 360km of secondary pipelines will be installed and four trunk sewers will be repaired. A wastewater treatment plant will also be built in the La Uruca municipality (IRC International Water and Sanitation Centre, 2010).

Existing Policy Framework

- Costa Rica's wastewater management framework was, up to a few years ago, characterised by an outdated centralized sector model and inadequate sector policy framework. The sector model, developed in the 1960s, was based on provision of services to the entire

country by the centralized public institution Costa Rican Institute for Water and Wastewater (AyA), which is also in charge of sector policy development (World Bank 2004). This was an inefficient, outdated model, not suitable for current market conditions where competition and use of modern technologies greatly contribute to a more efficient and reliable service, ensuring increase in coverage level and access by the poor.

- In addition, AyA is reforming the way in which backup support services are delivered to rural communities and has moved from a centralized to a decentralized model, under which six regional offices are being established to bring service delivery closer to rural communities.

- In 2004, the Government of Costa Rica signed a Memorandum of Understanding with the World Bank for a Country Assistance Strategy which involves the Modernisation of the Water and Sanitation Sector. This project involves a number of components, including:
    - Development and implementation of a Design Built Operate (DBO) contract for collection, treatment and disposal of the wastewater o f San Jose to be managed by a private operator;
    - Development and implementation of a contract for hiring a private operator to manage the commercial operations of the water and sewage public enterprise (AyA);
    - Modernization of financing mechanisms for water and sanitation services in rural areas;
    - Development and implementation of a pilot programme for incorporating the private sector in the provision of water and sanitation services in four medium size cities;
    - Preparation and implementation of a program for reduction of unaccounted for water; Development of a long term strategy for water supply in the metropolitan area o f San Jose;
    - Implementation of an institutional reform of the sector and of AyA; and
    - Strengthening of environmental management capacity.

- The Inter-American Development Bank (IDB) is presently assisting the government in designing a Water and Sanitation Sub-national Programme.

Existing Legislative Framework

- The Water Law (law No. 276 of 1946) establishes the main legal framework for the management and use of water resources in Costa Rica. The State, through the grant of concessions, regulates the use of public water resources by individuals and enterprises in accordance with the principle that, in the event of water scarcity, water for domestic consumption is to be accorded the highest priority over other possible uses (UNHRC, 2009).

- In addition to the Water Law, there are a wide number of laws and regulations on the protection and sustainable use of water resources, including:
    - The Potable Water Law (law No. 1634 of 1953)
    - The General Health Law (law No. 5395 of 1973)
    - The General Environment Law (law No. 7574 of 1995)
    - The Regulation on the Quality of Potable Water (decree No. 32.327-S of 2005)
    - The Regulation for the Evaluation and Classification of the Quality of Surface Water Bodies (decree No. 33.903-MINAE-S of 2007)

- According to the Potable Water Law of 1953 the country's 81 municipalities (called cantons) are constitutionally responsible for the provision of water and sanitation services. However, the centralized model has prevailed.

- Similarly, although Article 5 of the law governing the Regulatory Authority for Public Services allows the provision of water supply services by the private sector, the private sector does not play any role in the water sector.

- In addition to these laws, there are several other regulations that aim at ensuring the safe treatment and disposal of wastewater, including:
    - A regulation on the management of sludge from septic tanks (decree No. 21297-S of 1992)
    - A regulation on the dumping and reuse of wastewater (decree No. 26042-S-MINAE of 1997)
    - A regulation on the approval and operation of wastewater treatment systems (decree No. 31545-S-MINAE, revised in 2005)
    - A regulation creating the environmental tax for dumping polluting substances in water (decree No. 34431-MINAE-S of 2008)

- In the early 1990s, the Regulation Creating the Environmental Canon for Effluent Discharges was modified to allow for the rapid formation of legally recognized community water management associations, which have the delegated authority to administer and maintain water supply systems on behalf of the state (World Bank 2004).

- The General Regulation on Environmental Impact Assessment Procedures was implemented to require EIAs of development activities that may have negative environmental effects.

Existing Institutional Framework

- The Ministry of the Environment, Energy and Telecommunications has overall responsibility for the management of water resources. It has far-reaching functions relating to the supply, management, use, protection and monitoring of public water, including the power to grant water permits or licences for the drilling of new wells in accordance with the Water Law. The Ministry also has general responsibilities for the collection, management, treatment and disposal of human excreta, wastewater and stormwater.

- The Ministry of Health is responsible, in accordance with the General Health Law, for preventing contamination of water resources, developing regulatory measures on water quality and for monitoring their effective implementation by water suppliers. Its responsibilities include monitoring the quality of safe drinking water provided by national operators. The Ministry is also responsible for authorizing projects concerning sewage system and wastewater treatment, as well as for monitoring their implementation.

- The main service provider and policy maker in the water sector is the Costa Rican Institute for Water and Wastewater (AyA). It is a centralized public institution reporting to the Minister of Health. AyA is in charge of directly administering and operating most water and sanitation systems in the country, serving 46 percent of the population, mostly in urban areas, and directly serves 3 percent of the rural population. It is responsible for:
    - Providing services to about 50 percent of the population including urban and rural users;
    - Providing technical support to rural concentrated communities that have local administration committees for the management of their water services;
    - Guaranteeing the continuity of provision of service nationwide (to the point of being able to assume actual operation of failing systems not operated by AyA); and
    - Leading the development of the sector nationwide.

- AyA has an important indirect policy and regulatory de facto role since it monitors the compliance with technical norms, can take over failing systems and advises the Ministry in the development of the sector. This double role implies a conflict of interest.

- AyA's role concerning sector development and definition of sector strategy and policies is not actually being carried out. AyA does not define sector goals, does not develop and implement policies for the sustainable development of the sector and is not involved in improving organizational and operational arrangements. In practice, AyA acts mainly as a service provider, the largest among several others (World Bank, 2004).

- The population not served by AyA is served by the following service providers:
    - Municipalities, which in total serve 16 percent of the population;
    - The Heredia Public Services Company, which is an autonomous multi-services public utility constituted under private law that provides water, sewer and electricity services to Heredia in the North of the country, which serves 5 percent of the country's population;
    - Administrative Committees of Rural Water Systems and Administrative Associations of Rural Water and Sanitation Systems, which serve a total of 24 percent of the country's population in 1,620 communities.
    - Other private organizations, such as housing developers, serving about 5 percent of the population.

- The Regulatory Authority for Public Services, created in 1999, is responsible for economic regulation including tariff setting, monitoring and control of efficiency and of quality of service, amongst others duties.

- The National Service for Groundwater, Irrigation and Drainage is a technical agency with a mandate to establish, manage, maintain and develop systems of irrigation and drainage, as well as to protect and monitor the use of surface and groundwater resources. It also carries out hydrological studies to assess the potential production of aquifers, and gives permits for the use of groundwater resources, indicating the maximum amount of water that can be extracted on an annual basis.

- Over 20 other ministries and public institutions play a role in the water sector, sometimes with overlapping functions and responsibilities. These include the Ministry of Agriculture and Livestock, the Costa Rican Institute of Tourism and the Costa Rican Institute of Electricity.

Grenada

Current Issues and Challenges

- A UNDP-sponsored Core Welfare Indicator Survey conducted in 2005 revealed that 87% of households have access to safe drinking water; 70% have access through publicly supplied water piped into the dwelling; 8.4% through publicly supplied water piped into the yard; and 8.5% through public standpipes.

- In rural areas, 60.3% of the population has access to safe excreta and sewage disposal and sanitation services; 88.3% of urban households do. Septic tanks are used in 54.4% of households; 36.3% rely on pit latrines; 5.4% flushing toilets; and 0.7% have no access at all (PAHO, 2007).

- There is one sewage treatment plant in the city of St. George but virtually no sewage treatment in other areas of the country resulting in pollution of Grande Anse Bay (UNEP-CEP 1998a).

Wastewater Technologies in Use

- There are 5 sewage treatment facilities only one of which was in good operating condition (UNEP-CEP, 1994)

- The sewer system in Grenada, before 1991 existed only in the town of St. George. This system was started in 1939 and was commissioned in 1940 by Howard Humphrey's a British Consulting Firm. In 1991 the Grand Anse Sewer project was started and completed in 1993. In 1999, the development of the sewer marker plan was completed. However the projects identified have yet to be implemented (NASWMA website).

- There are designs and plans for a sewerage projects which will include the extension of the St. George's sewerage system, construction in the St. John's area, and a sewerage system in Grenville at a cost of US$15 million (UNEP, 2000).

- The Southern Grenada Water Supply Improvement project, financed by grant by the European Development Fund, began in mid-2009. Its main objective is to improve the quantity, quality and reliability of the water supply in the southern part of Grenada by installing pipelines and upgrading seven critical water treatment plants located at Annandale, Mardi Gras, Les Avocats, Windsor Forest, Mamma Cannes, Petit Etang and Pomme Rose (Flora, 2008; GrenadaBroadcast, 2010).

- One hotel is using aquaculture systems, utilizing the water hyacinth, with reasonable success (UNEP-CEP, 1998c). Aquaculure systems are basically shallow ponds covered with floating plants that detain wastewater at least once per week. The main purpose of the plants in these systems is to provide a secure habitat for bacteria which remove the vast majority of dissolved nutrients.

Existing Policy Framework

- Grenada has completed a National Water Policy that seeks to address many of the issues relating to IWRM and Water management in general; a Water Sector Review that identifies the major issues relating to water in Grenada; a National Implementation Plan; and most recently, a water legislative review and draft legislation relating to the National Water Policy (GNWIS, 2008).

- Grenada's National Strategic Development Plan, prepared under the auspices of the Agency for Reconstruction and Development, was approved by Parliament in mid-2007. The comprehensive 151-page document was developed with stakeholders representing every sector of the Grenadian society. The plan indentified several priority areas for revitalization of the national economy following a detailed analysis of the major sectors. Environment and physical development has been recognized as priority and the strategic outcomes include a proposal for environmental considerations to be integrally linked to national development.

- The National Strategic Development Plan identifies the need to promote awareness of and commitment to environmental considerations. The plan also highlighted the need to promote the enforcement of legislation in relation to environment, the need to promote and provide disaster risks reduction and hazard mitigation and the need to implement the national environment strategy and the national integrated physical development plan (MOF, 2004).

- The Government has recently expressed its commitment to the development of a national Integrated Water Resources Management Plan (CEHI, 2009). This builds on the following initiatives which are intended to promote more sustainable systems of water resources management: the Marine Protected Areas Project, the draft Revised Water Legislation, the Grenada Irrigation and Drainage Project, the Annual School Coastal Zone Management Competition and the legal designation of Clarks Court/Woburn Bay and Molinière/Beauséjour Bay as Coastal Protected Areas.

- The Government of Grenada intends to implement a policy to ensure that all wastewater is disposed of in a sanitary manner. The operational problem associated with this policy is that less than seven percent of all water customers are metered. Even after connection to the sewerage system was made mandatory, very few of those customers were metered (FAO, 2001).

- In 2005, the Government approved a National Environmental Policy and Management Strategy (NEMS). The NEMS is Grenada's formal expression and commitment to arrest and reverse trends of environmental degradation and to ensure that sound environmental management is fully integrated into the national development policy framework (MOF, 2004).

Existing Legislative Framework

- The national policy on the environment calls for the establishing of an integrated, efficient and effective legislative and regulatory framework for environmental management. The policy mandates a comprehensive review of the current suite of sectoral legislation that addresses environment, natural resource management and sustainable development issues and the enactment of required comprehensive legislation and regulations.

- In addition there are several pieces of legislation that deal with various aspects of the environmental management on the sectoral level. As a consequence of the review a Draft Environmental Bill has been elaborated and is now subject to consultation on the national level. The draft bill seeks to address the critical gaps found during the legislative review (MOF, 2004).

Existing Institutional Framework

- The National Water and Sewerage Authority (NAWASA) was formed by an Act of Parliament in 1990 with the responsibility for the development of potable water supplies as well as the sanitary disposal of sewage. This institution evolved over the years from what was known as Water Works, a unit in the then Public Works Department. In 1969 Water Works formalized into the Central Water Commission that was solely responsible for water production and distribution. In 1990 the responsibility of sewage collection and disposal, which was under the auspices of the Ministry of Health, was passed unto NAWASA (NAWASA website). The Authority is a statutory body and as such has to finance its operation through activities for which it is responsible. The Authority is controlled by a Board that is responsible for the policy and the general public administration of the Authority.

- The Ministry of Agriculture's Forestry Division is responsible for the protection of water catchment areas, while its Agronomy Division is responsible for the development of irrigation on the island.

- An Environmental Affairs Department was established within the Ministry of Health in 2001 and is charged with facilitating the management of activities pertaining to Grenada's natural resources. The department is responsible for enforcing the institutional framework for environmental management and sustainable development to minimize indiscriminate potential adverse effects on human health and national development. Also, the department is charged with increasing the level of public awareness on environmental issues in Grenada and facilitating the development of attitudes and skills necessary for community-based activities of environmental management (PAHO, 2007).

- The Ministry of Health, Social Security, the Environment, and Ecclesiastic Relations is responsible for the overall management of the health sector.

- The Environmental Health Department is responsible for controlling water pollution; improving wastewater treatment, ensuring that safe drinking water is delivered to the population; and identifying risks to health and safety within water catchment areas. The Department also is responsible for improving systems for the disposal of excreta and other harmful substances to humans, animals, and plants, as well as food hygiene.

- In 2005, the Environmental Health Department continued to ensure the availability of safe water through the water quality monitoring program that was instituted in 1998. In addition, reports of weekly bacteriological sampling conducted by the National Water and Sewerage Authority are reviewed and analyzed. Reviews of these bacteriological results show a general adherence to the water quality according to established standards. The Environmental Health Department also continues to be responsible for overall sanitation; however, efforts are being made to relieve the Ministry of Health of these traditional roles and to function more in a monitoring and regulatory capacity (PAHO, 2007).

Guatemala

Current Issues and Challenges

- According to the Ministry of Planning and Programming of the Presidency of the Republic, in Guatemala the piped water supply has improved significantly. Water coverage of households in the country (household water to several homes or public stream) increased from 52.3% in 1981 to 68.4% in 1994 to reach 74.6% in 2002. Significant differences remain in coverage between urban and rural areas. For 2002, the urban coverage reached 89.4% of households surveyed, and rural areas stood at 59.6%.

- There has been improvement in coverage rates of wastewater treatment systems. The table below indicates that coverage has improved with proper disposal (toilet and flushable toilet) from 24.8% of households in 1981 to 46.9% in 2002, but still too low to ensure adequate quality of life for the population, with almost six million people without access to this basic service. In urban areas the proper coverage reaches 76.7% of households, while at the rural level is only 16.8%. Wastewater is treated in very few places (only 5% nationally), so that the sewage flow into rivers and surface water pollution by promoting other water resources.

Households by type of health service, according to census year

Type of Service	1981	%	1994	%	2002	%
Total	1,151,872	100.0	1,591,823	100.0	2,200,608	100.0
Toilet	246,646	21.4	469,206	29.5	921,515	41.9
Flushable toilet	39,550	3.4	91,154	5.7	110,434	5.0
Latrine or cesspool	368,086	32.0	823,913	51.8	849,542	38.6
Nothing	497,590	43.2	207,550	13.0	319,117	14.5

Censos de población y Habitación 2002, INE.

- There have been recent increases in investment in the sector: public investment in the water sector doubled from 418 million quetzales in 2003 to 863 million quetzales in 2006. These values represented 4.34% and 8.54% of total public investment. Investment in water and sanitation tripled. In 2003 this represented 60% of the total investment in the sector and in 2006, 80%. However, only 4% of the total investment is used for operation and maintenance, which affects the quality, maintenance and expansion of services.

Wastewater Technologies in Use

- Nine percent of urban sewage is treated before discharge and of that 9%, 46% receives only primary treatment with the remainder receiving secondary treatment (UNEP, 2000).

- Out of 27 treatment facilities there are 16 wastewater treatment plants in the metropolitan area, but only 4 of them are in full operation giving a total treated flow below 0.1 m3/s. Only 15 municipalities out of 286 have wastewater treatment plants comprising Imhoff tanks, lagoons, trickling filters, and activated sludge. Many treatment facilities are impaired due to poor design, lack of spares, and shortage of qualified operators.

- In May 2000, a pilot wastewater treatment system was placed into operation in the town of Puerto Barrios, Guatemala to treat sewage that has been discharged untreated directly into ditches and rivers that flowed through the town. Traditional wastewater collection systems would have been very expensive to install (US EPA, nd). The pilot project incorporated the use of two wastewater treatment plants, each with a design flow of 5000 gallons per day (gpd). Each WWTP could treat wastewater from approximately 100 people. The wastewater treatment pilot project was built utilizing septic tanks at the homes in conjunction with a collection system that utilizes small diameter gravity sewers. The sewers utilized four-inch diameter lines to transport the septage from the septic tanks to a pumping station. The pumped wastewater is treated in a recirculating sand filter with a design criteria of 5 gallons per square foot per day loading. Treated effluent from the sand filter is discharged to the Escondido River.

Existing Policy Framework

- The Government has established an overarching policy for national water resource management, the National Policy for Integrated Management of Water Resources, which contains six themes including Water and Human Development, where water and sanitation is a priority. From this policy was derived the National Plan of Public Utilities Water and Sanitation for Human Development 2008-2011 (Guatemala Country Strategy, 2007).

- Policies have been developed at the community level. An association of eight municipalities in the Río Naranjo basin, Communities Associated for the Water, Environment, Integral Development and Infrastructure was formed in 2005 and developed Municipal Water Policies through dialogues focused on “rights and obligations.” The Municipal Water Policies is a consensus document related to the valuation of water resources and their management, which is recognized by the municipal authorities that participate in its implementation. Citizens and authorities have become involved it its design and in the designation of resources for its implementation with the help of specialized institutions. One of the dimensions of the water policies is to promote collectivism and the contribution of municipal government in multi-stakeholder investments in order to support the

awareness-raising programs as well as the development of environmental infrastructure (GWP, 2008).

- There is currently at least one major project on the ground for wastewater management. A project for the Capacity Development for the Conservation of the Water Environment in the Metropolitan Areas is being implemented (2006-2010) with the support of the Japanese International Cooperation Agency. This project is focused on nine metropolitan areas throughout Guatemala and is based on the use of appropriate technologies, enforcing regulations on integral wastewater components, creating and strengthening the monitoring and information systems, designing and implementing formal and informal education programs and raising awareness of the issues. The project uses strategies that include cooperation and incentives.

- A large share of the financing for water and sanitation comes from foreign donors. Communities and local governments, however, also make significant contributions in the form of unqualified labour, local materials and cash contributions. For example, under the program "Agua, fuente de paz" initiated in 1992, communities contributed 35% and local governments and other local stakeholders 25% of project costs, with only 40% financed by donors. The program supported 800 rural communities, focusing on those in extreme poverty.

Existing Legislative Framework

- Based on the Health Code, Decree 90-97 of Congress, the Ministry of Public Health and Social Assistance is the lead agency in the health sector and is legally responsible for monitoring drinking water quality at a national level. They provide water quality testing services for private and public operators.

- Government Agreement 376-97 declares that the National Institute for Municipal Development (INFOM) is responsible for coordinating the management of the Strategic Policy of Water Supply and Sanitation Sector, and emphasizes that the Ministry of Agriculture, Livestock and Food continues to be the main entity responsible for water and sanitation.

- According to the law, the provision of services is a responsibility of municipalities. Article 253 of the Constitution of the Republic of Guatemala gives the country's 332 municipalities the responsibility to use their resources to provide public services. In 2002 the Municipal Code published as Government Decree 12-2002 confirmed the legal responsibility of municipalities to deliver public services, including water and sanitation, to all those living in

urban and rural areas. However, municipalities have a difficult time serving urban and especially rural areas due to a lack of resources. In reality, therefore, a variety of public, communal and private entities provide services alongside the municipalities.

- The Regulation on the Download and Reuse of Wastewater and Sludge Disposal, Government Agreement No. 236-2006, was created in May 2006, as the official regulatory instrument. The Ministry of Environment and Natural Resources (MARN) has monitored the 400 industries in the metropolitan area to date.

- There are no tariff regulations aimed at industries that use the public sewer system; this issue is being resolved. Discharges are monitored currently directed to a public sewer, according to the Rules of the Downloads and Reuse of Wastewater and Sludge Disposal, Government Agreement No. 236-2006.

Existing Institutional Framework

- In 2008 a special "Water Cabinet" was created by Governmental Agreement 204-2008 with the purpose of coordinating government efforts to design and manage policies, plans and budget for the water to help achieve goals and objectives of national development. This cabinet consists of 22 government institutions, including ministries and departments and is chaired and coordinated by the Vice President of the Republic of Guatemala. Among its objectives are: a) promote the adoption and implementation of criteria for integrated management of water resources in all public institutions, centralized and decentralized; b) ensure the contribution of water to achieve the goals and objectives of national development c) facilitate the coordination of government agencies, autonomous and civil or private, to achieve sustainable management of water resources of the country, d) ensure the harmonious implementation of financial and human resources allocated to water management and e) promote institutional strengthening and public participation in water sector, to promote good governance in the field.

- Constitutionally, the provision of water and sanitation services is the responsibility of the municipalities. Services can be provided directly by a single municipality or through a group of municipalities who are organized to provide services together ("mancomunidades"). Most of the resources that they invest come from the central government. The Municipality of Guatemala City created the Municipal Water Company (EMPAGUA) in 1972 to manage Guatemala City's sewage and water services. Today it is the largest municipal water provider in the country. XELAGUA manages the water supplies in Quetzaltenango, Guatemala's second largest city.

- The Ministry of Environment and Natural Resources (MARN) is the governing body of environmental sector. The agency was created in 2000 by Decree No. 90-2000. Under Article 29 b, MARN is responsible for formulating and implementing policies relating to the industry: to comply and enforce the rules concerning the conservation, protection, sustainability; to improve environmental and natural resources in the country; to support the right to a healthy and ecologically balanced environment; and to prevent pollution of the environment, reduce environmental degradation and loss of natural heritage. Also, MARN is required to "formulate policy for water management as appropriate to contamination, quality and renewal of that resource."

- The National Institute for Municipal Development (INFOM), created in 1957, is an autonomous institution whose mission is to support municipalities through the provision of administrative, financial, and technical assistance. In 1997 the Government Decree 376-97 gave INFOM the responsibility to manage the political and strategic aspects of the water and sanitation sector in Guatemala. The agency is responsible for coordinating the management of the Strategic Policy of Water Supply and Sanitation Sector.

- The Ministry of Health and Welfare is the body responsible for regulating, monitoring and enforcement of existing legislation on water, sanitation and hygiene. Among its policies related to water and sanitation include the following: a) Carry out preventive interventions, technical assistance and control, the private sector, local authorities and community on water and sanitation; b) Promote coordination among actors in the subsector drinking water, sanitation and hygiene; c) To form and train the staff of the Ministry of Public Health and Social Assistance in environmental health; d) Implement the National Plan of Public Services Water and Sanitation Development Human approved by the government of the republic; e) Sign agreements with community organizations, NGOs and municipalities responsible for compliance of drinking water and sanitation.

- In 2005, Governmental Agreement Number 19-2005 created the National Commission of Coordination for Water Resources (CONAGUA) as a temporary institution and eliminated the 441-2000 Governmental Agreement. CONAGUA was charged to work for a 3 year period and it worked directly with the Presidency of the Republic. CONAGUA is responsible for promoting and coordinating the execution of the National Water Policy. Included in these responsibilities are developing regulations for the use and handling of water resources in general, and specific political, institutional and regulatory policies. In addition, CONAGUA is charged with developing research opportunities within the sector and creating a National Information of Water System database. Its final role is coordinating with other institutions

involved in working towards achieving MDG 10[2] which has been ratified by the Guatemalan Government. CONAGUA has not been successful at meeting its policy goals (Water For People, 2007).

- In 1997, the Executive Unit of the Rural Aqueduct Program (UNEPAR) and the Highlands Drinking Water and Sanitation Project, programs for rural water and sanitation that had formerly been under the Ministry of Health, were placed under the management of INFOM. Although UNEPAR is placed under INFOM it continues to have separate financing from the national budget as well as the German Development Bank.

- Other government institutions that have a role in the water and sanitation sector include, the Planning Secretariat in the President's Office and the Ministry of Agriculture, Livestock and Food.

- Guatemala has a relatively well-established system of community-based providers of water and sanitation services. Assistance to community-based service providers is a key function in the water and sanitation sector. In Guatemala this function is not clearly assigned to a government institution. INFOM, through UNEPAR (see above under policy), does provide this function. In addition, many NGOs also support community-based organizations.

- Servicios para el Desarrollo is a local NGO dedicated entirely to water and sanitation through its program “Agua para todos.” Created in 1996, the organization counts among its ranks 14 professionals from various disciplines dedicated to support communities in finding sustainable integrated, sustainable and affordable water and sanitation solutions. It also tries to raise the awareness of civil society and the state concerning water and sanitation, and undertakes research and documentation to systematically assess experiences in the sector.

- Guatemala’s Water and Sanitation Network, formed in 2006, is heavily involved in advocating for policy changes within the water and sanitation sector. Institutions involved in RASGUA include national and local Guatemalan government units, Water For People-Guatemala and other local and international NGOs, and the private sector.

[2] Halve, by 2015, the proportion of people that lack sustainable access to safe drinking water and sanitation.

Guyana

Current Issues and Challenges

- Key issues in the water and sanitation sector in Guyana are untreated and poorly treated sewage due to a lack of wastewater treatment facilities, a low level of cost recovery and low levels of access.

- Despite increases in coverage, only about 13 percent of Guyana's population has access to sewerage, according to the WHO/UNICEF Joint Monitoring Program (2006).

- According to the 2002 census, only 5 percent of the population had access to a water closet (W.C.) linked to a sewer; 36 percent had access to a W.C. linked to a cesspit or septic tank; 56 percent had access to a pit latrine; and 2 percent had not access to sanitation facilities JMP WHO/UNICEF 2006).

SANITATION	% House connections	
	Urban	Rural
Flush to sewage system/septic tank	71.4	20.8
Pour flush latrine	0.4	0.3
Improved pit latrine	0.6	1.7
Traditional pit latrine	26.8	74.4
Open pit	0.4	1.3
Other	0.0	0.4
No facilities/bush/field	0.5	1.2
TOTAL	100.1	100.1
50% of traditional pit latrine considered improved	13.4	37.2
access to improved sanitation	86%	60%

Source: Report of Multiple Indicator Cluster Survey Guyana, Bureau of Statistics, Guyana, July 2001

- Sewers only exist in the capital, Georgetown. Regions 7, 8 and 9 in the Hinterland show the highest share of population with no access to sanitation, each with more than 15 percent of the population without access.

- Current sewage disposal practices appear to cause faecal contamination of drinking water sources. Pollution of surface and ground water also has serious impacts on fisheries resources in coastal and marine waters, which then enters the food chain for the human population. Water quality is also affected by discharge of waste from distilleries and surface runoff (pesticides). Agricultural runoff which ultimately enters the coastal zone may contribute potentially significant pollutants in the form of increased biochemical oxygen

demand (BOD) and nutrient enrichment. Such pollution may have serious impacts on aquatic and marine life and any contamination of drinking water from this runoff would impact human health. Untreated industrial effluents discharged into nearby canals and rivers will affect the quality of drinking water if not rapidly dissolved (NDS, 1997).

- Only limited water quality monitoring is done for drinking water sources (i.e., surface and ground waters) and limited testing is done of rivers and coastal waters as well.

- Health data show that the population suffers from environment-related diseases that are transmitted to humans from contaminated water, food, or soil. These include cholera, dysentery, gastroenteritis, typhoid, dysentery, gastroenteritis, infectious hepatitis and hookworm (NDS, 2007). 1998 health statistics show water-borne diseases are estimated to have risen more than fourfold over the last decade.

- As with other public services, an inadequacy of operating budgets has also troubled the water and sewerage sector. Yet there is abundant scope for recovering costs in this sector through the application of the appropriate charges. The prevailing picture is one of low water tariffs and low collection rates across the board for all uses of water.

- Guyana Water Incorporated has identified the following challenges faced by the company in the area of sewage disposal:
    - Frequent blockage of yard and road sewer lines, resulting in overflows
    - Frequent lost of pump-motor assembly, resulting from unwanted solids that destroy mechanical parts
    - Unplanned down time resulting from electro-mechanical faults at the sewer stations or from power outages
    - Inappropriate public behaviour – blocking inspection chambers, indiscriminate dumping of solids and non-biodegradable substances into the sewer system, illegal connection to the sewer system, vandalism – especially inspection chambers, manholes covers and sewer control stations
    - Release of industrial waste and high level of fat from restaurants into the system that results in blockages
    - Lack of education among sewerage customers as it relates to the use of the system.

Wastewater Technologies in Use

- Central Georgetown is served by a separate sewerage system constructed between 1924 and 1929. Central Georgetown is the only city in Guyana served by a communal sewerage

system. The system consists of 24 interlinked gravity sewerage basins each draining to a dedicated pumping station. These stations discharge to a common ring force main, which in turn discharges untreated sewage through two short outfalls at Fort Groyne, Kingston, at the mouth of the Demerara River. One outfall extends approximately 100m in the river and another outfall only extends about 40 m (160 feet) into the Demerara River.

- There are three (3) Sewerage Treatment Works serving relatively small areas. These are located at Tucville, University of Guyana and the South Ruimveldt Shopping plaza. These systems are very old and experience constant problems since they are in need of repair and rehabilitation (Government of Guyana /UNEP- CAR/RCU, nd; NDS, 1997).

- Drainage of the effluent from the Tucville treatment works is subject to preliminary treatment by screening and grit removal followed by an activated sludge treatment process. Finally the effluent is disinfected by dosing with chlorine. The activated sludge process and chlorine dosing has fallen into disrepair and current treatment relies on settlement and the remaining preliminary treatment followed by anaerobic digestion.

- In the rest of Georgetown domestic sewage is distributed to septic tanks or pit latrines. The septic tanks in some areas are generally well kept but in some they are frequently in a poor state because of infrequent emptying and poorly designed filter chambers. In such areas the discharge is to drainage canals. This results in most drainage ditches in the town becoming heavily polluted and often clogged with solid waste and other disposed materials.

- The street sewerage network in Georgetown remains unchanged today since it was first completed in 1929. Some of the yard sewers were changed over the years as buildings were rehabilitated, expanded or whenever foundation work was done for new construction. Additional yard sewers were done with AC pipes in the 1970s and more recently PVC pipes were used when changes were done.

- Periods during the wet and dry seasons are more susceptible for inducing contamination; open-ditch sewers and septic tanks may flood during the wet seasons, whereas during the dry seasons there may be insufficient flow to flush and dilute the contaminants.

- The population of the other major communities (e.g. New Amsterdam, Linden, Corriverton, and Rose Hall) is served by septic tanks and pit latrines, which overflow from time to time to ditches and storm channels, providing opportunities for clogged drains, foul odours and unsightly conditions. More seriously, there is also the potential for contaminated surface

water from storm channels to enter drinking water mains at times of low or negative pressure and during flood conditions (Government of Guyana, nd).

- In rural areas, septic tanks and pit latrines are commonly used for sewage disposal. Septic tanks, which are generally approved by the Regional Environmental Health Officer, employ a filter box for dispersing tank effluent into the soil to a depth that depends on the level of the water table.

Existing Policy Framework

- Chapter 18 on Environmental Policy of Guyana's National Development Strategy highlights sewage pollution as a major national concern and identifies wastewater management and pollution control as a priority. The policy proposes legislative reform as a critical strategy and as a result, the Environmental Protection Act was passed in 1996.

- The Environmental Policy makes the link between human health and sanitation. In keeping with the priority given to public health issues, the Government committed to give emphasis to replacing, over time, Georgetown's reliance on groundwater with piped water from upstream supplies. Investment priorities will include better sewage treatment facilities and/or extending Georgetown's current sewage outtake to several kilometres offshore.

- The development of a national water policy is mandated by the Water and Sewerage Act passed in 2002 (see below).

- In 2009, the Government of Guyana along with national, regional and international partners, implemented a pilot project in the community of Linden Guyana to develop a Water Safety Plan, adopting a holistic approach to addressing the key issues of watershed management and drinking water quality. The approach included all steps in the water supply chain; from catchment to consumer. The adopted approach gave rise to the merger of two initiatives – the development of a National Programme of Action under the global framework of the Global Plan of Action and the Cartagena Convention on Land Based Sources of Marine Pollution (LBS Protocol) and a Water Safety Plan as recommended under Chapter 4 of the World Health Organization Guidelines for Drinking Water Quality 3rd Edition (2004) (CEHI et al, 2009[3]).

- In July 2009, a Watershed Assessment Management Plan was developed.

[3] Water Safety Plan Linden Guyana April 2009, CEHI

Existing Legislative Framework

- Article 36 of Guyana's Constitution of 1980 expressly provides for protection of the environment, including “all appropriate measures to conserve and improve the environment."

- In 1996 the Environmental Protection Act was enacted to give effect to the provisions of the Constitution. Its objectives are “to provide for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment, the sustainable use of natural resources and for matters incidental thereto or connected therewith."

- The Act established the Environmental Protection Agency (EPA) and empowers the Agency to performs its functions based on certain principles of environmental management, namely:
    - the "polluter pays principle": the polluter should bear the cost of measures to reduce pollution decided upon by public authorities to ensure that the environment is in an acceptable state, and should compensate citizens for the harm they suffer from pollution;
    - the "precautionary principle": where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation;
    - the "strict liability" legal principle: any person who contravenes this Act or regulations shall be liable to the penalties prescribed thereafter;
    - the "avoidance" principle: it is preferable to avoid environmental damage as it can be impossible or more expensive to repair rather than prevent damage;
    - the "state of technology" principle: measures protecting the environment are restricted by what is technologically feasible and as technology improves, the improved technology should be used to prevent and repair environmental damage.

- The EPA accomplishes its mandate through the National Environmental Action Plan which sets out the environmental development strategy of Guyana (Government of Guyana, UNEP- CAR/RCU, nd). The functions of the EPA include the following:
    - to take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection, sustainable use of its natural resources;
    - to establish, monitor and enforce environmental regulations;
    - to prevent or control environmental pollution;
    - to ensure that any developmental activity which may cause an adverse effect on the natural environment be assessed before such activity is

commenced and that such adverse effect be taken into account in deciding whether or not such activity should be authorised;
    - to promote and encourage a better understanding and appreciation of the natural environment and its role in social and economic development.

- In the exercise of its functions the Agency is mandated, among others, to "provide information and education to the public regarding the need for and methods of protection of the environment, improvement of the environment where altered directly or indirectly by human activity, and the benefits of sustainable use of natural resources."

- The Environmental Protection Act also provides for environmental impact assessments and the establishment of an Environmental Assessment Board which hears and determines appeals of developers from decisions of the Agency.

- However, since the Act came into force, prosecution of offenders has been done on a low scale.

- The Environmental Protection Act has associated regulations governing pollution control and waste management. These regulations include the Air and Water Quality Regulations (2000) and the Hazardous Waste Regulations (2000).

- The Pesticides and Toxic Chemicals Act (2000) and accompanying regulations govern the Pesticides and Toxic Chemicals Board that falls under the Ministry of Agriculture.

- In 2002 the Water and Sewerage Act was passed, which merged the Georgetown Sewerage and Water Commissioners and the Guyana Water Authority to form Guyana Water Inc. (GWI) and called for the establishment of a National Water Council and the development of a national water policy. The merger was effected in order to focus not only on delivery of potable water but on management of water resources in an integrated approach.

Existing Institutional Framework

- As indicated above, the Environmental Protection Agency (EPA) has overarching responsibility for the effective management of the country's natural environment. The EPA is responsible for the environmental education and monitoring functions conducted by the former Guyana Agency for Health Sciences Education, Environment and Food Policy.

- At the national level, responsibility for sector policy is vested in the Ministry of Housing and Water. In 2008, the National Water Council was launched to facilitate the promotion of an integrated water resource management approach in Guyana. The Council was established to serve as an advisory forum to the Minister of Housing and Water in implementing, developing and amending the national water policy. In addition, the Council will make recommendations on the national water policy and other functions as stipulated under the Water and Sewerage Act.

- Water and sewerage service provision is the responsibility of Guyana Water Incorporated (GWI), a commercial public enterprise. GWI was formed by the merger of the Guyana Water Authority, set up to work with regional councils and municipal authorities to provide water supply and sewerage services in Guyana, and the Georgetown Sewerage and Water Commissioners, established in 1929 under British colonial rule to operate and maintain the sewerage and waterworks of Central Georgetown. GWI's specific role is to operate and maintain the Georgetown sewerage system. The company's service area is divided into five divisions along the Coast, numbered 1-5 from West to East. The Hinterland is served by a separate unit within GWI which provides support to community-based organizations that provide services in that part of the country.

- The Ministries of Health and Agriculture share environmental responsibilities. The Ministry of Health has authority over environmental health and pollution control, which it exercises through the Environmental Health Unit and the Regional Environmental Health Services.

- The Central Housing and Planning Authority exercises development, planning, and control authority.

- At the regional and local levels, many counterpart institutions perform environmental management functions. For example, the ten Regional Environmental Health Services and local health authorities have been delegated authority for implementation and enforcement of Public Health Ordinance provisions, and the Regional Democratic Councils and Local Government authorities carry out the water supply and sewerage responsibilities of GWI.

Honduras

Current Issues and Challenges

- Water supply and sanitation coverage in Honduras has increased significantly in the last decades. However, the sector is still characterized by poor service quality and poor efficiency in many places. Coverage gaps still remain, particularly in rural areas (JMP WHO/UNICEF, 2006).

- Data about access to water supply and sanitation in Honduras vary depending on the source of information. For example, according to a survey in 2006, 86 percent of households had access to sanitation. The sanitation figures are much higher than the information from the WHO Joint Monitoring Programme, which shows that about 36 percent of the total population had access to sewerage; of the in the following table.

		Urban (46% of the population)	**Rural (54% of the population)**	**Total**
Water	Broad definition	95%	81%	87%
	House connections	91%	62%	75%
Sanitation	Broad definition	87%	54%	69%
	Sewerage	66%	11%	36%

Source: WHO/UNICEF Joint Monitoring Program/2006.

Wastewater Technologies in Use

- According to the National Autonomous Water and Sewerage Service (SANAA), only 11 of the 55 major sewerage systems of Honduras have wastewater treatment plants (UNEP, 2000).

- SANAA has demonstrated some innovation in its approach to extending the sewerage system into un-served areas. One example of a creative approach is SANNA's approval of the use of smaller diameter pipes to reduce the cost of extending the sewer network; we were told that costs were more than cut in half by using 4-6 inch pipes rather than the standard 8-inch pipe (Angel et al, 2004).

Existing Policy Framework

- In 2006 the government issued a Strategic Plan for the Modernization of the Water Sector to strengthen the decentralization of services.

- In 2003, a new Framework Law for water supply and sanitation was passed. It includes service decentralization from the national utility, National Autonomous Water and Sewerage Service (SANAA), to the municipalities. It also creates a policy council and a regulatory agency. Nevertheless, the new institutions remain weak and the process of decentralization has been slow. Furthermore, there is no policy of sector financing.

- According to the Framework Law, SANAA will have to transfer its service provision functions to the concerned municipalities until 2008 and transform itself into an agency providing technical assistance to municipalities and Juntas. The new sector structure foreseen by the law is still in process of being established, with the new institutions still being weak and new institutions still adapting to their new roles.

- Honduran investment per capita in water supply and sanitation from 1997 to 2006 in constant US Dollars of 2006. The World Health Organisation (WHO) estimates that average urban water tariffs in 2000 were only US$0.13 per cubic meter. A household in Tegucigalpa with a house connection paid only US$2.45 per month for water and US$0.50 for sanitation. Tariff increase approvals occur infrequently and are insufficient to compensate for inflation, thus resulting in an erosion of real tariff levels. Tariffs in municipal systems tend to be even lower than tariffs for systems managed by SANAA, suggesting that tariff setting in municipalities is more prone to political capture in Honduras than tariff setting at the national level. SANAA's sanitation tariff corresponds to 25% of the water tariff.

- According to the Honduran ministry of finance, US$262 million were invested in the sector between 1997 and 2006, which is on average US$4 per capita and year. The annual investment mostly ranged from US$1.1 and US$4.6 per capita. However, in 2001 it was extremely high, reaching US$16.9. On the other hand, in 2006 it was at only US$0.2 per capita. On average, the investment level is similar to Costa Rica and Mexico, but lower than South American countries like Argentina, Peru and Colombia.

- The Honduran water supply and sanitation sector receives significant support in terms of financing and technical assistance from a big variety of donors. Most important donors are the World Bank, the IDB, USAID, the European Union, German KfW and Swiss SDC. Some channel their support through the FHIS and others through SANAA. While all donors assist municipalities and their mancomunidades concerning decentralization, some implement small subprojects for the communities themselves and others carry out subprojects of a certain size through construction companies.

Existing Legislative Framework

- According to the 2003 Water Framework Law sector policies are defined by the National Water and Sanitation Council which is chaired by the Minister of Health. Regulation is the responsibility of the Potable Water and Sanitation Regulatory Agency.

- Before the Water Framework Law was adopted, there was no regulatory framework that could have been applied in decentralizing processes such as the developments in San Pedro Sula and Puerto Cortés. Thus, local regulatory agencies were created for the concession contracts to secure a sustained process. For instance, in Puerto Cortés a regulatory agency was created at the municipal level including selected representatives of civil society, such as doctors, engineers and lawyers.

Existing Institutional Framework

- Water and sanitation service provision in Honduras is the responsibility of the following institutions:
    - Municipalities in most urban areas;
    - A private utility under concession by the municipality of San Pedro Sula;
    - The National Autonomous Water and Sewerage Service (SANAA), which operates approximately half of the urban water supply and sanitation systems of Honduras, including Tegucigalpa;
    - About 5,000 water boards (Juntas Administradoras de Agua) in rural areas and in marginal peri-urban areas;
    - According to the Water Framework Law which passed in 2003, SANAA will have to transfer management to the municipalities until/ by? 2008.

- All urban water supply and sanitation systems are public, except three: In San Pedro Sula, the municipality has given a concession to a private operator for 30 years in 2000. In Puerto Cortés, the same happened in 1999, in Choloma, governments created mixed utilities.

- The Honduran Social Fund (FHIS) also plays an important role in the sector, since a large share of donor funding to the sector is channeled through it.

- The Honduran Network of Water and Sanitation (RAS-HON) is an institution for dialogue, advice and interchange of the water supply and sanitation sector, consisting of organizations, institutions and collaborating people who develop and carry out plans and projects.

- Most rural municipalities are organized in Mancomunidades or Inter-municipal Associations, many of which have formed Inter-municipal Technical Units in charge of investment

projects management. The FHIS' Rural Infrastructure Project (PIR) gives support to six of the Mancomunidades.

- Many NGOs are active in the Honduran water supply and sanitation sector. One of them is the Foundation Water for Everybody (FUNDAPAT), created in 1992 on the basis of an initiative of UNICEF, SANAA, the Tegucigalpa Chamber of Commerce and Industry and the Media Association. FUNDAPAT has reached to extend coverage of potable water to 105,000 persons in 104 communities, in particular in the metropolitan area of Tegucigalpa. The communities pay back investment into a rotating fund without interests to maintain the Foundation's capital and make possible the extension of coverage to more quarters. SANAA created a special unit for supporting those projects in poor areas.

- The following other NGOs are also very involved in the sector: Engineers Without Borders Lafayette College, PLAN de Honduras, Save the Children, Catholic Relief Services, Agua para el Pueblo, World Vision, CARE PASOS 3 (Project of sustainable water supply and sanitation), Global Village and Water for the People.

GOOD PRACTICE CASE STUDY – PUERTO CORTES

In Puerto Cortés the water and sewer system had been managed by the national public water and sewer company, SANAA. The municipality requested the transfer of the system after the city remained without drinking water for months in the aftermath of Hurricane Gert which hit the city in September 1993. After a lengthy period of negotiations the system was finally transferred in 1997. During that period USAID provided substantial financial assistance to modernize and expand the water system, doubling access between 1993 and 1997 and improving service quality. As a consequence the incidence of waterborne diseases such as diaorrhea declined significantly.

Despite an upcoming election the city's mayor, Marlon Lara who had become mayor in January 1994, more than doubled water tariffs, had non-paying users disconnected and had water meters installed. Although many voters resented the measures, Marlon Lara managed to win the elections. Shortly afterwards, in 1999, the city decided to create a mixed company called Aguas de Puerto Cortés (APS) in order to reduce the potential for political interference in day-to-day management. Initially 95% of the company was owned by the municipality, with symbolic shares held by various associations in the city. However the municipality subsequently decreased its share of ownership: In 2006 the company was owned by the association of port employees (16%), the association of central market vendors (16%), two women's cooperatives (32%), the Chamber of Commerce and Industries (16%) and the municipality (20%). The company signed a contract with the municipality which specified specific targets to be achieved, and the municipality created a municipal regulatory body to monitor the company's performance.

Access and service quality improved substantially between 1995 and 2006. Water supply is now continuous, monthly billing has increased 25-fold in nominal terms, water production has more than doubled and non-revenue water has been reduced from an estimated 40% to 25%.

In 1998 the city obtained financing from the Inter-American Development Bank to extend the sewerage system and to build a wastewater treatment plant to put an end to the pollution of the Alvarado lagoon near the city. In 2003 the consulting firm Halcrow won a contract to design the wastewater treatment plant using stablization ponds, a natural technique with low operation and maintenance costs.

Jamaica

Current Issues and Challenges

- Coverage of sewerage services has increased significantly in recent years, but it is less extensive than the coverage of water services. Significant investments and operational improvements are needed in this area.

- Several assessments[4] have revealed that the low level of performance of Jamaica's wastewater sector has been linked to: improper plant designs; old technology; overloading; lack of maintenance; and improper operations are possible reasons for the performance. A detailed examination of the situation indicates that operational and maintenance issues are the most predominant reasons for the low level of performance. The significant operational and maintenance issues are: plants in a state of disrepair; limited self-monitoring; over-loaded plants; limited technical capacity of the staff; inadequately trained staff and absence of documented standard operational procedures; lack of proper equipment and poor maintenance.

- In 2002, NEPA[5], through the Coastal Water Quality Improvement Project, (funded by the USAID and Government of Jamaica), commissioned a special study on the performance of the domestic wastewater sector. Over the period 2001-3, a combined total of 60 plants were monitored by NEPA through CWIP and the Section 17 Programme. The results presented an alarming situation with low levels of compliance with both the Sewage Effluent Standards and the LBS Protocol. For example, only 23 (40%) of plants met the national NRCA Sewage Effluent Standard for Biochemical Oxygen Demand (BOD). When the data for all the plants are combined, the average values exceeded all the respective standards. Effluent data also indicated a significant deterioration in the performance and level of compliance of the sector over the previous three years.

- The discharge of improperly treated wastewater effluent is one of the main contributors to coastal zone degradation in Jamaica.

[4] NEPA's monitoring programmes along with special study by the Scientific Research Council (SRC) indicates that poor operating practices and inadequate maintenance at sewage treatment plants are very evident. The Jamaica Wastewater Operators Association (JWOA) presents a similar situation is its status report on Wastewater Treatment Plant, 2003. The JWOA study looked at 14 plants, highlighting the conclusions of the plant operators on the facilities they operate.

[5] The National Environment and Planning Agency comprises established in 2001 is an amalgamation of the Natural Resources Conservation Authority, the Town Planning Department and the Land Development and Utilization Commission

- Sewerage services exist in most major urban areas, and are being improved. The majority of the households (98.9 per cent) surveyed in 2007 had access to water closets and pit latrines, which were defined as acceptable forms of toilet facility. Water closet (flush toilet) was the main type, accounting for 64.3 per cent of households. Use of water closets has increased from 58.1 per cent in 1997 but has levelled off at 64.0 per cent since 2004. A distinction should, however, be made between access to flush toilets linked to wastewater treatment facilities (sewers) and those that are not. Some 42.4 per cent of households were not linked to sewers, indicating that soil absorption systems were the predominant means of sewage disposal for the country.

- Sewerage is not generally provided in rural areas, except in small housing developments. The percentage of rural households with flush toilets has increased from 28 percent in 1990 to 31 percent in 1991. However, over the period 1997-2007, rural areas experienced a 10 percentage point increase. The commonest form of rural sanitation is the pit latrine, used by 68 percent of rural households. Septic tanks, pit latrines and other types of onsite sanitation can be effective and safe. However if not constructed, used and maintained properly they can pose a threat to health and the quality of aquifers and surface water. Lower population densities mean that the cost of water provision in rural areas is often higher than in urban areas, while lower incomes in many rural areas make it hard for some customers to meet the full cost of high quality services.

- It is apparent that the use of pit latrines is still significant in Jamaica, especially in rural areas. Some of this usage is based on environmental factors such as inappropriate soil conditions or close proximity to water sources prohibiting the use of flush toilets with septic tanks and absorption pits or no access to sewerage systems. However there is no data readily available that indicates the number of pit latrines that are in use due to these reasons.

- Pit latrines are still in use by public schools, from Infant to Secondary, throughout the country in fairly significant numbers, especially in the rural areas. St. Catherine is the parish with the largest number of schools (120) and the largest number of schools (43) with pit latrines. St. Elizabeth and Westmoreland have 50 percent and 54 percent of the schools respectively with pit latrines. There are no schools in Kingston with pit latrines and only 8 schools in St. Andrew (7 percent of total within the parish) with pit latrines. While many schools are equipped with toilets and piped water, the infrastructure is often not in satisfactory condition. The data shows that in most parishes about 40 percent of the public schools do not have satisfactory toilet facilities and 40 percent do not have adequate or reliable water supply (Ministry of Education 2003-4).

- Industrial wastewater treatment facilities in the agro-industrial sector have been plagued with poor trade effluent discharge quality. This is of particular concern in the sugar industry, coffee industry, distilleries, and abattoirs. Wastewater tends to have high biochemical oxygen demand (BOD), total suspended and dissolved solids. End of pipe treatment options tend to be looked at as the first solution to the problems. However, NEPA has been encouraging waste generators to look at waste minimisation and cleaner production as alternative solutions which usually end up saving scarce financial resources as water and energy consumption are reduced. Codes of Practice have been developed for the coffee and sugar industries.

Wastewater Technologies in Use

- There are a number of entities that own and operate wastewater treatment facilities in Jamaica. Sewage treatment facilities comprise the largest network of wastewater treatment facilities on the island. There are approximately 260 sewage treatment plants in Jamaica, with the majority owned and operated by the National Water Commission (NWC). Major urban centres such as Kingston and St. Andrew, St. James and St. Catherine account for approximately 90 percent of the waste handled by the NWC. Within the NWC system, plant capacities range from 0.0528 MLD - 52.8 MLD (million litres per day) with about 90 percent of plants less than 2.65 MLD. There are a variety of plants within the NWC such as contact stabilisation, oxidation ditch, aerated lagoons and stabilisation ponds.

- The Soapberry Treatment Plant in Kingston and St. Andrew is an example of an innovative approach to addressing a long-standing problem. The project cost is US$55M and the Urban Development Corporation is the lead agency in the construction phase of this project. The construction of the new wastewater treatment plant commenced in July 2005 and was completed in 2007, along with the trunk conveyance facilities and rehabilitation of a major pump station. The new plant will replace the dysfunctional Greenwich and Western sewage treatment plants. This new plant will be expanded as the sewerage network is expanded over time. This is a critical project as a component in the Kingston Harbour cleanup Project as it would result in properly treated effluent being discharged into the Harbour.

- Within the past decade, the NWC has completed three other new sewage treatment facilities in Ocho Rios, Montego Bay and Negril. This was necessary because tourist destinations that have seen rapid growth in population resulting from migration into the areas, which strained and over-loaded the existing infrastructure.

- In addition to the NWC, sewage treatment plants are owned by hotels, strata corporations and public housing development agencies; this sector, particularly the hotels, is dominated by mechanical packaged plants.

- Over the past several years, there has been significant improvement in technology, and construction of new facilities with up-to-date performance. However, many of the plants across the island are currently using old technology; most of the plants are old extending, up to 30 years, with some exceeding their design lifespan. In addition, the original designs for some plants do not allow them to meet the new effluent standards; however, in most cases, plants are not even meeting the standards according to their original design specifications. Coupled with this is the fact that most of the plants are mechanical, using the aerobic process for treatment. Also, the plants are subject to frequent breakdowns.

- Plants are being overloaded. This usually occurs in urban centre when the housing stocks are increased and connected to the plants without commensurate increase in capacity of existing plants.

- Inadequate monitoring and limited enforcement options by regulatory agencies continue to allow plants to operate at undesirable levels.

- Owners/operators of most plants do not conduct any form of monitoring in order to assess the performance of their plants. Effluent quality for most plants is only known when compliance monitoring by regulatory agencies or special studies are done. This lack of monitoring is evident from the Section 17 Programme Pollution Control Programme, with little or no monitoring reports being submitted by owners/operators of plants.

- Most plants are staffed by operators who lack the necessary technical knowledge. Many plants are simply being run mechanically but are not operating properly. There were some plants that were in fairly good working condition but are producing effluent of poor quality, most likely as a result of poor operation.

- Most sites do not have documented Operation and Maintenance procedures. Some operators are working based on what they are told and their own experience.

- Important equipment for the proper functioning of a significant number of sewage treatment plants is either missing or not functioning properly. This is particularly so for the various pumps and motors used at the plants. Also, there seems to be no adequate maintenance programmes in place for some equipment. In addition, most plants lack a

documented operational and maintenance programmes. There is little effort to replace or repair vital components responsible for the effective functioning of plants.

Existing Policy Framework

- NEPA (then NRCA) and the Planning Institute of Jamaica jointly developed the Jamaica National Environmental Action Plan (JANEAP) in 1995, with technical assistance from the World Bank. The JANEAP is the main environmental management policy instrument, and its stated purpose is 'to document the major environmental problems facing the country and to formulate the appropriate policy framework, Institutional arrangements, legal instruments, strategies, programmes and projects to address and mitigate these problems'. This document is significant because it explicitly recognizes the need to pursue the goal of sustainable development and the role, which the Polluters Pays principle must play in order to achieve that goal. It contains the commitment that the Government must have in place standards for trade effluent, sewage effluent, ambient water quality, potable water, irrigation water and recreational water (pool and beaches). Status updates on the implementation of the JANEAP are published annually.

- The Jamaica Water Sector Policy (1999) articulates the government's objectives in the provision of urban and rural water and sewerage. In the area of the services provided to consumers, the Government intends to:
    - Ensure the availability of minimum necessary quantities of potable water and minimum standards of sanitation service to all in a cost effective and efficient manner, with due regard to health and environmental considerations and at a price customers can afford;
    - Ensure minimum standards/levels of service for the public supply of potable water. For municipal/urban households and other urban consumers, this will include potable water available 24 hours per day;
    - Focus the provision of water and sewerage services on meeting the needs of areas targeted by the National Industrial Policy so as to have the maximum impact on growth and development;
    - Provide for expansion of the sewerage network in areas with high population densities having regard to health and environmental considerations;
    - Ensure improvements in sewage treatment and disposal, to protect the environment;
    - Control and reduce the production of industrial effluents, and ensure that such effluents are adequately treated, to avoid contamination of existing water resources.

- Within the Water Sector Policy, there are strategies focused and designed for water pollution prevention and control including:

- Maintenance of ecosystem integrity through the protection of aquatic resources from negative impacts caused by development and natural processes;
- Protection of public health against disease vectors and from pathogens;
- Ensuring sustainable water use and ecosystem protection on a long-term basis;
- Implementing the polluter pays principle.

- The 1999 policy outlines specific roles and responsibilities of key institutions in the water, wastewater, drainage and irrigation sectors. The principal actor is the Water Resources Authority, which has had responsibility for regulation, control and management of the nation's water resources since April 1996.

- The revised draft Water Sector Policy, Strategy and Action Plan (2004) outlines the sewering of all major towns by 2020; and the rehabilitation of existing non-compliant facilities to achieve compliance with national environmental standards as key objectives.

- The Draft Jamaica National Sanitation Policy (2005) consists of situation analysis which provides a background on sanitation at the local and national levels. The institutional framework for sanitation was outlined, including the role of non-governmental organizations (NGOs) and community-based organisations (CBOs) and highlighted the importance of stakeholders in the improvement of sanitation. Additionally, the inter-linkages with other existing policies which can complement the sanitation policy were elucidated. These included the water sector policy, poverty eradication policy, health policy, solid waste management policy and the social housing policy.

- The vision of the policy is to see to it that "Every Jamaican understands what proper sanitation and hygiene means and has the means to be able to practice proper sanitation". The main objectives which are:
    - Acceptable water supply and sewage and excreta disposal systems available in homes, schools and public places;
    - Sustained education on sanitation, hygiene and solid waste management for the general public, new parents and early childhood, primary and secondary students;
    - Sanitation facilities mandatory where food is prepared and sold and at public entertainment venues/functions;
    - All communities with a safe and reliable solid waste management system in place.

- Strategies were also synthesized to improve environmental sanitation and wastewater disposal and are dependent upon local political, institutional and economic conditions. There include:

- Health issues as key rationale;
- Streamlining the Institutional and Policy Framework;
- Waste minimisation, reuse and recycling;
- Promote Local Solutions;
- Encourage the Involvement of all Stakeholders;
- Regulation and Monitoring;
- Population targeting;
- Appropriate sanitation solutions for location;
- Recognition of dimensions of gender and poverty;
- Financial issues – Funding for infrastructure and cost recovery;

- The existing laws policies and guidelines to obtain the vision and goals were outlined and the new legislation required was proposed. Importantly, the monitoring and evaluation system and responsibility of the various ministries for effecting the goals and objectives was outlined.

- Other policies that have been drafted and support improved sanitation include the Health Policy (Ministry of Health); the Squatter Management Policy (Ministry of Land and Environment); and the Social Housing Policy (Ministry of Water and Housing).

- The NWC has a development manual which outlines requirements for wastewater management in the island and the types of systems deemed appropriate.

Existing Legislative Framework

- In Jamaica there are at least fifty existing statues which relate in one way or another to environmental management and protection. The existing legislation is widespread and fragmented. With regards to wastewater management the most important statues are:
    - The Natural Resources Conservation Authority (NRCA) Act, 1991
    - The Public Health Act 1974, amended in1985
    - The National Water Commission Act, 1963, amended in 1965, 1973 and 1980
    - The Water Resources Act, 1995

- The NRCA Act has significant powers related to the management of the environment, and specifically for the regulation of effluent discharges, Section 9(4) and 12. The National Environment and Planning Agency (NEPA) has the mandate for environmental management in Jamaica, which it executes on behalf of the Natural Resources Conservation Authority (NRCA). The NRCA is empowered by the NRCA Act 1991.

- Section 12 of the NRCA Act indicates that a license is needed for the discharge of wastewater into the environment and also for the alteration, reconstruction and construction of

wastewater treatment facilities. Effective January 1, 1997, the Permit and Licence Regulations were promulgated and required that a Permit be obtained from the NRCA for the construction and operation of a new wastewater treatment facility and that a licence be obtained for the discharge of trade and sewage effluent. NEPA processes permit applications for new wastewater treatment facilities and licence applications for the discharge of effluent. The organisation is also involved in enforcement and public education.

- There are established standards for sewage and trade effluent quality and meeting the standards is a condition of every licence granted by the Authority (NRCA) through NEPA. It should be noted that there are currently two standards for sewage effluent, standards for some existing facilities (which are defined as facilities in operation prior to 1997) and those for new facilities (licensed after 1996).

- The conditions of the licence usually require that there is self-monitoring on a specified frequency to ensure that standards are being met. An Environmental Monitoring and Management Plan is usually requested of the entity that has been granted the Licence. NEPA conducts post-approval compliance monitoring to ensure that conditions are being met. Samples of effluent are also analysed by the NEPA laboratory. Standard conditions included in sewage treatment facility permits and licences include the need for standby generators and standby pumps where there are mechanical plants, as well as contingency plans in case of malfunction of the plant.

- In 1997 the then NRCA initiated the Section 17 Programme to work with some of the existing major generators of effluent. The Programme initially targeted those entities that discharged wastewater into the Kingston Harbour but has since expanded to include all sugar factories and distilleries, the bauxite/alumina plants, the coffee pulperies as well as other establishments known to generate sewage and trade effluent. This was a voluntary compliance programme for entities which operated prior to January 1997. As of the start in the 1999/2000 fiscal year, these entities were eventually incorporated into the licensing system for existing entities.

- Jamaica took the milestone step of developing the draft NRCA Wastewater and Sludge Regulations for the practice of safe environmental sanitation (ecosan) and protection of public health. The wastewater and sludge regulations are intended to allow the safe management, treatment and disposal of sewage and industrial sludge. The regulations establish strict pathogen and heavy metal content limits for treated domestic sewage sludge (called National Treated Sewage Sludge/Biosolids Standard) that is suitable for land application. The regulations are designed to encourage the land application of biosolids and

biosolids derived products in a manner that protects the public health and maintains or improves environmental quality.

- The draft regulations make provisions for wastewater discharge fees, which utilises the "polluter-pays" principle. The regulations require that the entity discharging effluent pay a calculated rate fee for that discharge whether the effluent is in or out of compliance with the effluent standards. The aim is to encourage the polluter to fix the problem rather than to pay the penalty.

- The draft regulations include the standard for pathogens using an indicator of faecal coliforms of less than 1000 MPN/g of treated sludge and the absence of Salmonella. For metals ceiling concentrations, annual loading rates and cumulative loading rates for metals in treated sewage sludge when applied to agricultural land were established. Licence requirement for sludge treatment and sewage sludge disposal and the requisite forms are also included.

- The regulation are based on the approach of self monitoring by the generator, the performance of an auditing function by NEPA, the polluter pays principle, economic incentives for development of environmentally sound alternative uses for sludge and effluents and progressively severe penalties.

- The regulations are complemented by 10 schedules which provide the standards for the sewage and trade effluent, including for use of discharges for irrigation, landfilling of sludge, water quality standards, forms, and reporting stipulations.

- The Public Health Act allows for the Minister to make regulations in relation to air, soil and water pollution in Section 14. It also allows the Local Board of Health to make regulations for the sanitary collection and disposal of garbage and other waste matter in Section 7(p).

- The National Water Commission (NWC) Act of 1980 gives the NWC responsibility for public water supply systems and public sewerage and sewage treatment. The National Water Commission has developed various regulations under the National Water Commission Act, mainly concerned with setting and collection of tariffs for water supply and sewerage services.

- Since the completion of the new central sewerage systems in Negril, Montego Bay and Ocho Rios by NWC, there still exists the problem of interconnection to the system by those entities that generate wastewater. This presents a challenge to the NWC as there is no legislation binding the wastewater generator to interconnect to the sewerage system. There is an

updated policy whereby facilities located within 100m of the NWC sewerage network are required to pay sewerage charge whether they opt to connect to the system or not.

- The Water Resources Act was established to provide for the establishment of the now Water Resources Authority whose responsibility is to regulate, control and conserve water resources.

Existing Institutional Framework

- With regards to wastewater management, the agencies that play a significant role are: National Environment and Planning Agency (NEPA), Environment Health Unit of the Ministry of Health, National Water Commission (NWC) and Water Resources Authority. The Ministry of Water and Housing has recently established a Sanitation Committee.

- The Ministry with responsibility for Environment has responsibility to develop and implement Environmental Management Policies.

- Ministry of Health has responsibility to develop and implement health policies and legislation to promote appropriate sanitation practices; establish and monitor health indicators for sanitation; enforce Public Health laws; provide Public Education on sanitation and hygiene; and promote good hygiene practices. In the area of water quality standards, the World Health Organisation guidelines and the Interim Jamaica guidelines will continue to apply, and to be monitored by the Parish Public Health Departments and the Environmental Health Unit of the Ministry of Health. These organisations monitor effluent standards for permissible limits on discharge of treated sewage, as well as ambient water quality guidelines for recreational waters. This responsibility for monitoring and enforcing compliance with these standards is shared with NEPA. In addition to their role as regulators, the Ministry of Health operates the sewage treatment plants associated with their hospitals and health care facilities.

- National Environment and Planning Agency (NEPA) establishes planning requirements and develop and enforce environmental management standards; establishes and enforces legal standards for effluent disposal; ensures, through regulatory instruments or otherwise, that housing developments are not sited in vulnerable areas; ensures that planning requirements for housing developments meet required standards for density and sanitation facilities (water supply and sewage disposal).

- Ministry of Water and Housing focuses on development and implementation of policies for the management of water supplies, wastewater treatment/disposal systems and housing developments; implementation of programmes to provide potable water to all communities in Jamaica; implementation of programmes to provide for the safe collection, conveyance, treatment and disposal of sewage; and ensuring that all housing developments meet required standards for sanitation.

- The Local Authorities, including Parish Councils, provide adequate number of properly maintained public sanitary conveniences (especially in urban centres); prohibit/penalize urination and defecation in areas that are not designated for that purpose; and work as work as partners with communities to establish acceptable water supply and excreta disposal systems.

- The National Water Commission (NWC) is the largest owner of sewage plants in the island. In recent years NWC has been incurring losses. Currently, it comes close to covering its operating costs, but does not generate any surplus which could be used to finance investment. The practice has been for the NWC to rely on the Government to finance new infrastructure. However, competing demands on the Government budget mean that this source has not been adequate to provide for the water infrastructure needs of the country. In spite of numerous interventions by GOJ to make NWC businesslike, the desired results have not been achieved for a number of reasons, including:
    - Absence of timely and adequate tariff adjustments;
    - An increase in the area served by the NWC and hence demand for the service consequent on NWC taking over Parish Council systems;
    - Insufficiency of capital to upgrade facilities taken over from Parish Councils;
    - The NWC's infrastructure is in a generally poor state, and significant investment will be needed to rehabilitate it.

- The NWC has indicated that they are discouraging the use of package plants and promoting the use of sewage treatment ponds where applicable. There is a preference for low technology facilities so that the maintenance costs can be reduced.

- The Scientific Research Council provides information/ advice on design and implementation of environmentally friendly wastewater management systems such as Anaerobic Technology and Biodigesters. Services include measuring, analyzing and characterising the types of wastewater produced at a given source and determining the methods for treating it to reduce pollution. The experts do feasibility studies and offer consultancy for waste problems. The Scientific Research Council is the sole provider of anaerobic technology in Jamaica. The SRC provides technical support to the National Water Commission,

communities, schools, farmers and housing developers in commissioning and maintaining waste treatment systems.

- The Jamaica Wastewater Operators Association is a professional body for wastewater plant operators. The association, which was formally registered in 2002, provides a framework for establishing the first wastewater operators' certification programme in Jamaica. The Association, now inactive, was formed to act as an oversight and lobby group. The organisation is expected to set stringent codes by which its members, operators and owners of industrial and sewage treatment facilities, are bound to abide.

- The National Housing Trust usually operates sewage treatment plants associated with government housing projects but eventually hands these plants over to the NWC. Increasingly the NWC has indicated that they must agree to the proposed sewage treatment facility that they are eventually expected to take over.

- The Urban Development Corporation operates a number of small sewage treatment plants across the island.

- Local involvement in wastewater management has improved significantly over the past five years with establishment of a North Coast Wastewater District by the NWC. It has also seen the strong involvement of Environmental Non-Governmental Organizations (ENGOs) and Community Based Organizations (CBOs).

- There is increasing collaboration between regulatory agencies such as NEPA, MOH/EHU/Public Health Department and WRA. An extensive monitoring programme has been in place for NEPA and as of 2009 has seen results of several enforcement actions taking place.

Panama

Current Issues and Challenges

- Water supply and sanitation in Panama is characterized by relatively high levels of access compared to other Latin American countries. However, challenges remain especially in rural areas. According to the Ministry of Health, in 2006, 97 percent had access to at least basic sanitation. However, WHO's and UNICEF's Joint Monitoring Program/2006 estimates access to improved sanitation was 89 percent in urban areas and 54 percent in rural areas. Despite a lack of statistical data about water quality and continuity of supply, potable water is perceived to be of good quality in Panama and most users receive continuous service.

- While average water and sanitation coverage in Panama is high by regional standards, there are still gaps in rural and in particular in indigenous areas. Sanitation coverage is estimated at 90 percent in rural areas (27 percent for septic tanks and sewers) and 47 percent in indigenous areas (0 percent for septic tanks and sewers). Urban coverage with sewers and septic tanks is estimated at 77 percent, but it is only 45 percent in the lowest quintile in urban areas.

- Service quality is often poor in areas officially defined as having coverage. While there are no reliable data on service quality, there is anecdotal evidence and frequent press coverage of supply interruptions. Although water quality is perceived as being good, there are only limited data on water quality, in particular in rural areas. Less than one-fifth of wastewater collected receives any form of treatment.

- Many rural water systems suffer from sustainability issues. These include mismanagement of water sources, and insufficient tariff levels to ensure proper operation and maintenance. In addition, inappropriate hygiene practices limit the health impacts from the improvements in water and sanitation systems.

- In urban areas, the national water utility, IDAAN, is by far the largest provider of water and sanitation services. According to the latest Living Standards Measurement Study (LSMS-2003), about 60 percent of the population of Panama lives in urban areas. IDAAN currently provides about 70 percent of the population of Panama with water. Although water coverage levels are generally high, service quality is often poor and coverage in sewer systems and wastewater treatment lags behind. IDAAN pays relatively scant attention to sanitation compared to water supply. One reason for this is that there is no sewer tariff, providing no incentive to expand access. Every time IDAAN builds sanitation infrastructure,

its operation and maintenance costs increase, with no concomitant increase in revenues, which further deteriorates its financial health.

- The industrial sector evidences a lack of awareness in regards to wastewater management and there is a need to obtain greater compliance with regulations from this sector, including the agricultural sector.

- The bulk of investments for the water and wastewater sector are in water supply, with much less invested in sanitation.

Wastewater Technologies in Use

- In 2000, 6 sewer systems served 95% of coastal population, four of which had primary treatment (10% of coastal population); 2 systems discharged raw sewage (85% of coastal population) (UNEP, 2000).

- Substantial investments are underway in urban water supply and sanitation in Panama City. Substantial urban water supply investments are financed by a government trust fund (Fondo Fiduciario de Desarrollo). The resources allocated from this Trust Fund to water and sanitation (US$90 million) are now almost entirely spent, and investments will again have to be financed by regular government expenditures and international loans. A key investment program in the sector is the Panama City and Bay Sanitation Project, implemented by the Ministry of Health, partly funded by the Inter- American Development Bank and the Japanese Overseas Economic Cooperation Fund. This project entails the rechanneling of the sewer system and will benefit 1.4 million inhabitants. The estimated cost for this project is $300 million and it will be functional by 2012.

Existing Policy Framework

- There is a strong legal and policy framework in the sector, but de facto there is no sector policy, that is, there is no national policy on water and sanitation and insufficient coordination among sector stakeholders. Law No. 2 of January 7, 1997, which creates the regulatory and institutional framework for the sector, clearly assigns the sector policy role to the Ministry of Health (MINSA).

- The law assigns specific functions to MINSA, including setting objectives, formulating policies and strategies, developing coordination mechanisms, formulate financing and subsidy policies, setting norms, and the design and implementation of a sector information system.

The law also assigns the role of executing budgets and of managing international loans in the sector to the Ministry of Economy and Finance. In reality the government does not fulfill most of the functions specified in the law. There are no clear objectives for the sector.

- Priority setting within the Ministry of Health and changes of administrations have contributed to weakening the policy framework in the sector. While it is not entirely clear why the policy framework set out in Law No. 2 has not been implemented, a few factors can be mentioned that are likely to have contributed to the current situation. First, water and sanitation have never been a top priority for the Ministry of Health, given the many other urgent priorities within the purview of the Ministry, including the running of many of the country's hospital.

- There are a number of poorly targeted subsidies in the sector (World Bank, 2006) consisting of a complex mix of direct subsidies, indirect subsidies, hidden subsidies, and "cross-subsidies." Most of these subsidies benefit the non-poor, who tend to consume more water than the poor and who are more likely to be connected to the sewer network. This comes at the expense of those not connected, who are predominantly poor and who are penalized by the low levels of investment in the sector. In addition, The lack of a sewerage tariff implies a substantial inequity, since the better-off are more likely to be connected to sewers, but all water customers-whether they have a sewer connection or not-pay to cover IDAAN's costs, thus cross-subsidizing the better-off. It has been estimated that a sewer tariff set at 35 percent of the water tariff would allow IDAAN to reach financial equilibrium and would have a progressive distributive impact.

- While the ultimate goal of the government is to achieve universal access to water and sanitation, there are no specific and targeted plans to reach that goal. The government programme for 2005-09 aims at increasing rural water coverage from 75 percent in 2004 to 82 percent in 2009. For rural sanitation, no specific target has been set. Improving service quality and sustainability have not been stated as priorities by the Government of Panama (GOP), although sector professionals recognize that these issues require attention.

- In 2006, the government of Martín Torrijos established the Community Development for Public Infrastructure Programme (PRODEC).

Existing Legislative Framework

- The legal framework is strong. Laws governing aspects of the wastewater sector include:

- Law 66 (1947), which created the Health Code of the Republic of Panama that controls excreta disposal, the collection, treatment and sanitary disposal of septage and sewage treatment
- Law No. 2 (known as the Water Law) (1997), which dictates the regulatory and institutional framework for the provision of safe water and sanitation
  Law 77 (2001), which organizes and modernizes the Institute of National Aqueducts and Sewers Authority Rules and Orders
- Resolution 78 (1998), which was approved by all parties for standards for the siting, construction and installation of latrines and sanitary requirements

- Law No. 2 (the Water Law) was passed with the objective of promoting private sector participation and to eventually replace the water and sewer agency, the Institute of National Aqueducts and Sewers (IDAAN) with other operators. After a change in government in 2000 a new law (Law No. 77) was passed to modernize and reorganize IDAAN. That law eliminated the sections related to private sector participation from Law No. 2. It also gave IDAAN the authority to "determine the priority, appropriateness and viability of projects proposed by public, municipal or other entities." Law No. 77 also specifies that the Board of IDAAN will elect the President of the Board, which previously had been nominated by the Minister of Health. It thus effectively strengthened the role of IDAAN and reduced the role of MINSA. The administration at that time de-emphasized Law No. 2, passed by the previous administration not only related to private sector participation, but also concerning the definition of the policy functions of the Ministry of Health. The overall result was that momentum was lost and the country remained without a clearly defined sector policy.

- In addition to the laws above, the following technical regulations exist:
  - Technical Regulation DGNTI-COPANIT 35-2000. This technical regulation establishes the maximum permissible limits to be met by liquid effluent discharges from domestic, commercial and industrial activities, into surface water and groundwater.
  - Technical Regulation DGNTI-COPANIT 39-2000. This regulation applies to liquid effluents from domestic, commercial and industrial activities that are discharged directly to the systems of wastewater collection and sewers
  - Technical Regulation DGNTI-COPANIT 24-2000. Current legislation regulates dumping and wastewater use. The regulation aims to foster the rational use of resources and establish regulations for the various uses that might be made of treated wastewater.

- Technical Regulation DGNTI-COPANIT 47-2000. The scope of this rule includes all facilities or systems that discharge wastewater, and all types of sewage treatment plants, and sewage sludge generated as a result of process treatment.
- Resolution AG-0466-2002 which establishes the requirements for permit applications or concessions to discharge sewage or waste
- Resolution AG-0026-2002 which establishes compliance schedules for the characterization and alignment of wastewater discharge technical regulations DGNTI-COPANIT 35 and DGNTI-COPANIT 39.

- The Government's approach to rural water supply and sanitation was strengthened by the World Bank-financed Rural Health Project. The Rural Health Project was executed by MINSA from 1995 to 2003 and partially funded by the World Bank. One of the achievements of the Rural Health Project was a complete revision of the legal framework for the provision of water services to rural communities. Among others, this project led to the creation of dedicated Water Boards (JAAR) that took over the management of the water systems from the Health Committees that had been, until then, entrusted with all of the health aspects of the community (including water supply). The new legal framework also opened the way for the Water Boards to contract "operators" to execute the day-to-day management of the system. In practice, those operators have mostly been individual members of the community, working for a symbolic remuneration. The project also created dedicated water units in the regional Health departments, all of which are considered important ingredients to achieve a higher degree of sustainability. However, the regional water units were dissolved after the Rural Health Project closed.

- The provisional draft of the General Health Act is in the analysis and consultation phase at the internal and institutional level. With regard to the Health Code currently in force, the General Health Act outlines the organization of the national health system, establishes the norms governing health—not just those having to do with disease—includes elements related to the rights and responsibilities of the population with respect to health, and establishes a frame of reference for the responsibilities of the Government, society, and individuals.

Existing Institutional Framework

- The Constitution of Panama establishes that safeguarding the health of the population of the Republic is an essential function of the State and affirms that, as part of the community, an individual is entitled to the promotion, protection, preservation, restoration, and rehabilitation of health, and also has an obligation to preserve it. In order to meet these

responsibilities, the State has created a number of institutions to provide health services. Principal among them are the Ministry of Health, the Social Security Fund, the Institute of National Water Supply and Sewerage Systems, and the Metropolitan Department of Hygiene.

- The Ministry of Health (MINSA) is responsible for defining the sector's policy, whereas the National Authority for Public Services acts as regulatory agency.

- Management of water resources is the responsibility of the Institute for Water Resources and Electrification and the Institute of National Water Supply and Sewerage Systems, which have initiated the preparation of comprehensive integrated plans for joint surveillance. In 1996, water quality standards were drafted, and the preparation of wastewater quality standards was also begun. The Institute of National Water Supply and Sewerage Systems and the Ministry of Health are responsible for enforcing the quality control standards for drinking water.

- The Environmental Planning Unit and the Environmental Health Bureau of the Ministry of Health were established in 1995. The priority is to conduct research and training projects that will make it possible to reduce or eliminate environmental health risks.

- According to the Water Law, IDAAN is responsible for water and sanitation services in urban areas with more than 1,500 inhabitants, thus preventing decentralization to municipalities. The only exception is the municipality of Boquete, which manages its own water supply and sanitation system. Privatization was proposed at the end of the 1990s, following the telecommunications and electricity sector. Privatization was abandoned until a change of government in 1999. In 2001, Law 77 was approved to modify the Water Law, permitting privatization and strengthening IDAAN.

- The lack of clear "rules of the game" regarding service provision particularly affects small towns and rural areas. Water supply and sanitation in localities with over 1,500 inhabitants is the responsibility of IDAAN (except for Boquete, as noted above). Service provision in localities with less than 1,500 inhabitants is the responsibility of MINSA. However, the dividing line between the areas of responsibility of IDAAN and MINSA actually is far from clear, so that IDAAN intervenes in smaller localities and MINSA in larger ones. MINSA also has four units that work on water and sanitation with insufficient coordination among themselves. This leads to sub-optimal interventions and lack of clarity about roles and responsibilities.

- Neither the tariffs of IDAAN, nor rural tariffs are sufficiently high to cover investment costs. The tariff structure does not provide incentives to save water. Since half of urban and almost all rural users do not dispose of water meters, those user do not receive bills based on consumption. In addition, even those who have meters pay a fixed tariff for the first 10,000 gallons each month, which is included in the basic residential tariff.

- IDAAN is the key player in the sector. However, its human resources and finances have deteriorated during the past two decades due to the fact that tariffs have not increased since 1982. IDAAN is nominally under a board consisting mainly of nongovernment members- representatives of industry and professional associations. However, this does not impede political considerations from having an important influence on key decisions. Finally, management is highly centralized, impeding the effective functioning of regional branches.

- The multi-sectoral regulatory entity, the National Public Services Authority (ANSP), is a relatively marginal player in the sector and has not been very active in recent years. ANSP is charged by law with the approval of urban water and sanitation tariffs and the monitoring of urban service quality. However, in practice it has found it difficult to fulfill that role since there have been no requests for water tariff increases since the creation of the agency. Also, ANSP has been unable to collect some key information on service quality over the past years. The law does not attribute any function to ANSP in rural areas.

- The Social Fund (FIS) and the Community Development for Public Infrastructure Programme (PRODEC) also intervene in both urban and rural areas throughout the country, using a different approach from that of MINSA. MINSA requires a community contribution of 10 percent as a demonstration of ownership and commitment by the community. The Social Fund, on the other hand, invests in potable water, in particular in rural areas and requires no such contribution, which speeds up execution but most likely undermines project sustainability. The new PRODEC program also will not require such a contribution by the beneficiaries. The project will highlight the need to harmonize these policies through its policy component, although it is clear that such harmonization would require political support from the President. PRODEC aims at investing US$100m of the Panama Canal's gains into community infrastructure, including water supply and sanitation. The use of these funds is decided on a participatory basis through consultative councils at the local level.

- An inter-institutional commission chaired by MINSA has been created as part of project preparation to steer the work leading to the establishment of a sector policy. The committee has broad membership from various units within MINSA, IDAAN, MEF, the National Environment Agency (ANAM), ANSP, the Social Investment Fund (FIS), and ACP. It is

expected to be broadened to include the unit in charge of PRODEC in Presidencia and the Social Development Ministry. The committee is expected to be formalized in the near future.

- There are approximately 3,300 water supply systems in rural areas, of which 1,800 are managed by Rural Water Boards; the remaining systems are managed by Health Committees.

Saint Lucia

Current Issues and Challenges

- There is an absence of wastewater management in most communities except for the main city. However, the Castries Sewage System is only a collection system with no treatment, resulting in raw sewage being dumped directly into the Castries Harbour. The water and sewerage company has the mandate to provide services islandwide but does not have the financial capacity.

- In most parts of the island, industrial wastewater is either partially treated and discharged into a natural water course or untreated and discharged into open drains. This pollution ends up on the coast, often near villages and towns, causing severe environmental problems.

- The inadequate and non-functional sewage system of the St. Jude's Hospital that was originally intended to provide some primary treatment before disposal via a submarine pipe. Despite the fact that it did not function for years, it was further burdened with connection from a new housing development and several illegal connections. This led to overflow of the sewer into a marshland area which provided some natural attenuation before eventual runoff to the coast via the Black Bay River (UNEP-CEP, 2006).

- 57 percent of local communities in Vieux Fort had access to water closets (of which 86 percent had septic tanks and soak-aways, 12 percent had septic tanks and tile fields, and 2 percent had connection to a sewage treatment plant), while 39 percent used pit latrines and 4 percent were associated with indiscriminate defecation (UNEP-CEP, 2006).

- Poor sewage treatment and disposal results in high bacterial levels in some coastal areas and affects the health of the local population and the environment. Children have been affected by parasitic worms called helminths (UNEP-CEP, 2009).

- There is an absence of policies and a lack of will to enforce laws.

Wastewater Technologies in Use

- In Saint Lucia, wastewater treatment is inadequate. Castries is served only with a wastewater collection system which discharges raw sewage into the marine environment via a near shore outfall (UNEP-CEP, 2006).

- The only wastewater treatment is applied to wastewater from Gros Islet, for which the Water and Sewerage Company employed an Advanced Integrated Pond System. With this system the sewage goes through a screen before going through four lagoons, of which the first two are equipped with surface aerators. The effluent then flows into Rodney Bay via a stream. Recent assessments of the system by the Caribbean Environmental Health Institute (CEHI, 2009) revealed that the effluent quality was described as good, but the system capacity was under-utilized. This system is used by 13.2% of the country's population.

- There is also a system in place for areas within Vieux Fort although it is not functioning.

- The rest of the island is served with small package plants, septic tanks, out-houses and other undefined local systems. Although for the most part, the technology used in septic tanks is not appropriate, it is the disposal and treatment method that is promoted.

- CEHI (2009) describes package plants, largely extended-aeration package plants used by hotels, as generally operating well. The best quality effluent was obtained, however, from a wetland treatment system that was used by a medium-sized hotel.

- In terms of the operational status of treatment plants in St. Lucia, 23 percent are good; 23 percent are moderate; 15 percent are poor; while 39 percent of treatment plants were non-operational.

- In the Vieux Fort area, the Sewage Needs Assessment surveys (UNEP-CEP, 2006) which were conducted among agencies, institutions, organisations and the relevant communities, revealed the following:
    - Grey water was discharged either in the sewer system or into open drains, with little to no treatment before disposal. With respect to black water, only 15 percent of the agencies undertook secondary treatment via a sewage treatment plant (STP), and effluent from STPs were disposed of in the marine environment;
    - The majority of the agencies (76 percent) utilized septic tanks and soak-away systems, and a small proportion (8 percent) used a septic tank and watercourse;
    - The potential for pollution was clearly evident as 46 percent of the sewage disposal systems were within 100 m of a natural watercourse; 23 percent were within 100 m of the high water mark; 23 percent indicated that their systems had overflowed in the past due to malfunctions; and 8 percent of STPs frequently malfunctioned and discharged raw sewage in the marine environment;
    - Many of these systems suffer from illegal connections.

- Presently, a subsurface wetland system has been developed to address the level of black water in a community within the Font D'Or watershed. This project could be adapted in many rural settlements, particularly in areas of unplanned development.

Existing Policy Framework

- At the national level, an important study – the Development of a Coastal Zone Management Framework for Saint Lucia (MPDEH/ATRIA, 1995) – was conducted, aimed at establishing institutional arrangements to facilitate the sustainable development and management of the coastal resources. The Coastal Zone Management Unit (CZMU) was established and the study led to the development of the Coastal Zone Management Project (2001-2003). The CZMU operates as a coordinating body for stakeholder agencies, focusing on protection and conservation of the coastal zone and marine environment (UNEP-CEP, 2009).

- The Coastal Zone Management Project was established under the Ministry of Agriculture, Forestry and Fisheries with its major responsibility being the preparation of a coastal zone management policy and guidelines (Scott, 2004). Issues covered natural resources; productive sectors; physical development (including pollution control and waste management); and management systems (including environmental standards, data collection and management; public awareness and education; and environmental law) (UNEP-CEP, 2009)

- The objectives of Saint Lucia's Coastal Zone Management Policy are to maintain the integrity and productivity of the coastal zone to social and economic development through the sustainable use of resources and the equitable sharing of benefits; and harmonised use of the coastal zone and provide a framework for the management and resolution of resource use conflicts. The CZM policy is guided by a number of principles including: equity; stewardship; collaboration and participation; multiple use; enforcement; capacity-building; coordination and integration; and public awareness (UNEP-CEP, 2009).

- A country's national water policy is expected to address not just issues related to drinking water, but also to the issue of wastewater management as well, including sewage treatment and disposal as reflected in the National Water Policy for Saint Lucia. The Saint Lucia policy outlines the intention of the Government to undertake the expansion of the sewerage network in areas of high population densities; to investigate the feasibility of wastewater reuse; and to strengthen the capacity of monitoring and regulatory agencies.

- A national environmental plan has been drafted.

Existing Legislative Framework

- A number of national legal instruments exist which are applicable to the management of sewage.

- The Saint Lucia Building Code was found to have a section that dealt specifically with sewage management, and it detailed the conditions that were followed by the National Housing Corporation for their housing developments, as it related to the choice of wastewater management options used. It did not take into account the wide range of technologies available, and focused on the role of the Development Control Authority, the Ministry of Health and the Water and Sewerage Company. Unless specifically encouraged and convinced to do so, it does not appear that the NHC would vary their modus operandi where selection of technologies is concerned, as long as they operate within the parameters set by the Building Code. This could easily be the same position that other national agencies and private sector agencies hold as there is generally a tendency to stick with the familiar, unless forced to change (UNEP-CEP, 2009).

- The National Conservation Authority (NCA) Act (1999) establishes the National Conservation Authority, whose functions include conserving, protecting, and controlling the development, maintenance of, and access to public areas and beaches. Part III, Section 7 fully details the responsibilities of the Authority. The NCA Act details licensing procedures, offences, and penalties related to actions taken by the Authority and with the approval of the governing Minister. Part VI details the prohibitions on selling and littering at protected areas. This Act is of importance to the coastal zone since there is a close link between residents and the use of marine and coastal resources. Access to these resources, enhancement and maintenance of use of these coastal resources are elements covered by this Act (UNEP-CEP, 2009).

- The Public Health Act (1975) outlines the rights and powers of the Minister of Health in order to promote the public health and well-being of Saint Lucians. According to Section 9, the Minister of Health can make regulations regarding:
    - Prevention, treatment, limitation, and suppression of diseases;
    - Prevention of overcrowding of premises;
    - Maintenance of proper sanitary condition of premises and the prevention, abatement, or removal of unsanitary conditions;
    - Institution of measures for ensuring the purity of the water supply;
    - Sewers and sewage disposal works, as well as the collection, removal, and sanitary disposal of rubbish, night soil, and other offensive matter;
    - Licensing of the relevant business; insect, vermin, and rodent control and elimination;

    - Control of food and drugs sales, quality, and composition;
    - Inspection of hotels, boarding houses, and other places of accommodation;
    - Inspection and sanitary conditions of beaches and swimming pools in the interest of public health.

- The Public Health (Sewage and Disposal of Sewage and Liquid Industrial Waste Works) Regulations (1978) specifically aims to regulate and decrease pollution through liquid waste and sewage in order to protect human health and safety. No sewer fluid or liquid industrial waste may be discharged into any watercourse, river, stream, or any other place without the Public Health Board's permission. The Act provides specific regulations defining the permissible waste disposal systems and mechanisms. This extends to water purification facilities, sewage treatment plants, and sewage systems.

- The Water and Sewerage Act (2004) describes the responsibilities and powers of the Crown and the Minister in controlling and protecting water and gathering grounds (all areas of land where water is collected for the purpose of waterworks). The Water and Sewerage Act provides legislation for investigating, controlling, conserving, and managing water resources for domestic, industrial, commercial, and agricultural purposes. The Act makes provisions as follows:
    - The Minister and the Crown are also entrusted with protecting human and animal health and safety as relates to water matters.
    - The Minister may also declare any area a waste control area if he believes the regulation of waste discharge into or on any land, sewer, or water is necessary to protect water resources.
    - A permit is required for a person to use water or discharge waste in a water control area or a waste control area, respectively. To do so without a permit is a punishable offence. This Act therefore impacts on the availability of sufficient quantity of water of potable quality as per WHO Drinking Water Quality Guidelines.

- The absence of national standards is a weakness. Whereas the Ministry of Health can make reference to the nuisance factors contributing to negative environmental impacts, the absence of standards makes it harder to prosecute such cases. Currently, the Government of Saint Lucia along with the Saint Lucia Bureau of Standards is currently in the process of developing Recreational Water Quality Standards, the define parameters and limits for coastal and riverine waters (UNEP-CEP, 2009)

- There is no legislation requiring generators of wastewater to conduct routine testing and water quality monitoring. The onus is on regulatory authorities to verify through surveillance and monitoring, that generators comply with legally enforceable limits, or

disposed of effluent within limits that did not constitute public health nuisances. The contributing factors to this weakness were largely identified as human resource and technical capacity and budgetary constraints. In some cases, due diligence policies internal to the organization accounted for some monitoring, but this was not legally required and the results could not be submitted to the regulator as an obligation. In St. Lucia, this type of monitoring was largely noted among hotels, who conducted quality checks of drinking water, recreational water (e.g. in swimming pools), treated wastewater and more rarely for coastal water.

Existing Institutional Framework

- There appears to be a multi-stakeholder approach to the management of the environment. Saint Lucia has established a Coordinating Committee to better manage natural resources and communicate on institutional plans and programmes in order to harmonize policies and regulations (UNEP-CEP, 2009b).

- The Coastal Zone Management Unit is the Focal Point for the LBS Protocol, and as such is involved in assisting the country with various actions leading to the minimizing of the negative impacts of land-based sources of pollution to the coast. The Unit attends meetings of the Development Control Authority, the body that reviews all commercial developments on the island. Also, the CZM Unit, through the Sustainable Development and Environment Section is one of the referral agencies that review all EIAs done for proposed developments on the island. The Ministry of Health is responsible for approving the choice of technologies from the perspective of human health and safety; the Water and Sewage Company (WASCO) advises on the capacity of their existing systems or lack thereof; the Ministry of Physical Development and Environment ensures that the wastewater treatment and disposal systems specifications conform to the building code and other planning regulations, but this could all still perpetuate the implementation of systems with indirect negative impacts to the coast. This situation, where the responsibility resides in several government institutions, is not uncommon to many of the other countries of the WCR (UNEP-CEP, 2009).

- In Saint Lucia, although the Ministry of Physical Development and Environment has tried to ensure that as much as possible systems must be in place for dealing with wastewater from domestic and hotel sources, wastewater from commercial sources are likely to enter the environment from the drainage system, untreated. It was frequently cited throughout the data collection process that finances and manpower were the main limiting factors in the control of the discharge of untreated or inadequately treated sewage into the environment.

- The Department of Fisheries and the Ministry of Health, undertake water quality monitoring of coastal areas during the wet and dry seasons. Parameters measured include faecal coliform and enterococci.

- In Saint Lucia, the OECS Building Code used by the National Housing Corporation emphasised the role of the Development Control Authority, WASCO and the Ministry of Health in the approval of the development, construction, implementation and monitoring of wastewater treatment and disposal systems. No mention was made however, of the role of other institutions or bodies such as the Coastal Zone Management Unit. There was also an absence of social and cultural acceptability aspects or inputs, except where such an undertaking formed part of a Social Impact Assessment (SIA) within an EIA, and currently, there is no standard methodology for conducting SIAs. This weakness may also be typical of most of the other regional countries (UNEP-CEP, 2009).

St. Vincent and the Grenadines

Current Issues and Challenges

- St. Vincent and the Grenadines presently has a population of approximately 120,000 persons with the capital, Kingstown, having a resident population of about 15,000 to 16,000 people. Environmental issues affecting health and preventing further degradation of the environment are becoming focal points of attention, as illustrated by the implementation of the OECS Solid Waste project, and the studies for the sewerage treatment project.

- Predominantly throughout St. Vincent and the Grenadines, sewage treatment consists of septic tanks for collection and treatment and soak-away systems for disposal of effluent. This applies to both domestic households and commercial premises such as hotels, etc. As such, sewered areas are basically areas of central Kingstown and a small area in Arnos Vale, not too far from the capital.

- The two major areas of focus in SVG as related to sewage treatment is the area of central Kingstown and its surrounding environs, and the South Coast area of the island which is an extremely densely populated area with several hotels and beaches all in the same locality. The latter is of great concern due to the political and economic thrust to greater developed tourism. The Kingstown area has quantities of waste generated from the several restaurants and other food establishments as would be expected with any other capital city, however, the majority is domestic sewage. Hence, industrial waste is not a concern eliminating the threat of heavy metals.

- The South Coast is separated from the capital Kingstown by the highlands of Cane Garden, having an elevation of approximately 330 ft. Along this coastline, there are a number of beaches bounded by hotels, and the area is also densely populated. Many of these hotels make an attempt to have some form of septic tank and soakaway system but this is problematic due to the proximity to the coastline and resultant high water table level. Instances arise whereby sewage from seepage discharges straight to sea and, in all cases, sullage (grey water) from kitchens and bathrooms is discharged straight to sea through stormwater drains. The result is an extremely heavily stressed environment in this area. Practically all corals have died and bathing water standards are of critical concern. It should also be remembered that the absence of corals negates from nature the ability to regenerate its beaches with sand, which is a concern when one considers tourism.

- Villages, which are located close to streams, often cause pollution to these water courses. Pollution occurs as a result of human activities as many persons use the streams for several

domestic purposes: Washing, cooking, backyard gardening, bathing, the dumping of garbage and the discharge of sewage. Thus, villagers upstream can pollute the water for downstream users. Where these activities take place close to the source of streams and/or water catchment areas the problem assumes quite serious proportions. The real impact of these activities will not only have a negative effect on other villages that use the streams for the same purposes, but may even affect the domestic water supply to the island.

Wastewater Technologies in Use

- As mentioned previously, only the central Kingstown area is sewered. The system consists of 5.8 km of PVC sewers ranging in size from 150 mm (6") to 600 mm (24"). The system was constructed in the early 1970's with provision for future extension to serve an expanded area and other parts at a later date. All sewers feed to a collection tank on the sea front, having a capacity of 54,000 gals. The collection facility is in fair to poor condition and requires extensive refurbishment.

- Collected sewage is disposed via marine disposal, with sewage being pumped out to sea through a 400 mm PVC outfall. This outfall is approximately 1500m (4800 ft) long and is supposed to discharge sewage outside of the Kingstown bay locality and into the sea currents where it does not pose a threat to marine coastal life and man. However, the outfall is in very poor condition and has several cracks and breaks along its length. Hence, sewage is pumped into the sea much closer to the coastline than originally intended, only 300m (100 ft) off the nearest bay.

- Collection and disposal aside, collected sewage is not treated in any manner. Even the comminutor which was at the inlet of the collection tank has not functioned for a long time now and the by-pass arrangement has had to be utilized permanently. This consists of a large grill that is difficult to clean and regularly blocks.

- Recent studies have shown that due to the depth of the outfall at the location of the break and the quantity and duration of the sewage pumping regime, environmental impacts to date have been minimal. This is due mainly to the high dilution factor which is achieved on discharge of the sewage, and the distance of the break from the shoreline is luckily adequate. Usual signs of negative environmental impacts are minimal, e.g. there are very few signs of non biodegradable deposits on Edinboro beach (nearest coastline) and bathing water standards are marginally acceptable as compared to European and EPA standards. Marine life also still appears to be thriving in this area.

Existing Policy Framework

- The Government of St. Vincent and the Grenadines (SVG) acknowledges that the preservation of the environment is necessary for sustainable development, through the effective management and utilisation of scarce resources. During the 1998-2000 period, the draft National Physical Development Plan was completed. This, together with the National Environmental Action Plan, which is currently being updated, is expected to provide the foundation for environmental planning and management. Among the main environmental issues facing St. Vincent and the Grenadines are drainage and lack of adequate toilet facilities especially in the poorer communities, land use planning, reforestation, watershed management and squatter settlement control.

- Since the development of SVG's National Environmental Action Plan (NEAP) in 1994, a stronger emphasis has been placed on the implementation of SVG's environmentally related legislation. Though the NEAP dealt with broader issues of sustainable development, such as urban planning, pollution, and some issues relating to renewable natural resources, tourism, and biodiversity conservation, the analysis of environmental issues undertaken by the NEAP processes greatly facilitated the biodiversity planning process by identifying gaps and opportunities for specific biodiversity conservation interventions.

- The St. Vincent & the Grenadines National Environmental Management Strategy (NEMS) and Action Plan (2004 – 2006) was developed as part of the Government's requirement in discharge of its obligations under the St George's Declaration (SGD) of Principles for Environmental Sustainability in the OECS, 2001 (Homer and Shim, 2004). The NEMS is intended to guide programmes in environmental management over the long term and is The NEMS is structured around the major principles contained in the St George's Declaration of Principles for Environmental Sustainability in the OECS, including one related to wastewater management: Prevent and Control Pollution and Manage Waste. However, while the NEMS includes a strategy for identification, adoption and enforcement of effluent and emission standards and guidelines, there is no specific focus on sanitation and wastewater management.

Existing Legislative Framework

- St. Vincent and the Grenadines does not possess comprehensive wastewater legislation.

- The Central Water and Sewerage Authority Act, 1992 (section 21) authorises the Minister to set aside protected areas for the protection of water resources related to water supply needs. The Minister may where he considers it necessary regulate activities within such an

area. Private agricultural lands near catchments might be regulated by the Central Water and Sewerage Authority Act (1992) under its power to ensure that activities near water supplies are undertaken in a manner that will not harm water supplies. Such authority might be exercised either by declaring an area a protected area (Section 20) or through the general power to advise the Minister to preserve and conserve water resources in the country (Section 8).

- The Central Water and Sewerage Authority Act (1992) could be more specifically used to protect forest areas that are critical as catchments for maintaining water supplies. Powers include the power to investigate water resources of St. Vincent and to advise and make recommendations to the Minister relating to the improvement, preservation, conservation, utilization, and apportionment of those resources and the provision of additional water supplies. This section could be interpreted to include the necessary measures to protect land that is providing those water supplies, as well as the source or course of any body of water used for water supplies. The Authority's power is not restricted to public lands.

- The Central Water and Sewerage Authority Act establishes a legal framework for the conservation, control, apportionment and use of water resources in St. Vincent and the Grenadines. The Act establishes the Central Water and Sewerage Authority whose duty includes investigating the water resources, formulating proposals for meeting existing and future water supply.

- There are plans to prepare Guidelines and Standards for Environmental Impact Studies, as well as to develop regulations for the various Acts, which relate to environmental management.

Existing Institutional Framework

- The Ministry of Health and the Environment was formed in 1989. The Ministry comprises the public health services transferred from the former Ministry of Health. The responsibilities of this ministry are not clearly defined, except Maintenance of environmental health with respect to the provision of policy advice on health-related matters. However, within the Ministry's Public Health Department, public health responsibilities are carried out under two broad divisions: Environmental Health and Community Health. A Central Board of Health was established under the Public Health Act (No. 9, 1977), but it has not been functional since 1979. The Department coordinates some of its responsibilities with the Central Water and Sewerage Authority which monitors drinking water supplies and notifies the Public Health Department when levels of bacterial contamination are excessively high.

- The Environmental Unit of this ministry has subsequently been established in order to advise the Minister on environmental management and conservation matters. The unit is currently headed by an Environmental Officer, and also employs a Resource Analyst, and a Secretary. The Unit was envisaged from its inception to have expanded into the role of an environmental monitoring/regulatory agency in addition to facilitating public education and awareness on environmental issues and initiatives, as well as enhancing its project execution capacity. The St. Vincent and the Grenadines National Biodiversity Strategy and Action Plan (NBSAP) (2000) proposes staffing in order for the unit to effectively carry out these additional functions include: an Environmental Chemist, Environmental Engineer/Planner, legal Specialist, and a Sociologist trained in Education/Public Relations. However, these additional appointments are pending approval by the SVG Cabinet.

- The National Environmental Advisory Board falls under the Environmental Unit of the Ministry of Health and Environment. The primary mandate of the Board is to advise the government on the implementation of the SVG NEAP. The Board is chaired by the Chief Environmental Officer of the Environmental Unit, and also seeks to provide advice to the minister on all environmentally related matters, which also include biodiversity conservation/management concerns. The Board consists of eleven members who serve on a voluntary basis, and represent several sectors including the Environmental Unit, Ministry of Communications & Works, Community Development, Legal Department, Planning Division, Environmental Health Department and NGO representation.

- The Central Water and Sewerage Authority was established by legislation of the same title in 1978 (Central Water and Sewerage Authority Act, No. 6, 1978) and is governed by an inter-ministerial Board. The Authority was given broad powers to provide for the conservation, control, apportionment, and use of water resources. A laboratory for the monitoring of drinking water quality at public production facilities is maintained by Authority. Lausche (1986) had pointed out earlier that while the 1978 Act gave the Authority power to make regulations in such areas as water pollution control, soil conservation, and water quality regulation, such regulations had never been enacted. The NBSAP (2000) proposed legislation that would expand the powers of the CWSA and mandate that the Authority prepare a national water resources development plan; construct and operate sewerage works; regulate private sewers, septic tanks and latrines; regulate commercial and industrial treatment of effluents; establish “protected zones” around water supplies; and impose substantial penalties for violations of anti-pollution laws.

Suriname

Current Issues and Challenges

- The kinds of wastewater which are produced in the city are: rain water run-off that is contaminated through contact with the surface; domestic waste water, industrial waste water, wastewater from hospitals and mortuaries. For the city of Paramaribo the Ministry of Public Works is responsible for the collection and discharge of household waste as well as the discharge of rain/storm water. Since both types of water run through the same (combined) system of open canals and pipes, operation and maintenance influence its effectiveness to the protection of public health. Discharge of rain water and sewage of the city occurs mainly on the Suriname River (CEPIS et al, 1998).

- Wastewater from the city of Paramaribo drains indirectly to the river through the Saramacca canal. There, main sewers are laid in a South-North direction and convey the water on the Saramacca canal. Drainage via the Saramacca canal is problematic since this water is not only used for drainage but also serves as a water transport route. Part of northern Paramaribo is drained directly on the Atlantic Ocean through pumping stations (CEPIS et al, 1998).

- Greater Paramaribo has a population of approximately 294,000. The area of Greater Paramaribo is served by 25 sluices and/ or pumping stations. Part of the domestic sewage (faeces and urine) is treated in septic tanks. The effluent of the septic tanks is collected in the street sewer. According to Bureau of Public Health and the Pan American Health Organization (PAHO), 86 percent of the houses have a septic tank. The remaining 14 percent have pit latrines. The remaining portion of the domestic sewage, sullage, resulting from personal washing, laundry and from the kitchen enters the street sewer untreated (CEPIS et al, 1998).

- The occurrence of flooding and inundation in Paramaribo and other places in the coastal plain is common, and is mostly a problem in urban areas than in rural areas.

- The building code for Paramaribo recommends a standard septic tank/ filter bed design for all buildings. In general, it has been shown that where design specifications are followed, the level of treatment is satisfactory in the removal of solid matter and floating material and stabilization of organic waste including pathogenic organisms. However, some defects can be noted in the design and the operation of this treatment system: the joints may leak giving chance of contamination soil. It is suspected that due to lack of surveillance sometimes no septic tank bottom and no filter bed are applied. The Bureau of Public Health

has no control on the construction and functioning of the septic tanks. The filter bed drains on the public sewer or ditch. During heavy rain the water may back up. Thus the rainwater can be contaminated with wastewater which has received little or no treatment (CEPIS et al, 1998).

- Both the septic tanks and the pit latrines are emptied periodically at the home owner's expense by private owned suction tank trucks. This trucks discharge their content in to the Suriname River. Due to the fact that the location of the discharge is close to the city public slaughter house and next to the flour mill, this practice creates health hazards. There is neither data on the quantity that is being discharged daily nor on its composition. Moreover continuation of this practice may endanger the export of meat and fishery products from the country.

- Oostburg (1993) in a book about the freshwater ecosystems of Suriname, mentioned the water-related diseases in the country, which are caused by organisms that can survive in water and are ingested when sewage-contaminated water is drunk (CEPIS et al, 1998). Some examples of water-borne diseases are:
    - Dysentery caused by Shiguela;
    - Acute diaorrhea that can be caused by Rotavirus, Giardia lambia, Escherichia coli, Campylobacter and others;
    - Typhoid fever and leptospirosis.
    - In 1991, one case of cholera occurred in the country.
    - Some parasitic helminths spend part of their lifecycle in intermediate host organisms that live in fresh water. Humans can be infected when in contact with this water, the best example is schistosomiasis.

- Many of the diseases indicated above may also be transmitted through contaminated food, hands contaminated with feacal matter, and via some helminthic worm infections, directly through the skin. They are mostly related to poor sanitation conditions. The incidence of infectious diseases is associated with deficiencies in the water supply and sanitation services.

- Lack of safe water in some areas, particularly in the interior, deprives the population of the necessary hygiene conditions needed to maintain good health. On the coastal areas, the contamination of piped water during its distribution is putting the health of the population at risk. In some poor urban areas with lack of sanitation, the spread of water-borne diseases is common during the rainy season (CEPIS et al, 1998).

- Some of the issues regarding wastewater which are affecting the country are as follows:
    - An integrated approach towards water, sanitation and hygiene is lacking;

- There are few laws or policies governing wastewater management;
- The public health sector is not involved in the introduction of water distribution services in villages in the interior of Suriname;
- There is no systematic sanitary and environmental education in the country. In addition, health education and also education about handling and maintenance at the distribution site is not linked to the installation of systems;
- The existing environmental health surveillance systems is inadequate; and
- Project design in the water and sanitation sector is taking place in a predominantly technical, more or less, blueprint mode which is not an effective tool for encouraging participation of communities;
- Lack of proper sanitary behaviour is a more fundamental problem than the availability of facilities in the Hinterlands. There is not enough understanding about the complex interaction of cultural and other factors that influence this behaviour.

Wastewater Technologies in Use

- Greater Paramaribo has 25 sluices and pumping stations. Some of the pumping stations are in very poor condition. The sewer system is badly in need of rehabilitation, as it is doubtful whether the sewer operates well. In many, the pipes have collapsed; the house connections are often badly constructed. In addition, because of the fact that most of the sidewalks are not paved, heavy rain carries sand into the system clogging sewers and catch pit gullies. Clogging also occurs due to solid waste. It is also observed that illegal discharge of waste oils into the sewerage takes place. Covers of catch pit gullies are often missing, increasing the chances of clogging (CEPIS et al, 1998).

- Paramaribo had three plants where the sewage was treated before the effluent went into the open water. The first is an activated sludge plant operated by the bauxite company Suralco at the so called Suralco Village ("Via Bella"), which serves not more than fifty houses. The operation gives satisfactory results. At the second plant are the lagoons that collect the wastewater of the inmates of the prison Santo Boma. According to a report from the Hydraulics Research Division of the Ministry of Public Works, lack of maintenance and other forms of neglect have negatively influenced the performance of this system. The third location was the oxidation ditch at the area of Half Flora. This aeration ditch was meant to purify the sewage before it entered the Saramacca canal. The system failed and has been replaced with a septic tank at each house (CEPIS et al, 1998).

- The problems inherent to Paramaribo are representative of those found in the rest of the coastal area, especially Nieuw Nickerie, Moengo and Albina.

- Nieuw Nickerie, with a population of 15,000 is the second largest city in the country. Just as in Paramaribo, the storm water system is used to dispose of sullage and flush toilet

effluents. Sullage is not treated, but the flush toilet effluent passes through a septic tank system before discharge into open water. This system is inadequate because of insufficient hydraulic capacity of the canals and sluices. Therefore, during rainstorms a mixture of sewage stays on the streets and on the yards, causing health hazards (CEPIS et al, 1998).

- In the rural areas these areas, mostly pit latrines are encountered and only a few houses are equipped with septic tanks.

- The rural city of Moengo was a company town of Suralco with a good sewage system. Suralco is gradually handling over its facilities to the government. The wastewater is treated in lagoons. Many of the Moengo houses are no longer in use by workers of Suralco, but are occupied by Maroons who fled the internal war. The system now is badly clogged, because of misuse.

- The Hinterland includes remote locations such as the Brokopondo area; the Upper-Suriname area; Upper- Marowijne, Lawa and Tapanahony River; and scattered villages of Amerindians and Maroons in the Sipaliwini district.

- The Brokopondo area comprises of Maroons who were transmigrated from the Brokopondo lake area in the 1960s. The new villages are, by layout, less traditional. For this reason the acceptance of a western live style is relatively easy in this village. For instance in Brownsweg there is a growing dependence on tap water even in the houses themselves, while sanitation such as flush toilets and septic tanks are gradually being introduced. The latter mainly takes place in Klaaskreek.

- Though some of the villages of the Upper-Suriname area show more traditional Maroon aspects. The villages and the layout are traditional. The area is densely populated. This constitutes a problem in the dry season with the occurrence of waterborne diseases. In particular, the high incidence of childhood mortality can be related to poor sanitary conditions, such as lack of drinking water and lack of sanitation.

- The University of Suriname is currently conducting studies on artificial wetlands for domestic wastewater treatment.

Existing Policy Framework

- The long-term national development plan indicates the importance of the environment but wastewater management is not prioritized in it.

- A National Health Policy report covering the period 1997-2001 was prepared by the Ministry of Health along with the Health Sector Reform Plan. Both documents highlight the importance of improving health and water delivery services for the population of Suriname in order to effectively improve health and delivery services.

- The 2015 Sewage Masterplan for the area of Greater Paramaribo was financed by the Government of The Netherlands. The plan provided an assessment of the functioning of the sewerage system, and made suggestions for improvement and water quality. Recommendations for addressing the institutional aspects.

Existing Legislative Framework

- The Constitution of the Republic of Suriname provides for a legal basis for a national environmental policy. Article 6g states that the social objective of the State is directed towards the creation and stimulation of conditions necessary for the protection of nature and the maintenance of ecological balance (NIMOS, nd). Regarding sanitation, Article 36 states: "Everyone has the right to health. The State shall promote general health-care by a systematic improvement of living and working conditions and shall give guidance on the protection of health."

- The Government has a draft Environmental Law and Environmental Impact Assessment (EIA) law and guidelines and has drafted wastewater management legislation for groundwater.

- However, in Suriname there exists no specific legislation to regulate the overall water supply and sanitation sector. As far as wastewater is concerned, there are even less legal tools to regulate this sub-sector. There are inadequate provisions for the assignment of the responsible authorities, rules regarding the discharge of domestic and industrial wastewater into the sewerage, tariffs, etc.

- The Water Supply Law (Waterleidingbesluit GB 1938 no.33.) obliges owners of buildings and houses to make use of the public water supply system. It also forbids the possession of water tanks and wells in the areas where the law is applicable. However, even though groundwater is the main source of water for the country, there are currently no laws for its protection; and there is an absence of laws for preventing the discharge of wastewater (industrial or otherwise) into surface waters, including rivers.

- Suriname lacks technical standards for wastewater discharge and effluent limitations.

- The Concession Law (Concessiewet GB 1907 no.34 geldende tekst 1944 no.129.) has rules concerning the exploitation of the public utilities. The Suriname Water Company (SWM) operates as a concessionaire according to this law. However this concession expired in 1982.

- Private companies providing water supply and sanitation in villages are only meeting the requirements of the Drilling Law. The companies do not have concessions for the use of water. The current laws do not include technical standards so most of them do not fulfill the water quality requirements.

- The Harbour Decree (Decreet Havenwezen SB 1981 no. 86) forbids the discharge of waste (solid waste, oil waste) into the rivers.

- The Anchylostomiasis Law governs the protection of water wells against contamination from anchylostomiasis (Anchylostoomwet GB 1917 no. 83, geldende tekst GB 1937 No. 23). This Act forbids the use of faeces as fertilizer and protects wells against contamination with faeces. Regulations are given on the distance to build latrines, stables, cow sheds and folds. The law gives instructions on water well sites. The Anchylostomiasis law are not applicable in the whole country.

- All the applicable laws in relation to the sector have the rank of Act of Parliament. The responsibilities, however, are assigned to several ministries. That makes the enforcement very difficult. But even when an infringement is detected and punished, the very low fines do not deter. To be more effective and efficient in managing the whole water supply and sanitation sector in the country there is a need for clear legislation.

- There is no legislation that comprehensively regulates the water supply and sanitation sector as a whole. All the applicable laws in relation to the sector (responsibilities) are assigned to several ministries that make the enforcement very difficult. The existing legislation regarding the health and environmental issues of the water supply and sanitation sector is vague and more than 50 years old.

- The Ministries that are legally involved in health and environment are: Ministry of Labour Technological Development and Environment; Ministry of Public Health; Ministry of Regional Development; Ministry of Planning and Development; Ministry of Agriculture, Fisheries and Animal Husbandry; Ministry of Natural Resources; Ministry of Finance; and Ministry of Education.

- The Ministry of Public Health should be responsible for the evaluation and the revision of the legislation for the health issues since there is no adequate legal base for the National Institute for Environment and Development (NIMOS), and the different Ministries are still individually responsible for the protection of the environment.

- The Fisheries Act governs certain aspects of the marine environment.

- Suriname has a pesticide law, but the law and the institutions for pesticide monitoring and control are not operational (Monsels-Thompson, nd). There is therefore no control of the use of pesticides which are harmful to human health, and also to the estuary fishing activities, to aquaculture and vulnerable ecosystems and species in the estuarine area.

Existing Institutional Framework

- The National Council for the Environment (Nationale Milieuraad, NMR) was established as a policy en advisory body to the President. The Council, which was installed by Presidential Order in 1997, has the mandate to support the Government of the Republic of Suriname by means of advice concerning the preparation and oversight of implementation of environmental policy at the national level (NIMOS, nd). The regulations for the Council states that it will consist of 10 members who are appointed by the President of the Republic of Suriname: five experts who are nominated by the government, plus representatives from the trade and industry, labour unions, indigenous- and Maroon communities and consumer organizations.

- In 1998 the National Institute for Environment and Development in Suriname (Nationaal Instituut voor Milieu & Ontiwikkeling in Suriname, NIMOS) was established as the executing agency of the NMR. The NIMOS is a foundation with the following objectives:
    - To realize national environmental legislation in the widest sense;
    - To prepare and realize regulations with regard to protection of the environment;
    - To coordinate and supervise the observance of those regulations.

- The establishment of NIMOS notwithstanding, the following may be highlighted as deficiencies in the institutional framework for wastewater management in Suriname:
    - The actual management responsibility is shared by various institutions – however there is lack of or poor consultation between these institutions;
    - The institutions linked to the sector lack the necessary financial and other means (cleansing equipment and the like, and even the most elementary office supplies) – there is no certified lab;
    - The lack of sufficient qualified personnel, as a result of lack of motivation and from the low salaries; and

- The lack of a clear legislative and regulatory scope within which the activities have to be carried out.

- Experience has shown that an authority which is in charge of maintaining and managing the drainage of an urbanized area like Greater Paramaribo, needs to be independent to a great extent. In Paramaribo this authority does not exist, and as already mentioned those duties are assigned to the Ministry of Public Works

- The Government Decree (Besluit Taakomschrijving Departmenten 1991 SB 1991 no. 58) concerning the division of responsibilities of the Ministries, establishes that the entities responsible for sanitation are: the Ministry of Public Works, Sewerage and Drainage Division, and the Ministry of Public Health, through the Environment Control Division of the Bureau of Public Health.

- The responsibilities for the sewage management and wastewater disposal are shared by the Sewer and Drain Division of the Ministry of Public Works and the Environmental Control Division of the Bureau of Public Health of the Ministry of Health. The Ministry of Regional Development provides logistic support.

- The Ministry of Public Works is in charge of sewage and waste collection and disposal activities in the capital. It is also responsible for the hydrological aspects of the country including the water cycle and measurements of water quality and river characteristics, which are carried out by its Hydraulic Research Division. The Ministry is also responsible for the policy, planning and development of general provisions for civil engineering and infrastructure; the preparation, execution and maintenance of civil engineering works, excluding secondary and tertiary civil works located in the interior; city planning and development (in cooperation with other relevant ministries) involved; and research regarding the construction industry, and inspecting whether construction rules and regulations are complied with.

- The responsibility of the Ministry of Health is environmental health management including the testing of the quality of water for human consumption and the disposal of waste. The Ministry is in the process of setting standards for water quality as they relate to human health. This Ministry is also responsible for: public health in the broadest sense and the supervision regarding the promotion of public health in particular, including health extension and education; the prevention of contagious diseases via marine and air traffic; the inspection of food as well as the preparation and sale thereof; optimal external living conditions, as well as inspecting whether legal regulations with respect to these conditions are complied with; environmental hygiene such as sanitary inspection, hygienic conditions in

business establishments, inspection of and assistance with respect to the disposal of pharmaceutical, clinical and industrial waste; this should be done in cooperation with other institutions involved. The Bureau of Public Health is in charge of monitoring water quality.

- There are a number of international and indigenous nongovernmental organizations (NGOs) working in Suriname on matters related to the environment and public health, including water supply and sanitation. The local NGOs are important in facilitating the expression of community views and promoting grassroots participation. They have been involved in small-scale projects in villages. In indigenous and Maroon villages water supply projects have been implemented with funding from NGOs. The "NGO Forum" has assisted project planning and implementation.

- The private sector is involved in the management of water supply systems in Suriname. The Palm Oil Company of Pattamacca, the Banana Company Surland, the Rice Company SML, the Suriname Aluminum Company (Suralco) and Billiton of Onverdacht are managing the drinking water supply systems for the villages of Pattamacca, Jarikaba, Wageningen, Paranam, and Onverdacht. All of the above mentioned private companies have provided housing, water supply and sanitation in the corresponding villages. Services of cleaning septic tanks and latrines in Paramaribo are taken care of by the private sector.

- Most of the institutions of the Water Supply and Sanitation Sector in Suriname are weak. They are affected by lack of the necessary financial means, lack of sufficient qualified personnel and clear legislative direction. Most of them offer services which are not self-sustaining.

- The current limitation of financial resources is a major constraint for the future development of the Water Supply and Sanitation Sector. This situation is linked to the economic difficulties of the country. At present, there is limited financing and limited government financial resource allocation to the sector due to the fact that wastewater is not yet recognised as one of the main sources of water pollution.

- Structural and institutional factors have hindered planning in the whole water supply and sanitation sector. Responsibilities for the management of the services are fragmented across several institutions and departments because of lack of coordination. The effect is that there are some functions and responsibilities that are duplicated, while others are neither assigned nor assumed.

- The sector needs a strong and effective coordination and cooperation between the main government institutions of the water supply and sanitation services (the Ministry of Labour

Technological Development and Environment, SWM, Ministry of Natural Resources, Ministry of Public Works, Ministry of Regional Development and Ministry of Health.)

Trinidad and Tobago

Current Issues and Challenges

- Pollution of the country's rivers comes from inadequately treated effluent from sewage treatment plants and the widespread utilisation of on-lot septic tanks, soakaways, and pit latrines as well as from a wide range of agricultural, animal husbandry, and urban land use activities. Use of chemical pesticides in agricultural lands has increased, resulting in an increased pollution load. Also there has been an increase in thermal pollution in addition to nutrient pollution. This reveals the need for the development of regulatory and monitoring mechanisms to control the discharge of trade effluents in to the public sewers.

- In 1999 only approximately 28 percent of domestic sewage generated in the country was processed in treatment plants (WASA, 1999), the waste of the remaining households being directly or indirectly discharged to surface waters. The Population and Housing Census 2000 indicates that 50 percent of households utilised septic tanks and soak-away systems to dispose of their domestic sewage, while 27 percent utilised pit latrines, and only 22 percent enjoyed disposal to a sewer system.

- Sewage is handled by aging wastewater infrastructure that is below required capacity and upgrading infrastructure and introduction of new technology is slow. Proper operation and maintenance of treatment plants is often lacking. There has been an increase in the number of private wastewater treatments plants that are not supervised by state agency, many of which are dysfunctional (UNEP-CEP, 2009b). It is important for legal issues involved in taking control of private sewage treatment plants to be addressed.

- Industrial estates have been created as new industries begin operation, resulting in an increase of industrial wastewater production. This is compounded by little regard by private sector industries for proper management of wastewater and unwillingness by the private sector to pay for appropriate treatment

- Increased hillside development has led to increased stormwater run-off and flash flooding in capital city.

- The wastewater sector is constrained by inadequate funding and financial resources. There is the need for implementation of appropriate wastewater/sewerage tariff for public (WASA) and private wastewater systems. Recognising this, the Government has undertaken a review

of wastewater/sewerage tariffs to appropriate levels with respect to domestic wastewater discharges and trade effluent discharges.

- Sewage is routinely found in river water samples taken in any of the developed areas. The CRB Research Project 2004-2005 revealed the presence, in all of the rivers monitored, of bacteria at levels exceeding environmental limits for domestic, agricultural, and recreational purposes. Several stations sampled showed total and faecal coliform levels in excess of the WHO (drinking water criteria); Canadian (agricultural, irrigation); Canadian (recreational, contact); and USEPA – 500 (total).

- Other studies indicate the presence of sewage-associated bacteria in several areas of the coast in both Trinidad and Tobago, in some instances at levels sufficiently high to indicate a hazard to human health through the transmission of gastro-intestinal illnesses and dermatological infections. Sources of contamination include run-off from improperly constructed pit latrines and septic tanks, effluent discharged from hotels, campers and villagers releasing untreated body wastes in to rivers, effluent from poorly- or non-functioning treatment plants; untreated waste from yachts, run-off from pig farms (EMA/CARIRI, 1997; Akili and James, undated; IMA, 1992 (b); IMA, 2005; TIDCO, 2003) Seafood marketability is affected, as the risk of contracting typhoid and cholera from consuming shellfish contaminated from contact with sewage is well documented and has, in the past, led to bans on the harvesting of shellfish in certain areas. Sewage pollution of Great Courland Bay was considered to be significant given that the bay is an important nursery area for commercial species of fish, nesting site for turtles, and feeding area for avifauna) (IMA, 1994).

- A 2001 study of water quality and benthic biota at fringing coral reefs in Tobago found that recent increases in local nutrient pollution, particularly from sewage, had served to push Tobago's coral reefs over the threshold indicative of eutrophication on Caribbean coral reefs (La Pointe, 2007).

- One of the contributing factors to the contamination of water sources is that there is a general lack of awareness of the link between environmental degradation and health issues.

- From 1965 to the present, the focus of the Water and Sewerage Authority (WASA) was mainly on expanding the potable water supply to meet the increasing demands of both domestic and industrial consumers, as attested to by the fact that approximately 95% of the country has access to a potable water supply, but less than 25% of the country has access to

centralized sewerage systems. Only 6% of the annual budget for wastewater and water production is allocated specifically for wastewater treatment.

Wastewater Technologies in Use

- The Water and Sewerage Authority (WASA) owns and operates twelve (12) systems, while about twenty- four (24) fall under the jurisdiction of the Ministry of Housing and Settlements, its agencies and the Urban Development Company of Trinidad and Tobago. There are over one hundred and fifty (150) others which are privately owned. Only those persons who are connected to the systems owned by WASA pay wastewater rates. While the Government-owned systems were maintained to some level of functionality, the privately owned ones, especially those in housing developments, are poorly maintained and almost all are in a state of disrepair.

- There are four central sewered areas in Trinidad – the cities of Port of Spain and San Fernando, the Borough of Arima, and Tucker Valley east of Point Gourde. In Tobago, only 12 percent of the population was at that time serviced by sewerage treatment facilities. The four urban centres at Port of Spain, San Fernando, Arima and Scarborough account for the majority (95 percent) of the wastewater generated within the public systems, while the remaining eight smaller systems account for a mere 5 percent of the total wastewater treated.

- There are a number of package sewage treatment plants servicing institutional facilities, large housing developments, hotels, and industrial estates. Most of these are, however, either poorly maintained or altogether non-functional, and dispose effluent directly or indirectly into inshore coastal waters.

- There are approximately 158 other non-WASA plants; 56 wastewater treatment plants in housing developments; 55 in various institutions owned by the government (incl. schools), 18 at industrial/commercial sites and 9 at various hotels. In addition to these treatment facilities, there are also approximately 20 associated lift stations.

- Most non-WASA installations, especially those owned by private housing developers are in an advanced state of deterioration, offering little or no treatment and some have even been abandoned by their owners (developers) leaving the residents the responsibility for the operation and maintenance of their wastewater treatment plants. Less than five of those developments actually have a regular maintenance programme in place. Numerous

complaints have been received from residents and Resident Associations about raw sewage overflowing in the roads and backing up in their homes.

- One of the more neglected areas in wastewater management is in the field of onsite wastewater treatment and disposal. Even though the design and use of advanced onsite systems has taken place in other countries, the systems still being constructed in Trinidad and Tobago are of designs several decades old.

- Effluent from the Beetham treatment plant, which was described as being "hydraulically and organically overloaded and….poorly maintained and operated" prior to 2005 (WASA, 2006), is discharged to the Caroni River. The multi-million dollar new treatment plant was completed in April 2004 and treats approximately 20 million gallons of wastewater a day. The domestic stream of the new plant has improved the quality of the effluent and alleviated the problem of contamination in the service area. It is intended that treated wastewater from the facility be reused for industrial cooling purposes at the Point Lisas, La Brea, and Point Fortin Industrial Estates, once this can be arranged without adverse environmental impact upon the Caroni Swamp ecosystem. There are no disinfection facilities at either the other three plants. The Pt. Gourde facility provides only primary treatment and discharges effluent generated from the Chaguaramas area into the Gulf from an Imhoff tank.

- Since WASA was incorporated in 1965, growth within the public sewerage sector has been realized primarily through the adoption of seven (7) small private systems. Currently the Authority owns and operates 12 wastewater systems - comprising 12 treatment plants and 22 pumping stations. These systems serve a population of approximately 250,000.

- Over the years the collection systems, pumping stations and treatment plants have deteriorated to such levels that major refurbishment works are required to restore satisfactory performance and reliability to these systems. Current budget allocations do not support improvement works in the sewage sector since the concentration of efforts has traditionally been in the production of potable water to meet consumer demands.

- Considerable housing and industrial development has taken place over the last two decades and is continuing to take place in many areas of the country irrespective of the fact that the expansion of the existing network of centralized sewerage systems has not kept pace with this development. Developers therefore have been required to construct, operate and maintain their own private wastewater systems and this has resulted in the proliferation of numerous small private wastewater systems all over the country. This is clearly evidenced by the fact that the estimated 150-odd private systems (including those operated by state

agencies such as the National Housing Authority) serve a mere 10 percent of the population of the country.

- A number of initiatives are currently being pursued by the government in an attempt to improve system performance. These include:
    - Water Supply and Sewerage Rehabilitation Projects (WSSRP) - Programme for the complete refurbishment of 9 treatment plants and 21 pumping stations operated by WASA. Funding provided by the World Bank and the European Investment Bank
    - Greater Port of Spain Sewerage System Study (GPOSSSS) - A study to evaluate the Greater Port of Spain Sewerage System. Funded by the Caribbean Development Bank
    - A study funded by the Tobago House of Assembly and valued at $0.5m, aimed at developing proposals for the integration of the Signal Hill sewerage system into the existing Scarborough sewerage system
    - Proposals to improve the existing wastewater systems within the South-West region of Tobago have been submitted by the Trinidad and Tobago Water Services (TTWS) on behalf WASA

- The $1.2 billion Water Sector Modernisation Programme includes the refurbishment, upgrade and integration of 43 wastewater treatment plants.

Existing Policy Framework

- It has been recognized that the provision of water generates the production of sewage. With this in mind, the Government has also been actively preparing for the next stage in the development of the Water and Sewerage Sector to deal with issues relating to the maintenance and expansion of the existing sewerage system, constructing and developing new sewage works, adopting and rationalizing private sewage systems, and establishing the legal framework for control and monitoring of all wastewater systems in the future. The Environmental Management Authority has been appointed by Government to establish and implement a Pollution Control and Monitoring Programme to ensure compliance by all owners and operators of wastewater treatment facilities.

- The Vision 2020 National Strategic Plan, 2005 presents the national strategy to guide the country to 'developed nation' status by the year 2020, and was prepared by the Vision 2020 Multi-sectoral Core Group through a process that involved extensive consultation with stakeholders in the national community. The Plan identifies among environmental issues to be addressed, pollution from non-functioning sewerage treatment plants, industrial effluents, and oil spills; Indifferent attitudes and values toward the environment; and Failure

to implement or enforce important environmental and natural resource management legislation.

- To address these issues the Plan points to the need to "apply a new set of values to the treatment of our environment"… a new "environmental consciousness", and the modification of human behaviour toward the environment through public awareness, education and regulation at all levels, and founded upon a number of tenets including:
    - Respect and care for the full ecosystem;
    - Conservation of the vitality and diversity of the natural environment;
    - Changing personal attitudes and practices to manage the environment; and
    - Empowering communities to care for their environment.

- As part of the implementation of Vision 2020, Trinidad & Tobago developed the Water and Wastewater Master Plan for Trinidad and Tobago to 2035 that will provide a framework for the comprehensive rehabilitation, reconstruction and extension of the country's water and wastewater infrastructure. The master plan will result in the transformation of the water and wastewater sector so that by the year 2014, 98 percent of the population would have a 24-hour continuous supply of water and at least 75 percent of households and other such entities would be connected to the central sewerage system by the year 2020.

- The National Environmental Policy 2005 was prepared by the Environmental Management Authority in accordance with section 18 (1) of the Environmental Management Act. The goal of the policy is "environmentally sustainable development, meaning the balance of economic growth with environmentally sound practices in order to enhance the quality of life and meet the needs of present and future generations". The basic principles on which the policy is based include respect and care for the community of life, and empowering communities to care for their own environments. The Policy proposes the application of the 'Polluter Pays' and 'Precautionary' principles, and recommends that growth be kept within the carrying capacity of the country. Proposals relating to forest policy include the offer of incentives to landowners, and the involvement of CBOs in forestry conservation and reforestation. The Policy aims at the conservation of wetlands, and proposes beverage container deposit/refund schemes. The Environmental Management Act mandates the EMA and all governmental entities to conduct their operations and programmes in accordance with the NEP.

- The National Water Resources Management Policy, 2003, is the policy to guide the management of water resources in the country and was prepared with the support of the IDB for the Water Resources Management Unit, Ministry of Public Utilities and Environment (MPUE). Relevant policy goals and objectives include the restoration of wetlands and coastal

areas to "…maintain healthy ecosystems; and the integration of the management and development of watersheds and coastal areas". The policy incorporates basic principles to guide water resources management are, inter alia:

  - Treating the river basin as "the basic unit for water resource management, with … effort to maintain and restore ecosystem functioning within catchments and the coastal and marine ecosystems with which they are connected";
  - The 'Polluter Pays' Principle; and
  - The 'Precautionary' Principle.

- With respect to policy implementation it is proposed that planning be conducted, wherever practicable, on a watershed basis. Relevant proposals for Watershed Management include measures to address non-point sources of pollution including agricultural runoff, and effluent from septic systems and other sources, such as best management paractices designed to reduce the generation of pollutants.

- The Coastal Zone Management Policy commits the country to pursuing an integrated coastal zone management programme with emphasis being placed on integrating watershed and coastal zone management. A national coastal zone management plan that designates uses for various coastal areas will be developed and implemented. The Plan will promote the sustainable utilisation of the coastal zone by implementing policies that ensure a sustainable balance between environmental protection and economic development.

- The operation and maintenance of private sewage systems has remained the responsibility of the respective owners and the recently concluded Adoption Strategy Study, occasioned by the Government and conducted by a joint GORTT/WASA/TTWS Team, is targeted to address the rationalization, adoption, maintenance and expansion of these systems.

- Until this Strategy is implemented, the private owner/operator remains responsible for the operation and maintenance of the private wastewater system within the constraints of the Public Health Ordinance, Water and Sewerage Act, Environmental Management Act, and other relevant legislation.

- The Government is exploring an interim provision for private owner of wastewater systems to charge sewerage rates from the residents/users of these facilities once the owner efficiently operate and maintain the wastewater system and meet the effluent discharge conditions set by the EMA.

- The discharge of high-strength waste into the public sewers is a matter of concern to the Government and one which is to be addressed by the development of appropriate

regulatory procedures, wastewater tariffs for trade effluent, as well as monitoring and control systems to manage this aspect of the WASA's operations.

- Sewerage tariffs in Trinidad and Tobago are low both in absolute terms and relative to water supply charges. In Trinidad and Tobago, the sewerage tariff is only 50 percent or half of the water supply tariff. The rates charged for sewerage services are a poor reflection of the cost of providing those services. A revised tariff structure, which is directly related to the true costs of sewerage and sewage disposal services, is needed as the cover the initial costs to provide infrastructure for new sewerage systems or expand/up-grade the existing sewerage systems and treatment plants; and to provide a source of continuing funding (revenue) for the operation and maintenance of the various sewerage systems. The Government is currently conducting a review of wastewater/sewerage tariffs to appropriate levels with respect to domestic wastewater discharges (tariffs should be at least equal to that of water), and trade effluent discharges.

- The National Policy and Programmes on Wetland Conservation was developed in 2002 as part of the country's commitment as a Contracting Party to the Convention on Wetlands. The policy provides a rational framework through which the wise use of the country's wetlands can be achieved (National Wetlands Committee, 2002). The goals of policies concerning wastewater management are will support the goals of this policy as the wetlands and swamps are prime areas that are contaminated by improperly treated sewage.

- There is a draft Forestry Plan which includes reforestation of watersheds.

- The Institute for Marine Affairs prepared a National Plan of Action for the LBS Protocol. The Local Plan of Action is to be implemented in 2010 (UNEP).

Existing Legislative Framework

- The Municipal Corporation Act of 1990, the Public Health Ordinance, Chapter 12, No. 4, and the Water and Sewage Act 16 of 1965 are the legal mechanisms that regulate the disposal of excreta and waste. The health sector is involved through enforcement of the Public Health Ordinance, as well as coordination and collaboration with the Local Health Authorities and the Water and Sewage Authority (WASA).

- The Ministry of Health operates within a legal framework consisting of several laws and regulations including the Public Health Ordinance, Chapter 12 No. 4.

- The Environmental Management Act – Water Pollution Rules is the legal mechanism responsible for overseeing problems related to water pollution. The Water Pollution Rules, amended in 2007, will provide strict guidelines for commercial and industrial entities in respect of effluent discharges into watercourses. The Water and Sewerage Act is the legal mechanism guaranteeing the population's access to drinking water. The health sector is involved via recommendations regarding the suitability of premises for connection to service.

- In Trinidad and Tobago, under the Water and Sewerage Act, 1965, the Water and Sewerage Authority (WASA) is responsible for both water supply and public sewerage systems. Under Section 62 of the Water and Sewerage Act, Chapter 54:40, WASA is responsible for:
    - Maintaining and developing the existing sewerage system, and all sewerage works vested onto it;
    - Constructing and developing such further sewerage works as it considers necessary or expedient; and
    - Administering the sewerage services, thereby establishing and providing sewerage facilities in Trinidad and Tobago.

- Under Section 65 of the same Act, the Water and Sewerage Authority, by Order may divide Trinidad and Tobago into sewerage areas for inter alia, "Vesting in itself any sewerage works constructed in such areas as well as the existing sewerage system". By Legal Notice No. 97 of 1987, the entire country of Trinidad and Tobago has been divided into five (5) distinct sewerage areas: Port of Spain Sewerage Area; San Fernando Sewerage Area; Arima Sewerage Area; Trincity Sewerage Area; the entire country of Trinidad and Tobago excluding the Port of Spain, San Fernando, Arima and Trincity Sewerage Areas.

- In addition to these core activities, WASA provides several other services such as approval of building and housing development plumbing plans; development of water and wastewater infrastructure; provision of geographic information for Trinidad and Tobago; repair of leaks and road restoration; clearing of sewer chokes; and licensing of water abstractors.

- The adoption of the non-WASA facilities is fraught with legal issues. Land ownership and titles, outstanding rates and taxes, transfer details, rights-of-way are many of the issues that must be addressed.

- Standards are being updated continually. The plumbing code revision is almost complete. The new guidelines to developers for the design of water and wastewater systems are ready for public comment. An official request has been made to update the old on lot (septic tank) system standard. The trade effluent standards for discharge into public sewers has been approved but have not been made compulsory.

- The National Standard, TTS 16 80 400:1991, "Code of Practice for the Design and Construction of Septic Tanks and Associated Secondary Treatment and Disposal Systems" has not been reviewed in 13 years. A request was made to have a review of this standard in 2004. Synthetic materials now used for septic tank designs and drainfields are not addressed in the standard.

- The Waterworks and Water Conservation Act (1980 revised) governs the abstraction and use of water.

Existing Institutional Framework

- The existing institutional framework includes the following key players in wastewater management:
    - Water and Sewage Authority (WASA)
        - Incorporated in 1965 and major sanitation agency in Trinidad and Tobago
        - Reports to the Minister of Public Utilities
    - Environmental Management Authority (EMA)
        - Established in 1995
        - Reports to Minister of Public Utilities and Environment
    - Ministry of Public Utilities
        - Main government ministry which represents WASA in cabinet and parliament
    - Regulated Industries Commission (RIC)
        - Monitoring and enforce compliance with license conditions
    - Ministry of Health
        - Responsible for overall management of the health sector
        - Responsible for effects of wastewater pollution of surface and subsurface water resources
    - Other Government Ministries
        - Ministry of Planning, Ministry of Housing, Ministry of Works and Transport, Ministry of Education, Ministry of Trade and Industry, Ministry of Local Government, Town and Country Planning Division, Lands Settlement Agency, The National Physical Planning Commission, Tobago House of Assembly

- The Government has appointed a Steering Committee under the chairmanship of the Chair of the Board of Commissioners of the Water and Sewerage Authority to monitor the implementation of the National Water and Wastewater Master Plan.

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