



Caribbean Regional Fund for Wastewater Management



Situational Analysis

Regional Sectoral Overview of Wastewater
Management in the Wider Caribbean Region
CEP Technical Report 66



SITUATIONAL ANALYSIS



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c/o

Sustainability Managers

*Promoting development with the environment in
mind.....securing a sustainable future*

REVISED DRAFT

Project on Testing a
Prototype Caribbean
Regional Fund for
Wastewater Management
(CreW)

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Table of Contents

List of Acronyms	4
Background	5
Scope of the Situational Analysis	9
Section 1: Social, Environmental and Economic Issues of Poor Wastewater Management	11
A Snapshot of Wastewater Management Issues in the WCR	13
Social Implications of Poor Wastewater Management	17
Environmental Implications of Poor Wastewater Management	21
Economic Implications of Poor Wastewater Management	24
SECTION 2: Policy, Legislative and Institutional Framework	28
A Snapshot of Policy, Legislative and Institutional Framework Issues in the WCR	29
Wastewater Management Policy and Practices in the WCR	31
Legislation, Regulations and Standards in Wastewater Management – A Snapshot	37
Institutional Arrangements	42
Section 3: Wastewater Management Technologies in the WCR	44
Regional Sectoral Overview of Wastewater Management Technologies in the Wider Caribbean Region	50
A Synopsis of Financing Issues and Wastewater Management Projects and Technologies	59
SECTION 4: National Country Assessments of Policy, Legislative and Institutional Frameworks	61
Antigua and Barbuda	62
Barbados	67

Costa Rica	71
Guatemala	77
Guyana	82
Honduras	89
St. Lucia	94
Suriname	101
Bahamas	110
Belize	115
Jamaica	129
Trinidad and Tobago	142
St. Vincent and the Grenadines	155
Panama	161
Rapid Assessment of Policy, Legislative and Institutional Frameworks	169
Bibliography	175

List of Acronyms

AyA	Costa Rican Institute for Water and Wastewater
BOD	Biochemical Oxygen Demand
CARICOM	Caribbean Community
CARSEA	Caribbean Sea Ecosystem Assessment
GPA	Global Plan of Action
CEHI	Caribbean Environmental Health Institute
CEP	Caribbean Environment Programme
CRew	Caribbean Regional Fund for Wastewater Management
CTO	Caribbean Tourism Organization
CZM	Coastal Zone Management
CZMU	Coastal Zone Management Unit
EIA	Environmental Impact Assessment
ENT	Ear, Nose, Throat
GEF	Global Environmental Facility
IADB	Inter-American Development Bank
LBS	Land Based Sources
MDG	Millennium Development Goals
OECS	Organization of Eastern Caribbean States
PAHO	Pan American Health Organization
SIA	Social Impact Assessment
SIDS	Small Island Developing States
SS	Suspended Solids
UNICEF	United Nations
USVI	United States Virgin Islands
WCR	Wider Caribbean Region
WHO	World Health Organization

Background

The United Nations Environment Programme Caribbean Environment Programme has partnered with the Inter-American Development Bank (IADB) and the Global Environmental Facility (GEF) to develop a Prototype Regional Revolving Fund which will provide sustainable financing for environmentally sound and cost-effective wastewater management projects in the Wider Caribbean Region. Funding for this project is being jointly provided by the IADB and GEF.

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.

The majority States in the Wider Caribbean Region (WCR)¹ have ratified the Cartagena Convention and the LBS Protocol in recognition of the need for shared responses to the threats which land-based sources of pollution pose to population health, the marine environment and economic welfare.

The Cartagena Convention names domestic wastewater² as a priority pollutant and Annex III of the LBS Protocol sets out

During the 21st century, water and wastewater management is likely to be one of the most critical resource issues that the Latin American and the Caribbean countries will have to face. All the countries of the region are already facing serious problems in terms of how best to provide a reliable water supply for all uses, and then how to treat the resulting wastewaters adequately. With increasing population growth and accelerating human activities, the regions' water problems are likely to get worse, unless the existing water management processes are significantly improved within a short period of time.

¹ As defined in the Cartagena Convention, the Wider Caribbean Region comprises the marine environment of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent thereto, south of 30 north latitude and within 200 nautical miles of the Atlantic Coasts of the United States. The countries of this Region (who are also members of the Caribbean Environment Programme) are: Antigua and Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Saint Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Venezuela.

² The LBS Protocol defines "Domestic Wastewater" as "all discharges from households, commercial facilities, hotels, septicage and any other entity whose discharge includes the following:

- i. Toilet flushing (black water);
- ii. Discharges from showers, wash basins, kitchens and laundries (grey water); or
- iii. Discharges from small industries, provided their composition and quantity are compatible with treatment in a domestic wastewater system.

Small quantities of industrial waste or processed wastewater may also be found in domestic wastewater."

specific obligations of state parties to address the urgent and serious problem of inappropriate and ineffective wastewater treatment and management.

Numerous scientific studies, including UNEP/ Global Programme of Action's (GPA) 2006 report on the *State of the Marine Environment*, singled out untreated wastewater entering the world's oceans and seas as the most serious problem contributing to marine pollution. In the region, the recent *Caribbean Sea Ecosystem Assessment* (CARSEA) study similarly found that "sewage pollution from land-based sources and from ships has been the most pervasive form of contamination of the coastal environment".

UNEP/GPA estimates that as much as 85 percent of wastewater entering the Caribbean Sea is currently untreated. According to the Pan American Health Organization (PAHO) (2001), 51.5 percent of households in the Caribbean Region lack sewer connections of any kind and only 17 percent of households are connected to acceptable collection and treatment systems.

Within Caribbean SIDS, less than two percent of urban sewage is treated before disposal; this is even lower in rural communities. On some islands (e.g. Antigua and Barbuda, Dominica, Haiti) there is no sewerage system; sewage is disposed mainly through septic tanks and pit latrines, many of which do not comply with minimum technical specifications or are not adequately maintained.

Indeed, as a result of rapidly expanding populations, poorly planned development, and inadequate or poorly designed and malfunctioning sewage treatment facilities in most Caribbean countries, untreated sewage is often discharged into rivers and bays. This practice has serious repercussions to human health, marine life and ecosystem services, and the already fragile economies. There is thus an urgent need to increase wastewater treatment in the Wider Caribbean, which is presently far below required levels.

While countries increasingly recognize the importance of improving wastewater management, obstacles exist to meeting the obligations of the LBS Protocol and taking such steps necessary to address the problems. UNEP/ GPA reported in the 2006 *State of*

...as a result of rapidly expanding populations, poorly planned development, and inadequate or poorly designed and malfunctioning sewage treatment facilities in most Caribbean countries, untreated sewage is often discharged into rivers and bays.

the Marine Environment Report that significant financial constraints exist and that there is a lack of adequate, affordable financing available for investments in wastewater management in the Wider Caribbean Region. Smaller communities, in particular, often find it difficult to obtain affordable financing improving wastewater infrastructure.

In addition to financial constraints, other substantial barriers exist: inadequate national policies, laws and regulations; limited enforcement of existing laws and regulations; poor communication and collaboration between various sectors and agencies which contributes to a fragmented approach to wastewater management; and limited awareness, knowledge and understanding of appropriate, alternative and low cost wastewater treatment technologies. Other limitations in technical capacity (e.g. in developing project proposals, operating and maintaining treatment systems, and monitoring and analyzing wastewater discharges and impacts) constrain progress in effectively managing wastewater.

Furthermore, wastewater treatment is considered by many water utility managers and stakeholders as a low priority. In most cases, provision of a reliable and safe potable water supply ranks first, with the second priority being the collection of sewage by means of covered sewerage systems, and wastewater treatment being the least important.

Most countries in the region have failed to take a long-term, integrated approach to wastewater management and few have made adequate budgetary provisions for and investments in sewerage infrastructure, policy reform and public education. Thus, countries often engage in “opportunistic capital planning” based on the availability of funding from donors or governments, and not on best value and net economic benefit.

It is within this context that the development of innovative financial mechanisms and affordable financing to assist countries within the WCR constitutes a very high priority. This is critical to support, expand or establish domestic wastewater management programmes and policies; and to finance cost effective, sustainable and environmentally acceptable wastewater management facilities that meet the needs of communities and other stakeholders.

The Prototype Regional Revolving Fund is being piloted as a possible modality for providing sustainable financing for wastewater management projects in the region while also addressing key capacity constraints within existing legal, institutional, policy frameworks for wastewater management.

Overall, the CReW Project will consist of four components:

- **Component 1:** A flexible and innovative investment and financing mechanism;
- **Component 2:** A policy reform component in support of improved wastewater management, including institutional and legal strengthening and capacity building, as well as public awareness and information exchange;
- **Component 3:** Regional dialogue, linkages, coordination, communications and liaison between CReW staff, counterpart agencies, implementing partners, related programmes and relevant Caribbean stakeholders;
- **Component 4:** A project management component, under which a governance structure would be established as the primary coordination mechanism for launching and implementing the CReW.

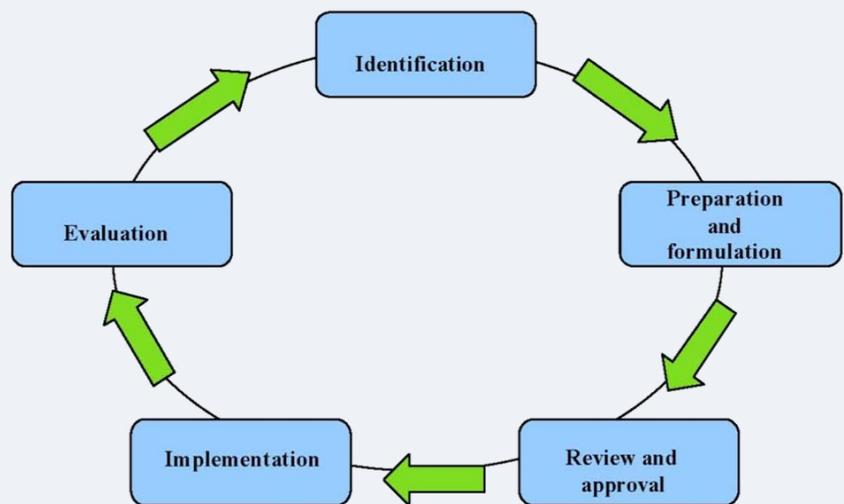
This consultancy will assist in designing the most effective intervention by providing needed technical input into the development of the full GEF Project Proposal for a Caribbean Regional Fund for Wastewater Management (CreW). This will be done by:

- Conducting a situational analysis of wastewater management in the Wider Caribbean Region, with particular emphasis on wastewater technologies, policy and legislation for wastewater management;
- Preparing a gap analysis to be derived based on the situation with respect to the management of wastewater in the Region and international best practices related to wastewater management with an emphasis on small island developing states (SIDS);
- Examining knowledge, attitudes and practices regarding wastewater management as well as the modes of information dissemination within the Wider Caribbean region. This analysis will inform the development of a public education and communication strategy on wastewater issues in the Region.

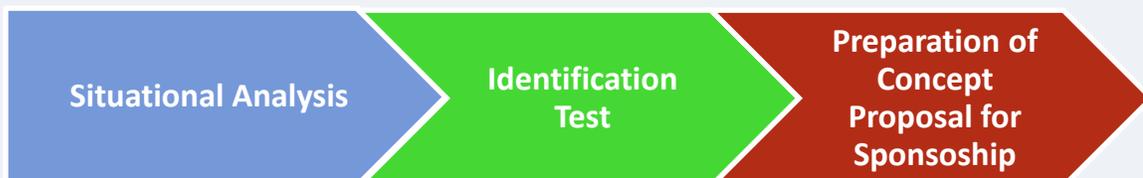
Scope of the Situational Analysis

In approaching this aspect of the assignment, it was necessary to first define the scope of the issues to be assessed. With the Terms of Reference for the consultancy providing necessary guidance, the nature of the issues, concerns and expectations surrounding the management and treatment of domestic wastewater (as defined by the LBS Protocol) in CreW pilot countries was investigated. Country-level capacity was analysed in the context of compliance with UNEP/ GPA Municipal Wastewater Guidelines and Annex III of LBS Protocol.

The Situational Analysis is aligned to the UNEP project cycle which can be explained in terms of five stages: identification, preparation and formulation, review and approval, implementation, and evaluation.



This Situational Analysis forms part of stage one of the project management cycle which is project identification. Project identification contains three main parts as follows:



This situational analysis is intended to enhance understanding of the likely causes and linkages between existing problems related to wastewater management in the WCR and the needed actions. A situational analysis based on a scientifically sound conceptual framework generates key actions and strategies to be applied for the intended project intervention.

The information in this Situational Analysis is based largely on a review of various studies and reports which were provided by the client, and is supplemented by data available on the Internet. It must be highlighted that much of the available information is dated, and in many cases data was insufficient. Surveys and interviews will be conducted with key country stakeholders in order to fill out some of these data gaps.

Latest country reports and statistics prepared by Governments, researchers, or international organizations on the relevant environmental, social and economic issues, including gender and poverty, can facilitate the assessment

This report does not, at this stage, include recommendations and does not offer solutions for project-level interventions; this will be provided in a follow-on gap analysis report. Rather, this preliminary report provides an overall baseline scenario and context for the wastewater management in the Wider Caribbean.

The Situational Analysis is divided in four parts as follows:

- Section 1: Social, Environmental and Economic Issues of Poor Wastewater Management
- Section 2: Policy, Legislative and Institutional Framework
- Section 3: Assessment of Wastewater Technologies in WCR
- Section 4: Country Profiles on Wastewater Management

Section 1:

Social, Environmental and Economic Implications of Poor Wastewater Management



Introduction

Issues associated with the management of marine resources and coastal areas are particularly fundamental to the development of many of the poorer nations of the world and the countries of the Wider Caribbean Region are no exception. For these countries, the coasts are often where both the most intense development pressures and some of the most acute pockets of poverty are found.

It is for this reason that the problems associated with sewage pollution in the coastal waters of WCR are an extremely broad set of issues, covering almost all aspects of socio-economic development and environmental conservation. Some of these problems include:

- Increased fish mortality and negative effects on commercial fisheries;
- Algal overgrowth (eutrophication) and threats to coral reef ecosystems, swamp ecosystems and seagrass beds;
- Biological diversity loss;
- Red tides which have killed marine organisms;
- Threats to human health due to elevated numbers of pathogenic microorganisms (e.g. viruses, bacteria) and toxins created by algal bloom;
- Threats to tourism and the risks to the reputation of destinations.

Improper sewage disposal systems and practices are the causes of these problems. Recent studies indicate that 51.5 percent of households in the Caribbean Region lack sewer connections and only 17 percent of these are connected to acceptable disposal facilities (PAHO, 2001). For communities where most homes and businesses have piped water, typical pollutant composition of domestic sewage was significantly lower than for areas where there was no central sewage system and septic tanks were common (UNEP-CEP, 1998).

Wastewater is viewed a national resource and there is universal sewerage of all existing and new developments with effluent reuse for secondary activities. Legislation which controls the use of effluent, permits wastewater plants and a system for compliance with establish environmental targets which is supported by a comprehensive environmental monitoring. Research into low cost treatment solution through the University the West Indies and a component to support advancements in the area of wastewater management. (A citizen of Barbados articulates his vision for wastewater management in his country at a workshop in Cuba in November 2009)

A Snapshot of Wastewater Management Issues in the WCR

The graphic below provides a snap shot of some issues related to wastewater management in selected WCR countries. The information contained herein is based on a survey instrument administered in November 2009 at a workshop in Cuba entitled, “Terminal Lessons Workshop for GEF Contaminated Bays and Regional Verification for GEF CReW Projects” at one administered at the “18th Caribbean Water and Wastewater Association Conference” held in St. Thomas in the USVI in October 2009.

WCR Country	Key Wastewater Management Issues/Problems
Antigua and Barbuda	<ul style="list-style-type: none"> • Discharge of sewage effluent (untreated) from septic tanks and sewage treatment plants • No proper enforcement programme for wastewater discharge
Aruba	<ul style="list-style-type: none"> • Not all sewage systems are connected to the wastewater treatment facilities (most of them are) • Septic trucks discharge wastewater in illegal places (this is reducing due to new facility that has been constructed specifically for septic tanks) • The polluters are not paying • Lack of legislation and enforcement • Lack of awareness by the general public of wastewater management issues
Bahamas	<ul style="list-style-type: none"> • Need a comprehensive plan for wastewater • Old treatment plants (6 public plants and many private plants at hotels, businesses, condos – supposed to be monitored by Department of Environmental Health Services) • Wastewater is given low focus compared with water. The focus is on providing everyone with water then deal with sewage. • Septage and sludge facility has become a generic liquid waste facility – overwhelmed. • Rates for septage disposal are low - \$11 per truck – therefore no profit in managing septage leading to low focus • Sewer rates are artificially low and based on fixtures,

WCR Country	Key Wastewater Management Issues/Problems
	<p>not flows (therefore not equitable or appropriate)</p> <ul style="list-style-type: none"> • BWS is currently governed by Water and Sewage Act. There is a move to separate the regulatory function from the service provision/utility function.
Barbados	<ul style="list-style-type: none"> • Financing for maintenance of wastewater treatment systems • Human capacity (numbers and technical skills) for monitoring and maintenance • Inadequate treatment of domestic wastewater • Cost of installation of wastewater systems due to the spatial distribution of development
Belize	<ul style="list-style-type: none"> • Incomplete treatment of industrial effluent due to technology and capacity shortfalls • Booming tourism industry – more resorts being built in coastal and off-shore sites • Inadequate treatment of municipal wastewater
Cuba	<ul style="list-style-type: none"> • Inadequate coverage of sewage and wastewater treatment • Defectiveness of some sewerage systems (leakage, tears, insufficient capacity of collectors, obstructions, illegal interconnections, stormwater runoff, operational problems of pumping stations among others) and its existence in part in many cases • Deterioration of processing systems due to lack of maintenance and rehabilitation • Insufficient implementation of a system of regular monitoring • Insufficient reuse of treated wastewater • Employment of obsolete technologies • Evidence of organizational and technological indiscipline in industry • Practices of cleaner production has been incorporated only partially

WCR Country	Key Wastewater Management Issues/Problems
Grenada	<ul style="list-style-type: none"> • Inadequate infrastructure – no treatment plants
Guyana	<ul style="list-style-type: none"> • Untreated and poorly treated sewage • Lack of water treatment facilities • Discharge of waste from distilleries • Surface runoff (pesticides) • Operation and maintenance of sewer system
Haiti	<ul style="list-style-type: none"> • Industries/companies without wastewater treatment • Lack of drainage in “new” neighbourhoods without control or urban infrastructure • Lack of industrial and community wastewater treatment plants • Lack of application of existing legislature • Lack of awareness in the public and private sector
Jamaica	<ul style="list-style-type: none"> • Lack of adequate numbers of sewage treatment plants. • Majority of plants treat only to secondary level • Low or no maintenance of existing plants • Improper planning/development practices • Lack of adequate enforcement of existing legislation
Trinidad and Tobago	<ul style="list-style-type: none"> • Release of untreated wastewater into receiving environment • Aging infrastructure that is below required capacity • Increase in number of private wastewater treatment plants that are not supervised by state agency; many dysfunctional • Increase of industrial wastewater production as new industries begin operation – industrial estates • Increase in thermal pollution in addition to nutrient pollution • Use of chemical pesticides in agricultural lands has increased • Increase in aggregate demand under 150 ha are not controlled by environmental law (no EIA required)

WCR Country	Key Wastewater Management Issues/Problems
	<ul style="list-style-type: none"> Increased hillside development has led to increased stormwater run-off and flash flooding in capital city

The main wastewater management issues and problems (most pressing) highlighted in the table could be grouped according to similarity of issue among countries. The management issues/problems could be categorized into the following issues:

1. Poor attitudes and low levels of awareness of wastewater management issues
2. Poor practices
3. Low levels of enforcement
4. Need for improvements in legislative and policy frameworks
5. Low levels of capacity
6. Old infrastructure and technologies

The table below shows each of the categories above aligned by country to similarity of issues faced by countries in wastewater management. The numbers 1 to 6 in the first row of the table correspond to the issues highlighted in the bulleted list above. The table below shows that participants felt that poor attitudes and low levels of awareness of wastewater management issues coupled with poor practices and old infrastructure and technologies were the most pressing concerns of countries. Low levels of capacity (technical) were cited as the least concern of participants.

Country	1	2	3	4	5	6
Antigua and Barbuda						
Aruba						
Bahamas						
Barbados						
Belize						
Grenada						
Guyana						
Haiti						
Trinidad and Tobago						
Jamaica						
Cuba						

Social Implications of Poor Wastewater Management

This section provides a brief overview of some of the social implications, primarily health and sanitation issues of poor wastewater management in the region. It provides some examples of the issues and their effects and draws on a myriad of studies and reports.

- Sanitation in Latin America and the Caribbean is characterized by insufficient access, particularly in rural areas, and in many cases by poor service quality, with possible impacts on public health.
- In total 125 million or 23 percent of the people in the region did not have access to improved sanitation. In Haiti only 25 percent of the population in 1995 and 30 percent of the population in 2004 had access to improved sanitation. Honduras, Dominican Republic, Mexico and Guatemala are the countries with the largest increase in the access to improved sanitation between 1995 and 2004 (CEHI, 2009).
- According to the Joint Monitoring Program of UNICEF and the World Health Organization (2008) the percentage of people in the region who have access to improved sanitation facilities has risen from 68 percent in 1990, 77 percent in 2004 to 79 percent in 2006. According to the year 2004 calculations, of those 77 percent, 51 percent of the houses were connected to a sewer and 26 percent of the population had access to septic tanks and various types of latrines.
- According to the 2004 study “GIWA Regional Assessment 3a for the Caribbean Small Island subsystem”, in Saint Lucia only 13% of the population is connected to the sewage system (GEF et al 2001). The unregulated disposal of human waste, for example in Antigua & Barbuda, and insufficient drainage has resulted in standing pools of contaminated water. During severe weather conditions, these pools present a major source of sewage-related outbreaks of diseases (GEF et al 2001).

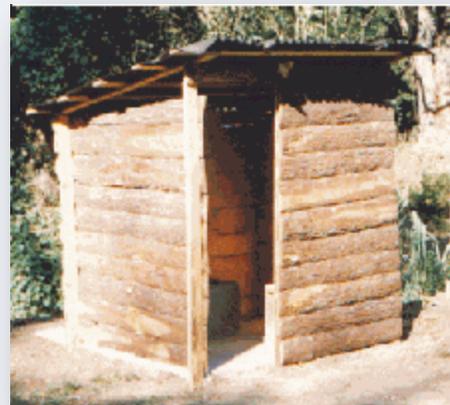


- In the Bahamas, 15.6 percent of the population has access to sewage collection services and 44 percent of sewage treatment plants are in poor condition. In Haiti, there are no sewage collection services and only 40 percent (mostly urban) of the population use latrines and septic tanks, of which 80-90 percent of the solids are dumped illegally into rivers and seas (UNEP/CEP 1998).
- In Trinidad and Tobago, organic matter is considered to be the most extensive pollutant in watercourses in TT, and much of it comes from sewage, mainly from domestic sources. 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 soakaway systems to dispose of their domestic sewage, while 27 percent utilised pit latrines, and only 22 percent enjoyed disposal to a sewer system. In Tobago, only 12 percent of the population was at that time serviced by sewerage treatment facilities.
- Most of the communities in the lower reaches of the Magdalena River Basin, Colombia do not have sewage treatment facilities and suspended solids and faecal matter affect the health of downstream coastal communities.
- Ineffective wastewater treatment is a major source of pathogens, which are biological/ infectious agents that cause diseases or illnesses, including acute respiratory illnesses, skin infections and gastrointestinal illnesses such as diarrhoea, cholera, dysentery, typhoid, and hepatitis A. Pathogenic bacteria can survive in the sea from a few days to several weeks; viruses can survive in water, fish or shellfish for several months while the hepatitis virus can remain viable in the sea for over a year (GESAMP 2001).
- According to GESAMP (2001), contamination of the coastal marine environment by sewage leads to significant numbers of infectious diseases linked to bathing and swimming in marine waters and to the consumption of seafood. Human exposures to toxins associated with algae blooms also impose significant risks.

- Studies on bacterial contamination have indicated that most inner harbours and many beaches in the region have water quality which exceeds water quality limits for human contact and recreations areas (Land-Based Pollution Sources and Marine Environmental Quality in the Caribbean (CEHI, 1991).



- Water quality and sediment studies conducted on the major rivers of eastern Venezuela found that around Matazas the sediments contained high concentrations of organic material and Coliforms which far exceed the Venezuelan water standards (Senior et al 1999).
- In St. Lucia, children have been affected by helminths. In Barbados, extremely high coliform counts have been measured. According to PAHO data, as of 1979, enteric and diarrhoeal diseases are the most common cause of infant mortality in many Latin America and Caribbean countries (CEP, 2010).
- In The Bahamas, health authorities have advised its 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).
- Depending on its source and collection



methods, sewage may also contain a range of chemicals and specialized wastes including industrial chemicals, nutrients such as nitrates and phosphates, heavy metals, pharmaceuticals, medical wastes and oils and greases. These result in additional threats to human health.

- However, as this report will show, several States are making efforts to address the issues of sanitation. A report published by UNICEF and the World Health Organization (2008) show that the Latin American and Caribbean progress towards the Millennium Development Goal (MDG) sanitation target is on track and by 2015, 84 percent of the region's population should have access to improved sanitation (UNICEF/WHO, 2008).

Environmental Implications of Poor Wastewater Management

This section provides a brief overview of some of the environmental implications of poor wastewater management in the region. It provides some examples of the issues and their effects and draws on a myriad of studies and reports.

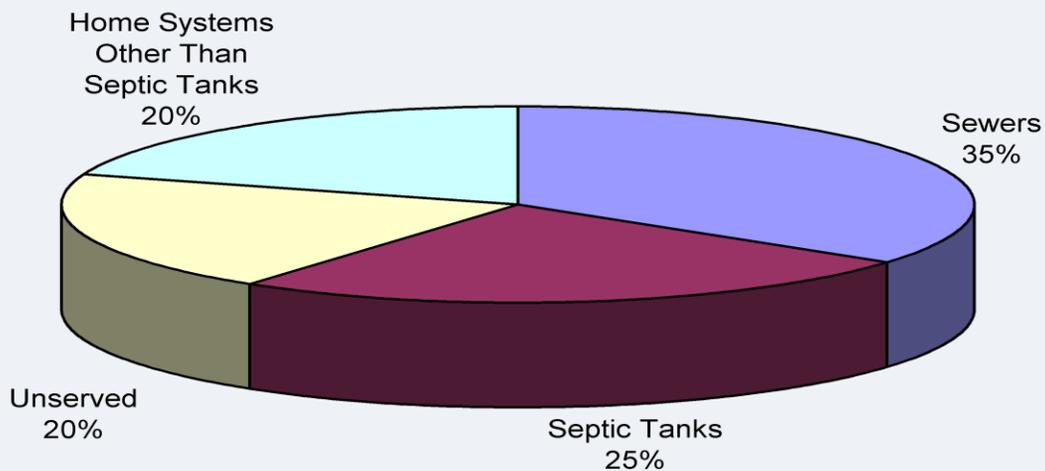
- Sewage is regarded as one of the most widespread causes of degradation of the coastal environment in the Caribbean (Siung-Chang 1997). This was re-enforced by the regional priority rankings of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) categories, which showed sewage to be the first priority (GESAMP 2001). In Trinidad for example, domestic waste which finds its way into watercourses includes sewage, which is considered to be one of the most common causes of pollution in local rivers. The widespread utilisation of on-lot septic tanks, soakaways, and pit latrines generates large volumes of effluents high in septage.
- Poorly functioning, or non-functioning wastewater treatment plants cause pollution of coastal waters, and damage fragile coastal resources such as coral reefs. The nutrients in wastewater stimulate the growth of aquatic plants and algae, reducing the clarity of the water, limiting oxygen, which threatens marine life and causing once healthy reefs to be covered with seaweed and algae. This degradation of the marine environment is evidenced in many States of the Caribbean. (WWTD Report, CEHI, February 2009)
- In Colombia and the United States bordering the Gulf of Mexico, sewage pollution has been identified as the cause of fish kills. In Cuba, impacts of sewage pollution have been measured as far as 1 kilometre from sewage effluent discharge points.
- Marine environmental problems in the Caribbean are compounded by the generally small size of individual States, the relative small distance between them, and the proximity of all land-based activities to the coast. As a consequence, garbage, sewage and other forms of excreta disposal, industrial effluent discharges and run-off from agricultural areas directly affect the near shore marine environment. Adverse environmental effects may accrue from these contaminant loadings since the coastal and marine environment is their most biologically productive as well as economically important zone (Land-Based

Pollution Sources and Marine Environmental Quality in the Caribbean (CEHI, 1991).

- The Caribbean coral reefs appear to be much less resilient than those of the Great Barrier Reef and contain lower diversity. Little to no recovery have been observed on Caribbean reefs within the last 10 years (Suggested Effluent Guidelines for the Wider Caribbean Region (TUHH/CEHI, 1998).
- The pristine conditions [of coral reefs] are threatened by pollutants from point or non-point sources, which vary in toxicity and in their impact on marine and human life. These include: suspended solids, pathogens, nutrients, oxygen demanding substances, organic compounds of synthetic and natural origin and heavy metals (Suggested Effluent Guidelines for the Wider Caribbean Region (TUHH/CEHI, 1998).
- In Barbados the coral reefs have been impacted by eutrophication, causing changes in the species composition of the corals (Linton & Warner 2003).
- During the 1980s, many shallow reefs around Grenada & the Grenadines were degraded and became overgrown with algae, presumably resulting from a combination of sewage, agro-chemical pollution, and sedimentation caused by coastal development (Smith et al 2000).
- Eutrophication has further caused degradation of coral reefs at Islas del Rosario, Colombia (Garzón-Ferreira et al. 2000).
- Nutrient enrichment of the coastal waters especially from nitrogen and phosphorus compounds above threshold concentration can result in eutrophication with several hazardous ecological effects: algal blooms; change in aquatic community structure; decrease biological diversity; fish kills; and oxygen depletion (CEHI, 2009).



- Plants such as algae often experience a population increase (called an algal bloom) which limit the sunlight available and cause lack of oxygen in water. When oxygen levels decline, marine animals, coral reefs, seagrass beds and other vital habitats in the Wider Caribbean Region suffer and may die.
- Between 1991 and 1996, a climatic anomaly and pronounced nutrient enrichment resulted in a severe algal bloom followed by sudden oxygen depletion, which led to a reduction of coral reef cover from 43% to less than 5% in Morrocoy National Park, Venezuela (Garzón-Ferreira et al 2000).
- Some bays in the US Virgin Islands have high levels of bacteria, especially those with a large concentration of boats. The increase of bacteria cause serious threats to human health and impair water quality with algal blooms. Additionally, fish kills have occurred repeatedly, and beaches have been closed because of poorly designed and failing sewage systems (DPNR/DEP & USDA/NRCS 1998).
- According to the 2006 “GIWA Regional Assessment 3b and 3c for Colombia, Venezuela, Central America and Mexico”, 472 653 m³/day of untreated sewage is discharged into the sea along the Colombian Caribbean coast. Eutrophication in the Cartagena Bay and the Ciénaga de Tesca in Colombia have caused mass fish mortalities due to discharge of non-treated wastewater and fertilizer runoff (PNUMA 1999). In February 2000, there was also a mass fish mortality recorded in Barlovento, Venezuela associated with pathogenic bacteria (UNEP 2002).



Economic Implications of Poor Wastewater Management

Data on the economic cost of poor wastewater management in the WCR is rather limited both in terms of the financial costs associated with developing and implementing appropriate systems, and also with respect to the social, economic and environmental costs of poor wastewater management.

Poor wastewater management resulting in impacts on human health is one economic implication. Tremendous human suffering is caused by diseases that result from contaminated water. For example, diarrhoeal diseases kill about 2 million children and cause about 900 million episodes of illness worldwide each year. The most widespread contamination of water is caused by disease bearing human waste, which are usually detected through the measuring of faecal coliform levels. Over 1,000 million people around the world do not have access to an adequate supply of safe water for household consumption.

Also, a lack of sewerage connections or other systems to hygienically dispose of human waste can result in the presence of disease-carrying pathogens in the human environment. With respect to the natural environment, the mixing of untreated human excrement and wastewater in rivers, streams and gullies also pose additional risks. Human faeces are a threat to human health because of the pathogens they contain. Ingestion of faecal pathogens through consumption of contaminated water and poor food handling practices, etc., can cause:

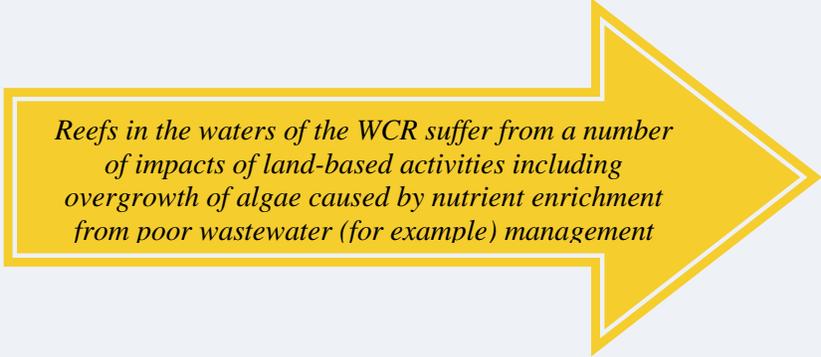
- Diarrhoeal disease
- Cholera
- Intestinal worm infections
- Typhoid fever

Where untreated sewage, industrial effluent and agricultural wastes are discharged into inland waterways, lakes and coastal zones, the health of those individuals who use these water bodies for recreational purposes such as swimming and



windsurfing can be threatened. Exposure to polluted waters for purposes of recreation can cause a myriad of problems, depending on the specific pollutants involved, including:

- Diarrhoea
 - Respiratory Infections
 - Skin Irritations
-
- The economic implications of wastewater management are felt in the tourism sector, which relies largely upon healthy coral reef systems, clean beaches, and good quality bathing water. With few exceptions, the countries in the WCR are highly dependent on tourism, which is an important economic driver of Gross Domestic Product, foreign exchange and employment. The links between this key sector and the issue of how wastewater is managed has been examined in some detail. The main conclusion from just about all of these studies is that tourism in both a victim and a vector of poor wastewater management. Studies have also shown that coral reefs contribute to the and beaches along adjacent shorelines and help to protect the coastline from erosion and the effects of storm surge and tsunamis.



Reefs in the waters of the WCR suffer from a number of impacts of land-based activities including overgrowth of algae caused by nutrient enrichment from poor wastewater (for example) management

- The economic value of reefs is therefore substantial, as shown in the following information contained in the Reefs at Risk in the Caribbean Report, 2004:
 - Shoreline protection offered by Caribbean reefs has been estimated to save countries between US\$700 million and US\$2.2 billion each year
 - In 2000, approximately US\$2.1 billion was earned from the reef-based dive industry
 - Continued degradation of the reefs is projected to lead, by 2015, to loss in revenues from dive tourism by as much as US\$300 million each year

- The 2007 assessment of the Caribbean Sea ecosystem report estimates that the continued decline of coral reefs could cost the region between US\$350m and US\$870 million per year by 2050 (CARSEA 2007).
- On the one hand, marine pollution by sewage is a source of bacterial pathogens, which threatens public health and the attractiveness of bathing areas and consequently the future of the tourism industry (Suggested Effluent Guidelines for the Wider Caribbean Region (TUHH/CEHI, 1998). The public health concerns associated with this malpractice are skin, ear nose and throat (ENT), enteric infections due to contact with the waters during recreational use or extraction of fish for consumption (Impacts of Wastewater on Caribbean Health & Tourism (CEHI, 1998).
- One the other hand, according to a study on the Impacts of Wastewater on Caribbean Health & Tourism (CEHI, 1998), untreated or poorly treated sewage is discharged into rivers, freshwater courses and into the sea via short outlets from hotel operations which line the coastlines (Impacts of Wastewater on Caribbean Health & Tourism (CEHI, 1998). Additionally a 2007 assessment of the Caribbean Sea ecosystem led to the conclusion that “continued neglect of ecosystems could start to create such degraded environments that the Caribbean would lose its appeal for many tourists (resulting in loss of foreign exchange earnings), and fish stocks might start to collapse” (CARSEA, 2007).
- In Mexico, tourism generates large quantities of wastewater and the management of this has become problematic. The wastewater is often discharged directly into lagoons and bays such as Chetumal Bay and Nitchupé Lagoon in Cancun, Mexico. According to the 2006 GIWA study the tourism industry has lost income and fisheries production has been reduced in Costa Rica and Chetumal Bay as a result of pollution.



- The other economic sector which is directly affected by contamination of coastal waters is the fisheries. Some algal blooms are toxic and may harm or even kill whales, dolphins and other marine mammals - and cause hundreds of millions of dollars worth of damage to commercial fisheries. Jamaica for example suffers from loss of habitat for fish due to coastal degradation and pollution.

Sewage Waste in the Wider Caribbean Region

In 1993, PAHO indicated that only 10% of the sewage generated in Central America and the Caribbean is properly treated. The inadequate number of sewage treatment plants in operation, combined with poor operating conditions of available treatment plants, and the practice of discharging mostly untreated wastewater are likely to have an adverse effect on the quality of the coastal marine environment.

The past two decades have seen a growth in Tourism in the Caribbean region. Statistics from the Caribbean Tourism Organisation (CTO) indicate that in the cruise ship visitors total over 10 million per year. While larger ships should have holding tanks for sewage, which according to the MARPOL agreement, they are not permitted to discharge within four miles of the nearest land, unless they have approved treatment plants on board. Coastal cargo vessels and recreational boats do not have holding tanks and are likely to discharge their waste waters in marinas and near shore coastal areas due to lack of port reception facilities for sewage wastes in many developing coastal regions.

Additionally, figures also indicate an excess of 12 million stay-over visitors per year to the region. In response to the increasing number of visitor arrivals to the region, hotels and recreational facilities are being built, and because of a lack of the necessary municipal sewerage waste systems, hotels are being placed in the position of operating their own treatment plants. It has been approximated that only 25% of the treatment plants operated by hotels and resort complexes are in good operating conditions.

SECTION 2:

Policy, Legislative and Institutional Framework



Introduction

Within the WCR, there has traditionally been more focus on the quality and accessibility of drinking water compared with wastewater management, but there is growing concern over the impact of wastewater on health, the sustainability of livelihoods and other socioeconomic issues. This may be the result of increasing land use pressures on small islands as development and populations density increases, as well as the increased awareness of the social, environmental and economic costs.

Many of the international conventions onto which the countries of the region have signed have also directed attention to the negative impact of wastewater, and some like the LBS Protocol of the Cartagena Convention have provided mechanisms to assist with assessing and addressing the situations.

The following observations were made regarding the policy, legal and institutional frameworks which obtain for wastewater management in the Wider Caribbean.

A Snapshot of Policy, Legislative and Institutional Framework Issues in the WCR

The table below provides a snap shot of some issues related to policy, legislative and institutional framework issues in the WCR³ countries. The table shows that the sample countries all have similar issues with respect to the policy, legislative and institutional framework. Most of these issues relate to low levels of capacity within institutions responsible for wastewater management, lack of policies and laws or outdated laws and low levels of compliance and enforcement.

Country	Key Issues – Policy, Legislative and Institutional Framework
Antigua and Barbuda	<ul style="list-style-type: none">• Institutional capacity – which would involve lack of policy and enforcement
Aruba	<ul style="list-style-type: none">• Lack of specific environmental laws and solid and liquid waste laws

³ The information contained herein is based on a survey instrument administered in November 2009 at a workshop in Cuba entitled, “Terminal Lessons Workshop for GEF Contaminated Bays and Regional Verification for GEF CReW Projects” at one administered at the “18th Caribbean Water and Wastewater Association Conference” held in St. Thomas in the USVI in October 2009.

Country	Key Issues – Policy, Legislative and Institutional Framework
	<ul style="list-style-type: none"> • Lack of legislation and regulations
Barbados	<ul style="list-style-type: none"> • Outdated policies and Laws that do not reflect the reality of present day development and the impacts from development. • Limited technical human capacity in terms of numbers of personnel.
Belize	<ul style="list-style-type: none"> • Low levels of institutional capacity • Low levels of technical capacity
Guyana	<ul style="list-style-type: none"> • Low levels of institutional capacity • Lack of specific legislation for wastewater management
Haiti	<ul style="list-style-type: none"> • Low levels of institutional capacity – there is no technical staff • Inadequate laws and policies and a lack of applying those in existence • Lack of adequate labs
Jamaica	<ul style="list-style-type: none"> • Inadequate institutional capacity, training • Limited resources (financial, human)
Suriname	<ul style="list-style-type: none"> • Lack of policies and laws in regard to wastewater management
Trinidad and Tobago	<ul style="list-style-type: none"> • Need to implement more compulsory legislation, e.g. trade effluent standards • Lack of compliance with standards

Wastewater Management Policy and Practices in the WCR

Most countries have established coastal zone management (CZM) frameworks. For example, at the national level in St. Lucia, the Initial Development of a Coastal Zone Management Framework for St. Lucia (MPDEH/ATRIA, 1995) was an important study which influenced the development of a Coastal Zone Management Project (2001-2003), and the policies that would guide coastal zone management in St. Lucia through the Coastal Zone Management Unit (CZMU). The policies of such a Unit and its functions would most likely be similar in most Caribbean Countries. Whereas the development path may vary, it is likely that the policies and functions of the CZMU (or analogous entity) would operate as a coordinating body for stakeholder agencies, focusing on protection and conservation of the coastal zone and marine environment (CEHI, 2009).

However, very few countries have integrated CZM and wastewater management plans. In St. 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 Unit. Belize also has a good plan (CEHI, 2009).

Some countries have integrated water and wastewater management plans. There are only a few countries that made the link between clean, safe potable water and good sanitation have a national water policy which addresses not just issues related to drinking water, but also to the issue of wastewater management as well, including sewage treatment and disposal. The Jamaica Water Sector Policy (1999) and the Draft National Water Policy for St. Lucia are examples of policies which do this.

The Draft National Water Policy for St. Lucia outlines the intention of the Government to undertake the expansion of the sewage network in areas of high population densities; to investigate the feasibility of wastewater reuse; and to strengthen the capacity of monitoring and regulatory agencies.

Jamaica's Water Sector Policy focused on the need to upgrade the status of central systems and to provide assistance to private entities where necessary towards that end. The St. Lucia Policy outlined the intention of the Government to undertake the expansion of the sewage network in areas of high population densities; to investigate

the feasibility of wastewater reuse; and to strengthen the capacity of monitoring and regulatory agencies.

Similarly, Guatemala's National Plan of the Public Services of Potable Water and Sanitation for Human Development 2008-2011, integrates the twin objectives of provision of potable water and increasing the quality and access to sewerage services.

Antigua and Barbuda has no specific policy which addresses wastewater management. However the problem is identified as a concern in both the National Biodiversity Strategy and Action Plan (NBSAP) and the National Environmental Management Strategy (NEMs). Several regional countries including St. Lucia, Grenada, St. Vincent and the Grenadines, Barbados, St. Kitts and Nevis, Dominica, Antigua and Barbuda, have also recently expressed their commitment to the development of a national Integrated Water Resources Management Plans (CEHI, 2009). This will address both the quantity and quality issues of water from all sources including surface water, groundwater, desalination and from rainwater harvesting. Wastewater can be viewed in this context as a resource that can be treated and reused for irrigation.

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. The Water Supply Law (Waterleidingbesluit GB 1938 no.33.) obliges owners of buildings and houses to make use of the public water supply system; and 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.

There is little or no internalisation of the cost of sewage waste pollution and inattention to cost recovery in the sector. Guyana's Water Incorporated, as with other national water and wastewater companies, faces an inadequacy of operating budgets and 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. In Honduras, water and sewerage tariff increase approvals occur infrequently and are insufficient to compensate for inflation, thus resulting in an erosion of real tariff levels.

Similarly, 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.

Most countries require 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 connection/ linkage between health promotion, environmental health and environmental management is poor. This is generally because the responsibility for these areas is housed in different/ separate agencies of government. In some instances it would appear that there are conflicts of between the instruments for public health and environmental management (CEHI, 2009). The Antiguan Draft Environmental Health Act and the Draft Environmental Protection Management Bill conflict, particularly as it regards pollution control.

The Jamaica Draft National Sanitation Policy (2005) is one of several national policies that have overlapping implications for sewage management and seeks to integrate this issue with environmental management and public health. One of the goals of this policy is ensure that “[a]cceptable water supply and sewage and excreta disposal systems available in homes, schools and public places (based on established national standards)”. However, to date the policy is still not promulgated.

Several countries have an environmental policy or action plan. 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 proposed legislative reform as a critical strategy and articulates the need for the establishment of an Environmental Protection Agency (EPA) and the promulgation of the Environmental Protection Bill.

Jamaica’s National Environmental Action Plan (JANEAP) 1995, 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). However, there is generally no single policy regulating the environment. There

are often several policies for different aspects of natural resource management and pollution control

With few exceptions, waste management is characterised by an outdated centralised sector model. This is 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 and rural populations. For example in Costa Rica, 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.

Even where there are provisions for decentralised or delegated service provision exists, the centralised model has prevailed. This is due to inadequate sector policy framework and the generally unsatisfactory performance of providers outside the national water and sewerage authority. According to Costa Rica's Drinking Water Law of 1953 the country's 81 municipalities (called cantons) are constitutionally responsible for the provision of water and sanitation services. However, the Costa Rican Institute for Water and Wastewater (AyA) has maintained control over most of that country's water and sewerage services, serving about 50 percent of the population.

However, the provision of water and sanitation services is the constitutional responsibility of the municipalities in Guatemala. Services can be provided directly by a single municipality or through a group of municipalities who are organized to provide services together ("mancomunidades"). 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; the Municipal Development Agency (INFOM), through the Rural Aqueduct Programme (UNEPAR) provides this function to a large extent.

In Honduras, a new Framework Law for water supply and sanitation was passed in 2003. 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.

Technological innovation is generally not encouraged. The St. 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.

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. The Bureau of Public Health has no control on the construction and functioning of the septic tanks.

In most countries, there is widespread use of septic tanks and pit latrines - 65 Percent of the population of Antigua and Barbuda use septic tanks; 56 percent of the population in Guyana have access to a pit latrine; while in Suriname 86 percent of the houses have a septic tank and the remaining 14 percent have pit latrines. There are limited incentives/disincentives for construction and use of effective septic tanks.

The enabling environment for technology innovation is weak throughout the WCR. Most countries have no system of incentives in place to support the adoption of best environmental technologies and appropriate technologies.

Jamaica's draft sewage regulations show some potential in facilitating new and innovative technologies in the sector. The regulations are based on the approach of self monitoring by the generator, the performance of an auditing function by National Environment and Planning Agency (NEPA), the polluter pays principle, economic incentives for development of environmentally sound alternative uses for sludge and effluents and progressively severe penalties.

Sewage packing plants are used extensively, particularly in the case of hotels, which are poorly maintained. In Antigua and Barbuda, 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.

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 (CEP, 2009).

Legislation, Regulations and Standards in Wastewater Management – A Snapshot

Full enactment of obligations of Annex III of the LBS Protocol into national law has not yet been achieved in most countries. Both Barbados and Trinidad and Tobago have established differentiated effluent limitations for Class I and Class II waters. Trinidad has effluent limitation standards for sensitive ecosystems.

New wastewater standards have been proposed under the Marine Pollution Control Act in Barbados. 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 reef (defined as Class 1 waters which will include all land based discharges), or outside the reef (Class 2 waters). The sewage discharge from new facilities are expected to meet the Domestic End of Pipe Standards, which correlate with the prescribed effluent limitations in Annex III of the LBS Protocol.

There is fragmentation of legislative instruments for wastewater management. In most countries, there are various different legislative instruments, governing from protection of public health to conservation of ground and surface freshwater resources, which may or may not be leading to the desired outcome of better management of wastewater. In most of the English-speaking Caribbean, the Public Health Act is established to control the quality of sewage discharge, while there are separate regulations for environmental management. The Table below summaries the ideal suite of legislation for effective sewage pollution control and the extent of coverage in each country (this information was gathered during a UNEP organized workshop in Cuba in November 2009).

Status of Elements of the Ideal Suite of Legislation in the Wider Caribbean

Legislation, Regulations for:	AN	AR	BD	BH	BZ	CO	CU	DR	GR	GT	GY	HA	JA	MX	PA	SL	SU	TT	VZ
1. Emission limits	X			G													X		
2. Marine areas, fish										G									
3. Recycled water			D		P	S	S						S		S				
4. Urban ww ³ management				Y				S											
5. Agricultural pollutants						D													
6. Storm water runoff				G		D										G			
7. Pesticides				G															
8. Regulation of industry types				G													G		
9. Construction of treatment plants		X															G		
10. Marine protected areas		D																	
11. Good agricultural practices								D											
12. Levels of treatment				G				N					G						
13. Septic tanks								N	G		G				G	G	G		
14. Municipal ww standards				G												G			
15. Public education		D									S		G		G				
16. Specific pollutants																			G
17. EMS, codes of practice					G	SV							G			G	G	G	
18. IWRM ⁴															P				

	Yes – legislation and/or regulations exist	AN – Antigua & Barbuda	DR – Dominican Republic	PA – Panama
	No – legislation or regulations do not exist	AR – Aruba	GR – Grenada	SL – St. Lucia
	Only guidelines exist	BD – Barbados	GT – Guatemala	SU – Suriname
	External standards are used	BH – Bahamas	GY – Guyana	TT – Trinidad & Tobago
	Draft legislation or regulations exist	BZ – Belize	HA – Haiti	VZ – Venezuela
	Legislation and/or regulations for some aspects exist	CO – Colombia	JA – Jamaica	
	Policies or plans exist	CU – Cuba	MX – Mexico	
	Unknown			

Legislation for the control and prevention of sewage pollution is outdated and the regulations are often inadequate. In Antigua and Barbuda, the Public Health Act of 1955, establishes the Central Board of Health’s institutional powers for marine areas management. However, the agency’s scope of responsibility is limited to the abatement of nuisances.

Barbados’ 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. However, the policy classifies the entire coastal strip as a “least sensitive” zone (control zone 5), and as a result there are sewage disposal related restrictions. Most tourism related developments and activities occur in this zone, and there is a proliferation of packaged plants which contribute to marine pollution.

Guyana has is no legislation governing pollution control, regulation of pesticides and toxic chemicals, or waste management. The main measures dealing with air and water

pollution and solid waste control are the antiquated water supply, drainage, sanitary and nuisance provisions of the Public Health Ordinance.

More appropriately, St. Lucia's Public Health 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 Public Health (Sewage and Disposal of Sewage and Liquid Industrial Waste Works) Regulations (1978) of St. Lucia is somewhat more focused and specifically aims to regulate and decrease pollution through liquid waste and sewage in order to protect human health and safety. According to the regulations, "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."

Most countries do not have specific regulations restricting pollution of the marine environment. Barbados is one of few countries in the region with specific laws for marine pollution. According to Marine Pollution in Barbados (EPD, 2004), the Marine Pollution Control Act (1998) and the Coastal Zone Management Act (1998) are the legal instruments governing the impacts to the coastal and marine environment from sewage among other forms of pollution. Within the Marine Pollution Control Act, is reference to a list of prohibited concentrations, which was developed by adaptation and adoption of existing and acceptable relevant standards, guidelines and research. The USEPA standards for faecal coliforms and enterococci are used for the weekly monitoring regime undertaken for near shore bathing waters.

Standards and Guidelines

Few countries have national sewage effluent standards. The LBS Protocol, which most countries in the WCR are signatory to, addresses the issue of guidelines for the discharge of wastewater into water bodies. However, there are often no national standards in place to govern the quality of effluent entering the environment.

In St. Lucia, for example, although the Ministry of Planning 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. The absence of national standards was cited as 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.

Jamaica is one of the few, if not the only regional country to develop draft sewage sludge regulations. The regulations establish strict pathogen and heavy metal content limits for treated domestic sewage sludge (called National Treated Sewage Sludge/Bio-solids Standard) that is suitable for land application. The regulations are designed to encourage the land application of bio-solids and its derivatives in a manner that protects the public health and maintains or improves environmental quality. The regulations are intended to be complemented by 10 schedules which provide the standards for the trade effluent, industrial discharges, landfilling of sludge, water quality standards, forms, and reporting stipulations.

The Jamaican National Sewage Effluent Standards (1996) and Jamaican National Trade Effluent Standards (1995) consist of two categories which allow for the setting of different limits for older as compared with newer Sewage Treatment Plants (STPs) (i.e. those commissioned after January 1, 1997). Where the parameters for trade effluent are the same as those for sewage, the limits are the same, however, the suite of tests required for trade effluent is more comprehensive.

Surveillance and Monitoring

Surveillance and monitoring is an area of weakness in most countries. There did not appear to be legislation requiring generators to conduct routine testing and so the onus was on the regulator to verify through surveillance and monitoring, that generators complied with legally enforceable limits, or disposed of effluent within limits that did not constitute public health nuisances. The contributing factors to the weaknesses 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. It was not overtly stated, but informal discussions led to the conclusion that the hotels had a tendency to monitor water quality for impacts over which they could exercise more control. Given that coastal water was subject to impact from several sources of contamination, they were less likely to investigate this. The regulators believed that in some cases, there was also the

reluctance where the hotels themselves might have been responsible for the poor coastal water quality as a result of the poor performance of their treatment systems.

Some countries are involved in monitoring coastal water quality, primarily from the perspective of recreational water quality. In Antigua, the Central Board of Health (CBH) has been monitoring the near shore water quality status since 1989 in conjunction with the Caribbean Environmental Health Institute (CEHI). The faecal coliform/ faecal streptococcus ratio is used as indicators of the level of pollution.

Enforcement

There is inadequate capacity to enforce wastewater laws. Like surveillance and monitoring, this was commonly identified as a weakness in most, if not all the countries, and was also linked to inadequate manpower and financial resources.

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.

There was widespread fragmentation of enforcement responsibility. Legislation commonly existed for the Ministry of Health to act as a regulator for certain activities with negative environmental impacts. The Ministry responsible for Physical Planning also has a role to play in the granting of permission and as it relates to zoning, establishment of sewage treatment systems etc., and they had the power to stop construction. In some countries there was an Environmental Protection Agency or an Environmental Management Agency that had powers to legally limit activities with negative environmental consequences in respect to WWTD (GEF-IWCAM, 2009).

In other countries these powers exist alongside sectoral agencies that deal with specific issues, such as fisheries, where their legislation gave them powers over the coastal and marine environment; or forestry departments who could address polluting activities in watershed areas, etc. The common weakness in the enforcement agencies was the financial and human resource capacity to enforce the legislation.

Institutional Arrangements

Most countries have a designated national provider of water and wastewater services.

In most of the islands there are National Water and Sewerage Utilities responsible for operation of public sewerage systems and the Environmental Health Departments responsible for the enforcement of the regulations and policies.

Many of these organizations suffer from low levels of technical capacity. The sanitation services that they provide to the population are often deficient. The sector is typically under-funded, and the financial situation of water and wastewater authorities has been deteriorating over many years (largely attributable to a low level of cost recovery in the sector). This has led to insufficient investment in the sector and poor maintenance of wastewater management infrastructure and equipment. The water and sanitation sector in Guatemala for example is characterized by “low coverage, poor quality services, and deteriorating physical assets,” related to a need for increased investments in basic infrastructures.

Most countries have a multi-agency approach to pollution control and the protection freshwater and coastal resources.

This is leading to better management of sewage and is evident from the development of multi-stakeholder bodies e.g. Coastal Zone Units, Environmental Protection Agencies, Water Resources Management Agencies, among others, in the various countries (CEHI, 2009). These agencies interact with several other bodies including Government departments, the water utility company and the Solid Waste Management Authority, for example, in order to coordinate and effectively discharge their duties. The discharge of the functions of the bodies responsible for Environmental Impact Assessments (EIAs) also requires the interaction of several referral agencies. In some countries, EIAs are legislative requirements for certain types of developments, and are intended to minimize the negative impact to the environment.

There are a multitude of government entities involved in water and sanitation in Guatemala, and none of them has been assigned a clear leadership role in the sector. The Ministry of Health, the Municipal Development Agency (INFOM), the Ministry of Environment and the Planning Secretariat in the President's Office and all have a role, albeit ill-defined, in determining policies and strategies for water and sanitation, as well as for water resources management. A Permanent Coordinating Committee for Water and Sanitation (COPECAS) was created in 1985 by the Government Decree (Acuerdo Gubernativo) 10036-85 to coordinate the work of all public agencies in the water and sanitation sector, but it is inactive (Wikipedia.com).

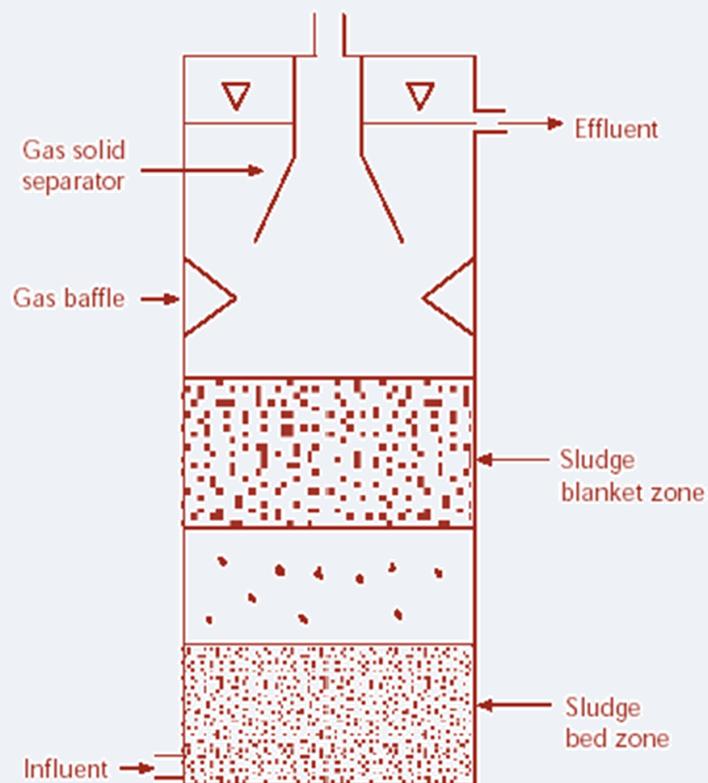
Responsibility for aspects of wastewater management resides with several separate government institutions. This fragmentation of responsibility is not uncommon to many countries of the WCR and in some cases there may be a gap between the formalised and realised roles of agencies. For example, in St. Lucia the Coastal Zone 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. It is not evident, however, that this Unit plays a very active role in some of the key physical development issues as a matter of routine e.g. they do not form part of the core team of referral agencies in the undertaking of EIAs (CEHI, 2009).

The Ministry of Health would approve the choice of technologies from the perspective of human health and safety; the Water and Sewage Company (WASCO) would advise on the capacity of their existing systems or lack thereof; the Ministry of Planning would ensure 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.

In Suriname, 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 (CEPIS et al, 1998).

Section 3:

Wastewater Management Technologies in the WCR



Introduction

This section highlights the main challenges to improving wastewater management in the Wider Caribbean Region and discusses the extent to which appropriate wastewater treatment technologies are being used. The root causes limiting the adoption of appropriate wastewater management interventions in the region are examined, including critical technological barriers to adopting new and innovative wastewater management measures.

A snapshot of issues and challenges related to technologies in wastewater management is presented in the table below⁴:

Old technologies
Lack of training on operation and maintenance of current and imported technologies
Financial constraints to implementing new technologies
Fewer than needed treatment plants /inadequate wastewater treatment facilities
Lack of infrastructure coverage
Reliance on imported technologies that are sometimes difficult to maintain

Special attention is given to the level of regional compliance of existing wastewater systems with Annex III of the Land-Based Sources of Marine Pollution Protocol under the Cartagena Convention and required gaps that needs to be addressed.

⁴ The information contained herein is based on a survey instrument administered in November 2009 at a workshop in Cuba entitled, "Terminal Lessons Workshop for GEF Contaminated Bays and Regional Verification for GEF CReW Projects" at one administered at the "18th Caribbean Water and Wastewater Association Conference" held in St. Thomas in the USVI in October 2009.

Annex III LBS Protocol Requirements

Summary of Types of Domestic Wastewater Management Requirements Under Annex III

Discharge of Domestic Wastewater: Regulate domestic wastewater discharges; locate, design, and construct wastewater facilities and outfalls; encourage and promote domestic wastewater reuse and reduction of discharges; promote use of cleaner technologies; and develop plans to implement requirements of Annex III. Compliance should be attained within a 20-year schedule, based on when the respective country signed Annex III.

Effluent Limitations: Ensure that (1) a nation's domestic wastewater management plan is designed to comply with Annex III effluent limitations for Class I and II waters, (2) all discharges take into account impacts associated with total nitrogen and phosphorus requirements, and (3) residual chlorine concentrations and amounts are not toxic to marine organisms.

Industrial Pre-treatment: Develop and implement industrial pretreatment programs to manage discharges into new and existing domestic wastewater treatment systems to avert operations damage, population endangerment, sludge contamination, and environmental toxins.

Household Systems: Provide for household system construction, operation, and maintenance of sewage collection in areas without them.

Management, Operations, and Maintenance: Provide for resources, including development of training programs, development and access to operations manuals, and other technical support for management and system operators to ensure proper system operations.

Discharges into Class II Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class II waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total Suspended Solids	150 mg/l*
Biochemical Oxygen Demand (BOD5)	150 mg/l
pH	5-10 pH units
Fats, Oil and Grease	50 mg/l
Floatables	not visible
* Does not include algae from treatment ponds	

Discharges into Class I Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class I waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total Suspended Solids	30 mg/l*
Biochemical Oxygen Demand (BOD5)	30 mg/l
pH	5-10 pH units

Fats, Oil and Grease	15 mg/l
Faecal Coliform (Parties may meet effluent limitations either for faecal coliform or for E. coli (freshwater) and enterococci (saline water).)	Faecal Coliform: 200 mpn/100 ml; or a. <i>E. coli</i>: 126 organisms/100ml; b. <i>Enterococci</i>: 35 organisms/100 ml
Floatables	not visible
* Does not include algae from treatment ponds	

All Discharges

Each Contracting Party shall take into account the impact that total nitrogen and phosphorus and their compounds may have on the degradation of the Convention area and, to the extent practicable, take appropriate measures to control or reduce the amount of total nitrogen and phosphorus that is discharged into, or may adversely affect, the Convention area. The table below provides information on the current effluent standards and guidelines in the Caribbean Region. It should be noted that the table shows that most effluent limitations set by Caribbean for the standards are in keeping with those set under the LBS protocol or are more stringent.

Effluent Guidelines and Standards in the Caribbean Region

	BOD ₅ mg/l	TSS mg/l	pH	F-Coli #/100 ml	T-Coli #/100 ml	Res. Cl mg/l
Bahamas ²	<30	<30	6-9	+>85% removal of BOD and TSS		
Barbados	<25	<25				
Cayman Islands	<30	<30	(disposed by deep well injection)			
Columbia ³	>30%r	>30%r	6-9			
Colombia ⁴	>80%r	>80%r	6-9			
Cuba	<50	<50	6.5- 8.5	<200	<2000	
Guadeloupe ⁶	<40	<30				
Honduras	<30	<30	6-9	+>85% removal of BOD and TSS		
Jamaica	<20	<30		<200		<1.5
Panama	>80%r	>80%r				
Puerto Rico	<30	<30	6-9	+>85% removal of BOD and TSS		
St. Lucia	<25	<30				
Trinidad ⁷	<25	<30	6-9	<200		
Trinidad ⁸	<125	<175	6-9	<400		
Venezuela	<40	<50	6-9	<200	<1000	<0.5

² EPA standards have been adopted in the Bahamas, Honduras and Puerto Rico

³ Existing treatment plant, in % removal from influent

⁴ New treatment plant, in % removal from influent

⁵ Guidelines-use water quality base approach

⁶ Effluents from aerated lagoons

⁷ For discharge into inshore seas and environmentally sensitive areas

⁸ For discharge into environmentally non-sensitive areas

Regional Sectoral Overview of Wastewater Management Technologies in the Wider Caribbean Region

The broad conclusion of the Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992) study was that the performance of the treatment plants was generally poor, and this was accounted for as a result of poor maintenance and management owing to poor financial resources for these activities.

- Causes of failure of many wastewater treatment facilities include the use of inappropriate technology, poor operation and maintenance practices, and insufficient funding and skilled personnel (Source: Directory of Environmentally Sound Technologies for the Integrated Management of Solid Liquid and Hazardous Waste for SIDS in the Caribbean Region (2004).
- Sound environmental technologies as well as those that were commonly employed throughout the region, include: conventional sewerage, wastewater collection and transfer, wastewater treatment (on-site; centralized, decentralized); wastewater reuse, wastewater disposal systems; residuals management; “zero” discharge, sludge management (Directory of Environmentally Sound Technologies for the Integrated Management of Solid Liquid and Hazardous Waste for SIDS in the Caribbean Region (2004).
- According to UNEP/GPA (2006) the high costs of building and maintaining traditional sewage treatment plants are frequently the reason for not treating sewage before its disposal. Nevertheless, biological methods of treatment are available for sewage that is not contaminated with industrial waste and which are suitable to the tropical character of the Caribbean region (UNEP/GPA 2006).
- Low-cost, low-technology options for the management of domestic sewage are the most appropriate technologies for domestic and industrial sewage pollution control in the WCR (Appropriate Technology for Sewage Pollution Control in the Wider Caribbean Region (UNEP-CEP, 1998).
- In areas of higher population density, it is feasible to develop a local collection system and use a single facility to treat the community’s wastes.
- Lagoons, stabilisation ponds, and aerobic package plants are common treatment options for mid-size communities in the WCR. Lagoons are often appropriate, but they require a large area to provide adequate treatment.

- Package plants are used mostly for resort communities, hotels, and other public buildings. Many package plants in the WCR are operating improperly because of improper design and inadequate maintenance.
- In centralised, urban centres, lagoons, package plants, and conventional activated sludge systems are used. Many of these treatment facilities do not provide adequate treatment because of improper maintenance, and lack of skilled operators (UNEP-CEP, 1998).
- A report by CEHI and PAHO described the following disposal practices for systems in the WCR that collect and treat sewage (Bartone, 1984):
 - 21 percent reuse effluent;
 - 14 percent practice subsurface discharge;
 - 28 percent use marine disposal, mainly on shoreline;
 - 22 percent discharge to surface waters such as lagoons or streams;
 - 14 percent practice on-site disposal.
- Sources upon which water quality standards can be based, include extensive studies on the effects of pollution in receiving waters as well as existing standards from other countries or states. Most countries in the WCR use microbiological water quality standards taken from USEPA guidelines written prior to 1986. However, these standards often are too stringent and expensive for a developing nation. Planners need to account for the economic realities and development priorities of developing nations when setting water quality standards.
- Generally decentralized systems were more cost effective in rural areas where the distance between households were greater and the cost of a centralized system for collection and treatment would be more expensive (within the context of technical and environmental suitability) (Needs Assessment Guidance to Develop National Plans for Domestic Wastewater Pollution Reduction (UNEP, 2003).
- About 2/3 of the total population of CARICOM countries (5,817,000) live in Jamaica and Trinidad and Tobago as well as 2/3 of 303 plants are located in these countries. The survey collected data on 138 treatment facilities i.e. 46 %. It is believed that the absence of large centralised sewer systems has resulted in the proliferation of package sewage treatment plants (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- Of the 138 plants investigated 25 % were operating good, 36 % were operating moderately and 22 % were operating poor and 13 % were not operational (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).

- Of the plants surveyed there was a relationship between the operational responsibility and operational status indicating that 59 % of the plants were privately owned and operated of which the majority was owned by hotels and resorts. The NWSUs operated about 25 % of the wastewater treatment facilities and operated their plants better than the private and Government sector (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- Most operators had no formal training (72%), but had knowledge of wastewater treatment through on the job training, private studies and experience. A 7 % higher score for good operating plants with certified operators was observed compared to the plants with non-certified operators and a 6 % higher score for moderately operational plants (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- The lack of test results for operational parameters presented severe constraints for proper operational management and control as well as plant monitoring and inspection. Laboratory testing facilities were generally limited to field tests like residual chlorine. The NWSUs monitored 24 % of the plants, the governmental departments monitored 23 % and in 5 % of the cases samples were sent to private laboratories. Only in 13 cases (9 %) were analyses performed onsite (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- Environmental monitoring was conducted in 41 % of the cases where the effluent was discharged into aqueous environments. The monitoring programme was conducted by the national governments (84 % of cases) and by the NWSUs (32 %) of the cases. In nine cases the NWSU and the national government cooperated in the sampling programme. The environmental monitoring programmes have clearly showed that there was a widespread pollution from wastewater and effluent discharge (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- The reuse of effluent was applied only to a limited extent in the Caribbean and only where freshwater resources were scarce (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).
- Interrelated reasons for the low status of operation of treatment plants included the lack of adequate regulations and approval procedures; inspection procedures and programmes; financial resources allocations; operational skills and process understanding; operation and maintenance manuals; operational support and service contracts; maintenance and absence of preventative maintenance; process monitoring and inadequate laboratory facilities; inappropriate selected

technologies; and unavailability of spare parts (Assessment of Operational Status of Wastewater Treatment Plants in the Caribbean (CEHI, 1992).

- The most common scenario is typified by tourist resorts maintaining their own collection and treatment facilities. These plants do not comply with the criteria for good operation due to:
 - Application of technologies that require high levels of skilled human resources and energy input in operation and maintenance;
 - Inadequate operating skills and limited understanding of treatment processes and insufficient process monitoring;
 - Insufficient time allocation to maintenance;
 - Insufficient operational support through operation and maintenance contracts;
 - Insufficient funds allocation;
 - Inadequate disposal facilities for excess sludge.

- According to Bullock, 1994 presented a paper (Near Zero Discharge Systems: Low Cost, Advance Technology for Caribbean Water and Wastewater) on a concept for on-site systems including "underwater reversing sand filters" for sink and washing drainage followed by aeration and reverse osmosis. The intended use of this system is to treat household grey water for return to potable use. A separate, smaller system would be used for toilet water to prepare it for soil absorption or discharge to receiving water.

- According to Archer in Impacts of Wastewater on Caribbean Coastal and Marine Areas, 1994, sewage pollution problems faced by the Caribbean region include algae deposition on sea-grass beds, coral reef damage, and reduction in fisheries. The potential for amelioration of these problems by nutrient removal from sewage effluent and installation of long marine outfalls was discussed.

- In Sand Filtration Treatment of Domestic Wastewater a Viable Option in Complex Areas, 1994, Monroe presented a discussion of potential solutions to the pressing problem of nitrate contamination of ground water supplies by septic tank effluent. A series of alternatives were considered including:
 - Evapotranspiration beds
 - Intermittent sand filters
 - Aerobic systems
 - Total retention, and
 - Overland flow system

- Wastewater Disposal in the Caribbean: Status and Strategies (Archer, 1989) and Developing Alternative Approaches to Urban Wastewater Disposal in Latin America and the Caribbean (Bartone 1984). These papers provided good overviews to

wastewater disposal in the Caribbean. The authors mentioned such possible waste treatment technologies in the WCR as submarine outfalls with minimal pre-treatment, treated effluent reuse for irrigation and other "unconventional" technologies for urban slum sanitation. They also mentioned current problems in setting water quality standards. Too often, the regulatory agencies in Latin America and the Caribbean attempt to define a set standard based on water usage or classification. This approach has not worked well because of its inflexibility, its failure to correlate water quality with discharges, and its disregard of economic issues.



SUMMARY OF SEWAGE COLLECTION AND TREATMENT PRACTICES AND EFFECTS IN THE WCR

Country	Degree of Collection	Degree of Treatment/ Type of Treatment Prevalent	Problems	Monitoring Programs and Standards
Bahamas	15.6% of population	Deep well injection of raw sewage; 44% of sewage treatment works (STW) are in poor condition or non-operational	High incidence of gastro-enteritis	Department of Environmental Health conducts random sampling of coastal waters; Twice monthly sampling to begin; WHO and U.S. EPA standards currently used
British Virgin Islands	1 collection system	Pumping of raw sewage to marine outfall; some septic tanks	Some wastes return to shoreline, ground water pollution problems	Permanent program being established; monthly sampling of total (TC) and faecal (FC) coliforms in bays. U.S. EPA standard of 200 FC/100 mL and 1000 TC/100 mL
Dominica	13.5% of population	Raw sewage, septage, and effluent disposal into rivers and ocean; virtually non-existent treatment	High incidence of water borne diseases—65 cases typhoid in 1982	
St. Lucia	13.2% of population. Treatment facility in Rodney Bay	Usually untreated raw sewage discharged into ocean & inner harbours; 54% STW are in poor condition or non-operational	High bacterial levels in some coastal areas	Random sampling of coastal waters conducted by the Ministry of Health in co-operation with CEHI
Trinidad & Tobago	Most of population serviced	Lagoons, trickling filters, activated sludge; oxidation ditches; package plants; discharge into estuaries and rivers; 46% in poor condition or non-operational	Poor maintenance practices; high coastal bacterial counts. Rivers of poor water quality.	Institute of Marine Affairs conducts surveys to assess quality of bathing. No legally declared standards yet, but EMA, CEHI, and Trinidad & Tobago Bureau of Standards developing them now.
Montserrat	Virtually none, only 1 STW	Septic tanks with soil absorption fields (volcanic sandy loam provides good treatment)	Inadequate for large developments; otherwise few problems	
Barbados	10% - only for Bridgetown, South Coast system under construction	STW for Bridgetown, outfall for South Coast, remainder of island - septic tanks and soakaway pits or suck wells. Few package plants at hotels.	Nutrients in coastal zone impacting coral reefs. High coliform counts in some coastal areas.	Coastal Zone Management Unit & Environmental Engineering Unit monitor swimming areas for faecal coliform.
Grenada	1 for city of St. George	Virtually no treatment in some areas; about 60% STW in okay condition	Pollution at Grand Anse Bay	
Guadeloupe (France)		Oxidation ponds		Sanitary quality of bathing waters assessed on a regular basis and before each tourist season. Maps issued to describe water quality. EEC guidelines of 1976 used
St. Vincent	6% - only for City of Kingstown	Kingstown has preliminary treatment and outfall. Most of island uses septic tanks and poor quality absorption pits or fields. Few package plants at hotels.	Impervious soils and high water table in coastal zone causes overflowing of absorption fields.	None

SEWAGE COLLECTION AND TREATMENT PRACTICES AND EFFECTS IN THE WCR

Country	Degree of Collection	Degree of Treatment/ Type of Treatment Prevalent	Problems	Monitoring Programs and Standards
Antigua & Barbuda	Mostly for hotels	Numerous hotel package plants; 48% in poor condition or non-operational; septic tank effluent directly to sea		Random sampling by Ministry of Health with CEHI; Emphasis on potable water quality; WHO standards used mainly
St. Kitts - Nevis	Mostly for hotels and hospitals	A few package plants, most in decent condition; the remainder use septic tanks	No serious problems, but some septic tank effluent saturation	Random sampling of coastal waters conducted by the Ministry of Health in co-operation with CEHI
Belize	Very little; new system being built for Belize City	Aerated lagoons before ocean outfall; high water table encourages draining septic tank effluent directly to canals and ocean for fear of contaminating drinking water supplies	High coliform counts in coastal waters	
Colombia	25% of coastal population	Very little treatment	Enteritis, hepatitis, and typhoid fevers; eutrophication in harbours	Regular sampling and analysis in a few area, such as Cartagena Bay. Very developed environmental legislation, set standards for faecal coliforms, and waste water effluents for new & existing plants.
Cayman Islands	System built in 1988	Stabilisation ponds outfall		Government agencies jointly monitor coastal water quality (total, faecal coliforms & Enteroc...). EEC & WHO standards currently used. Comprehensive surveys carried out in identified pollutant areas.
Costa Rica		Limon discharges raw sewage into harbour	No major problems except coliform count near Limon discharge	No regular program is known to exist. Studies of coastal waters have found total coliforms (TC) to be twice that of faecal coliforms (FC). In U.S., more common values of TC:FC are 5:1
Cuba			Problems concentrated in Havana with faecal coliforms	Ministry of Public Health is in charge of ensuring compliance with standards. Regular monitoring program in place. Standards and guidelines adopted from international organisations & European countries.
Dominican Republic	25% of urban population (in 1979)	Sewage discharge into sea		
Guatemala		At least 27 treatment facilities - Imhoff tanks, lagoons, trickling filters, and activated sludge.	Many treatment facilities impaired due to poor design, lack of spares, and shortage of qualified operators.	
Country	Degree of Collection	Degree of Treatment/ Type of Treatment Prevalent	Problems	Monitoring Programs and Standards
Haiti	None	40% population (mostly urban) uses latrines and septic tanks; 41% urban + 12% rural have acceptable disposal means 80-90% septage and latrine solids dumped into rivers and sea illegally	Human waste disposal is most pressing problem	

Honduras	No data.			
Jamaica		109 STW; 21 serve Kingston area; however not enough capacity; 8-10 mgd of inadequately treated sewage is discharged into Kingston harbour; 25% STW are in poor condition or are non-operational	Coastal waters are abiotic	There is monitoring of sewage and discharge limits for sewage treatment plants. However, no documentation if regular monitoring of coastal waters is conducted.
Mexico		Commonly discharge into rivers; in Cancun, sewage collected and discharged into lagoon	Abiotic conditions near urban centres	Monitoring program or practices not known. Minimum water quality levels are required for various water uses, such as bathing or shellfish growing.
Panama	6 sewer systems serve 95% of coastal population	4 have primary treatment (10% of coastal population); 2 systems discharge raw sewage (85% of coastal population)		No information available on monitoring programs. Water quality criteria recently adopted based on WHO/PAHO standards.
Gulf of Mexico, U.S.	460 municipalities discharge	Majority receive secondary treatment or better; 10% have only primary treatment; more than 1 billion gallons per day Some malfunctioning septic systems, particularly in Louisiana and Florida	Oxygen depletion in areas has caused fish kills due to marine growths	National monitoring, assessment, and control system in place for all coastal states. US/NOAA program determines national inventory on pollutants discharged into coastal waters. EPA, FDA, etc.
Puerto Rico				
U.S. Virgin Islands				
Venezuela	65% served	3% of population served by sewage treatment - mainly on Margarita Island. Projects under construction for Valencia and Maracaibo. No municipal treatment for Caracas and other major cities. Significant industrial load.	Oxygen depletion and coliform contamination of rivers.	Monitoring and compliance programs are implemented. National standards for coastal water quality criteria developed in 1983 based on EEC, WHO, and U.S. EPA guidelines.

A Snapshot of Current Wastewater Management Infrastructure for 3 WCR Countries

Barbados:

- 99% population provided with piped water
- 95% population uses septic tanks and wells to wastewater disposal.

Belize:

- 90% population provided with piped water
- Belize City is 40% sewerred; remainder use septic tanks.
-

Bahamas:

- New Providence is 15% sewerred; remainder use septic tanks.
 - 35% population has piped water; remainder use wells
-

A Synopsis of Financing Issues and Wastewater Management Projects and Technologies

- Challenges to Private Sector Financing of Wastewater Projects
 - Difficult sector for attracting private capital, operational skills, & management expertise
 - High capital intensity
 - Political pressure on tariffs and conviction of water and wastewater services as a “free” good
 - Deficient regulations
 - Lack of sub-sovereigns access to financing
 - Poor condition and insufficient knowledge of networks and customer bases
 - Currency mismatch between revenues and financing sources
 - Local governments and utilities lack the financial capacity or regulatory framework and governance to act as credible financial partners
 - Low level of risk mitigation instruments

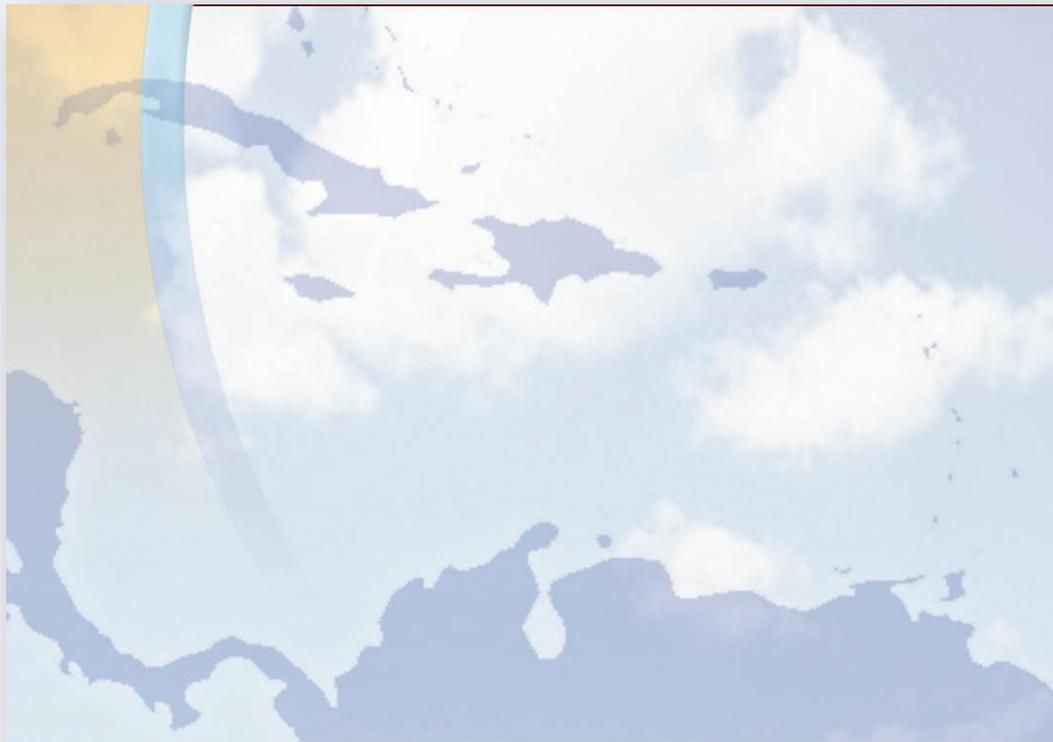
- Characteristics of Water Service and Wastewater Management in the Region
 - Diverse ownership structures with some sub-regional groupings
 - Caribbean - primarily island-wide government owned utilities (Jamaica, Saint Lucia, Barbados)
 - Central America— mixture of municipalities, municipal enterprises (Belize) and one private mixed-capital company (Honduras), along with some national governmental entities that provide services
 - Mexico (Yucatán) – State-owned public entity, with one water and sewerage concession (Cancún)
 - South America – local and regional governments and private companies (Colombia)

- Source of Funding for Water and Wastewater Projects
 - Caribbean – primarily annual grants to utilities from the central government although some borrowing and in one case (Grenada) financing from the national social security fund
 - Central America – grants and loans from central government to local water providers
 - Mexico – grants from Federal Government to state provider along with private investment from concessionaire (in Cancún)

- South America – Private sector financing thorough PPPs and public sector financing (e.g., in Colombia from FINDETER, a national government lending agency)
- Wastewater Management Projects in the Wider Caribbean
 - Varies greatly among countries & utilities in the region
 - Many utilities have completed feasibility studies, cost benefit analysis, and preliminary design work for pending projects
 - Some have developed long-term capital plans but not specific project preparation
 - Virtually all projects would benefit from technical assistance to reach financing stage
 - Greatest value proposition for technical assistance is financial structuring and design for projects
 - Utilities and countries engage in opportunistic capital planning based on availability of donor or government funds – projects based on eligibility for donor assistance or local political pressure - not on best value for dollar
 - Wastewater treatment is last priority of water utilities
 - 1st is water supply – political advantages
 - 2nd is covered sewage systems – health concerns
 - 3rd is sewage treatment – with higher maintenance costs
 - Therefore need to develop financial programs that level the playing field between wastewater and other water related projects

SECTION 4:

Profile of Wastewater Management in WCR Countries



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 from 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 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 excrements are stored in pails/buckets and are 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).

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).

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 (GAB) and adopted as a Hotspot within the Caribbean using the UNEP/GEF Global International Waters Assessment (GIWA) 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.
- The GAB 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.
- 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 Legal 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 CBH has been monitoring the near shore water quality status since 1989 in conjunction with the Caribbean Environmental Health 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 (DCA).
- 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.

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.
- 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 caters 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 m³/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

- 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 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 recognised academic institution accredited by the Ministry of Environment, Water Resources and Drainage.

Existing Legal 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).

Costa Rica

Current Issues and Challenges

- The main problems faced by the water and sanitation sector in Costa Rica are: 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

- In the metropolitan area of San Jose, only 47 percent of the population is connected to sewerage networks, which discharge raw sewage to the water courses that cross the city, rendering these water courses completely contaminated. In most of the regions of the country water production capacity is very close to current demand, so the risk of facing water deficits in the near future is high and in fact, various cities already suffer water shortage and rationing.
- In addition, 21.6 percent of Costa Rica's 4.1 million residents consume contaminated drinking water, corresponding to some 882,000 residents. Limon, Puntarenas and Alajuela provinces have the highest vulnerability levels of drinking water. Contamination is caused by decomposition and leaks into septic tanks, and also the use of nitrogen fertilizers, which causes health problems (World Bank, 2004).
- In 2008, it was reported that eight popular Costa Rican beaches lost their Blue Flag certification - an eco-label of clean and safe beaches – and a popular hotel was ordered closed due to sewage pollution.

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 the early 1990s, legislation 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).

- 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 of 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 of 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

- According to the Drinking 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 (ARESEP) allows the provision of water supply services by the private sector, the private sector does not play any role in the water sector.

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Existing Institutional Framework

- The Ministry in charge of the water sector in Costa Rica is the Ministry of Health (MINSALUD).
- 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.
- De facto, AyA has an important indirect policy and regulatory 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 sound economic, financial, social, technical and environmental policies for the sustainable development of the sector and is not involved in improving organizational and operational arrangements so as to avoid unnecessary duplications and overlapping responsibilities between sector agencies. In practice, AyA acts mainly as a service provider, the largest among several others (World Bank, 2004).

- AyA suffers from all typical problems of public utilities. Its management is politically nominated and frequently replaced on the basis of political cycles. The sanitation services that it provides are deficient and its financial situation has been deteriorating since 1999 (World Bank, 2004).
- For many years AyA and the government have 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 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 (ESPH S.A.), 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 (CAARs) and Administrative Associations of Rural Water and Sanitation Systems (ASADAS), 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 performance of most of these providers is unsatisfactory, although ESPH and AyA perform better than others. Only 21 percent of the population is connected to wastewater collection networks. Many of these organisations have the dual role of providing potable water and supplying wastewater collection services. There is low cost recovery and high levels of inefficiencies in most systems; Unaccounted for Water (UFW) is usually above 50 percent. Revenues, therefore, do not permit adequate management of the potable water nor the wastewater infrastructure, and the financial situation of the sector is precarious.
- The other main institutions involved in the sector are:
 - Regulatory Authority for Public Services (ARESEP) created in 1999, which is responsible for economic regulation including tariff setting, monitoring and control of efficiency and of quality of service, amongst others duties; and

- Ministry of Environment and Energy (MINAЕ) which is responsible for water resource management in Costa Rica in accordance to the Environment Law, and for environmental licensing. In addition to the mentioned institutions, many others have a role in the sector, sometimes with overlapping functions and responsibilities.

Guatemala

Current Issues and Challenges

- According to the WHO/ UNICEF Joint Monitoring Programme for Water Supply and Sanitation, access to sanitation services has slowly risen over the years in Guatemala. In 1990, 58 percent of the total population having access to adequate sanitation in 1990, to 86 percent with access in 2004. The government of Guatemala estimates that the population without access to water services is growing at a rate of at least 100,000 people every year.
- Accurate and reliable data regarding coverage in rural areas is unavailable. Conflicting statistics as to the percentages of the population using improved drinking water sources present difficulties in assessing the seriousness of the problem.
- Access to water in urban areas is irregular, as 80 percent of urban water systems function for an average of 12 hours every day. As of 2000, 25 percent of water in urban systems was disinfected and only 1 percent of all collected sewage water has been treated (WHO/UNICEF JMP).
- The water and sanitation sector in Guatemala is characterized by “low coverage, poor quality services, and deteriorating physical assets,” (WHO/ UNICEF JMP) related to a need for increased investments in basic infrastructures. Population growth, agricultural expansion, unevenly distributed services, and polluted sources have contributed to the inability of citizens to access adequate amounts of clean water (WHO/UNICEF JMP).

Wastewater Technologies in Use

Existing Policy Framework

- The principal policy governing the sector is the National Plan of the Public Services of Potable Water and Sanitation for Human Development 2008-2011 (Guatemala Country Strategy, 2007).
- There is currently at least one major project on the ground for wastewater management. A project for the Development of Capabilities for the Conservation of the Aquatic Environment in the Metropolitan Areas is being implement with the

support of the Japanese International Cooperation Agency (JICA). This project is focused on the use of appropriate technologies in nine metropolitan areas throughout Guatemala.

- 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.
- One of them is Servicios para el Desarrollo (SER), a local NGO dedicated entirely to water and sanitation through its program "Agua para todos". Created in 1996, SER 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.
- In 2005 investments in water and sanitation stood at only US\$ 14 million or about US\$ 1 per capita, one of the lowest levels in Latin America. In 1999 investments had been much higher. The WHO estimated them at Quetzales 285.8 million (US\$ 37.1). This represented approximately 0.2% of the Gross Domestic Product and 1.5% of total government expenditures for 1999. Spending by the central government increased dramatically in the sector, with only US\$ 6.07 million spent in 1995 to US\$ 56.13 million spent in 1998. Investments in the sector lagged far behind other sectors in 1998, especially when taking into consideration the previously small investments made in water and sanitation. For example, spending in each of the sectors of Education, Culture and Sports; Transportation; Defense and Security; and Work and Social Provision, exceeded that of the sector for Water and Sanitation by an average of 900%.
- Government sponsored investment is channeled through various organizations, including INFOM and UNEPAR, the Ministry of Health, the Social Investment Fund (FIS), and the National Fund for Peace (FONAPAZ). The lack of cohesion amongst these organizations prohibits the coordinated growth and advancement of the water and sanitation sector. Various NGOs directly assist communities, especially in rural areas.

- 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 labor, 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

- The principal legislative instrument governing the sector is Regulations for the Discharge, Disposal and Reuse of Wastewater (government regulation No. 236-2006). One of the main problems faced by Guatemala is the lack of effective application in operation and enforcement of the regulations. In addition, the collection and monitoring of ambient water quality data to support effective enforcement is seen as a major weakness.
- Another major problem is involving local governments in the management of wastewater such that industry complies with the regulations of the Discharge of Residual Water and other relevant regulations.
- The Ministry of Public Health and Social Assistance (MSPASA) is legally responsible for monitoring drinking water quality at a national level. They provide water quality testing services for private and public operators.
- The Ministry of the Environment and Natural Resources, along with the Municipal Development Agency (INFOM), is officially responsible for environmental regulation in the water and sanitation sector. However, there is no real effective environmental management in the sector.
- Economic regulation in the sector is practically non-existent. Tariffs for service provision are determined by politics, and there are no organizations which monitor providers in order to detect abuses of the system.
- 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.

Existing Institutional Framework

- 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”). 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.
- There are a multitude of government entities involved in water and sanitation and none of them has been assigned a clear leadership role in the sector. The Ministry of Health, the Municipal Development Agency (INFOM), the Ministry of Environment and the Planning Secretariat in the President's Office and all have a role, albeit ill-defined, in determining policies and strategies for water and sanitation, as well as for water resources management.
- INFOM, created in 1957, is a decentralized public 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.
- In the same year, the Executive Unit of the Rural Aqueduct Program (UNEPAR) and the Highlands Drinking Water and Sanitation Project (PAYSA), 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. UNEPAR also manages the data base of (Information on(SAS).

- A Permanent Coordinating Committee for Water and Sanitation (COPECAS) was created in 1985 by the Government Decree (Acuerdo Gubernativo) 10036-85 to coordinate the work of all public agencies in the water and sanitation sector, but it is inactive. The committee is supported by the Pan–American Health Organization (PAHO).
- Guatemala's National Environment Commission (Conama) is responsible for environmental management and promotion.
- The Environment and Natural Resource Secretariat was created into bring together different entities that are involved in environmental policy development in an effort to streamline and reduce conflicts in jurisdiction

The actual effectiveness of these organisations relative to their mandate is unknown.

Guyana

Current Issues and Challenges

- Key issues in the water and sanitation sector in Guyana are poor service quality, 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. In addition, the 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).

- Water quality monitoring - Only limited water quality monitoring is done for drinking water sources (i.e., surface and ground waters) and no testing is done of rivers and coastal waters. Nevertheless, as noted, one significant indicator of the environmental health problem is the increase in the incidence of environmental diseases.
- 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).
- Other diseases that afflict the population are transmitted by common vectors that are directly influenced by environmental conditions. These include dengue, filariasis, malaria, yellow fever and schistosomiasis (NDS, 2007).
- 1998 health statistics show increases in the number of reported cases of malaria and a high mortality rate, especially in the interior. The increases in cases of gastroenteritis reflect poor conditions in water supply and sanitation, as does the outbreak of cholera along the border with Venezuela. In total, water-borne diseases are estimated to have risen more than fourfold over the last decade. In addition, the infant mortality rate is the highest in CARICOM.
- 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.
- The role of Guyana Water Incorporated's (GWI) Sanitation Department is to ensure that a certain amount of sewage pumps are working to keep the overflows to a minimum. This has become a very difficult task for the operators and maintenance workers. This is due mainly to the abuse of the sewerage system.

Wastewater Technologies in Use

- There are two sewerage systems in Georgetown: Central Georgetown and the Tucville Sewerage System. In the Central Georgetown Sewerage System there are no treatment processes. This system was first commissioned in 1929 and essentially comprises 24 interlinked sewerage basins each having a network of gravity sewers draining into a single pumping station. The 24 pumping stations deliver the “untreated” flows into a common ring force main then they are discharged to the mouth of the Demerara River via short outfall at Fort Groyen, Kingston (NDS, 1997).
- 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.
- Floods also have serious public health consequences in coastal areas. In Georgetown, sewage is discharged untreated through an outfall into the mouth of the Demerara river and during high tides and flooding this sewage is returned inland. Other areas use septic tanks and pit latrines, which may contribute to pollution of groundwater and, during flooding, surface waters.
- Sewage systems in the urban areas are inadequate to nonexistent with minimal purification of water via filtration and chlorination, which occurs only in Georgetown when supplies are available and operational. The rest of the country uses septic tanks. Water distribution systems within Georgetown are poorly maintained and unreliable, forcing most residents to use individual cisterns (NDS, 1997).
- Canals throughout Georgetown are sources of water, but they also serve as sewers and are usually laden with agricultural and biological contamination and solid wastes.

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 articulates the need for the establishment of an Environmental Protection Agency (EPA) and the promulgation of the Environmental Protection Bill.
- The EPA was subsequently created out the Environmental Protection Act (1996). The Act, empowers the EPA to performs its these 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 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.

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 Environmental Protection Agency (EPA) was established in accordance with the Act which accorded it several functions including 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 protection 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 as far as can be ascertained no prosecutions have been launched although investigations have been carried out.
- There is no legislation governing pollution control, regulation of pesticides and toxic chemicals, or waste management. The main measures dealing with air and water pollution and solid waste control are the antiquated water supply, drainage, sanitary and nuisance provisions of the Public Health Ordinance.

- In 2002 the Water and Sewerage Act was passed, which merged the Georgetown Sewerage and Water Commissioners (GS&WC) and the Guyana Water Authority (GUYWA), to form Guyana Water Inc. (GWI).
- The Georgetown Sewerage and Water Commissioners Act provides for the disposal of sewage and prohibits the disposal of anything other than sewage and paper into the city's sewers. However, the Act does not define the term "sewage" so at present it is unclear whether industrial wastewater may be disposed of in the sewers.

Existing Institutional Framework

- At the national level, responsibility for sector policy is vested in the Ministry of Housing and Water. The Public Utilities Commission (PUC), a multi-sectoral regulatory body, is in charge of reviewing water and sewer tariffs. However, the PUC seems to be less autonomous from government than other utility regulators in the Caribbean. Local government plays no role in the sector.
- Water and sewerage service provision is the responsibility of Guyana Water Incorporated (GWI), a commercial public enterprise. GWI'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 Georgetown Sewerage and Water Commissioners (GS&WC) were established in 1929 under British colonial rule to operate and maintain the sewerage and waterworks of Central Georgetown.
- 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 Guyana Agency for Health Sciences Education, Environment and Food Policy (GAHEF), whose Environment Division is charged with environmental monitoring and education, reviews of EIAs, and coordination of the Environmental Management Committee for the Coastal Zone. The role of this agency in environmental

management is now uncertain, since some of its functions have been transferred to the Environment Unit attached to the Office of the President.

- The Guyana Water Authority (GUYWA), which works with regional councils and municipal authorities to provide water supply and sewerage services in Guyana; and
- The Central Housing and Planning Authority (CHPA) 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 GUYWA.

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

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 (World Bank, IDB, KfW, USAID, COSUDE) and others through SANAA (USAID, European Union). While all donors assist municipalities and their mancomunidades concerning decentralization, some implement small subprojects for the communities themselves (KfW) and others carry out subprojects of a certain size through construction companies (World Bank)

Existing Legislative Framework

- According to the 2003 Water Framework Law sector policies are defined by the National Water and Sanitation Council (CONASA) which is chaired by the Minister of

Health. Regulation is the responsibility of the Potable Water and Sanitation Regulatory Agency (ERSAPS).

- 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 – JAA) 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, advise 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 (UTIs) 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 (CRS), 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 diarrhea 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 stabilization ponds, a natural technique with low operation and maintenance costs.

St. Lucia

Current Issues and Challenges

- Poor sewage treatment and disposal affects the health of the local population and the environment. In St. Lucia, children have been affected by helminths (UNEP-CEP, 2009).
- 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. In both cases this pollution ended up on the Vieux Fort coast, causing severe environmental problem.
- 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 soakaways, 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).

Wastewater Technologies in Use

- In St. 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.

- 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.
- The direct discharge/loading of sewage into the marine environment in St. Lucia is summarized in the **Table** below. Although only 13% of the population is connected to a treatment plant, many homes and businesses have septic tanks. Although for the most part, the technology is not appropriate, it is still what is promoted. Although for the most part, the technology is not appropriate, it is still what is promoted.

Sewage Loading in the Marine Environment for St. Lucia				
	% Sewer	Treatment Level	Impacts	Monitoring
St. Lucia	13.2% of population. Treatment facility in Rodney Bay	Usually untreated raw sewage discharged into ocean and inner harbours; 54% STW are in poor condition or non-operational	High bacterial levels in some coastal areas	Random sampling of coastal waters conducted by the Ministry of Health in co-operation with CEHI

- In the Vieux Fort area, the Sewage Needs Assessment findings surveys 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 soakaway 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 (HWM); 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.

Existing Policy Framework

- In 2001, the Government of St. Lucia embarked on an initiative aimed at establishing institutional arrangements to facilitate the sustainable development and management of the coastal resources. As part of the initiative, a Coastal Zone Management Project (CZMP) was established under the Ministry of Agriculture, Forestry and Fisheries (MAFF) 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 St. 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).
- At the national level in St. Lucia, the Development of a Coastal Zone Management Framework for St. Lucia (MPDEH/ATRIA, 1995) was an important study which influenced the development of a Coastal Zone Management Project (2001-2003), and the policies that guided coastal zone management in St. Lucia through the Coastal Zone Management Unit (CZMU). The policies of this Unit and its functions are similar to others in most Caribbean Countries. The policies and functions of the CZMU operate as a coordinating body for stakeholder agencies, focusing on protection and conservation of the coastal zone and marine environment (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 St.

Lucia. The St. Lucia Policy outlined the intention of the Government to undertake the expansion of the sewage network in areas of high population densities; to investigate the feasibility of wastewater reuse; and to strengthen the capacity of monitoring and regulatory agencies.

- In St. 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.

Existing Legislative Framework

- A number of national legal instruments exist which are applicable to the management of sewage.
- The St. 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 St. 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 did not appear to be 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 execution of certain relevant actions leading to better management of sewage and this is evident from

the development of multi-stakeholder bodies e.g. Coastal Zone Units, Environmental Protection Agencies, Water Resources Management Agencies, among others, in the various countries. These agencies interact with several other bodies including Government departments, the water utility company and the Solid Waste Management Authority, for example, in order to coordinate and effectively discharge their duties. The discharge of the functions of the bodies responsible for Environmental Impact Assessments (EIAs) also requires the interaction of several referral agencies. In some countries, EIAs are legislative requirements for certain types of developments, and are intended to minimize the negative impact to the environment (UNEP-CEP, 2009).

- There may be a gap between the formalised and realised roles of agencies as in the case of St. Lucia, where the Coastal Zone 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 does not form part of the core team of referral agencies in the undertaking of EIAs. The Ministry of Health would approve the choice of technologies from the perspective of human health and safety; the Water and Sewage Company (WASCO) would advise on the capacity of their existing systems or lack thereof; the Ministry of Physical Development and Environment would ensure 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 St. 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 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 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).

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, waste water 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 diaorrhoea that can be caused by Rotavirus, Giardia lamblia, 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 faecal 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 are as follows:
 - An integrated approach towards water, sanitation and hygiene is lacking;
 - 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 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 handing 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.

Existing Policy Framework

- 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 Legal Framework

- The fundamental legal instrument governing the provision of sanitation is the Constitution of the Republic of Suriname. 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.”
- 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.
- There is an urgent need to update the legal framework of the Water Supply and Sanitation Sector.

Existing Institutional Framework

- 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 Departementen 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 (BOG.)

- The responsibilities for the sewage management and waste water 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 (BOG) 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 waste water 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.)

BAHAMAS

Current Issues and Challenges

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 (WSSP). This will include a tariff study to update the WSC's financial modeling, and assistance to prepare a Corporate Business Plan.

Existing Legal Framework

- The Ministry of Health and the Environment (MOH) is entrusted with the administration of the Environmental Health Act (EHA) and the Health Services Act (HSA) 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.

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 responsible 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.
- 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.

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.
- 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.nationsencyclopedia.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.
- Potential effects of sewage waste on the marine ecosystem include: (i) increased turbidity or cloudiness of water caused by excessive algal growth, which blocks sunlight from penetrating the water and submerged vegetation and corals; (ii) changes the distribution, abundance, and reproduction of individual organisms which may have a direct impact on fisheries; (iii) decreased biological diversity which is often apparent in subsequent changes in food chain relationship and the aquatic community structure (due to increased algae growth); and (iv) excessive oxygen

depletion when large number of algae dies and decomposes by microorganisms. This oxygen depletion can in turn result in excessive fish kills and stunted growth of other marine life.

- 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 the beaches of Chetumal, Corozal Bay, and Cayes in the Lagoon system, on the western shores of Ambergris Caye, Belize City and surrounds, Placencia, Dangriga and Punta Gorda Towns. High concentration of *Escherichia coli* can pose serious public health risk.
- Poor water quality can also lead to high viral content and infectious diseases. Untreated domestic wastewater causes health related problems such as gastroenteritis, cholera and other waterborne illnesses. A review of three Environmental Impact Assessments (EIAs) indicates the presence of *E. coli*. E.I.A's for Blackadore Caye, Stake Bank and Ara Macao show the following figures. Blackadore Caye project has averages of 312/100ml Total Coliform, 1/100ml *E.coli* and 0/100 ml Faecal Coliform. Stake Bank Project recorded 84.8/100ml for Total Coliform and 23.6/100ml of *E.coli* and Ara Macao recorded 353.5/100ml of *E.coli*. World Health Organization (WHO) standards for drinking water for *E.coli* are 0/100ml and recreational waters are 200/100ml. Results therefore indicate that all samples are above the levels for drinking water and the area of southern Belize around Placencia is the only site that has above the standard for recreational purposes. Report from Public Health 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, is 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 coarse sand, highly porous, which can lead to leaching.
- The Belize City Water System currently includes a 3.0 million U.S. gallons per day (USGD) 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 g.p.d. 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 (or biodigestion?) 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 watertable 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 (AIRR) 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 (EPA) 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.

Existing Policy Framework

- 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 program 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.
- The department is headed by a program manager who, through the chief executive officer of WASA, reports to the permanent secretary of the Ministry of Natural

Resources. The key posts below the program manager are chief of operations (in charge of the well drilling crews), health educator, and district coordinators. The department operates from the main office at Ladyville. It has a recurrent budget from the Ministry of Natural Resources to cover permanent established staff, accommodation, and office expenses. A capital budget is also provided by the Ministry of Natural Resources as the government counterpart fund to match the contributions from donor agencies. The government portion covers items such as salaries, spare parts, vehicles, while the donor contribution is used for the provision of materials and equipment, such as tanks and pumps. Over the last year and a half, there have been significant reductions in donor support for water and sanitation programmes, including the Rural Water and Sanitation Support Programme (RWSSP).

Existing Legislative Framework

- Responsibility for natural resources and freshwater and coastal resources in Belize is primarily concentrated at a national level. The Department of the Environment (DOE), 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.
- 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.

- 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).
- 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
- Coastal Zone Management Act. Chapter 329 (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.
- Water Industry Act (revised 2000, 2003) covers national water services and is the responsibility of the Public Utilities Commission and Belize Water Services Limited

(BWSL). 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.

- 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.

Existing Institutional Framework

- In Belize, responsibility for management and provision of water and sanitation services at the sectoral level is shared by various government ministries and departments. The ministries directly involved are: Ministry of Natural Resources, Ministry of Health, Ministry of Tourism and Environment, and most recently, 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.
- Because many ministries and departments are involved, there is an overlap in responsibilities and there is a need to clarify which entity should lead in the execution of these responsibilities. Table x presents the responsibilities of the ministries and their departments in the water resources sector and illustrates the gaps where it is unclear who is responsible.
- 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. Up to date, only one company (Seatec) 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 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 RWSSP.
- 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 (IDB) 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 HECOPAB 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.
- Health Education and Community Participation Bureau (HECOPAB) was set up to support social mobilization, health education, and community participation activities. As part of the community-based strategy, HECOPAB intends to reorient its health education strategy to incorporate the behavioral approach accepted internationally as standard within hygiene education for water and sanitation projects. Using this framework, HECOPAB 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 behaviors 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 (CBET) 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.
- Lack of resources and clear policy guidelines within the Ministry of Health and the Ministry of Natural Resources, however, have constrained the full development of the approach and has diminished coordination over the last year. Neither the Ministry of Health nor the Ministry of Natural Resources have yet approved a set of proposed polices regarding community-based environmental health that were put forward in a position paper prepared by the two ministries in 1994. In the absence of such guidelines, HECOPAB and RWSSP are limited by their own institutional resources in providing community-based 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.

- The Land Utilization Authority is a coordinating committee that is provided for by law. In principle, it should be able to fill the gaps not covered by WASA and the Ministry of Housing. Unfortunately, a number of factors limit the effectiveness of this authority. Prominent among these is the lack of staff to follow up on implementation of the activities agreed upon as essential on a timely basis. Another factor is the frequency of attendance of the members at meetings and their level of preparedness when they are able to attend.
- Before the passage of the regulations which stipulate conditions and situations under which an Environmental Impact Assessment is required, there was no authority that reviewed development plans with the intention of ensuring that unsustainable use of the natural resources of Belize was minimized. In many ways the passage of the Environmental Impact Assessment regulations should be seen as complementing the work of the Land Utilization Authority and where applicable, should be supported by the work of the technical departments to ensure thorough and objective assessment of the potential effect of the development.
- 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.

Jamaica

Current Issues and Challenges

- The discharge of improperly treated wastewater effluent is one of the main contributors to coastal zone degradation in Jamaica.
- Several assessments⁵ 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.
- 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 Closet 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.
- The Soapberry Treatment Plant in Kingston and St. Andrew (KSA) is another 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

⁵ 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 in 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.

critical project as a component in the Kingston Harbour cleanup Project as it would result in properly treated effluent being discharged into the Harbour.

- Sewerage is not generally provided in rural areas, except in small housing developments. Some 88.8 per cent of households located within the KMA have water closets. This was more than twice the proportion in Rural Areas. Over the period, 1997–2007, there was little change in the proportion of households in KMA with water closets. However, there was a marked increase in the availability of water closets in Other Towns, moving to 72.6 per cent in 2007 from 60.0 per cent in 1997. Similarly, Rural Areas experienced a 10 percentage point increase over the period
- 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. The National Water Commission (NWC) operates the largest number of plants and has a fairly large network of sewerage systems in major cities and towns. 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.
- Approximately 20 percent of the population island wide is connected to sewage treatment facilities. 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.
- 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 approximately 260 sewage treatment plants in Jamaica, with the majority owned by the National Water Commission (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.
- In 2002, NEPA, through a special project known as 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 past three years.

- 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.
- 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.
- Several 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. The plants are subjected to frequent breakdowns and are rarely repaired.
- However, technology has improved significantly over the past several years and as such there are a number of new facilities with up to date performance. There however remain the older plants that are still in operation.
- 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.
- The NWC has, within the last six years, completed four new sewage treatment facilities in Ocho Rios, Montego Bay, Kingston 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.
- 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 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.
- Inadequate monitoring and limited enforcement options by regulatory agencies continue to allow plants to operate at undesirable levels.

Existing Policy Framework

- NEPA (then NRCA) and the Planning Institute of Jamaica (PIOJ) 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 (WRA), 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 sewerage of all major towns by 2020; and the rehabilitate 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 were 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).

Existing Legal Framework

- In Jamaica there are at least fifty existing statutes which relates 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 statutes are:
 - The National Resources Conservation Authority (NRCA) Act, 1991
 - The Public Health Act 1974, amended in 1985
 - 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 existing facilities (which are defined as facilities in operation prior to 1997) and those for new facilities (built after 1996). The definitions are in accordance with the NRCA Permit and Licences Regulation, 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 a draft 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-pay” 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 fecal coliforms <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. License requirement for sludge treatment and sewage sludge disposal and the requisite forms are also included.

- The regulations 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 intended to be 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 (WRA).

- 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 (SRC) 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 (JWOA) is a professional body for wastewater plant operators. JWOA, 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 (UDC) 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 (ENGO) and Community Based Organizations (CBO).
- These existing arrangements are not sufficient for the proper functioning of the wastewater sector and additional measures are needed to enhance the performance of the sector. There is a need for improvements in the monitoring and enforcement capacities of regulatory agencies. The collaboration between regulatory agencies such as NEPA and the Public Health Department is weak.

Trinidad and Tobago

Current Issues and Challenges

- The main issues impacting on the wastewater management in Trinidad and Tobago are:
 - Need for a national wastewater policy;
 - Institutional strengthening of the Sewerage Sector in Water and Sewerage Agency (WASA);
 - Development of a Wastewater Master Plan for Trinidad and Tobago;
 - Policy on (new and existing) private wastewater systems in Trinidad and Tobago;
 - Development of regulatory and monitoring mechanisms to control the discharge of trade effluents in to the public sewers;
 - Implementation of appropriate wastewater/sewerage tariff for Public (WASA) and Private Wastewater Systems;
 - Provision of centralized sewerage systems at all urban centres and industrial estates;
 - Strategy to integrate smaller wastewater systems;
 - Funding.

- Sewage pollution comes from both point and non-point sources. The former is caused mainly by inadequately treated effluent from sewerage treatment plants, the latter from a wide range of agricultural, animal husbandry, and urban land use activities.

- Domestic waste which finds its way into watercourses includes sewage, which is considered to be one of the most common causes of pollution in local rivers. The widespread utilisation of on-lot septic tanks, soakaways, and pit latrines generates large volumes of effluents high in septage.

- 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 soakaway 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 routinely found in river water samples taken in any of the developed areas. For example, pollution of the Courland River has been attributed to runoff from pit latrines in the drainage basin of the river and effluent discharged from a hotel into a

storm drain which runs into the river. Campers and villagers utilizing the Maracas Bay River as a toilet facility have caused the river to be polluted with sewage. Sewage contamination of rivers in the catchment of the Caroni Arena Water Treatment Plant (CAWTP) is evidenced by high chloride levels found in the catchment area (EMA/CARIRI, 1997).

- The CRB Research Project 2004-2005 has 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 some instances at levels sufficiently high to indicate a hazard to human health through the transmission of gastro-intestinal illnesses and dermatological infections. 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 is a major concern for most of southwest Tobago, in particular the area from Scarborough to Crown Point. The Scarborough central sewerage treatment facility which was designed to handle all of the sewage generated in that town operates at only one-fifth of its capacity because of the failure of domestic consumers to connect to the system. Treatment plants attached to the Milford Court and Buccoo Housing Estates do not function efficiently, and the effluent from these has been identified as being major contributors to the pollution of the Bon Accord Lagoon/Buccoo Reef complex. Sewerage outfalls from hotels in the southwest have also been found to threaten coral reefs, and have contributed to the degradation of the Bucco Reef system (Akili and James, undated).
- The septic tank/soakaway systems in widespread use tend to overload during peak visitor periods. The porous nature of the coralline limestone in which these are constructed allows contaminants to enter the coastal waters via ground water. A programme of coastal water quality monitoring carried out by Environment Tobago between 1997 and 1999 at several locations around Tobago found sewage pollution to be significant, the levels of faecal coliform bacteria detected being in many

instances much higher than the maximum levels considered safe by the World Health Organisation (Akili and James, undated).

- Yachting is another contributor to the problem of sewage pollution in the nearshore waters of Trinidad and Tobago as most of the visiting vessels do not have on-board treatment systems and there are no pump-out facilities anywhere in the country. Some yachts therefore release raw sewage directly into the sea.
- Chronic and significant sewage pollution results in eutrophication which causes algal growth and red tides that have the potential to damage coral reefs and cause massive fish kills as have occurred in the Gulf.
- There is a risk to human health stemming from direct contact through bathing and boating activities undertaken in contaminated water, and indirectly through the consumption of tainted shellfish which can transmit diseases such as cholera, typhoid and hepatitis A.
- A study carried out of Maracas and Chagville Beaches, and Welcome and Macqueripe Bays by the IMA in 1992 revealed that only two of the six beaches surveyed had bacteria levels which complied with the USEPA bathing beach standards; the survey determined that some respiratory illnesses, as well as ear, eye, and skin infections might have been caused by bathing in polluted water (IMA, 1992 (b)).
- Sewage pollution of Great Courland Bay investigated by the IMA in 1994 appears to have originated from run off from pit latrines located in Plymouth, effluent discharged from the malfunctioning sewerage treatment plant of a nearby hotel, and run off from pig farms and pit latrines located in the drainage basin of the Courland River (This finding 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).
- In 1997 the northern portion of Back Bay in Tobago was deemed unsafe for bathing because it was found not to be in compliance with the USEPA (1976) standard for bathing water quality due to sewage contamination caused by runoff from pig farms and poorly constructed pit latrines and septic tanks (IMA, 2005).

- Water quality at Man-O-War Bay was found in 1997 to be unsafe for bathing because of sewage contamination related to pit latrines located on the beach and yachts moored nearby (IMA, 2005 citing Environment Tobago).
- In 1997, bathing water quality at the northern corner of Buccoo Bay tested not in compliance with the USEPA (1976) standard because of raw or inadequately treated sewage transported from septic tank/soakaway systems and pit latrines, as well as effluent from a package sewerage treatment plant at Coral Gardens (IMA, 2005).
- During the wet season of 1997 the waters of Anse Bateau Bay off Blue Waters Inn were found to be unsafe for bathing because of high levels of bacteria (IMA, 2005).
- 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).
- A fish kill at the Caura River in April 2003 was attributed to pollution resulting from the discharge of sewage from a treatment plant and housing development that have led to chronic pollution of the river (IMA, 2003).
- High faecal coliform levels recorded at the North Coast Road crossing of the Rincon and Tucuche Rivers, and on the Texas River were related to the high levels of use of these rivers by villagers and campers as well as to the use of pit latrines for sewage disposal (TIDCO, 2003); and
- A fish kill investigated by the IMA in 2005 was found to have been caused by the presence of sewage on the Poole River in New Grant (IMA, 2005).
- In the modern world, the development of any country can be measured based on infrastructure, facilities and prevailing sanitary conditions. The standard of living of a country can be judged by the prevailing hygienic conditions, which in turn, are assessed on the level and quality of water supply and collection, treatment and disposal of liquid and solid wastes.
- From 1965 to the present, the focus of 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.

Wastewater Technologies in Use

- 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 (UDeCOTT). There are over one hundred and fifty (150) or so, 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 sewerage 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.
- There are a number of package sewerage 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 domestic stream of the new plant, which was commissioned in 2005, 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.
- 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.
- 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.

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 (EMA) 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.
- In the last 30 years, the development of the sewerage sector has been virtually at a standstill. Besides the provision of sewerage services to the city of Scarborough in Tobago, no major development has taken place in the sewerage sector since 1965. This situation has generated major concern by the present Government and a Task Force has been appointed to develop a National Policy for the Wastewater Sector Development.
- As mentioned before, a strategy for the adoption of privately-owned wastewater systems has been prepared by the Trinidad and Tobago Water Services on behalf of the Government of Trinidad and Tobago and the Water and Sewerage Authority, and is currently engaging the attention of the Government.
- 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.
- Policy initiatives undertaken by the Government include:
 - Appointment of a task force in May 1998 to develop a national policy for the wastewater (sewerage) sector development.
 - Institutional strengthening of the Sewerage Sector, funding for which is being pursued with the World Bank and the EIB.
 - Wastewater master plan for Trinidad and Tobago based on the recommendation of the Government appointed Task Force.
 - 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.
 - Development of trade effluent discharge regulatory procedures and monitoring system to control trade effluent discharged into public sewerage systems being done by the EMA. The EMA to establish and implement a Pollution Control and Monitoring Programme to ensure the compliance by the private owner/developer of the wastewater system until such time that they are adopted by the Water and Sewerage Authority based on their technical and economical viability.
 - Establish a joint focus team of stake-holders to develop and agree on the action plan based on the TTWS final report on the adoption of private sewage treatment works (November 1997) on adoption of private wastewater systems.
 - 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 Vision 2020 Draft National Strategic Plan, 2005 (NDSP) 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 main 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.

- The National Environmental Policy 2005 (NEP) was prepared by the Environmental Management Authority (EMA) in accordance with section 18 (1) of the EM 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 NEP 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 (EM) 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 (NWRMP), is the policy to guide the management of water resources in the country and was prepared with the support of the IADB for the Water Resources Management Unit, Ministry of Public Utilities and Energy (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 BMPs 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.
 - 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; and
 - Emergency works have been completed to repair deteriorated system at Beetham.
 - 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.

Existing Legislative Framework

- Public Health Ordinance
- Water and Sewerage Act
- Environmental Management Act

- 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 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 Environmental Management Act – Water Pollution Rules is the legal mechanism responsible for overseeing problems related to water pollution. The Water and Sewage 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 & 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 is 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.
 - 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.

Existing Institutional Framework

- The MoH is responsible for overall management of the health sector in Trinidad and Tobago. The Ministry exercises its management responsibilities through the functions of planning, regulation, policy making, monitoring and evaluation. Regulatory functions are implemented in part through the Ministry's responsibilities for carrying out existing legislation, as well as in the development of new legislation. These responsibilities include the area of public health, whose primary functions are defined in the relevant legislation, in particular the Public Health Ordinance.

St. Vincent and the Grenadines

Current Issues and Challenges

- St. Vincent and the Grenadines (SVG) 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 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.
- National Environmental Policy
- Environmental management strategy and action plan (2004 – 2006)
- NBSAP

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 advise 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 (CWSA) 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 (NEAB) falls under the Environmental Unit of the Ministry of Health and Environment. The primary mandate of the NEAB is to advise the government on the implementation of the SVG NEAP. The NEAB 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 (CWSA) 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 CWSA. 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.

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.

- Panama's severe income inequality results in a situation where its per capita gross domestic product (GDP) classifies it as "middle income," yet nearly 40 percent of the population lives in poverty.
- Panama's indigenous peoples, in particular, suffer from poverty and extreme poverty rates disproportionate compared to the rest of the population. Nearly all (98 percent) of those living in indigenous areas live in poverty. Between 1997 and 2003, indigenous extreme poverty rates increased from 86.3 to 90 percent. During this same period the country's overall extreme poverty rate declined. Forty-two percent of extreme poor live in indigenous areas, even though indigenous people account for only 8 percent of the population.

Wastewater Technologies in Use

Existing Policy Framework

- There is a strong legal 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 (MEF). In reality the government does not fulfill most of the functions specified in the law. There are no clear objectives for the sector.

- There is no policy or strategy, no effective coordination mechanism, no explicit financing policy, and no sector information system. Stakeholders intervene in the sector without a common approach or coordination.
- 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.
- Second, Law No. 2 was passed with the objective of promoting private sector participation and to eventually replace the National Water and Sewer Agency (IDAAN) with other operators. After a change in government in 2000 a new law was passed to modernize and reorganize IDAAN (Law No. 77 of December 28, 2001). 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 MINSAs. 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 MINSAs. The overall result was that momentum was lost and the country remained without a clearly defined sector policy.
- 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.
- The lack of a policy framework notwithstanding, 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 (IDB) (US\$50.2 million) and the Japanese Overseas Economic Cooperation Fund (OECE).
- 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 MINSAs 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.

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

Existing Legislative Framework

- Water Law
- Law 77
- 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 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.
- 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.

Existing Institutional Framework

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

- The risks generated by the use of growing quantities of chemical substances are ever-increasing. In response, 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.
- Responsibility for water resources is vested in two institutions: The National Environment Authority and the Panama Canal Authority.
- According to the Water Law, the Instituto de Acueductos y Alcantarellados Nacional (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.
- IDAAN was created in 1961 and was made responsible for investments in water supply in urban areas and a significant increase in coverage of potable water and - to a lesser extent - sanitation. The institution disposed of high financial capacities and human resources during its first decades. However, IDAAN's financial situation deteriorated significantly due the absence of any tariff increase until 1982. To face up IDAAN's weakness, its privatization was proposed at the end of the 1990s, following the telecommunications and electricity sector. At the same time, an agency for economic regulation of public services was created, which is now the ANSP.
- In 1997, a Water Law was adopted, defining the regulatory and institutional framework for water supply and sanitation. Privatization was abandoned until a change of government in 1999. Under Mireya Moscoso's administration, Law 77 was approved to modify the Water Law, permitting privatization and strengthening IDAAN. To significantly increase IDAAN's investments in urban areas, the government decided in 2003 to use financial resources earned through the telecommunication and electricity companies' privatization.
- 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 a 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.
- In 2005, IDAAN invested US\$49m in urban areas. FIS and MINSA invested a much lower amount in rural areas. The bulk of investments was in water supply, while much less was invested in sanitation.

- 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 (MIDES). The committee is expected to be formalized in the near future.
- 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). 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.
- Unlike in other Latin American countries, there has been no decentralization process in Panama, and municipalities remain weak and with very limited functions and resources. Municipalities have no official role in the sector, with the exception of one municipality (Boquete) operating its own water system. However, they may be assigned some responsibilities if the government should decide to engage in a substantial process of decentralization. A draft decentralization law is currently being debated by the Cabinet.
- There are approximately 3,300 water supply systems in rural areas, of which 1,800 are managed by Rural Water Boards (JAARs); the remaining systems are managed by Health Committees.

Rapid Assessment of Policy, Legislative and Institutional Frameworks

The outcome of the rapid assessment exercise will provide the basis for “filling in” and verifying the data used to compile the DRAFT National Country Reports on Policy, Legislative and Institutional Frameworks. It will be used to ascertain the gaps in existing policies, legislation and regulations, as well as knowledge base for wastewater management; and to assess the adequacy of existing policies and legislation to enable national compliance with Annex III of the LBS Protocol of the Cartagena Convention.

The information will then be analysed to produce national training needs assessments; and to prepare Terms of Reference (TORs) for the formulation of regional targeted capacity building and training activities to overcome existing policy, legislative and institutional barriers and gaps.

INDICATORS (Based on Objectives of UNEP GPA and LBS Protocol)	YES	NO	SOMEWHAT	COMMENTS
1. The country has highlighted domestic wastewater/ sewage as a priority pollutant in national objectives/ sustainable development planning				
<p>2. The country has a national programme/ plan of action for Wastewater Management</p> <ul style="list-style-type: none"> a. National domestic wastewater management plan contains provisions for compliance with Annex III of LBS Protocol b. National stakeholders perceive the plan to be pragmatic, comprehensive, continuing and adaptive c. There is integration and harmonization with environmental management approaches and processes including coastal area management, watershed management and land-use plans and policies d. There is integration with health promotion plans and policies for sanitation and hygiene e. There is a monitoring and environmental-quality reporting system in place to review and, if necessary, help adapt the strategies and programmes f. The plan identifies sources of finance and mechanisms available to cover the costs of administering and managing the strategies and programmes. 				
3. National stakeholders perceive that the level of promotion of measures for sustainable use of coastal and marine resources and to prevent/reduce degradation of the marine environment is adequate				

<ul style="list-style-type: none"> a. There are a number of entities across sectors utilising best available techniques and best environmental practices, including substitution of substances or processes entailing significant adverse effects; b. Introduction of clean production practices, including efficient use of energy and water in all economic and social sectors; c. There is wide application of best management practices (including EMS) in tourism and industry; d. Technologies to modify contaminants or other forms of degradation after generation, such as waste recovery, recycling (including effluent reuse) and waste treatment are generally available; and e. Information on use and suppliers of appropriate, environmentally sound and efficient technologies is readily available 				
<p>4. Criteria are established for evaluating and monitoring the environmental impacts of wastewater treatment projects, including criteria for siting of facilities</p>				
<p>5. The "polluter pays" principle is incorporated and operationalised in policy and law</p>				
<p>6. Non-regulatory instruments are used to induce compliance with national standards and regulations, such as economic instruments and incentives</p>				
<p>7. National, local and sectoral education and public awareness programmes and campaigns exist</p>				

<ul style="list-style-type: none"> a. Awareness activities encourage and promote domestic wastewater reuse and reduction of discharges; and promote use of cleaner technologies b. National stakeholders perceive wastewater education and public awareness programmes and campaigns to be adequate 				
<p>8. There is a designated/ lead national authority for wastewater management</p> <ul style="list-style-type: none"> a. Authority is adequately resourced b. Designated authority is perceived by national stakeholders as the leader in wastewater management 				
<p>9. There is periodic assessment of short-term and long-term data-collection and research needs for wastewater management</p>				
<p>10. There are regulations for domestic wastewater, including the location, design, and construction of wastewater facilities and outfalls</p> <ul style="list-style-type: none"> a. Elements of the LBS Protocol has been enacted into national legislation b. National domestic wastewater standards meet LBS Protocol Annex III requirements for (1) effluent limitations Class I and II waters, (2) total nitrogen and phosphorus requirements, and (3) residual chlorine concentrations and amounts which are not toxic to marine organisms. 				
<p>11. Existing domestic wastewater treatment systems are utilised by commercial entities and industry</p>				
<p>12. There are requirements for industrial pre-treatment programmes</p> <ul style="list-style-type: none"> a. There are regulatory requirements for spill 				

<p>containment and contingency plans</p> <p>b. Appropriate industrial wastewater management, such as the use of recirculation and closed loop systems, to eliminate or minimise wastewater discharges to domestic wastewater systems are promoted</p>				
<p>13. 100% of new residential developments constructed within the last 5-10 years have wastewater treatment systems</p> <p>14. New systems have developed in the last 5-10 years for existing communities (households) in rural and semi-urban areas</p> <p>15. National stakeholders perceive efforts to provide sewage collection systems to un-sewered households are adequate</p>				
<p>16. National stakeholders perceive that the construction, operation, and maintenance of sewage collection systems are adequate</p> <p>17. There are adequate resources for proper construction, operation, and maintenance of sewage collection systems</p> <p>a. Training programmes designed and executed which encourage compliance with Annex III of the LBS Protocol</p> <p>b. Training programmes developed for key target groups/ personnel (policy-makers, systems operators, communities)</p> <p>c. Development and access to operations manuals</p> <p>d. Access to technical support for management and system operators to ensure proper system operations</p>				

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