GEF Caribbean Regional Fund for Wastewater Management Project (GEF CReW)

Regional Wastewater Management Policy Template and Toolkit

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List of Acronyms

CARPHA	Caribbean Public Health Agency
CARSEA	Caribbean Sea Ecosystem Assessment
CBH	Central Board of Health
CReW	Caribbean Regional Fund for Wastewater Management
CZMA/I	Coastal Zone Management Authority and Institute
CZMU	Coastal Zone Management Unit
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIWA	Global International Waters Assessment
GPA	Global Programme of Action
IDB	Inter-American Development Bank
IWRM	Integrated Water Resources Management
KAP	Knowledge, Attitudes and Practice
LBS	Land-Based Sources
MEWRD	Ministry of Environment, Water Resources and Drainage
MPA	Marine Pollution Act
NEPA	National Environment and Planning Agency
NGO	Non-Governmental Organisation
NRCA	Natural Resources Conservation Authority
NWC	National Water Commission
OECS	Organisation of Eastern Caribbean States
PAHO	Pan American Health Organization
PCA	Pesticides Control Authority
R&D	Research and Development
SIDS	Small Island Developing States
UNEP	United Nations Environment Programme
UNEP-CAR/RCU	UNEP Caribbean Regional Coordinating Unit
VIP	Ventilated Improved Pit
WCR	Wider Caribbean Region
WHO	World Health Organization
WRA	Water Resources Authority
WWM	Wastewater Management

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PART 1
REGIONAL WASTEWATER MANAGEMENT POLICY TOOLKIT

1.0 PREFACE

Effective wastewater management is a continuing challenge for the small islands and coastal states of the Caribbean. Poorly functioning or non-functioning wastewater treatment plants have become prevalent[1] and cause pollution of coastal waters, damage fragile coastal resources such as coral reefs and endanger the health and safety of the region's inhabitants and visitors. Much of this wastewater includes black water, created when water is used to flush faecal solids, which threatens the environment and, if used in food production, threatens the health of workers and consumers, especially those in small local communities. Problems with less severe consequences include pollution of bathing beaches and the marine environment. The climate is also being impacted by the discharge of wastewater into the environment. As the health of coastal ecosystems deteriorates, their ability is sharply reduced to withstand extreme events such as more frequent hurricanes and floods as well as rising sea levels caused by climate change.

Jamaica's Minister of Water, Land, Environment, and Climate Change, Honourable Robert Pickersgill, summed up the current status of wastewater treatment in the nine Caribbean countries participating in the Global Environment Facility/Caribbean Regional Fund for Wastewater Management (GEF/CReW) Project when he said:
"… *there is an urgent need to increase the coverage of wastewater treatment in the Caribbean*[2]."

He went on to submit that current wastewater treatment levels within the region are far below what is needed, pointing out that as much as 85 per cent of wastewater entering the Caribbean Sea is untreated. He emphasised that this was unacceptable.

In comparison to water statistics, information on wastewater is scarce, indicating the capacity constraints for data collection and possible concerns for proper management. In addition, there is a lack of reliable data on the total volume of wastewater production from different sources in urban and rural areas of Caribbean countries. Consequently this document has relied on a limited information field comprising reports prepared by UNEP-CAR/RCU, the Caribbean Public Health Agency (CARPHA)[3], and other regional and international organisations. Reports from water utilities, agencies involved in public health and environmental management, such as municipal bodies documenting the state of wastewater management in countries of the Wider Caribbean Region, were also used (see Reference Materials Used).

[1] Adapted from internet: http://www.caribbeanhotelandtourism.com/downloads/CHTAEF_Wastewater.pdf

[2] Statement made at the official launch of the Global Environment Facility/Caribbean Regional Fund for Wastewater Management (GEF/CReW) project in Kingston on February 9, 2012 and reported by Athaliah Reynolds in Today's News. Retrieved from:http://www.caribbeannewsnow.com/headline-Caribbean-must-improve-wastewater-treatment,-says-Jamaican-minister-9769.html

[3] Formerly Caribbean Environmental Health Institute (CEHI)

The reports mentioned above have concentrated mainly on the state of sewage collection and treatment in GEF CReW participating countries[4] and have concluded that most collection and treatment facilities dispose their effluent and wastes directly into the marine environment, mainly on the shoreline or in lagoons or streams, resulting in high coliform concentrations and low dissolved oxygen levels in coastal waters. This is a hazard as the majority of the population lives in coastal rural areas where collection systems are rarely used, and pit privies, latrines, or septic tanks are the most common waste disposal systems.

The need for improving wastewater management has been recognised by the Wider Caribbean Region in meeting the obligations of the Protocol Concerning Pollution from Land-based Sources and Activities (LBS Protocol). UNEP / GPA (2006) reported that significant constraints exist, such as a lack of adequate and affordable financing for infrastructure renewal, rehabilitation and expansion across the region. The estimated cost of major developmental works within selected countries have identified as: Barbados (US$40MN), Jamaica (US$1,500MN), Guyana (US$75MN) and Trinidad and Tobago (US$545MN) at a total value of US$2.16 Billion.[5]). Notwithstanding these costs, the main constraint to improving wastewater management is the lack of capacity to enforce policies and regulatory measures.

In responding to the weaknesses in the sector, the Caribbean Regional Fund for Wastewater Management (CReW) Project was established in 2011 to provide sustainable financing for the wastewater sector. One of the components of the project is to provide technical assistance to project beneficiaries to assist them to reform their wastewater management sectors by addressing key capacity constraints within their legal, institutional and policy frameworks. As a first activity towards that reform objective, a baseline study[6] of wastewater management policies, legislation and regulations was conducted for GEF CReW participating countries[7]. The results of the analysis pointed to the need for guidelines to be developed to assist countries to prepare their wastewater management policies.

This Toolkit contains a package of information, with **useful and simple templates**, specifically designed to assist wastewater managers, chief technocrats or senior policy officers to improve capacity in developing and implementing wastewater management policies to improve the management of the sector. It sets out the key issues that should constitute wastewater management policy. It does not contain a comprehensive list of all possible subject areas that may arise in the development of wastewater management policies. It may also be used to strengthen other related policy activities. There may also be other relevant and important issues for which policy is not set out in this Toolkit which the wastewater manager may wish to consider. The fact that a particular subject or consideration is not covered in this Toolkit should not in itself be a reason for giving less weight to that matter or consideration and should not be taken to imply that the matter or consideration is not significant. Baseline and other research

[4]Archer, A. "Wastewater Disposal in the Caribbean: Status and Strategies", 1989 and Bartone 1984) "Developing Alternative Approaches to Urban Wastewater Disposal in Latin America and the Caribbean", 1984 provide good overviews to wastewater disposal in the Caribbean.

[5]http://www.caribbeanhotelandtourism.com/downloads/CHTAEF_Wastewater.pdf

[6]See Section 3 GEF CReW Baseline Study

[7]The nine GEF CReW participating countries in the Caribbean are Antigua and Barbuda, Barbados, Belize, Jamaica, Guyana, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

information, findings developed under the GEF CReW project should be considered along with the Toolkit.

The specifications in the Toolkit are not established in a sequential order nor are they of universal application to all GEF CReW participating countries but should be used in accordance with each country's national circumstances to complement policies, governance guidelines, protocols or activities related to wastewater which may be already in progress.

The overall intent of the Toolkit therefore is not to endorse any particular approach, but to direct managers, officials, and other decision makers to a range of fact sheets, case studies, ordinances, and other information that illustrate best practice. And while the UNEP CAR/RCU recognises that a certain approach may not be directly applicable to the situation in a particular country, it is hoped that the Toolkit provides new ideas or a useful template to influence the development of an effective policy framework for wastewater management.

The inclusion of wastewater management based on the concept of minimizing generation, adequately treating and reusing/discharges of wastewater on a collective or individual basis should be an essential component of national water policies and strategies, especially in transition and developing countries due to the increase in the quantity of waste caused by rapid population growth and urbanisation. The organisational polluter-pays principle and defining the optimal role of the public and the private sectors in providing, monitoring and regulating wastewater services should also be part of the policy.

The GEF CReW Project encourages the use of this Toolkit as a practical reference guide to stimulate change in how wastewater managers develop and revise policies on behalf of their governments.

1.1 MAJOR CONCERNS

Wastewater is any water that has been adversely affected in quality by anthropogenic influence and can encompass a wide range of potential contaminants and concentrations[8]. Wastewater generally comprises a mixture of domestic wastewater from baths, sinks, washing machines and toilets and from industry. It will often also contain rainwater runoff (storm water) from roads, roofs and other impermeable surfaces. Proper collection, treatment, discharge of wastewater and correct disposal of the resulting sludge allows clean water to be returned to the natural environment, helping to maintain river flows, which is important for other uses such as downstream abstraction, biodiversity and fisheries. Without suitable treatment, the wastewater that is produced every day pollutes the environment and creates problems for public health, water resources, wildlife and ecosystems in general - all of which could negatively impact the social and economic well-being of societies. Poor disposal practices can result in high coliform counts in coastal waters, eutrophication in bays and harbours, damage to coral reefs, and fish kills or abiotic waters in the most extreme instances[9]. One of these impacts, eutrophication, is a major regional concern as it affects the effective functioning of marine and freshwater ecosystems.

[8] http://en.wikipedia.org/wiki/Wastewater

[9] See: http://www.ewb-usa.org/theme/library/myewb-usa/project-resources/technical/CEP%20Sewage%20Pollution%20Cont

All waterways are connected. Inadequate treatment and a lack of ecosystem-based and resource-recycling approaches to wastewater management not only negatively impact the environmental and ecosystem services, but can also lead to lost opportunities to reuse and recycle nutrients, water and other materials in areas such as agricultural production. If these water bodies serve local communities the ecological impacts can be translated into financial losses.

Not much has changed since the 2004 study "GIWA Regional Assessment for the Caribbean Small Island subsystem", which opined that "wastewater treatment is often absent or insufficient in many countries of the (Caribbean) region. Despite efforts over the past three decades, problems associated with wastewater have "snowballed" due to an increase in the volume of wastewater generation particularly as a result of population growth, the growth of the industrial sector and the inability of Caribbean governments to secure the expansion of the sanitary sewerage system. Sewage therefore continues to find its way into the marine and coastal areas and rivers without any treatment. For example in Antigua and Barbuda insufficient drainage has resulted in standing pools of contaminated water. During severe weather conditions these pools present a major source of sewage-related hazards in forms of outbreaks of diseases illnesses such as hookworm, gastroenteritis and hepatitis A. Of particular concern is the use of fertilisers and pesticides and, thus, run-offs containing pesticides, nitrates and phosphates into coastal and marine areas which has been linked to elevated rates of chronic diseases that include several types of cancer, birth defects, autism and learning disabilities[10].

To address these challenges wastewater managers must apply the principles of integrated ecosystem-based management so that the ecosystem services on which society depends can be sustained from ridge to reef (from watershed to the marine environment). Wastewater managers need to understand the policy, legislation and regulatory linkages between wastewater management and protecting human health and ecosystems – that is the linkages and interconnectedness of the entire water chain- thereby making the case for ensuring that wastewater management is undertaken in a sustainable manner.

1.2 ENABLING CONDITIONS FOR WASTEWATER POLICY

Wastewater management is an important issue because it can affect the environment and ecosystems as well as the health and livelihood of communities. According to PAHO, enteric and diarrhoeal diseases are the most common cause of infant mortality in Caribbean countries. Tourism is a major economic activity and foreign exchange earner that contributes significantly to the GDP of Caribbean economies. The unregulated disposal of untreated sewage of tourism-related businesses has become a major source of concern. The situation is further compounded by increasing water demands for domestic uses, dwindling local sources of water and resulting increasing inability of water utilities to improve the wastewater infrastructure or undertake the necessary institutional reforms in the wastewater sector.

The practice of wastewater use in agriculture and the emerging environmental and health consequences are not well documented for GEF CReW participating countries. Run-off from agricultural lands and wastewater irrigation systems containing chemical pesticides and

[10] Pesticide-Induced Diseases Database: www.beyondpesticides.org/health

fertilisers drain into surface water, affect aquatic life and reduce biodiversity in Caribbean waters in the long run.

Earlier studies and reports have been undertaken as initial interventions towards reform in the wastewater sector. Some of this work comprises:

- A review of background project documentation related to wastewater management and policies, legislation and regulations as well as situational analyses and needs assessments that formed part of the CReW Project Preparation Phase, Regional Assessment Report and the LBS Assessment Report
- An identification of the key policy requirements for wastewater management
- An assessment of the current status of the development of national wastewater management policies, legislation and regulations.

GEF CReW countries participating in the study indicated the need for assistance in the form of guidelines that would assist them to develop wastewater policy. This need for new approaches to wastewater management is being driven by the need for access by all to clean water and appropriate sanitation.[11] This Toolkit therefore will fill a current gap and provide practical policy guidance to national and/or regional authorities to devise and implement sustained actions to prevent untreated wastewater from finding its way into the coastal and marine waters of the Caribbean.

The largest pollutant load in the Caribbean coastal waters is caused by discharges from industry, which can contain a wide range of contaminants and originate from a myriad of sources[11]. Reducing this load requires policy, laws and regulations that demand effective industrial wastewater management. This Toolkit addresses industrial wastewater discharges only from small industries – because the composition and quantity are compatible with treatment in domestic wastewater systems.

Reducing the unregulated discharge of wastewater and securing safe water are among the most important interventions for improving public health and achieving sustainable development in Caribbean countries. The knowledge and the technology exist to undertake these interventions. The key to success must blend immediate action and long-term thinking, and bring wastewater into the dialogue of wider planning and management. It is no longer possible to "do nothing": a sustainable long-term solution must be developed by regional governments to address the unacceptable levels of untreated wastewater. These levels of unregulated wastewater discharge will continue to have significant environmental, social and economic impacts and minimise the success of development objectives. According to Francine Clouden, a sanitary engineer with the Caribbean Environmental Health Institute, liquid wastes are a major source of land-based pollution of the marine environment and therefore pose a significant threat to the integrity of the fragile ecosystems on whose survival the tourism-based economies depend" (Clouden 1999)[12].

[11] Some of the biggest generators of toxic industrial waste include mining, pulp mills, tanneries, sugar refineries, and pharmaceutical production.
[12] See at: http://www.unep.or.jp/Ietc/Publications/TechPublications/TechPub-15/3-9IlandCaribbean/9-0.asp

This Toolkit elaborates the tools for developing effective wastewater policy that will improve public health and sustainable economic development in GEF CReW participating countries. The Wastewater Policy of Jordan was used to provide information for Part 2 of the Toolkit.

1.3 OVERVIEW OF WASTEWATER MANAGEMENT IN GEF CREW PARTICIPATING COUNTRIES

There is wide acceptance that the wastewater sector in Caribbean countries causes widespread degradation of the coastal environment. The majority of states in the Wider Caribbean Region (WCR) have ratified the Cartagena Convention[13] 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, economic welfare and the marine environment. The Cartagena Convention identifies domestic wastewater as a priority pollutant and contributor while Annex III of the LBS Protocol sets out the specific obligations of parties to address the urgent and serious problems of inappropriate and ineffective wastewater treatment and management.

The LBS Protocol mandates parties to establish measures to prevent, reduce and control pollution from land-based sources and activities, using the best practicable means at their disposal in accordance with their capabilities. These measures comprise the adoption of plans, programmes and measures, including the use of the most appropriate technology and management approaches (Article III). Further, a party to the LBS Protocol must address the source categories, activities and associated pollutants of concern listed in Annex I[14] by making provision for:

(a) effluent and emission limitations and/or management practices; and
(b) timetables for achieving the limits, management practices and measures (Annex IV).

The recent trend in wastewater management in the Caribbean is to look towards the LBS Protocol for guidance on the general practices for wastewater management.

In a general domestic context the countries all have similar issues with respect to their policy, legislative and institutional framework for wastewater management, with 38 per cent of countries having a weak policy and legislative framework. Twenty-three per cent have made considerable progress and are using a comprehensive framework for wastewater management in their country. Less than 10 per cent have legislation that focuses on wastewater management. Belize is an exception, having modified its effluent regulations to include domestic sewage. Across the region there is also fragmentation of legislative instruments for wastewater management – from protection of public health to conservation of ground and surface freshwater resources.

The recently published UNEP/RCU Report "*Review of the Access to Availability of, and Organizational Readiness for Uptake of Funding for the Wastewater Sector in Selected Participating Countries*" (February 2014) attributed this situation to the low priority accorded to the sector by governments in the region, resulting in the wastewater management framework of countries being relatively inadequate. The report however continues to point out that presently the wastewater sector occupies a higher priority on the agenda of governments than was

[13] The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region

[14] For the purposes of this work the categories being considered are domestic and industrial wastewater.

previously the case – albeit still a low priority. This can be supported based on the initiatives governments have taken to ratify the LBS Protocol: establishing national development plans that include wastewater management strategies as well as enacting legislation that incorporates provisions to control water pollution.

To benefit from these initiatives, governments must, as a follow-up, implement actions that include establishing wastewater policy, strengthening institutional arrangements, enhancing human resource capacity and enacting legislation and effective enforcement provisions. As noted above, GEF CReW participating countries have indicated the need for guidelines to assist them to develop or improve wastewater policy and to strengthen and enhance the foregoing initiatives. This Toolkit has been developed to respond to that need.

1.4 GOALS OF THE TOOLKIT

This Toolkit was developed by the GEF-CReW Project to assist participating countries to establish or improve their wastewater management policies. It is supported by and builds on previous work developed under the project (mentioned at Section 1.2 above).

Text Box 1

WHAT ARE THE GOALS OF THE TOOLKIT?

The Goals of the Toolkit are to:

- Lay out the key issues that constitute effective wastewater management policy
- Assist policy makers and water professionals in improving wastewater management policy
- Provide a starting point for developing wastewater management policy
- Promote compliance with Annex III of the LBS Protocol
- Improve the organisational readiness and absorptive capacity for investments in the wastewater sector
- Make information available on best practices from other jurisdictions in wastewater management
- Establish the fundamental synergies that exist between legal expertise and technical and management expertise
- Support practical implementation of policy principles
- Adopt the requirements and principles of the LBS Protocol as a measure to promote compliance with it.

Its developmental goals, therefore, are to:

- Improve wastewater management
- Stimulate improvements in the management of domestic wastewater as a priority source category under Annex III of the LBS Protocol
- Provide policy to support wastewater legislation
- Improve infrastructure, institutional and human resource capacity for wastewater management

- Improve the organisational readiness and absorptive capacity for investments in the sector including financing for operations and maintenance
- Promote the enactment of national legislation to implement the LBS Protocol
- Foster a regional approach to the management of coastal and marine areas of the Wider Caribbean Region

1.5 WHO SHOULD USE THE TOOLKIT?

The Toolkit can be used by a wide range of stakeholders involved in water resources management such as:

- Professionals within the sectors responsible for domestic wastewater management. ***This is the primary audience for the Toolkit.***
- Government officials from GEF CReW participating countries
- The private sector including water and sanitation service providers. Two such examples are the Caribbean Water Treatment Limited of Antigua and Barbuda and the Caribbean Desalination Company of Trinidad and Tobago.

Other persons that may find the Toolkit useful include legislative draftsmen, and persons from non-governmental organisations and interest groups, research institutions, academia, and other higher education institutions.

The Toolkit should be disseminated as an electronic document for quick reference or review.
In order to formulate wastewater policy, wastewater managers must first identify what it is that they want to achieve. Asking the following questions will assist wastewater managers in identifying which issues need to be included in the policy.

- What is the desired outcome of the policy?
- What are the overall objectives?
- What resources are available to implement the policy?
- Are there skills in-house to meet the policy demands or is there need for additional resources?
- Does the budget extend beyond simple maintenance to enable investment in new technology and improvements?

1.6 ENERGIZING GOVERNMENTS

Despite the fact that wastewater is on the agendas of many governments in GEF CReW participating countries, investments in the wastewater sector remain much lower than investments in the water sector.[15] To encourage governments to increase investments in wastewater management it is imperative that they fully understand the business benefits that can be derived from effective wastewater management.

[15]UNEP/RCU Report "*Review of the Access to Availability of, and Organizational Readiness for Uptake of Funding for the Wastewater Sector in Selected Participating Countries*", (2014) section 2.4

Text Box 2

WHAT ARE THE BUSINESS BENEFITS OF WASTEWATER MANAGEMENT?

Benefits of increased investments in wastewater management include:

- Improved **resource efficiency** and **productivity that** help build a **sustainable** business
- Reduced operating **costs,** including costs associated with environmental regulation
- Increased chance of **funding** by demonstrating responsible wastewater management
- Improved **legal compliance** with public health and environmental regulations

1.7 HOW TO USE THIS TOOLKIT

Text Box 3

WHAT IS IN THE TOOLKIT?

The Toolkit is divided into three parts

- Part 1 provides an introduction to the Toolkit
- Part 2 makes up the "guidance" sections of the Toolkit focusing on the key principles that make up the policy and how they may be delivered. It sets out the main drivers or focus areas, as general tools, that shape wastewater management policy
- Part 3 examines the status of wastewater management in each country. It categorises the countries into 2 groups – A: Parties to the LBS Protocol and B: countries that are not parties to the LBS Protocol – and provides an assessment and evaluation of the status of their development activities in relation to the main drivers

Antigua and Barbuda, Guyana, Saint Lucia, Trinidad and Tobago (Group A) are parties to the LBS Protocol. Barbados, Jamaica, Saint Vincent and the Grenadines, and Suriname (Group B) are not parties to the LBS Protocol[16].

Inputs collected from stakeholders should be used to further craft, build on or extend the Template/Toolkit. It must be stressed that these guidelines are not intended for absolute and direct application in each country. They are advisory in nature and are based on the state-of-the-art unscientific research and epidemiological findings that have been conducted by the World Health Organization (WHO) as early as 1973. Although the studies had an agriculture focus they are valid in their application to the protection of human health as the health risks that are posed

[16]Jamaica and Barbados are actively pursuing ratification

by poor wastewater management provide a common background against which national or regional standards may be derived[17].

Although the full policy framework for wastewater is inadequate for all the countries, variances do exist in the extent of policy development between them. It is expected that each country, in undertaking to develop or improve its policy framework, will adapt the main drivers (set out in Part 2) to suit that country's need. The wastewater manager or a designated official should, starting with the assessment in Part 3, examine its wastewater policy framework to determine the gaps. The wastewater manager or official may establish a team approach to undertake this activity. As a next step the wastewater manager and his team will, through several meetings develop the wastewater policy. This should be done using the tools and best practices identified in Part 2 in order to identify appropriate responses according to the specific circumstances of each country.

[17] In the 1970s and 1980s more literature became available on microbiological and epidemiological studies of wastewater reuse on the basis of which WHO revised its guidelines based on this new evidence. See: http://www.who.int/water_sanitation_health/wastewater/whocriticalrev.pdf

PART 2
DEVELOPMENT OR IMPROVEMENT OF WASTEWATER MANAGEMENT POLICY IN GEF CREW PROJECT COUNTRIES: GENERAL TOOLS

2.0 KEY POLICY TOOLS

Good governance requires consistency in decision making towards agreed objectives. Policies make up the framework to set national development priorities and provide decision-making criteria to guide the development process. Policies may lead to the creation of legislation.

Many countries have adopted (in principle) the use of treated wastewater as an important concept in their overall water resources policy and planning. A wastewater use policy transforms wastewater from an environmental and health liability to an economic and environmental resource (Kandiah, 1994a). Governments must establish and control wastewater reuse within a broader framework of a national effluent use policy, which itself forms part of a national plan for water resources. This requires lines of accountability and cost-allocation principles to be worked out between the various sectors involved, for example, local authorities responsible for wastewater treatment and disposal (Guyana, Trinidad and Tobago), farmers who will benefit from effluent use schemes, and the national government which is concerned with provision of adequate water supplies, protection of the environment and promotion of public health.

To ensure long-term sustainability therefore, sufficient attention must be given to the social, institutional and organisational aspects of effluent use in all aspects of wastewater management. This section of the toolkit summarises the information needed to formulate decision-making criteria, establish decision-making procedures and create effective institutional measures.

Water Resource Development

- ***Wastewater is a water source and shall form an integral part of renewable water resources and the national water budget***

Water resource managers and planners are continually looking for additional sources of water to supplement the limited resources available in their country. Barbados for example is described as a water-scarce country. In response, reliance on drinking water is supplied through expensive desalination systems while more than 19 per cent[18] (World Bank Indicators)[19] of the food demand is satisfied by importation. Competing claims for water for municipal and industrial use significantly reduces the availability of water for agriculture.

In such situations, wastewater should be considered as a renewable resource within the hydrological cycle. The water recycled by natural systems provides a clean and safe resource which becomes degraded by different levels of pollution depending on how, and to what extent,

[18] Food imports (% of merchandise imports) in Barbados, (2012)
[19] See at: http://data.worldbank.org/country/barbados#cp_wdi

it is used. The quality of the once-used water and the specific type of reuse (or reuse objective) define the levels of subsequent treatment needed, as well as the associated treatment costs.

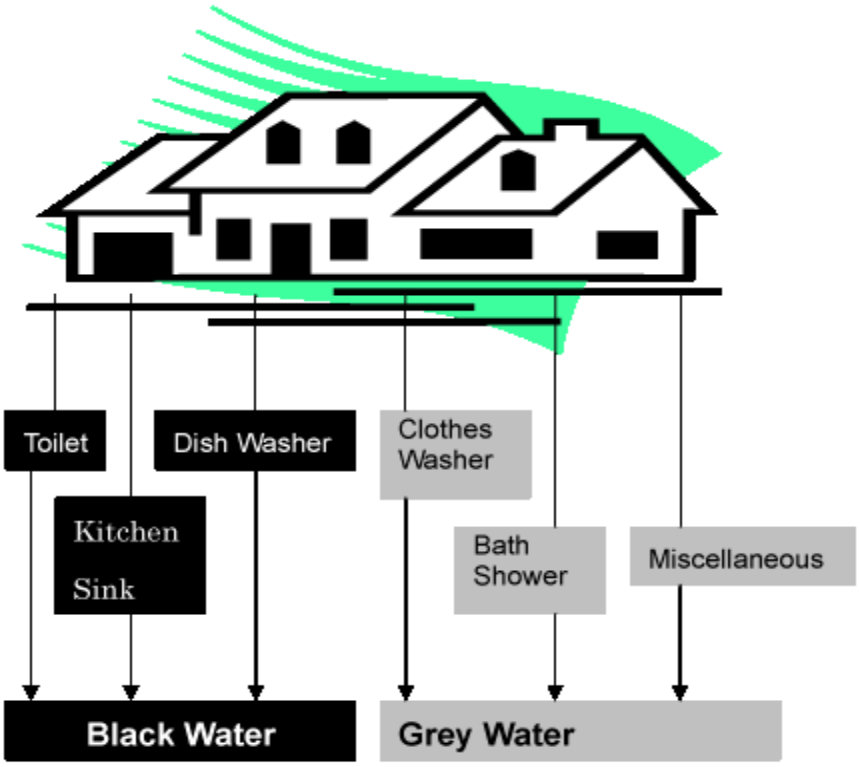

FIGURE 1: SCHEMATIC OF REUSE SYSTEM SHOWING THAT WASTEWATER IS SEPARATED ACCORDING TO SOURCE

Source: Crook et al (1992)

Text Box 4

WHAT ARE THE BENEFICIAL USES OF WASTEWATER?

Beneficial uses of wastewater can include:

- Urban – irrigation of such areas as public parks, playgrounds and residences; for fire protection, construction, air conditioning, and aesthetic purposes
- Recreation – irrigation of public parks, golf courses, recreation centres, athletic fields, school yards and playing fields; swimming, boating, fishing
- Aquaculture
- Agriculture – including irrigation of ornamental landscapes and decorative water features, such as fountains, reflecting pools and waterfalls, landscaped areas surrounding public, residential, commercial and industrial buildings
- Industrial – including evaporative, process and boiler feed water, fire protection, toilet and urinal flushing in commercial and industrial buildings
- Residential – boiler feed water, toilet and urinal flushing, gardens) fed from domestic wastewater

The constraints to using wastewater (non-potable reuse) are usually related to the high costs involved in the construction of dual water distribution networks, operational difficulties and the potential risk of cross-connection. Costs, however, should be balanced with the benefits of conserving drinking water and eventually of postponing, or eliminating the need for the development of new sources of water or the expansion of existing water supply networks.

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

Much of the wastewater, treated or untreated, eventually ends up in rivers, streams, lakes, and oceans – sometimes via groundwater, including the underground water source that is tapped for well water. When untreated wastewater reaches water used as a drinking water source by communities, there can be significant health risks because diseases and infections may be transferred to people and animals directly and immediately. Dysentery, hepatitis, typhoid fever, and acute gastrointestinal illness are some of the more serious examples. Inadequately treated sewage from failing septic systems is the most frequent cause of groundwater contamination.
To ensure safe drinking water, communities need both effective water and wastewater treatment. The primary objective of any wastewater use project must be to minimise or eliminate potential health risks[20].

Domestic wastewater can be treated to various levels, each of which includes specific activities or technologies that are intended remove, kill, or "inactivate" a large portion of the pollutants and disease-causing organisms in wastewater.

Text Box 5

WHAT ARE THE WASTEWATER TREATMENT LEVELS?

Primary treatment removes insoluble matter only.

Secondary treatment removes biological impurities from water treated at the primary level.

Advanced or tertiary treatment removes nutrients and chemical contaminants that remain after secondary treatment.

Each treatment level attracts a higher cost. This cost factor for collection and treatment is likely to cause slow progress in improvements being made in the Caribbean wastewater sector.

The major benefits of wastewater reuse schemes are health-related, economic and environmental. The levels of subsequent treatment that is needed for the once-used water is determined by the use to which it is to be put as well as the degree of bodily contact.

[20]A potential for disease transmission exists when wastewater is used for irrigation.

- **Existing levels of wastewater services shall be maintained and upgraded where necessary to enhance public health and the coastal and marine environment**

Maintaining wastewater collection infrastructure – pump stations, force mains, and sewers – is an integral component of the proper management of a treatment system and a critical step in preventing illegal wastewater releases. Implementation of effective preventive maintenance programmes has been shown to significantly reduce the frequency and volume of untreated sewage discharges, help governments save money on emergency response and local communities plan for the future.

When functioning properly, onsite systems prevent human contact with sewage, and prevent contamination of surface waters and groundwater. Factors that affect the proper functioning of onsite systems include the site and soil conditions, design, installation, operation and maintenance. The need for compliance with a maintenance schedule for all equipment and effective operation of wastewater systems is important for long-term system performance, to protect public health and capital investment. Wastewater managers must therefore select an appropriate and credible team of experts to develop design, maintenance and operational criteria to ensure that systems are maintained and upgraded.

- **Treatment of wastewater shall be targeted towards producing an effluent fit for reuse in irrigation in accordance with Annex III of the LBS Protocol as a minimum. Reuse of treated wastewater for other purposes shall be subject to appropriate specifications**

Wastewater can be a "reliable" source of water for irrigation throughout the year especially in areas of water scarcity, seasonal droughts, intense regional and seasonal tourism activity[21], population increase and related demands for food. There is also a growing recognition of the value of wastewater as a source of drinking water and nutrients. However, wastewater is always a public health risk. The WHO has set out guidelines[22] to control water-related diseases, but these may be difficult for Caribbean countries to implement.

Text Box 6

WHAT ACTIONS SHOULD WASTEWATER MANAGERS TAKE TO ENSURE THAT WATER REUSE IS SUITABLE?

Wastewater managers should:

- Adopt water application methods that would prevent contamination of farm workers and crops (e.g. pre-treatment, spray or drip irrigation)
- Identify suitable irrigation timing
- Restrict access to irrigated lands and hydraulic structures
- Ensure regular maintenance by technical experts

[21] Depending on market and on specific country. See: http://www.onecaribbean.org/statistics/annual-reviews-prospects/

[22] WHO (2006) Guidelines for the safe use of wastewater, excreta and greywater: Volume 1-4, [Online], World Health Organization, Available:www.who.int/water_sanitation_health/wastewater/gsuww/en/ [Accessed 01.09.2014].

❖ ***Coordination shall be maintained with entities responsible for physical planning, environment, health, agriculture, fisheries and tourism***

Wastewater management touches on the responsibilities of several ministries and government agencies. For adequate operation and minimisation of administrative conflicts, the following ministries and departments should be involved in developing wastewater policy:

Text Box 7

WHICH ARE THE KEY ENTITIES THAT SHOULD BE INVOLVED IN DEVELOPING WASTEWATER POLICY?

Ministries of:

- Agriculture and Fisheries: Overall project planning; management of state-owned land, installation and operation of irrigation infrastructure, agricultural and aquacultural extension, including training, and control of marketing
- Health: Surveillance of effluent quality according to local standards, health protection and disease surveillance, responsibility for human exposure control, such as vaccination, control of anaemia and diarrheal diseases and health education
- Water resources: Integration of wastewater use projects into overall water resources planning and management
- Public Works and Water Authorities: Wastewater or excreta collection and treatment

  Finance/Economy/Planning: economic and financial appraisal of projects, and cost/benefit analysis, financing, criteria for subsidizing, etc.

According to national arrangements, other ministries such as those concerned with environmental protection, trade and investment promotion, land tenure, rural development, trade, technology, information, co-operatives and gender affairs may also be involved.

Organisation of Eastern Caribbean States (OECS) countries starting activities involving wastewater use for the first time can benefit greatly from the establishment of an executive body, such as an inter-agency technical standing committee, under the aegis of a leading ministry (Agriculture or Water Resources),which takes responsibility for sector development, planning and management. Alternatively, existing organisations may be given responsibility for the sector (or parts of it), for example a National Irrigation Board (as in Jamaica) might be responsible for wastewater use in agriculture or a National Fisheries Board might be responsible for the use of excreta and wastewater in aquaculture. Such organisations should then coordinate a committee of representatives from the different agencies having sectoral responsibilities. The basic responsibilities of the inter-agency committee could be:

- Developing a coherent national policy for wastewater use and monitoring its implementation stages and work plan activities per quarter
- Defining the division of responsibilities between the respective ministries and agencies involved and the arrangements for collaboration between them

- Appraising proposed wastewater reuse projects, particularly from the point of view of public health and environmental protection
- Overseeing the promotion and enforcement of national legislation and codes of practice
- Conducting compliance reviews

❖ ***Specifications and minimum standards shall be issued by the wastewater utility for the use of septic tanks in rural areas. Particular attention shall be paid to the protection of underlying aquifers.***

Because septic systems treat and dispose of household wastewater on site, they are often more economical than centralised sewer systems in rural areas where lot sizes are larger and houses are spaced widely apart. They are also simple in design, which makes them generally less expensive to install and maintain. Septic system failures however, have caused pollution of groundwater, rivers and streams.

Text Box 8

WHAT ARE THE ADVANTAGES OF SEPTIC SYSTEMS?

The advantages of septic systems:

- Simple and effective wastewater treatment
- Less disruptive to the environment, to install and maintain
- Less expensive to operate than centralised treatment facilities
- Provide wastewater treatment in areas where it would not be available otherwise
- When functioning adequately, can help replenish groundwater

When planning cost-effective wastewater treatment, wastewater managers should:

- Identify the needs of residents and other potential users of a system, such as schools, businesses, and industry
- Evaluate factors such as the amount of money available for financing, regulations, and the performance of existing wastewater facilities and any needed repairs, expansion, or replacement
- Establish adequate regulations or guidelines for septic system design, construction, and installation
- Realistic enforcement timelines and maintenance capacity building

❖ ***Managers must also collaborate with public health officials to ensure that timely and efficient inspections are made and all public health regulations are complied with***.

Water Resource Management

❖ ***A Department in the Water Authority/Department shall be responsible for the development and management of wastewater systems as well as the treatment and reuse of the effluent.***

Caribbean wastewater policy frameworks focus mainly (if at all) on the health sector and does not involve the planning frameworks of other central sectors such as fisheries, agriculture, land use, environment and tourism sectors as *ex ante* partners in wastewater management. The result is that there is a fragmented approach to solving problems in the wastewater management sector.

Text Box 9

SECTORS OF ACTIVITY RELEVANT TO THE WASTEWATER DISCHARGES

Sectors relevant to wastewater management include:

- Coastal and marine
- Water
- Inland waterways
- Industrial – chemical industries, extractive industries, food processing, beverage manufacture, pulp and paper, sugar, oil refineries
- Mining
- Public health, municipal
    - Sewage
    - Domestic wastewater
    - Treatment facilities
- Agriculture – non-point sources, intensive animal rearing operations
- Construction and building
- Land use-planning
    - Planned land-based activities
- Finance – funding obligations
- Tourism – conservation of marine resources, water use efficiency, pollution control, energy efficiency

Source: Johnson (2005)

Integrated Water Resources Management (IWRM) has been defined by the Global Water Partnership as:
"A process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."[23]

Instituting this new paradigm will require:

- Changes in institutional structures and frameworks
- Changes in holistic environmental thinking
- Change in use of means and resources
- Changes in managerial methodologies and approaches and
- Changes in approaches to financial planning and management to include explicit attention to include considerations for the poor and gender-specific strategies[24]

[23]Wastewater forms part of the hydrologic cycle and is therefore embraced in the definition.
[24] Edwards (1993) has developed a manual that provides practical and immediately useful information about developing and managing institutional change projects in the water supply and sanitation sector.

To ensure that the linkages between the sectors are given sufficient weight and consideration, it is recommended that a department is also established with the responsibility to focus on all aspects of wastewater management and to emphasise the long-term socio-economic benefits that can be derived from effective wastewater management.

- ***Industries shall be encouraged to recycle its wastewater and to treat it to meet standards set for ultimate wastewater reuse or to meet the regulations set for its disposal through the collection systems and/or into coastal and marine waters.***

Wastewater reuse in the Caribbean is mainly in the form of irrigation water. A typical example of wastewater reuse is the system at Sam Lords Castle Hotel in Barbados. Previously, sludge was pumped out and sent to the Bridgetown Sewage Treatment Plant for further treatment and additional de-sludging. Cleaner technology now allows effluent, through a process that includes chlorine disinfection, to be pumped to an automatic sprinkler irrigation system for golf course irrigation.[25, 26] This treated wastewater has been used for human consumption after disinfection[27]. Wastewater managers must determine the uses for which water may be reused.

Text Box 10

USES OF REUSED WATER

Industry may reuse treated wastewater for:

- Internal reuse, for example as a source of cooling, processing and boiling feed water in power treatment plants
- Aquaculture
- Irrigation without undue health risks, but not so strict as to prevent its use
- Irrigation of food crops
- Irrigation of non-food crops

In order to ensure the public health and protect the environment, wastewater managers must:

- Treat wastewater from industries with significant pollution separately up to standards that allow reuse for purposes other than irrigation or to allow its safe disposal.
- Isolate treated wastewater from surface and ground waters that are intended for drinking purposes.
- Exercise oversight of industrial projects in order to minimise the deleterious impacts of wastewater discharges and ensure compliance with existing building codes
- Share information on wastewater reuse with other sectors
- Continuously monitor the performance of wastewater treatment plants to ensure that the effluent does not create environmental or health problems

[25] In Jamaica, some hotels have used wastewater treatment effluent for golf course irrigation, while the major industrial water users, the bauxite/alumina companies, engage in extensive recycling of their process waters. In Barbados, effluent from an extended aeration sewage treatment plant is used for lawn irrigation.

[26] Appendix B presents guidelines for the utilisation of wastewater, indicating the type of treatment required, resultant water quality specifications, and appropriate setback distances.

[27] Vlugman, Anthony. 1990. *Country Report on Waste-Water Treatment Facilities in Barbados.* Washington, D.C., PAHO.

Wastewater Collection and Treatment

- ***Wastewater shall be collected and treated in accordance with existing treatment and infrastructure standards as the basis for effluent quality requirements for reuse.***

As sources of water supplies have become limited, there has been a trend towards greater use of reclaimed wastewater effluents as an alternative source of water for a wide range of applications, including landscape and agricultural irrigation, toilet and urinal flushing, industrial processing, power plant cooling, wetland habitat creation, restoration and maintenance, and groundwater recharge. Government involvement is essential to ensure that the level of treatment is suited to the intended use to which the wastewater is to be put and meet the standard for discharges. Several factors determine the level of treatment that should be applied.

Text Box 11

WHAT FACTORS DETERMINE WASTEWATER TREATMENT LEVEL (EFFLUENT PARAMETERS)?

Factors that determine wastewater treatment levels are:

- The impact on human health
- Final reuse options
- Location of the reuse
- Type of crops to be irrigated
- Treatment plant location
- Operation and maintenance costs
- Energy savings
- Efficiency in attaining and sustaining quality standards

The use of technologies for the development of wastewater as an alternative source of water is probably, the single most adequate approach for solving the problem of water shortage. Managers must select and apply the most appropriate technology to remove health risks that may be posed to the intended use of wastewater. But technologies can vary depending on the treatment or discharge standard that is required for end users or end-point disposal.

The cost of treating wastewater to high microbiological standards can be limiting. Wastewater managers should encourage government to invest in research and development to develop local and less expensive technologies. This should not preclude the participation of other sectors in sharing the costs of advanced wastewater treatment technologies.

Standards, Regulations and Quality Assurance

A major weakness for GEF CReW participating countries is the inadequate legal framework for wastewater. To address this weakness, wastewater policy should put forward guidance on the aspects listed in Text Box 12.

Text Box 12

WHAT ASPECTS OF THE LEGAL FRAMEWORK SHOULD BE REFERENCED IN THE WASTEWATER POLICY?

The wastewater policy must include:

- A definition of "wastewater"
- Institutional arrangements for the administration of relevant legislation and coordination with relevant authorities (e.g. planning, environment, tourism)
- Identification of the ownership of wastewater
- Specifications for a system of licensing that introduces a system of taxation that makes the wastewater utility self-financing
- Mechanisms for wastewater avoidance
- Any restrictions that provide for the protection of public and environmental health with respect to:
    - Intended use of the wastewater
    - Treatment conditions and final quality of wastewater
    - Conditions for the location of wastewater treatment facilities
    - The control of wastewater discharges
    - Disposal of the sludge which results from wastewater treatment processes
- Water standards and compliance guidelines and mechanisms for their use
- Enforcement and compliance mechanisms including fees and penalties
- Cost allocation and pricing (economic-technical model)

At the operational level, regulatory actions should be applied and enforced through guidelines, standards and codes of practice.

To give effect to these essentials a choice may be made to either:

- Develop new, or amend existing, legislation and create new institutions having responsibility for wastewater; or
- Allocate new powers to existing institutions, attributing the roles of, and relationships between public health, environmental and agricultural legislation such as standards and codes of practice for reuse.

Whatever option is exercised, enabling legislation (new or amended) should contain coverage for Wastewater Management Plans and the mechanisms for their implementation.

- ***Particular attention shall be focused on adopting and enforcing treatment standards for domestic wastewater.***

Wastewater Policy must consider the factors stated below in establishing measures for enforcement of wastewater treatment standards.

Text Box 13

WHAT ARE THE MAIN CONSIDERATIONS IN ENFORCING WASTEWATER TREATMENT STANDARDS?

It is important to consider whether:

- Those responsible for complying with the wastewater laws are able to fulfill their requirements
- Compliance measures are practical
- The enforcement mechanisms are appropriate to act as a deterrent against future violations
- The enforcement mechanisms enable damage done to be rectified if appropriate
- The laws and regulations motivate self-driven innovation and upgrade of those to comply

Enforcement refers to the provision of the necessary controls and penalties to ensure that the treatment standards that guarantee that protection are being complied with fully and properly. Important enforcement requirements are:

- The law must be understood
- The law must be clear
- The objectives of the law must be well-defined

There are many different types of enforcement measures that can be incorporated into wastewater management laws. Some of these are listed below:[28]

[28] Enforcement mechanisms are discussed in the UNEP Draft Manual. Particularly see pp. 150-151, 182-185.

Text Box 14

WHAT TYPES OF ENFORCEMENT MEASURES ARE SUITED TO WASTEWATER MANAGEMENT LAWS?

Enforcement measures suited to wastewater include:

- Penalties - For a regime to be effective, it should impose appropriate penalties for violations. The consequences of non-compliance should be meaningful and penalties should deter, punish or remedy violations. A penalty or other relevant measure is more likely to act as a deterrent if it raises the cost of non-compliance above that of compliance
- Sanctions – Sanctions are a form of penalties that punish the offender. Sanctions range from civil sanctions (e.g. monetary fines, injunctions) to criminal consequences (e.g. imprisonment)
- Remedial penalties or liability approaches – Remedial penalties make the offender bear certain costs such as those arising from redressing the environmental damage caused by the offender's actions, the loss of use of natural resources, harm from the pollution caused by the offender's actions, remediation, restoration and mitigation
- Formal or informal enforcement - Informal enforcement is generally less severe with administrative cost recovery fees only. Formal enforcement can involve penalties and/or suspension of service. If the violation(s) persists, the informal response may escalate to a formal response initiated, typically by a compliance order. Violations that are more severe and/or involve intent may proceed directly to formal enforcement
- Reward – successful compliance needs to be recognised
- Incentive – pricing of fresh water vs. treated water
- Training and information – to be linked to gradual penalty scaling

In addition, any standards that may be established must be objectively quantifiable so as to ensure consistency, transparency and fairness in enforcement[29].

It is possible to have relatively strict laws and procedures but, if they are not enforced, they will be ineffective in making the desired improvements in water quality.[30] To address this issue, wastewater policy should establish a means of tracking progress towards compliance once enforcement has been initiated.

- ***Laboratories shall be maintained and properly equipped to provide services and reliable data needed to ensure enforcement of, and adherence to standards and regulations***

[29] For more detailed discussion see the UNEP Draft Manual (n.d.), Appropriate Technology for Sewage Pollution Control in the Wider Caribbean Region, pp.169-177.

[30] Commission of the European Communities (1997) "Commission Staff Working Paper - Guide to the Approximation of European Union Environmental Legislation. Brussels, pp.9.

The enforcement of wastewater quality standards and regulations relies heavily on efficient and well-maintained laboratories. Besides motivating and instilling a sense of pride in laboratory staff, properly maintained laboratories are valuable to enforcement efforts by:

- Providing a sound scientific basis for environmental management decisions
- Ensuring the protection of the environment in a cost-effective manner.
- Strengthening legal defensibility of regulatory actions
- Contributing to public confidence
- Keeping staff current with scientific and technological advances

In Caribbean jurisdictions, however, laboratories function independently of the organisational structure for wastewater management and this affects decision making and implementing practical actions for enforcement. To address this weakness, wastewater authorities (whether private or state-owned) must undertake to train laboratory analysts in not only analytical technique but also in understanding of enforcement of established wastewater standards (See Text Box 12).

Text Box15

WHAT ENFORCEMENT SUPPORT COULD LABORATORIES PROVIDE?

Laboratories can:

- Monitor pollutants
- Conduct inspections of wastewater plants
- Make recommendations to ensure proper operational control at the wastewater plant
- Sample significant industrial users of the sewer system to ascertain that the wastewater discharge meets local discharge pretreatment limits
- Protect downstream waterways
- Provide certified wastewater testing on a fee basis for wastewater dischargers

Due to the role and importance of laboratories to enforcement, the wastewater policy must cater for capacity-building measures for wastewater managers in bio-chemical engineering, biology, environmental engineering and environmental economics, which are used in the design of wastewater treatment and reuse systems. Capacity building also would require familiarisation with various wastewater treatment technologies now available, as these technologies are not yet in use in the Caribbean.

Public Awareness and participation

- ***The public shall be educated through various means about the risks associated with exposure to untreated wastewater and the value of treated effluents***

Educating the public is one of the most important aspects of wastewater management. Most people may not think about wastewater, where it goes or the complexities involved in providing wastewater services to prevent the spread of disease and the contamination of drinking water sources. Developing and maintaining a positive relationship with the public being served is key

to protecting public interests from wastewater associated diseases and making much needed improvements to the delivery systems associated with it. However, the vast majority of the public is not adequately educated on the impacts of wastewater on human health, the monitoring of discharges and disposal of wastewater and "in demanding protection by the government from polluters that cause health threats to the community."

To achieve general acceptance of reuse schemes, it is of fundamental importance that active public involvement is obtained from the planning phase to the full implementation process. Public involvement starts with early contact with potential users, leading to the formation of an advisory committee and the holding of public workshops on potential reuse schemes. The continuous exchange of information between authorities and the public representatives ensures that the adoption of a specific water reuse programme will fulfil real user needs and generally-recognised community goals for health, safety ecological concerns, programme cost, etc. (Crook *et al.,* 1992).

Everyone who uses water also contributes to the body of wastewater and therefore everyone has a role in preventing the impacts associated with the improper disposal of it. Public acceptance or refusal of the practice of wastewater reuse is not always applicable everywhere as they may be influenced by the socio-cultural and religious norms of the population. Wastewater managers, in developing programmes to maintain water quality and protect human health should make a complete assessment of local socio-cultural contexts and religious beliefs as a preliminary step to implementing reuse projects (Cross, 1985).

Text Box 16

HOW CAN SOCIO-CULTURAL ASPECTS OF WASTEWATER REUSE BE ASSESSED?

The socio-cultural assessment should enquire into the following:

- What have been the political reactions to past health and environmental hazards which may have been associated with wastewater reuse?
- What is the public's perception of wastewater reuse?
- What are the attitudes of influential people in areas where wastewater will be reused?
- What are the potential benefits of reuse to the local community?
- What are the potential risks?
- What is covered in curricula in schools to inform population?

Because the government generally acts as the primary provider of wastewater treatment for its citizens, it is also its duty to educate them about user responsibilities, and the water quality goals that the utility supports.

Text Box 17

WHAT ARE SOME TOOLS THAT MAY BE USED TO ADDRESS, EDUCATE AND INFORM THE PUBLIC ON WASTEWATER?

To educate and inform the public on wastewater, managers can:

- Establish a mission statement reflecting the goals of wastewater management. This is the single most important tool in helping the public understand the goal of wastewater management
- Have regular public meetings and consultations
- Distribute informational packages that cover a wide range of topics related to wastewater such as wastewater recycling, irrigation with wastewater, wastewater reuse, impacts of wastewater on human health etc.
- Conduct open houses, tours or other special events at wastewater utilities, demonstrate how wastewater systems work and how they protect the environment
- Make public service announcements containing environmental and safety messages
- Prepare newsletters informing about how actions such as the use and disposal of chemicals, fertilisers, pharmaceuticals and household cleaning products, can affect water supplies and what happens when individuals flush these items down the drain
- Inform the public about the types of common materials that are hazardous e.g. the used or leftover contents of household products, such as paints, cleaners, stains and varnishes, car batteries, motor oil and pesticides, are all household hazardous wastes
- Launch a vocational training course to become a technical expert in this field

In most parts of the world, there is no cultural objection to the use of wastewater, particularly if it is treated and its use is well accepted where other sources of water are not readily available, or for economic reasons (Hamilton et al, 2007).

❖ *Programmes on farmer's awareness shall promote the reuse of treated wastewater, methods of irrigation and handling of produce*

Due to increasing water shortages, many farmers in GEF-CReW countries grow crops, especially vegetables, and use diluted wastewater to irrigate these crops. Untreated wastewater may present a risk of contamination and may carry disease-causing organisms and chemical agents that can seriously affect the health of farmers, the traders who handle crops and the people who consume them. It is therefore very important for farmers, as a group, to be aware of the health risks associated with using untreated wastewater for irrigating their crops. They also need to be made aware of how to use wastewater safely at the farm level to reduce those health risks[31]. Training programmes developed for this purpose must include some of the following topics as presented below.

[31] FAP, (2012) "On-Farm practices for the safe use of wastewater in urban and peri-urban horticulture"

Text Box 18

WHAT ARE THE KEY COMPONENTS OF WASTEWATER THAT SHOULD BE INCLUDED IN A FARMER'S TRAINING TOOLKIT?[32]

Farmer training programmes should:

- Explain how and why farmers end up using wastewater in their farms
- Explain the flow of unplanned and planned water cycles specifically on natural interdependency, e.g. different types of water are part of one water cycle (Thomas & Durham, 2003)
- Identify human health risks associated with irrigating crops with wastewater, including the effects on farmers' health from own practices and their neighbours
- Identify various ways to reduce the health risks of using wastewater to irrigate crops
- Provide and explain options for wastewater reuse in the agricultural sector
- Promote the monitoring and evaluation of the performance of selected health-risk-reduction options
- Demonstrate to farmers how to use participatory training methods to transfer knowledge about the safe use of wastewater to other farmers, how to use the training materials and how to evaluate reactions to the training
- Introduce other methods of disseminating or sharing information to enhance learning including farmer-to-farmer discussion/dialogue, farmers' field days, television and radio programmes
- Provide better labelling for pesticide and fertiliser products and use messages that help to visualise their impacts and suggest 10 simple steps to improve and get help (cf. cigarette labelling efforts)

Acceptance of reuse systems will depend on the degree to which wastewater managers succeed in providing farmers with a clear understanding of the complete programme, the knowledge of the quality of the treated wastewater and how it is to be used; confidence in the local management of the public utilities and on the application of locally accepted technology; assurance that the reuse application being considered will involve minimal health risks and minimal impacts on the environment; and assurance, particularly for agricultural uses of the sustainability of supply and suitability of the reclaimed wastewater for the intended crops.

The Role of Non-Governmental Organisations (NGOs) and the Private Sector

❖ ***The private sector and NGO roles in reuse of treated effluent shall be encouraged and expanded***

Integrated water resources management acknowledges that no single institution has all the means to deliver sector goals, but should work and collaborate with other partners in government, the donor community, NGOs and the private sector, to avoid duplication and to enhance synergies.

[32] Id.

To make stakeholder participation effective, wastewater managers as well the physical planning and pollution control entities should cooperate closely to ensure that nationally significant infrastructure projects are implemented in accordance with environmental or public health regulations, Annexes III and IV of the LBS Protocol (mandatory if the GEF CReW participating country is a party to the Protocol).

Strategic partnerships involving private sector companies and NGOs present a successful approach for accomplishing the goal of effective wastewater management. Private sector involvement in wastewater services can occur in the provision of specific services such as meter reading, billing, bill collection and laboratory services. As an early activity for effective stakeholder participation, stakeholders and other partners could jointly work out the ecosystem specific standards for wastewater discharges. Also wastewater managers and entities that enforce building bylaws should be included in decision making about creating bylaws to ensure, for example, that suitable drainage systems are provided for in new development construction projects (and should be given license to construct or in the creation of disincentives for old constructions, which are not complying by any new building bylaws, in the form of additional taxes)[33] .

Text Box 19

ADDITIONAL EXAMPLES OF INVOLVEMENT IN DECISION-MAKING ENTITIES BY PRIVATE SECTOR AND NGOS

Examples of NGO and private sector involvement in decision making include:

- Providing periodic feedback on the norms for fixing the charges for water supply and sewerage connection, and provision of water subsidies to disadvantaged groups
- Deciding on the standards for wastewater services and any restrictions that may be applicable during floods
- Deciding on the criteria for new technologies by consumers
- Deciding on the penalty for illegal connections

Both private sector and NGOs can be very effective agents for building public awareness at the local level, for mobilizing community action, and for voicing local and national concerns about wastewater[34]. Wastewater managers should recognise the value of private sector and NGO input and encourage their involvement and participation in wastewater issues and in developing and implementing public awareness programmes. It would no doubt be beneficial for both sides if this form of cooperation is clearly established and maintained.

Human Resources Development

❖ ***Capabilities of human resources in the management of wastewater shall be enhanced through training and continuous education***

[33] Such as an energy pass for each real estate established in Germany, which could be an idea for approaching the licensing: http://www.dekra-consulting.com/en/energy-pass

[34]Often, however, environmental NGOs are focused exclusively on natural resource matters and global issues, and pay insufficient attention to improper waste disposal and other environmental health problems.

Human resources development or capacity building for wastewater is based on three premises (Alaerts and Hartvelt, 1996):

- Water is a finite resource, for which numerous users compete
- Water is essential for a healthy economy as well as for the environment and, therefore, it is a resource that should be managed in a sustainable way
- Institutional rather than technical factors cause weaknesses in the wastewater sector.

As a starting point for capacity building, wastewater managers must make assessments as to:

- The adequacy of local labour and expertise available for health and environmental control aspects, adequate operation and maintenance of: wastewater treatment, irrigation and groundwater recharge works and agricultural facilities
- The types of training programmes that should be developed
- Assessment of available technical trainers
- Available teaching material
- Available sources of funding for workshops

Wastewater managers must also identify and engage key national stakeholders as well as those with an interest in improved wastewater management (such as politicians, senior government officials, NGOs, international agencies and perhaps representatives of farmers and stakeholders who use wastewater associated with income generating activities). Formal initiatives can include mobilizing the most actively interested together into a national core group, dedicated to the cause of improved wastewater management.

Human resources development is usually implemented as training and education programmes based on the idea that equipping individuals with the knowledge, skills and professional competencies will enable them to successfully operationalise sustainable practices (Wakely, 1997). Most, if not all, water utilities in the Caribbean perform very limited functions in relation to wastewater. They are mostly engaged in supplying treated or partially treated or untreated water to domestic and industrial consumers, with the orientation mostly on conventional systems. But, there are many non-conventional systems, which can provide future water supplies in many villages and towns. Such systems include rainwater harvesting collection and desalination systems. To undertake these innovative approaches, the opportunities they offer and their economic aspects require an understanding by wastewater professionals.

The various dimensions of human resources development (or capacity building) that should be enhanced are presented in Text Box 20 below.

Text Box 20

DIMENSIONS OF CAPACITY BUILDING

Capacity Building Area	Description	Interventions
Human Resource Development	Equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively	Recruitment, training and training materials and schedule
Organisational Change	Elaboration of management structures, processes and procedures, not only within organisations but also the management of relationships between the different organisations and sectors (public, private and local community)	Changing institutional structure, accountability reporting systems, financial powers, funding
Institutional Reforms	Making legal and regulatory changes to enable organisations, institutions and agencies at all levels and in all sectors to carry out their mandates	Establish water pricing[35] according to sector & water distribution policies, laws on protection of water sources, development of new institutions, prevention of water theft etc.

Source: Brown (2003)

Wastewater management professionals can take a variety of actions to strengthen capacity. These actions may include:

- **Water sector assessments for sector analysis and programme development** which comprehensively analyze the water sector and suggest priority action plans that include actions that may be undertaken by interdisciplinary teams.

- **Training for change at different levels**, including decision makers, senior staff and engineers with managerial assignments, junior staff and engineers with primarily executive tasks, technicians and operators, and other stakeholders.

- **Education[36] of prospective experts who will play a role in the sector**: The wastewater sector requires a high level of technical expertise. Research and knowledge development and dissemination of pertinent knowledge on wastewater management are highly scattered and non-systematic in GEF CReW countries. Wastewater managers should ensure that skill sets that focus on physical and technological sciences, financial and human resource management and behavioural sciences are developed within the sector.

[35] Such as Pricing mechanism in Denmark http://www.eea.europa.eu/publications/assessment-of-full-cost-recovery , page 19, Box. 1.2.

[36] Vocational training programme, see German Chambers of Industry and Commerce (in German): http://www.dihk.de/ressourcen/downloads/umweltschafftperspektiven.pdf/at_download/file?mdate=1291826058878

Research and Development

- ***Applied research on relevant wastewater management topics shall be adopted and promoted including the transfer of wastewater treatment technologies, low cost wastewater treatment technologies, reduction of energy consumption should receive adequate support***

With population growth and rapid urbanisation, more and more highly urbanised centres around the globe are hard-pressed in keeping up not only with the ever-increasing demand for clean water but also with the provision of services to properly manage wastewater given the significant health, environmental and economic risks the latter pose. For governments and water service providers alike, the task at hand presents the challenge of finding ways – innovative solutions – to address such problems[37].

For many governments, a broad range of cost-effective technological options are becoming available to respond to these demands with the potential to reduce costs for each household. Examples range from ventilated improved pit (VIP) latrines, pour-flush latrines, condominial sewers to simplified sewerage, none of which seem attractive or are culturally appropriate to GEF CReW countries.

The emergence of various technologies and innovations also are welcomed and encouraged among water utility operators. With the unprecedented pace of technological advancement, operators now are given the flexibility to choose among a variety of technical solutions to manage wastewater. This of course depends on the specific objective/s to be addressed (e.g., operational efficiency, regulatory compliance, cost efficiency, resource recovery, etc.) as well as the operating and regulatory environment utilities work in.

Despite the massive capital and operating costs, only a relatively small amount of research and development (R & D) investment is being made in GEF CReW countries on wastewater technology. There are certainly knowledge gaps to be filled and substantial benefits could be gained from this. These gaps are opportunities and challenges for all researchers and professionals in this field to develop local or natural technologies that are likely to be more cost-efficient. Addressing them will therefore help in the continuing development of wastewater treatment technologies by making them more available for application in GEF-CReW countries. The way forward to fill these gaps should include the actions below.

[37] Asian Development Bank (2013) Case Study-Applying Solutions Technologies for Cost Effective Wastewater Management

Text Box 21

WAY FORWARD TO IMPROVE WASTEWATER TECHNOLOGY DEVELOPMENT

The way forward to improve wastewater technology includes the following:

- Implement a more integrated approach to ensure sustainability of the programmes as well as optimize the environmental and health benefits
- Establish a pool of experts through training programmes that create the opportunity for sharing innovative ideas and practices
- Establish and maintain close linkages with government agencies, academia, local communities and NGOs.
- Liaise with international institutions to keep abreast of modern technological advances and to facilitate technology transfer.

Financing

❖ ***The Government shall seek financial support for institutional capacity building, sanitation infrastructure, projects, procurement of equipment, training and human resources development for wastewater management***

The mix of problems and the capacity to deal with these sanitation problems varies amongst cities and countries. Confronting these problems requires an ability to face a number of challenges, including different environmental health challenges as well as financial, institutional and technical challenges[38]. But making progress on wastewater management and pollution control creates major financial challenges for developing countries. Mobilizing the necessary financial resources requires both recognizing the need for an urban sanitation subsector and reliance on new ways of financing urban sanitation, sewerage and wastewater management.[39] For GEF CReW participating countries investment in wastewater is low alongside limited commitments from the governments.

Lack of access to credit impedes investment in sanitation and drainage especially for small villages. And even when the appropriate financing and institutional principles are followed, very difficult issues can still arise with respect to the financing of wastewater treatment facilities making it clear the need for innovative financing mechanisms for GEF CReW participating countries. These may include reliance on any or all of the mechanisms shown below.

[38] WHO/UNEP (1995) Water Pollution Control - A Guide to the Use of Water Quality Management Principles, 1995
[39] Id.

Text Box 22

INNOVATIVE FINANCING MECHANISMS FOR WASTEWATER

An effluent tax - can be applied to dischargers to induce waste reduction and treatment and can become a source of revenue for financing wastewater treatment investments

Municipal sewer use charges - provides revenues to build and to operate sewerage and treatment works.

Service charges - gives access to cost-effective and affordable sanitation services via public or private utilities

Public-Private-Partnership - a means of enhancing efficiency and lowering costs, and of expanding the resources available for service delivery

The following is a checklist of policy questions that should be answered before proceeding with wastewater investments:

- Have measures been taken to reduce domestic and industrial water consumption?
- Is industrial wastewater pre-treated?
- Is it possible to reuse or recycle wastewater?
- Can the proposed investment be analyzed in a river basin context? If so, have the merits of the investment been compared with the benefits from different kinds of investments in other parts of the river basin? (Note that a least-cost solution to achieve improved water quality may involve different, or no, treatment at different locations.)
- Has the most cost-effective treatment option been used to achieve the desired ambient water quality?
- Has an economic analysis been undertaken to assess the benefits (in terms of ambient water quality, "return on investment that covers social, environmental and economic benefits") that could be achieved by phasing investments over 10 years or more?

Monitoring and Evaluation

- ***Projects and programmes associated with the use of wastewater should be led and coordinated by inter-agency committees under the aegis of a leading ministry***

Monitoring activities for wastewater use projects take two forms- process control monitoring and compliance monitoring.

Process control monitoring is carried out to provide data to support the operation and optimisation of the system, in order to achieve successful project performance. It includes the monitoring of treatment plants, water distribution systems, water application equipment, environmental aspects (such as salinisation, drainage waters, water logging), agricultural aspects (such as productivity and yield) and health-related problems (such as the development of disease vectors and health problems associated with the use of wastewater). In addition to providing data for process control, this level of monitoring generates information for project revision and updating as well as for further research and development. Responsibility for process control monitoring belongs to the operating agency (for example, a ministry, department of government or statutory body) which is part of the inter-agency committee.

Compliance monitoring is required to meet regulatory requirements. Compliance monitoring should not be performed by the same agency in charge of process control monitoring. This responsibility should be extended to an enforcement agency that possesses legal powers to enforce compliance with quality standards, codes of practice and other pertinent legislation. The responsibility for compliance monitoring is usually granted to ministries of health because health issues can emerge when wastewater use systems are not operating at optimal levels or are not functional.

A successful monitoring programme should be cost effective (only essential data should be collected and analyzed); it should provide adequate coverage (only representative sectors of the system should be covered); it must be reliable (representative sampling, accurate analysis with adequate analytical quality control, appropriate storing, handling and reporting of information); and it should be timely, in order to provide operators and decision-making officials with fresh and up-to-date information that allows the application of prompt remedial measures during critical situations.

2.1 SUMMARY OF GENERAL TOOLS OR DRIVERS

Wastewater management is not yet a priority concern in GEF CReW project countries and as a result the policy framework for the sector is in need of strengthening. Health risks posed by discharges of untreated wastewater are underestimated and information about technological and institutional options is insufficient. A lack of regulations, technical skills and organisational capacity remain fundamental obstacles to effective wastewater management.

Based on universally accepted criteria for good governance, and supported by the review of international literature on good governance practices the foregoing policies and practices have the potential to improve wastewater management and support the principle of sustainable water

resources management. In drafting a wastewater management policy, it is very important that stakeholders[40] participate in the process. Applying a strategic planning approach to wastewater management entails choosing the right policy instruments, agreeing on priorities, selecting appropriate standards for service provision, and developing strategic investment and cost recovery programmes. The foregoing identifies a recommended framework to assist the implementation by wastewater management entities.

2.2 CONCLUSIONS AND RECOMMENDATIONS

The incorporation of wastewater use planning into national water resource and agricultural planning is important, especially where water shortages exist. This is not only to protect sources of high quality waters but also to minimise wastewater treatment costs, safeguard public health and to obtain the maximum agricultural and aquacultural benefit from the nutrients that wastewater contains. Wastewater use may also help reduce costs, especially if it is envisaged before new treatment works are built, because the standards of effluents required for various types of use may result in costs lower than those for normal environmental protection. It also provides the possibility of recovering the resources invested in sewerage and represents a very efficient way of postponing investment of new resources in water supply (Laugeri, 1989).

The use of wastewater has been practised in many parts of the world for centuries. Whenever water of good quality is not available or is difficult to obtain, low quality waters such as brackish waters, wastewater or drainage waters are spontaneously used, particularly for agricultural or aquacultural purposes. Unfortunately, this form of unplanned and, in many instances unconscious reuse is performed without any consideration of adequate health safeguards, environmentally sound practices or basic agronomic and on-farm principles.

Authorities, particularly ministries of health and agriculture, should investigate current wastewater reuse practices and take gradual steps for upgrading health and agronomic practices. This preliminary survey provides the basis for the clear definition of reuse priorities and the establishment of national strategies for reuse.

The implementation of an inter-sectoral institutional framework is the next step that should be taken. This entity should be able to deal with technological, health and environmental, economic and financial, and socio-cultural issues. It should also assign accountable responsibilities and should create capacity for operation and maintenance of treatment, distribution and irrigation systems, as well as for monitoring, surveillance and the enforcement of effluent standards and codes of practice.

In countries with little or no experience on planned reuse, it is advisable to implement and to operate a pilot project. This experimental unit should include treatment, distribution and irrigation systems and provides the basis for the establishment of national standards and codes of practice which can then be fully adapted to local conditions and skills. Once the pilot phase has been completed, the system can be transformed into a demonstration and training project which could be “adapted to local conditions” of neighbouring countries.

[40] Stakeholders include Government Ministers, Members of Parliament/Assembly, officials from relevant sectors (e.g. health, tourism, finance), wastewater utility providers and operators.

PART 3
STATUS OF WASTEWATER MANAGEMENT POLICY DRIVERS IN GEF CREW PARTICIPATING COUNTRIES

3.0 INTRODUCTION

Part 2 of the Toolkit has set out the main policy drivers for wastewater management. Part 3 assesses the status of GEF CReW participating countries in relation to those drivers. The exercise reveals gaps in the wastewater policy of each GEF CREW participating country and suggests remedial actions that should be taken. The materials are presented in tabular format for (a) countries that are parties to the LBS Protocol (namely Antigua and Barbuda, Guyana, Saint Lucia and Trinidad and Tobago) and (b) those that are not parties to the LBS Protocol (Barbados, Jamaica, St. Vincent and the Grenadines and Suriname).

LBS PARTIES

ANTIGUA AND BARBUDA

Main Policy Drivers	Existing Status	Improvements to Coincide with WW Policy Framework	Responsible Entity(ies)
Institutional Arrangements for WWM	Central Board of Health, Development Control Authority and Public Utilities Authority share responsibility for wastewater management. Environment Department has overall responsibility for pollution control Pesticides and Toxic Chemicals Board is responsible for disposal of pesticides and toxic chemicals National Solid Waste Management Authority provides the framework for ship-generated waste	Institute inter- and intra-institutional collaboration among planning frameworks of key stakeholders –agriculture, environment, tourism- in decision-making on wastewater and agricultural run-off	Central Board of Health (CBH)
Water Resources-Related Enabling Legislation	Public Health Act, Cap. 353 regulates treatment and disposal of liquid waste Public Utilities Act, Cap 359 maintains sewerage system Pesticides & Toxic Chemicals Act regulates use and disposal of pesticides and toxic chemicals Physical Planning Act, 2003	Establish provisions for Wastewater Master Plan, infrastructure and treatment standards, appropriate technology, planning and design requirements, methods for hazardous waste disposal Require EIAs for wastewater treatment plants Establish a Tariff Authority to set rates for wastewater discharges	Central Board of Health, Environment Department, Development Control Authority

Main Policy Drivers	Existing Status	Improvements to Coincide with WW Policy Framework	Responsible Entity(ies)
	responsible for conduct of EIAs National Solid Waste Management Authority Act responsible for disposal of ship-generated waste Draft Environmental Protection and Management Bill, 2014 responsible for protection of marine environment	Implement LBS discharge standards	
Regulations, Guidelines etc.	Public Health Regulations vest public health officers with the duty to enforce against nuisances	Establish wastewater management regulations for domestic wastewater and agricultural runoff Develop treatment plant design requirements that minimise impacts of discharges Include odours and air emissions from wastewater treatment plants in nuisance regime Enhance CBH monitoring programme and laboratory capability of Department of Agriculture to ensure compliance LBS discharge parameters Update fines and penalties. Consider alternative compliance mechanisms	Central Board of Health in collaboration with Environment Division, Fisheries Division
Capacity-building/ Community and Private Sector Participation	Training programmes for farmers on good agricultural practices that reduce agricultural run-off. Low level knowledge and skills by wastewater operators Limited community and private sector participation in wastewater management	Encourage farmers to use modern and efficient irrigation technologies Implement public awareness programmes to promote community involvement in wastewater management	Department of Agriculture Central Board of Health, Environment Department, Tourism and wastewater utility Water utility should engage NGOs, private sector in services for billing, meter-reading etc.

BELIZE

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Department of Environment is responsible for management of pollution of marine environment, monitoring effluent discharges from industries, investigating and cleanup of pollution incidents, requires licences to discharge Coastal Zone Management Authority and Institute(CZMA/I) Public Health Fisheries Department Pesticides Control Board Water and Sewerage Authority ensures efficient use of water to promote adequate water quality	Establish lead agency for wastewater management Include tourism sector in decision making regarding wastewater Practice inter-institutional coordination and involvement with all relevant entities in decision making on wastewater matters (health, fisheries, agriculture, wastewater entity) Include Pesticides Control Board to offer considerations regarding agricultural run-off	CZMA/I
Water Resources-Related Enabling Legislation	Coastal Zone Management Authority Act (CZMA) establishes the strongest framework for wastewater management. Pesticides and Toxic Chemicals Act Lists hazardous chemicals prohibited from dumping at sea Port Authority Act Prohibits pollution of territorial waters	Extend EIA requirements to apply to wastewater infrastructure	CZMA/I
Regulations, Guidelines etc.	Environmental Protection (Effluent Limitations) (Amendment) and Pollution Control Regulations provide framework for prevention, control and reduction of land-based and marine sources of pollution to implement country's obligations under the LBS Protocol. Also requires	Use Wastewater Guidelines to assist in establishing clear policy on wastewater Include provisions to control agricultural runoff in regulations Consider air quality and odour discharges in regulations	Public Health Department should lead

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
	treatment of domestic and industrial systems and sets limits for discharges. <u>Environmental Impact Assessment Regulations</u> EIA mandatory for activities that have negative impact on environment <u>Fisheries Regulations</u> Monitors minor water quality parameters	Install metering systems CZMA/I performs water quality monitoring of development areas or projects and water quality testing, also Fisheries Department. Environment Department does quarterly monitoring of industries. Improve coordination among all actors	
Capacity-building/ Community and Private Sector Participation	National Education Policy and Strategic Action Plan developed to address lack of public awareness	Involve wastewater entity in projects that impact on the sector Implement programmes that improve understanding of wastewater linkages to public health, tourism, quality of food and sustainable development In programmes for laboratory personnel to improve monitoring	Environment, public health, Tourism, fisheries, agriculture should be involved in developing the programmes

GUYANA

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Environmental Protection Agency responsible for the prevention of pollution Guyana Geology and Mines Commission regulates activities in the mining sector Guyana Water Inc. responsible for sewerage system Environmental Health Unit of the Ministry of Health and Regional Environmental Health Services jointly responsible for control of pollution of rivers and coastal waters Pesticides and Toxic Chemicals Board regulates the disposal of pesticides and toxic chemicals	Institutional Coordination on wastewater management, include entities responsible for environment, agriculture, physical planning and health. Include entity responsible for wastewater and National Water Council	Environmental Protection Agency should lead efforts

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
	Central Housing and Planning Authority responsible for the grant of development consent National Water Council		
Water Resources-Related Enabling Legislation	Environmental Protection Act, 1996governs EIA process and control of pollution by controlling the concentration of discharges Pesticides and Toxic Chemicals Act establishes Board to control disposal of pesticides and toxic chemical	Fill gaps in the legal framework for wastewater infrastructure, planning and design requirements, appropriate technology, waste management and the establishment of Wastewater Master Plans Establish treatment standards for domestic wastewater Pursue the control of pesticides and toxic chemicals , which will contribute to improved quality of agricultural runoff Empower a tariff-setting authority to set rates for wastewater discharges	Ministry of Agriculture, Central Planning and Housing Authority and Environmental Protection Agency
Regulations, By-Laws etc.	Environmental Protection (Water Quality) Regulations 2000 establish effluent limitations for industries	Amend the pollution control framework established under the Environmental Protection Act Amend regulations to establish limits on domestic discharges and agricultural run-off as well as adequate fines and penalties and enforcement personnel In the framework, include provisions for wastewater treatment standards for odours and air quality and mitigation measures Establish a Water Quality Monitoring Programme	Environmental Protection Agency and Central Housing and Planning Authority
Capacity-building/ Community and Private Sector Participation	Environmental Protection Agency vested with duty to undertake public awareness and environmental education programmes Limited involvement of NGOs, key stakeholders, and private sector in wastewater matters	Foster collaboration of wastewater entity, health and environment to develop public and community awareness, training and education programmes. Foster cooperation of wastewater entity with key stakeholders in project development	Environmental Protection Agency

SAINT LUCIA

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Department of Environmental Health responsible for regulating pollution of rivers and coastal and marine areas. Ministry of Health grants permission for technology options for sewage disposal Water and Sewerage Company collaborates with other government agencies in control of water pollution Coastal Zone Management Unit responsible for integrated coastal zone management and coordinates with environment, agriculture, fisheries, health and forestry Physical Planning Department ensures development is in compliance with building codes , standards & regulations	Include Physical Planning Department and Water and Sewerage Company with CZMU group	CZMU as lead agency
Water Resources-Related Enabling Legislation	Public Health Act, 1975 empowers Minister to make regulations for the prevention or removal of discharges into any river, stream, watercourse Physical Planning and Development Act, 2002 empowers the Development Control Authority to conduct EIAs Water and Sewerage Act, 2005gives power to Minister to prevent any matter from entering water and mitigate any pollution there from Pesticides and Toxic Chemicals Control Act, regulates disposal of pesticides and toxic chemicals	Set infrastructure standards, design requirements. Establish Wastewater Master Plan Enhance water pollution control framework to place limits on domestic wastewater discharges and agricultural runoff, minimise odour from wastewater treatment plants	CZMU
Regulations, Guidelines etc.	Public Health Regulations: Sewage and Disposal of Sewage	Develop pollution control measures for odours and air	

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
	and Liquid and Industrial Waste Works (i) prohibits the discharge of sewage and other liquid wastes (ii) provide specifications on the siting and construction of sewage treatment facilities Voluntary Standard for Recreational Water Quality, 2010 establishes parameters and limits for riverine and coastal waters Ministry of Health and Department of Fisheries Coastal Water Quality Monitoring Programme on bacterial parameters	quality for sewage treatment plants and vest wastewater managers with authority to investigate and inspect complaints of nuisances caused by wastewater discharges Establish mandatory standards for domestic wastewater discharges. Update enforcement measures and coordinate with key stakeholder entities	
Capacity-building/ Community and Private Sector Participation	Training in sustainable land management conducted for multi-disciplines	Improve collaboration between Water and Sewerage Co., Public Health and Agriculture on conduct of public awareness programmes Conduct land management training for wastewater operators, key officials in agriculture, health, tourism, fisheries and environment Encourage private sector participation in wastewater services e.g. billing, metering Forge partnership between Water and Sewerage Company as wastewater utility and NGOs	Public Health Department, Water and Sewerage Company

TRINIDAD AND TOBAGO

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Environmental Management Authority responsible for control of water pollution and designation of sensitive areas Water and Sewerage Authority is the statutory authority responsible for water allocation and wastewater management	Foster inter-agency collaboration with other stakeholders (fisheries, physical planning, public health, agriculture, wastewater entity)	Water and Sewerage Authority Environmental and Management Authority as lead agency
Water Resources Enabling Legislation	Environmental Management Act, 2005 makes provision for control of water pollution and issue of certificates of environmental clearance Water and Sewerage Act Town and Country Planning Act 35:01 deals with the grant of development consent	Amend Water and Sewerage Act to make provision for Wastewater Master Plan and fill gaps in wastewater management framework by making provision for wastewater infrastructure and design framework, appropriate technology, waste management	
Regulations, By-Laws etc.	Certificate of Environmental Clearance Rules and Schedule II Water Pollution Rules, 2001 divides the country's receiving waters into 4 categories are stricter than Annex III of LBS Protocol	Strengthen regulatory framework to consider recycling and agricultural runoff Improve monitoring and enforcement for violations	Environmental Management Agency in collaboration with Public Health
Capacity-building/ Community and Private Sector Participation	Corporate Relations and Public Education Department conducts public awareness programmes on water pollution for NGO.s, community based organisations, civil society Institute of Marine Affairs implements education and public awareness programmes on marine matters	Conduct public awareness programmes on wastewater management for private sector. Include senior government officials of key entities, NGOs, farming community, private sector in audience for public awareness programmes	Environmental Management Agency with Institute of Marine Affairs

NON-LBS PARTIES

BARBADOS

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Coastal Zone Management Unit be responsible for protection of the marine environment Ministry of Environment, Water Resources and Drainage (MEWRD) responsible for policy implementation for management of marine and coastal resources. Policy coverage includes management of pesticides, control of wastewater discharges and monitoring of coastal area. No specific duty towards wastewater Town & Country Development Planning Office and Barbados Water Authority collaborates with (MEWRD) on private sewage and industrial discharges to soak-aways Ministry of Agriculture and Barbados Investment Development Corporation grants rebate to farmers and businesses respectively to promote sustainable farming techniques such as water reuse for irrigation or use of sustainable and clean technologies	Expand inter-agency collaboration to include wastewater utility (Barbados Water Authority), Town & Country Development Planning Office, Coastal Zone Management Unit, fisheries, tourism and agricultural sectors in decision making for wastewater	Coastal Zone Management Unit with Barbados Water Authority as Lead agency
Water Resources Enabling Legislation	Marine Pollution Act (MPA), 1998 Establishes discharge standards for marine environment Coastal Zone Management Act Cap. 394 establishes Coastal Zone Management Unit to be responsible for protection of the marine environment	Improve discharge standards, establish specific policy provisions for wastewater to incorporate infrastructure and design standards, septic tank design, appropriate technology, and EIA and waste management provisions. Establish a tariff authority	Barbados Water Authority in collaboration with Coastal Zone Management Unit and Town & Country Planning Office

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
	Town and Country Planning Act, Cap. 240 regulates developing planning process Tourism Development Act, Cap. 341and Income Tax Act, Cap 73 grant rebates for wastewater treatment	to set wastewater rates under the MPA	
Regulations, By-Laws etc.	Coastal Water Quality Monitoring Programme developed as a response to wastewater management challenges. Zone rule regulates the disposition of wastes inland	Improve collaboration with public health, environment on monitoring Establish comprehensive regulatory framework that places limits on discharges for domestic wastewater and agricultural runoff Town and Country Development Planning Office to control nuisance provisions (odours, air quality), give authority to wastewater entity to investigate nuisance complaints	Barbados Water Authority, Pesticides Control Board Town and Country Development Planning Office.
Capacity-building/ Community and Private Sector Participation	Little community and private sector involvement in wastewater issues	Increase participation of NGO, Barbados Water Authority in development projects Establish public awareness programmes to promote community involvement in wastewater management	Barbados Water Authority CZMU

JAMAICA

Main Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity*
Institutional Arrangements for WWM	National Environment and Planning Agency (NEPA) is lead agency for wastewater management and implementation of LBS Protocol Issues permits and licences for discharges into marine environment	Expand collaboration to include PCA to control agricultural runoff	NEPA as lead agency

Main Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity*
	Environmental Health Unit, Ministry of Health makes recommendations on applications for wastewater systems on basis of inter-agency cooperation with Water Resources Authority (WRA) and NEPA National Water Commission (NWC) is responsible for collection, treatment and disposal of sewage WRA approves wastewater design systems, conducts impact assessments for projects that impact wastewater Pesticides Control Authority (PCA) sets policies for control of pesticides and toxic chemicals discharges	and Fisheries Department and Tourism to control other discharges to coastal and marine areas Formalise wastewater design systems and infrastructure standards.	WRA
Water Resources-Related Enabling Legislation	Natural Resources Conservation Authority Act requires a licence to discharge wastewater, construction of wastewater treatment facilities, promulgates treatment standards Town and Country Planning Act grants development consent to wastewater facilities. National Water Commission Act and Water Resources Act provide framework for these entities setting water and sanitation policies and undertake monitoring and environmental impact assessments	Formalise infrastructure standards, planning and design requirements, and appropriate technologies. Include consideration of odours and air quality control in EIA process WRA Act to make provision for Wastewater Master Plans, appropriate technology, waste management and handling	NRCA
Regulations, Guidelines, etc.	Permits and Licences Regulations require permits for construction and operation of new wastewater treatment plant. Establishes treatment standards for trade	NEPA monitors sanitation standards WRA conducts environmental monitoring Coordinate activities between these entities	

Main Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity*
	effluent. Wastewater and Sludge Regulations Sewage Effluent Regulations allow safe management, treatment and disposal of sewage and industrial sludge Draft Sewage and Wastewater Regulations (2011)prepared to support LBS ratification Environmental Monitoring and Management Plan ensures that standards are being met Draft Wastewater Management Policy 2006 is in process to develop policy guidelines for planning, development, operation and management, financing and delineation of role and responsibilities of different stakeholders in wastewater management. Public Health Act & Nuisance Regulations authorises action where breach in sanitation occurs	Maintain self-monitoring of sewage treatment facilities	NEPA
Capacity-building/ Community and Private Sector Participation	National Environmental Education Action Plan for Sustainable Development (NEEAPSD) focuses on pollution control Jamaica Sustainable Development Network Programme (JSDNP)aims to improve information dissemination Local Government Reform Process focuses on sustainable development issues	Create programmes that promote community involvement Include NGO's, senior government officials of fisheries, tourism, agriculture, environment, health and farming community in programme participants Undertake efforts to establish a Champion for wastewater and to forge partnership with private sector	NEPA as Lead agency

SAINT VINCENT AND THE GRENADINES

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity*
Institutional Arrangements for WWM	Ministry of Health, Wellness and the Environment and Central Water and Sewerage Authority responsible for regulating coastal and marine pollution	Improve collaboration on wastewater management by including entities responsible for agriculture, health, tourism, fisheries	Central Water and Sewerage Authority as lead agency and Champion for Wastewater management
Water Resources-Related Enabling Laws	Central Water and Sewerage Authority Act vests entity with responsibility inter alia or controlling water pollution Town and Country Planning Act, 1992 provides for the preparation of EIA's for sensitive developments,	Establish standards for wastewater reuse for irrigation by hotels Establish design requirements and infrastructure standards Require EIA for sewage treatment plants	Central Water and Sewerage Authority Town and Country Planning Department
Regulations, Guidelines etc.	Draft Environmental Management (Pollution) Regulations	Enact Draft Pollution Regulations Establish standards for package treatment plants	Central Water and Sewerage Authority
Capacity-building/ Community and Private Sector Participation	Public awareness and education programmes	Develop public awareness programmes on wastewater management and control of water pollution to promote community participation	Tourism Department in collaboration with Central Water and Sewerage Authority

SURINAME

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Institutional Arrangements for WWM	Ministry of Public Health responsible for disposal of wastes Ministry of Public Works responsible for management of sewerage system Ministry of Labour, Technology Development and Environment responsible for developing environmental policy, EIAs, monitoring, enforcement, education and awareness	Establish linkage with stakeholder entities (fisheries, agriculture, environment, health)	Ministry of Labour, Technology Development and Environment as lead agency
Water Resources-Related Enabling Laws	Marine Pollution Act establishes comprehensive legislative framework for coastal and marine environment	Fill gaps in legislative framework for wastewater infrastructure standards, design requirements, appropriate technology for wastewater treatment, waste management	Ministry of Labour, Technology Development and Environment
Regulations,	Draft Marine Pollution	Strengthen pollution control	Ministry of Labour,

Main Policy Drivers	*Existing Status*	*Improvements to Coincide with WW Policy Framework*	*Responsible Entity(ies)*
Guidelines etc.	Regulations	framework to include monitoring, authorise inspections of wastewater treatment plants	Technology Development and Environment
Capacity-building/ Community and Private Sector Participation	Environmental education and public awareness programmes conducted.	Conduct training programmes for wastewater operators	Ministry of Labour, Technology Development and Environment with Ministry of Health

3.1 CONCLUDING THOUGHTS

The discharge of domestic wastewater and agricultural runoff into coastal and marine areas is a serious pollution problem which has for the most part been neglected for GEF CReW participating countries. This is probably due to the existing perception of considering wastewater as environmental 'nuisance' and not as a 'resource' by the water sector agencies and their personnel part of the reason for which appears to be due to a lack of institutional coordination across the water sector agencies. Instead much of the emphasis to date has been on the development of physical infrastructure and services in the collection, conveyance, treatment and safe disposal of wastewater while recycling and reuse of the wastewater has received little emphasis in the development and execution of the development programmes.

Compliance with Annex III of the LBS Protocol requires the implementation of new or innovative technologies which most of the GEF CReW participating countries are slow to adopt. Within recent times many new technologies for collecting, treating and disposing of wastewater are now available. These technologies include alternative sewers, constructed wetlands, enhanced pond systems, media filters, drip irrigation, and effluent reuse and can be combined to provide cost-effective wastewater services to local communities left behind by more conventional engineering approaches.

By ratifying the LBS Protocol, CReW participating countries appear to evidence commitment to establishing wastewater as a national priority. However activity towards implementation of the treaty's provisions is limited. These countries have pointed to the limited availability of financial resources for infrastructure, capacity-building, appropriate technology and research and development needed to make the much-needed improvements in the sector. By focusing on these existing weaknesses the CReW project can be the mechanism through which reform in the wastewater management sectors in the region may be achieved. The strongest signal and first step will involve the establishment and implementation of related policy and legal frameworks.

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ANNEX A: LIST OF TERMS USED

Agricultural non-point sources of pollution refers to wastewater discharges originating from the cultivation of crops and rearing of domesticated animals.

Conventional primary and secondary treatment refers to conventional treatment systems, such as plain sedimentation, bio-filtration, aerated lagoons and activated sludge, which are designed particularly for removal of organic matter, are not able to remove pathogens in order to produce an effluent that meets the WHO guideline for bacterial quality (≤ 1,000 fecal coliform per 100 ml). In the same way, they are not generally effective in helminth removal. More research and adaptive work is required to improve the effectiveness of conventional systems in removing helminth eggs.

Domestic wastewater refers to discharges from residences and commercial, hotels, septage and any other institution whose discharges include toilet flushing (black water) ,discharges from showers wash basins, kitchens and laundries (grey water).

Pollution refers to the introduction, directly or indirectly, by human activity, of wastes or other matter into the sea which results or is likely to result in such deleterious effects as harm to living resources and marine ecosystems, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.

Public participation refers to participation by the public (individuals, NGOs) in decision making ranging from merely commenting on drafts to co-decision making

Reused water refers to treated wastewater obtained from one application or process that is intended for use in another application or process.

Sludge treatment refers to the excess sludge produced by bio biological treatment plants are valuable as a source of plant nutrient as well as a soil conditioner. It can also be used in agriculture or to fertilise aquaculture ponds. However, biological treatment processes concentrate organic and inorganic contaminants as well as pathogens in the excess sludge. Given the availability of nutrients and moisture, helminth eggs can survive and remain viable for periods close to one year. If adequate care is taken during the handling process, raw sludge can be applied to agricultural land in trenches and covered with a layer of earth. This should be done before the planting season starts and care should be taken that no tuberous plants, such as beets or potatoes, are planted along the trenches.

Stakeholder refers to an agency, organisation, group, or individual that has an interest (direct or indirect) in the project/programme or who affects or is affected (positively or negatively) by the implementation or outcome of it.

Tertiary treatment refers to tertiary or advanced treatment systems are used to improve the physico-chemical quality of biological secondary effluents. Several unit operations and unit processes, such as coagulation-flocculation-settling-sand filtration, nitrification and denitrification, carbon adsorption, ion exchange and electro-dialysis, can be added to follow

secondary treatment in order to obtain high quality effluents. Due to the high capital and operational costs involved and the need for highly skilled personnel for operation and maintenance, careful assessments should be made by GEF CReW participating countries to determine whether tertiary treatment should be undertaken when treating wastewater for reuse.

If the objective is to improve effluents of biological plants (particularly in terms of bacteria and helminths), for the irrigation of crops or for aquaculture, a more appropriate option may be to add one or two "polishing" ponds as a tertiary treatment. If land is not available for that purpose, horizontal or vertical-flow roughing filtration units (which have been used for pre-treatment of turbid waters prior to slow-sand filtration) may be considered. These units, which are low cost and occupy a relatively small area, have been shown to be very effective for the treatment of secondary effluents and remove a considerable proportion of intestinal nematodes.

Waste stabilisation ponds refers to ponding systems integrating anaerobic, facultative and maturation units, with an overall average retention time of 10-50 days (depending on temperature) and can produce effluents that meet the WHO guidelines for both bacterial and helminth quality.

Wastewater is generally a mixture of domestic waste water from baths, sinks, washing machines and toilets, and waste water from industry. It will often also contain rainwater runoff from roofs, roads and other impermeable surfaces.

Wastewater management refers to the collection (excluding the fabric of the infrastructure) and treatment of municipal and industrial waste water, and the treatment and disposal or use of the products of these processes, in accordance with environmental standards.

ANNEX B: GUIDELINES FOR WATER REUSE

Type of Reuse	Treatment Required	Reclaimed Water Quality	Recommended Monitoring	Setback Distances
AGRICULTURAL	Secondary Disinfection	pH = 6-9	pH weekly	300 ft. from potable water supply wells
Food crops commercially processed		BOD □ 30 mg/l	BOD weekly	
		SS = 30 mg/l	SS daily	
Orchards and Vinerds		FC □ 200/100 ml	FC daily	100 ft. from areas accessible to public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
PASTURAGE	Secondary Disinfection	pH = 6-9	pH weekly	300 ft. from potable water supply wells
Pasture for milking animals		BOD □ 30 mg/l	BOD weekly	
		SS □ 30 mg/l	SS daily	
Pasture for livestock		FC □ 200/100 ml	FC daily	100 ft. from areas accessible to public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
FORESTATION	Secondary Disinfection	pH = 6-9	pH weekly	300 ft. from potable water supply wells
		BOD □ 30 mg/l	BOD weekly	
		SS □ 30 mg/l	SS daily	
		FC □ 200/100 ml	FC daily	100 ft. from areas accessible to the public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
AGRICULTURAL	Secondary Filtration Disinfection	pH = 6-9	pH weekly	50 ft. from potable water supply wells
Food crops not commercially processed		BOD □ 30 mg/l	BOD weekly	
		Turbidity □ 1 NTU	Turbidity daily	
		FC = 0/100 ml	FC daily	
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
GROUNDWATER RECHARGE	Site-specific and use-dependent	Site-specific and use-dependent	Depends on treatment and use	Site-specific

Source: USEPA, *Process Design Manual: Guidelines for Water Reuse,* Cincinnati, Ohio, 1992, (Report No. EPA-625/R-92-004).

ANNEX C: TYPICAL AUTHORITIES OF A REGULATORY AUTHORITY

- Develop and implement policy and regulations
- Provide management continuity
- Enforce regulations and program requirements through fines or incentives
- Conduct site and regional-scale evaluations
- Require certification or licensing of service providers
- Oversee system design review and approval
- Issue installation and operating permits
- Oversee system construction
- Access property for inspection and monitoring
- Inspect and monitor systems and the receiving environment
- Finance the program through a dedicated funding source
- Charge fees for management program services (e.g., permitting, inspections)
- Provide financial or cost-share assistance
- Issue and/or receive grants
- Develop or disseminate educational materials
- Provide training for service providers and staff
- Conduct public education and involvement programs
- Hire, train, and retain qualified employees