Government of Barbados

Road Map Towards Integrated Water Resources Management Planning for Barbados

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IWCAM Integrating Watershed and Coastal Areas Management in Caribbean Small Island Developing States
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Executive Summary

Water is the most vital natural resource and its integrated management is necessary for sustainable development. However, conflicting competing uses have resulted in water resources management issues, principally a water governance crisis in terms of securing water for people, securing water for food production, protecting vital ecosystems and gender disparities. Consequently, the concept of integrated water resources management (IWRM) was developed and recognised as an appropriate tool for the management of water resources in a sustainable manner. IWRM sets the framework for coordination of management decisions within an appropriate coherent policy setting taking into account overall social and economic goals.

The need for management of water resources was reinforced at the World Summit on Sustainable Development (Johannesburg, 2002). The resulting Plan of Implementation (JPoA) called for all countries to develop integrated water resources management (IWRM) and water efficiency plans by 2005. These plans will contribute to the foundation towards achievement of targets set out under the Millennium Development Goals as related to poverty, hunger, health and environment issues.

Barbados has been rated as one of the world's most water scarce countries and like many other Caribbean Small Island Developing States (SIDS), it is faced with competing demands for freshwater resources as it seeks to develop and grow its economy. Water management and pollution of groundwater and surface water run-off are issues that must be addressed as these resources underpin sustained economic growth and development. The 2005 National Development Plan has recognised the importance of good water management and the Government of Barbados committed itself to preparing an Integrated Water Resources Management Plan for the country. Cognisant of the need to manage water resources in Barbados in a sustainable manner, the Barbados Water Authority and the Coastal Zone Management Unit have taken the initiative to develop a "roadmap", policy and plan for IWRM at the national level.

Technical assistance in charting the way towards development of an IWRM Plan for Barbados, a "Roadmap", was provided by the Caribbean Environmental Health Institute (CEHI) and the Global Environment Facility (GEF)-funded Integrated Watershed and Coastal Areas Management (IWCAM) project, through funding from the United Nations Collaborating Centre for Water and the Environment (UCC) and support from the Global Water Partnership – Caribbean (GWP-C). The activities undertaken included stakeholder consultations and a situational analysis which generated the requisite information to develop the IWRM Roadmap that will define the series of steps that are necessary in preparation of an IWRM Plan.

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The roadmap anticipates the following requisite steps:

- Building political consensus and political will;
- Development and endorsement of a National Water Policy;
- Initiating mechanisms for cross-sectoral integration;
- A capabilities assessment;
- Review of legislation;
- Review of data collection, monitoring and assessment and development of indicators.

This will require: a holistic and comprehensive national policy and plan for the management of water resources; development of the legal and regulatory framework for the management of water resources; improving and, where necessary, developing the institutional and administrative framework for water resources management; enhancing capacity and capability for the management of water resources

Implementing IWRM in Barbados will involve a change in the way in which water resources are managed. The existing sectoral system needs to be replaced by a greater degree of coordination between sectors and measures put in place to ensure that the management of water resources is undertaken in a holistic manner. This will ensure that due consideration is given to the various potentially conflicting uses and allocations of water resources.

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The Caribbean Environmental Health Institute (CEHI) has been working since inception in 1989 in the area of water resources management. The work of CEHI in IWRM is guided by the Caribbean Community's (CARICOM) agreement establishing the institute, the Caribbean Cooperation in Health Phase II (CCH-II) priority area of water resources and water quality management. Furthermore, CEHI was identified as the lead regional agency for the management of water and waste management by the Ministers of the Environment with regards to implementing the Barbados Programme of Action (BPOA) which resulted from the United Nations Conference on Environment and Development for Small Island Developing States (UNCED-SIDS, 1994). The Institute is the lead executing agency for the GEF-financed Integrating Watershed and Coastal Areas Management Project. For more information visit the web-site at www.cehi.org.lc

Acronyms

ART	Agency for Rural Transformation
BADMC	Barbados Agricultural Development and Marketing Company
BB$	Barbados Dollars
BPOA	Barbados Plan of Action
BSAP	Biodiversity Strategy and Action plan
BWA	Barbados Water Authority
CARIWIN	Caribbean Water Initiative
CBO	Community Based Organisation
CEHI	Caribbean Environmental Health Institute
CIDA	Canadian International Development Agency
CWP	Caribbean Water Partnership
CWWA	Caribbean Water and Wastewater Association
CZMU	Coastal Zone Management Unit
DU	Drainage Unit
EPA	Environmental Protection Agency (USA)
EPD	Environmental Protection Division
EEZ	Exclusive Economic Zone
FAO	Food and Agricultural Organization
FTC	Fair Trading Commission
gals	Imperial gallons
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information Systems
GNP	Gross National Product
GWP-C	Global Water Partnership Caribbean
FoE	Friends of the Earth
IICA	Inter-American Institute for Cooperation on Agriculture
IPCC	International Panel on Climate Change
IWCAM	Integrating Watershed and Coastal Areas Management (project)
IWRM	Integrated Water Resource Management
km	kilometres
kph	kilometres per hour
m^3/d	cubic metres per day
Mm^3	Millions of cubic metres
mgd	million gallons per day
MACC	Mainstreaming Adaptation to Climate Change
MDG	Millennium Development Goals
MEA	Multi-Lateral Environmental Agreements
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoH	Ministry of Health
MoT	Ministry of Tourism
mm	millimetres
NAP	National Action Plan

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NGO	Non-Governmental Organisation
NIC	National Implementing Committee
OECS	Organization of Eastern Caribbean States
PAHO	Pan American Health Organization
RWH	Rain Water Harvesting
SCU	Soil Conservation Unit
SIDS	Small Island Developing States
SLM	Sustainable Land Management
SOPAC	South Pacific Applied Geoscience Commission
TCPO	Town and Country Planning Office
UNCCD	United National Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
US$	US dollar (equivalent to 2.0 Barbadian dollars)
UWI	University of the West Indies
WHO	World Health Organisation

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Finally, we sincerely acknowledge the United Nations Collaborating Centre on Water and the Environment for providing financial support for the IWRM road-mapping for Barbados and for advice given during the developmental process.

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NOTE: The background literature included in this roadmap document was in some places quoted verbatim from the primary source – the Integrated Water Resources Management Plans – Training Manual and Operational Guide produced by the Cap-Net Network and Global Water Partnership, 2005.

1.0 Background and scope

In January 1992 some five hundred participants, including government-designated experts from a hundred countries and representatives of eighty international, intergovernmental and non-governmental organizations attended the International Conference on Water and the Environment (ICWE)[1] in Dublin, Ireland. Out of the Conference, the Dublin Statement was crafted, underpinned by four principles that laid the foundation for and basis for guiding the integrated management of the world's water resources. The principles are:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment;
- Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels;
- Women play a central part in the provision, management and safeguarding of water;
- Water has an economic value in all its competing uses and should be recognised as an economic good.

Agenda 21 of the United Nations Convention on Environment and Development (UNCED, 1992) indicated in Chapter 18 the need for protection of the quality and supply of freshwater resources by application of integrated approaches to the development, management and use of water resources. Furthermore it exposed that integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization (UNCED, 1992). A number of programme areas were proposed including integrated water resources development and management.

A decade later, the World Summit on Sustainable Development (Johannesburg, 2002) and the resulting Plan of Implementation (JPoA, 2002) in ***Article 26:*** called for all countries to: "*Develop integrated water resources management and water efficiency plans by 2005, with support to developing countries.*" This was deemed as of utmost importance as an instrument to mainstream water in national economy and development and achieving the Millennium Development Goals (MDG´s) by 2015 specifically aimed at addressing the issues of poverty, hunger, health and environment.

Achieving the eight goals of the MDGs is underpinned by water in one way or another, hence it is inevitable that for progress to be made IWRM must be adopted. It should be emphasised however that an IWRM approach will support not just achievement of the MDGs but also the long-term economic development, poverty reduction and environmental sustainability that will be needed to sustain that achievement (GWP-TEC, 2005). Goal 7: *Ensure environmental sustainability (including the target of halving the number of people without access to water and sanitation),* illustrates that if the water resources environment is not managed and protected, it will not be able to sustain human communities.

[1] See reference on-line at http://www.wmo.ch/web/homs/documents/english/icwedece.html

Furthermore a direct contribution offered by IWRM to Goal 7 is to facilitate, in a structured way, the achievement of a balance between economic, social objectives and activities, and environmental sustainability (GWP-TEC, 2005).

It should also be noted that the Government of Barbados was a notable participant at the Johannesburg summit and has over many years taken a leading role in championing the cause of SIDS with respect to sustainability and climate change.

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2.0 Issues of water security

There is no doubt that water is the most vital natural resource and all of life and life support processes are dependent on this liquid medium. Water is vital for human survival, health and dignity and is a fundamental resource for human development. The finiteness of available water on earth is very discernible when we consider that of the 1,400 million cubic kilometers of water on earth and circulating though the hydrological cycle, only one-hundredth of 1% of this amount is readily available for human use (FAO, 2005). It is believed that this quantity is sufficient to meet humanity's needs if it were evenly distributed; however, this available 9,000 cubic kilometer volume is very unevenly distributed across the planet. Areas where the indigenous water supplies average less than 1,000 cubic meters per person per year are categorized as water scarce (FAO, 2005).

The amount of water available to each person is falling considerably as growing human populations continue to place tremendous pressure on diminishing water resources. Water scarcity is exacerbated by pollution. According to the FAO (2005), 450 cubic kilometers of wastewater pollute the world's surface waters each year reducing utility of these waters for safe human consumption. This has implications not only for human populations but also for the natural environment, offsetting the delicate balance of ecological systems, and in severe cases, unleashing irreversible consequences which may have direct adverse socio-economic consequences.

This situation is of particular concern for developing countries and Small Island Developing States (SIDS) where nearly one-third of the population has no access to safe drinking water. The Caribbean region has the least water available per capita as compared to other SIDS regions; just 13.3% of that available in the Indian Ocean SIDS and 1.7% of that available in the South Pacific SIDS on a per-capita basis. The island of Barbados for example is ranked among the ten most arid countries in the world. The geomorphology of most Caribbean islands limits the physical availability of freshwater reserves on account of relatively small landmass areas and typical mountainous terrain. The impacts of relatively frequent natural disasters (hurricanes and floods) exacerbated by human activity compromise water supply systems for extended periods, placing populations at risk under water scarce conditions. The impacts of climate change on the climatic and water regime in SIDS cannot be underestimated and constitutes an additional threat to water security.

In the GWP/Cap-Net Training Manual and Operation Guide for development of Integrated Water Resources Management Plans (2005), key issues in national water resources management were outlined along with the merits of adopting an integrated approach to water resource management planning. These include:

Water governance crisis: The sectoral approaches to water resources management (WRM) lead to fragmented and uncoordinated development and management of the resource aggravating the increase competition for the finite resource. The importance of IWRM is that it brings coordination and collaboration among the individual sectors, plus a fostering of stakeholder participation, transparency and cost-effective local management.

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Securing water for people: Deficiencies in water supplies primarily affect the poorest segments of the population in developing countries. In these countries, meeting water supply and sanitation needs for urban and rural areas represents one of the most serious challenges in the future. Implementing IWRM will assist in meeting the challenge of access to potable water, sanitary facilities and poverty alleviation.

Securing water for food production: Irrigated agriculture is already responsible for more than 70% of all water withdrawals projecting serious conflicts between water for irrigated agriculture and water for other human and ecosystem uses. IWRM offers the prospect of greater efficiencies, water conservation and demand management equitably shared among water users, and of increased recycling and reuse of wastewater to supplement new resource development.

Protecting vital ecosystems: The functionality and survival of our finite and vulnerable ecosystems depend on water flows, seasonality, water-table fluctuations and are threatened by poor water quality. Land and water resources management must ensure that vital ecosystems are maintained and that adverse effects on other natural resources are considered and where possible reduced when development and management decisions are made. IWRM can help to safeguard an "environmental reserve" of water commensurate with the value of ecosystems to human development.

Gender disparities: As custodians of family health and hygiene and providers of domestic water and food, women are the primary stakeholders in household water and sanitation. Hence, a crucial element of the IWRM philosophy is that water users, rich and poor, male and female, are able to influence decisions that affect their daily lives.

The conflicting uses of water resources and the need for integrated management as the key ingredient for sustainability were resounded during the World Summit on Sustainable Development (WSSD). Hence the resulting Johannesburg Plan of Implementation[2] contained commitments, targets and timetables to address the issues of water and sanitation. Noted among these are:

- Halve, by the year 2015, the proportion of people without access to safe drinking water *(reaffirmation of Millennium Development Goal)*.
- Halve, by the year 2015, the proportion of people who do not have access to basic sanitation.
- Develop integrated water resources management and water efficiency plans by 2005.

This formed the basis for the catalyzing of the present impetus by States to develop IWRM policies and plans.

[2] Note: this list is not exhaustive but provides information on the key commitments set out in the Johannesburg Plan of Implementation. For the full text, including the exact terms in which these commitments were made, visit the official website: www.johannesburgsummit.org

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3.0 Principles of integrated water resources management

3.1 What is integrated water resources management?

Integrated water resources management (IWRM) is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives (GWP/Cap-Net, 2005). As the term suggests the process seeks to strengthen cross-sectoral coordination in development of the country's water resources to reduce conflict, waste and unsustainable systems. In IWRM all the different uses of water resources are considered together. These uses range from water for domestic purpose to water for agriculture, to water for commerce and industry to water for environment. In the Caribbean context water is taken to include both fresh water and coastal marine waters including waste water.

IWRM sets the framework for coordination of management decisions within an appropriate coherent policy setting taking into account overall social and economic goals. By necessity the process towards realization of IWRM must be participatory involving all key stakeholders within the economic sectors (agriculture, tourism, manufacturing, etc), non-governmental and community-based organizations, the public sector and other relevant civil society groups. Involvement by the stakeholders can influence strategies for water resource development and management. A significant benefit from this approach is that informed users will be more inclined to observe self-regulation in relation to issues such as water conservation and catchment protection far more effectively than central regulation and surveillance can achieve.

An important consideration is that priority water problems affecting society must be shown to be effectively addressed through IWRM planning and implementation processes. For the IWRM process to succeed there must be strong buy-in at all levels, from top policy makers to the grass-roots, and it must be driven by a committed core group whose work is defined in an IWRM Roadmap.

3.1.1 Principles of IWRM

The IWRM development process has been given priority attention in recent years by international and national agencies given the recognition of increasing water scarcity and problems associated with threats to human health and sanitation, ecological integrity and social and economic development. An International Conference on Water and Environment, Dublin, Ireland, January 1992 laid out four guiding principles that have been agreed on to provide the framework for water sector reform and resource management from the global to national levels. The Global Water partnership/Cap-Net Training Manual (2005) elaborates these principles:

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Principle 1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

Understanding the finiteness of our water resources can be best done by appreciating the hydrological cycle. The notion that freshwater is a finite resource arises as the hydrological cycle on average yields a fixed quantity of water per time period. Thus, the freshwater resource is a natural asset that needs to be maintained to ensure that the desired services it provides are sustained. This principle recognises that water is required for many different purposes, functions and services; management therefore, has to be holistic (integrated) and involve consideration of the demands placed on the resource and the threats to it.

The integrated approach to management of water resources necessitates co-ordination of the range of human activities which create the demands for water, determine land uses and generate waterborne waste products. The principle also recognises the catchment area or river basin as the logical unit for water resources management.

Principle 2. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.

Water is a subject in which everyone is a stakeholder. Real participation only takes place when stakeholders are part of the decision-making process. The type of participation will depend upon the spatial scale relevant to particular water management and investment decisions. It will be affected too by the nature of the political environment in which such decisions take place. A participatory approach is the best means for achieving long-lasting consensus and common agreement. Participation is about taking responsibility, recognizing the effect of sectoral actions on other water users and aquatic ecosystems and accepting the need for change to improve the efficiency of water use and allow the sustainable development of the resource. Participation does not always achieve consensus, arbitration processes or other conflict resolution mechanisms also need to be put in place.

Governments have to help create the opportunity and capacity to participate, particularly among women and other marginalised social groups. It has to be recognised that simply creating participatory opportunities will do nothing for currently disadvantaged groups unless their capacity to participate is enhanced. Decentralising decision making to the lowest appropriate level is one strategy for increasing participation.

Principle 3. Women play a central part in the provision, management and safeguarding of water.

The pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. It is widely acknowledged that women play a key role in the collection and safeguarding of water for domestic and – in many cases – agricultural use, but that they have a much less influential role than men in management, problem analysis and the decision-making processes related to water resources.

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IWRM requires gender awareness. In developing the full and effective participation of women at all levels of decision-making, consideration has to be given to the way different societies assign particular social, economic and cultural roles to men and women. There is an important synergy between gender equity and sustainable water management. Involving men and women in influential roles at all levels of water management can speed up the achievement of sustainability; and managing water in an integrated and sustainable way contributes significantly to gender equity by improving the access of women and men to water and water-related services to meet their essential needs.

Principle 4. Water has an economic value in all its competing uses and should be recognised as an economic good as well as a social good.

Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Managing water as an economic good is an important way of achieving social objectives such as efficient and equitable use, and of encouraging conservation and protection of water resources. Water has a value as an economic good as well as a social good. Many past failures in water resources management are attributable to the fact that the full value of water has not been recognised.

3.1.2 What is an IWRM Plan and what does it aim to achieve?

An Integrated Water Resource Management Plan is the guiding framework for sustainable management and development of water resources. The development process for such a plan requires consultation with all users of the water resource to ensure that their requirements are adequately met within the quantities of water that are naturally available, or within the capacity to generate in the case of desalinization from the sea. The IWRM Plan also seeks to ensure that the water requirements to maintain health ecosystems (such as forests, mangroves, coral reefs) are also met. The IWRM Plan lays out how the stakeholders in the country will coordinate management of its water resources to sustainably meet the water needs of society, the economy and the natural ecosystems in an equitable manner. The IWRM plan is a *national-level* plan.

To summarize, an IWRM Plan aims to:

- heighten awareness and understanding of the value and benefits of integrated water resources management;
- identify and implement actions to address specific causes of negative impacts and threats on human health and the environment;
- mobilize resources and partners, including the private sector, for implementation of specific projects to address the negative impacts and threats on human health and the environment.

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3.2 The IWRM planning and implementation process

The IWRM planning and implementation process is a logical sequence of phases that is driven and supported by continuous events. The outlined main phases of the planning process are:

Initiation: Triggers to start a planning process and agreement that improved management and development of water resources is important and necessary. This phase will allow for the synthesis of a team to organise and coordinate effort and facilitate a regular stakeholder consultation.

Visioning: Captures the shared dreams, aspirations and hopes about the state, use and management of water resources in a country. In that sense, a vision provides guiding principles and direction to the future actions about water resources and in particular guides the planning process.

Situation analysis: Defines the actions needed to reach the vision and is facilitated by consultation with stakeholders and various government entities. This is vital to understand competing needs and goals in relation to the water resource availability. This phase elucidates the types of solutions that may be necessary or possible, identifies the strengths and weaknesses in water resource management, points out the aspects that should be addressed in order to improve the situation and guides the path for obtaining vision.

Strategizing: Establishing the goals for the IWRM plan is important at this stage and the most appropriate strategy is selected and assessed for feasibility as well as its conformity to the overall goal of sustainable management. The scope for technical and managerial action is very large given the complexity of the water sector and already at this stage priority areas for action should be identified.

IWRM Plan: On the basis of the vision, the situation analysis, and the water resources strategy an IWRM plan may be prepared. Consultations at all levels will be required to get politicians and stakeholders to agree to the various trade offs and decisions made.

Implementation and evaluation: The legal, institutional, management actions and capacities built will create the requisite enabling environment for implementing the plan. However, achieving sustainable management and development of water resources is a long term commitment and therefore the plan should be seen as a revolving plan with features of evaluation and reformulation at periodic intervals.

The main steps in the cycle for developing and adjusting an IWRM plan are depicted in **Figure: 1** (GWP, 2005).

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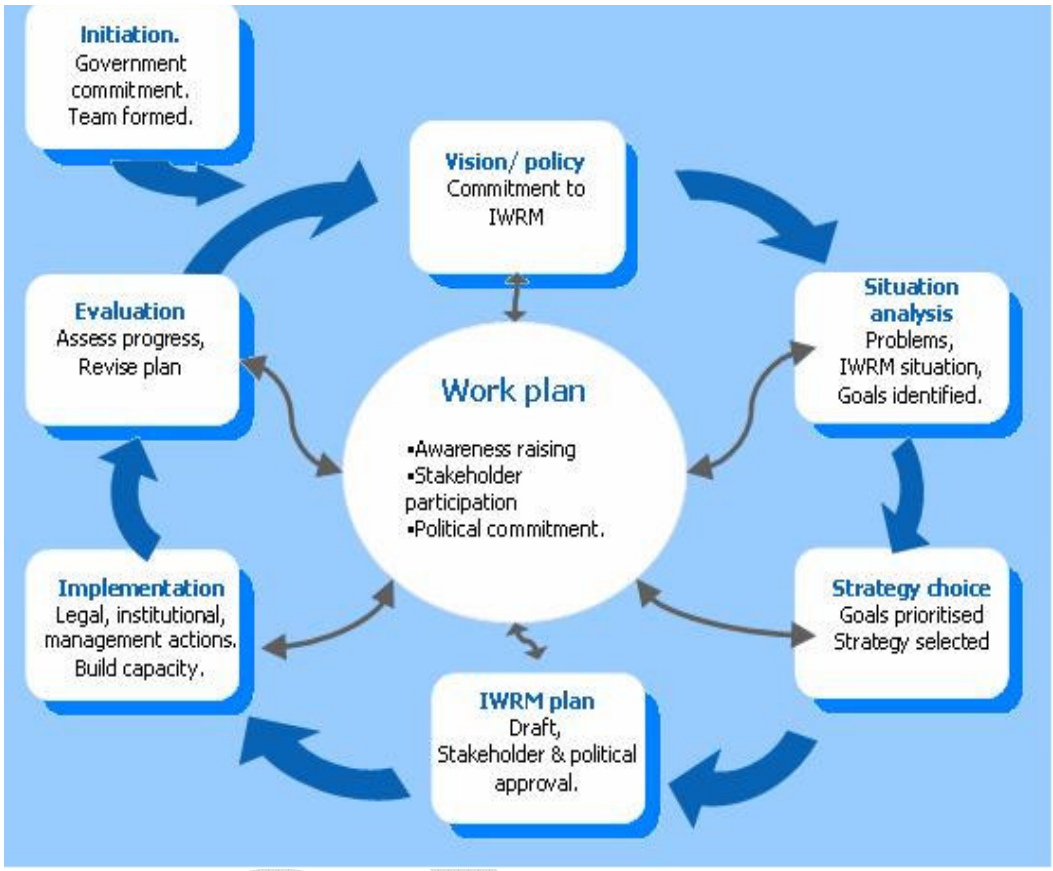
Figure 1: Cycle for developing and adjusting an IWRM Plan



3.3 Scope of initiative

The regionalization of the IWRM planning process in the Caribbean was initiated at the Third Caribbean Environmental Forum held in Antigua in 2006 which was jointly hosted by the Caribbean Environmental Institute and Clean Islands International (Annual Wider Caribbean Waste Management Conference). A significant component of the CEF was the convening of a workshop on Integrated Water Resources & Coastal Areas Management in the Caribbean Region that was supported by the United Nations Environment Programme Collaborating Centre on Water and Environment (UCC). The workshop was attended by representatives from water agencies and utility companies, ministries of water and environment, and technical resource agencies from across the region. Presentations were delivered by key resource agencies involved in water resources management in the region and internationally. Findings of a survey carried out by CEHI on behalf of the UCC on the status of national preparedness for IWRM was presented. Participants engaged in a visioning exercise to determine key strategic directions for IWRM in the Caribbean and set out follow up actions by the regional partner agencies and local focal point agencies.

The contributions to the IWRM road mapping process in Barbados were initialized at an Informal IWRM Working Group (IWG) meeting held in Jamaica in December 2006 under the aegis of the GEF-funded IWCAM project. The result is a collaboration between the Global Water Partnership–Caribbean (GWP—C), the United Nations Environment Programme Collaborating Center on Water and Environment (UCC-Water), the Caribbean Environmental Health Institute (CEHI), and the Integrating Watershed & Coastal Area Management (IWCAM Project) to help guide the Government of Barbados in developing an integrated water resource management (IWRM) roadmap.

On the 11th July 2008 an IWRM Inception Workshop meeting was held, which was opened by the Minister for Health, The Hon Dr D. Estwick. At the Inception Workshop some 25 stakeholders took part in identifying the steps necessary to improve water governance through the promotion, enhancement and effective implementation of legislation, policy programmes and institutional regulatory and administrative frameworks. The process of formulating an IWRM Road Map for Barbados builds on previous experience within the region from Grenada and Union Island in St Vincent and the Grenadines.

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4.0 Background on Barbados

4.1 Geography

Barbados is the most easterly of the islands of the Caribbean, located at 13^0 degrees north, 59^0 degrees west, approximately 160 kilometres from the nearest landmass, against prevailing winds and currents. The island is 34 km long and 23 km wide with a total land area of approximately 432 km^2, 92km of coastline and an Exclusive Economic Zone (EEZ) of 167, 000 square kilometres.

The island is divided into two distinct geological regions. Eighty-six percent of the island is made up of a karst landscape laid down in a series of limestone terraces, deeply incised by numerous gullies and honeycombed by a complex underground cave system. The remaining land area comprises the sedimentary deposits of the Scotland Series. These oceanic rock layers are highly folded and faulted and are very susceptible to erosion. Large scale land slippage is common in the Scotland District. In spite of the above the island is relatively flat, with the highest point being Mount Hillaby at 336m.

The 92 km long Barbados coastline has an interesting diversity of land and seascapes. The Atlantic coast faces the trade winds. It is continually exposed to high wave energy and contains the most rugged elements of the coastal landscape. Reef development is minimal offshore but there are extensive areas of limestone pavement dominated by sea fans. In contrast the Caribbean coast whilst backed by limestone cliffs has a very different aspect. The protected bays and shoreline were the preferred sites for trade, commerce and early settlement. More recently the sandy beaches, fringing reefs and relatively calm waters have been the focal points for the important tourism industry. Industrial facilities are located along or near to parts of this shoreline.

Figure 2: Location Map of Barbados

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4.2 Demography

Barbados' resident population in 2000 was estimated at 268,402[3] and in 2007 it was reported to be 290,000 (UN, 2007) making it one of the most densely populated countries in the world, with a density of 671 persons per square kilometre. There is also a sizable expatriate population on the island with British expat making up an estimated 34,000 full and part-time expats. The World Bank classifies Barbados as an upper middle-income country, given its Gross National Product (GNP) per capita of US$8,620 in the year 2000[4].

Barbados has been able to control its rate of population growth through the successful implementation of an island-wide family planning programme for the past five decades. This coupled with economic development has also contributed to the attainment of an average rate of growth of 0.3% between 1980 and 2007 which has led to a unique situation where the country has a population growth rate comparable with that of most developed countries.

The Barbados State of the Environment Report has highlighted the following:

"An analysis of the population structure for the census years 1970, 1980 and 1990 shows that the population under 15 years old declined from 87,100 in 1970 to 62,000 in 1990. The estimated total for this group for the year 2000 was 57,707, accounting for 21.5% of the estimated 2000 population. In contrast, the population over 60 years of age increased from 27,700 in 1970 to 39,900 in 1990. This represents a change from 11.7% of the total in 1970 to 15.3% of the total in 1990 (BESR, 1998), and 14.9% of the total estimated for 2000.

This trend of a gradually aging population is expected to continue as fertility rates decline and life expectancy increases. It is notable that the population of working age (15-60) increased from 128,600 in 1970 to 160,300 in 1990 and estimated at 179,892 for 2000."

The latest estimates from the United Nations suggest that the country's population will peak by 2025 with a total projected population of just over 300,000, thereafter it will exhibit a gradual decline, dropping to 265,000 by 2050.

4.2.1 Distribution, Settlement and Land Use

The majority of the population is settled along the south-east, south and west coasts of the island, predominantly in the coastal areas of the parishes of St. Philip, Christ Church, St. Michael, St. James, and the southern reaches of St. Peter. It is believed that the 'suburbanization' from the Bridgetown area will continue, leading to the gradual increase in densities to the northwest, north and east of Bridgetown, while most other areas will remain relatively constant

[3] Barbados Statistical Services population based on 1990 census data
[4] World Bank, 2000. Available at http://wbln0018.worldbank.org/

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Barbados' socio-economic development has been marked by increased demand for land for urban and suburban development, and declining amounts under agriculture. The Barbados National Report to Habitat II (1997) presents data suggesting that the percentage of land for residential and business development increased over the period 1966 to 1996, and notes that land previously identified for agricultural purposes has been subdivided for residential and business uses. Some 40% of land is allocated for urban development and just over 40% arable. With the decline in sugar the area of land under cultivation has decreased along with the number of plantations and small holdings. The reassignment of agricultural land to residential and other development has been most marked in the parishes of St George, St Michael and St Thomas.

The most recent estimate indicates that the total number of dwelling units was 83,026 (Caricomstats, 2004). More than 90% of the houses in Barbados have piped water and electricity.

4.3 Economic activity

Since its independence in 1966, Barbados has evolved from an agricultural economy in the early seventies and eighties to one driven by manufacturing and the provision of tourism services in the eighties and nineties. By the beginning of the 21st century, the importance of the manufacturing industry had declined substantially and tourism had become the main driver of economic expansion in the country. In fact, proceeds from the tourism industry are the main source of external current account receipts and represent the main domestic export of Barbados. As such, downturns in this sector tend to significantly hamper overall economic growth in the country. Industry and services account for 94% of GDP (2000). Since 2003 economic growth has been bolstered by increases in construction projects as well as tourism receipts. The country has one of the highest per capita incomes in the Caribbean region and an investment grade rating which reflects its political stability and economy. Offshore finance and information services are important foreign exchange earners benefiting from a relatively highly educated work force.

While the sugar industry continues to decline in overall importance it still has a role to play in the economy as it has sought to rebrand itself as a niche market commodity. At the same time Government's policy in agriculture has been to reduce dependence on sugar and to encourage diversification, especially in vegetables, poultry, livestock and fishing by providing support and incentives for small farmers. This took on added importance in 2008 as the price of food imports climbed leading to calls for more to be done to improve food security and to increase local production by bringing more land under cultivation.

With respect to tourism the Government continues to support the growth in tourism and especially at the so-called high end of the market. It is seeking to encourage the establishment of branded hotels as a way of attracting increasing numbers from the North American market. It is not yet clear to what extent the current financial crisis (late 2008) will have an impact on investment and development plans. The reliance on imported fossil fuels as the main source of energy is also a matter of concern as a result of the increases in oil prices in mid-2008. As a result there has been renewed interest in the use of

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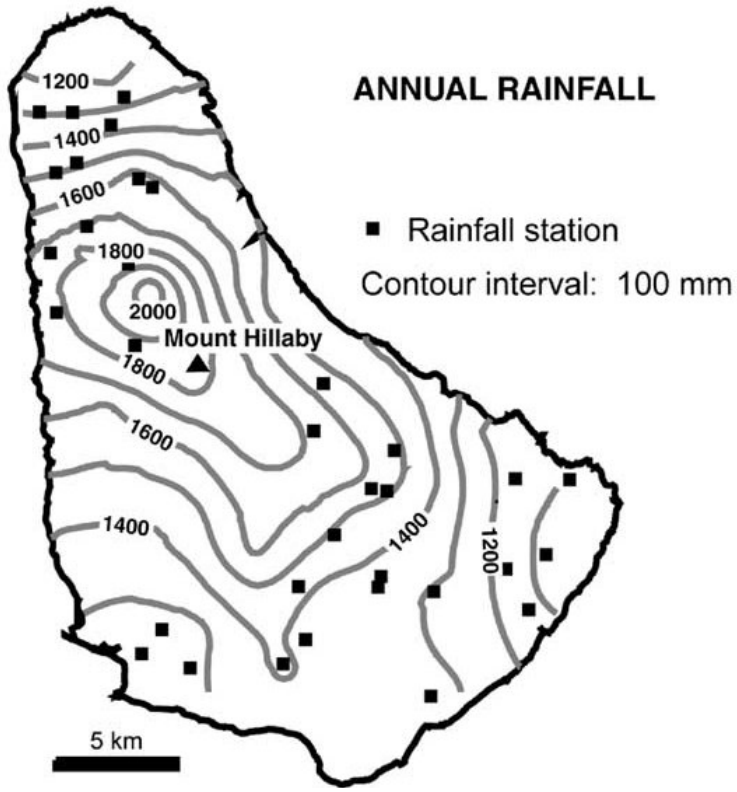
biofuels based on sugar cane as an alternative energy source. If this were to come about then it would have major implications for agriculture, land use and water resources management.

4.4 Climate and water resources

4.4.1 Temperature and Rainfall

Barbados lies within the humid tropics. Its generally pleasant maritime climate is influenced by the Atlantic northeast trade winds, which moderate the tropical temperature. Cool, north-easterly trade winds are prevalent during the December to June dry season. The overall annual temperature ranges from 24°C to 28°C; slightly lower temperatures prevail at higher elevations. Humidity levels are between 71 percent and 76 percent year round. Rainfall occurs primarily between July and December and varies considerably with elevation. Rainfall may average 1875 mm per year in the higher central area as compared with 1275 mm in the coastal zone, see Figure 2. Wet season rainfall accounts for approximately 60% of average annual rainfall. Dry season rainfall (January – May) is associated with local convection due to moist air flowing over the heated island. Rainfall distribution varies with the season such that during the dry season rainfall is highest at the centre of the island whilst during the wet season the western side of the island receives more rainfall.

Figure 3: Rainfall distribution map of Barbados (taken from Jones and Banner, 2003)

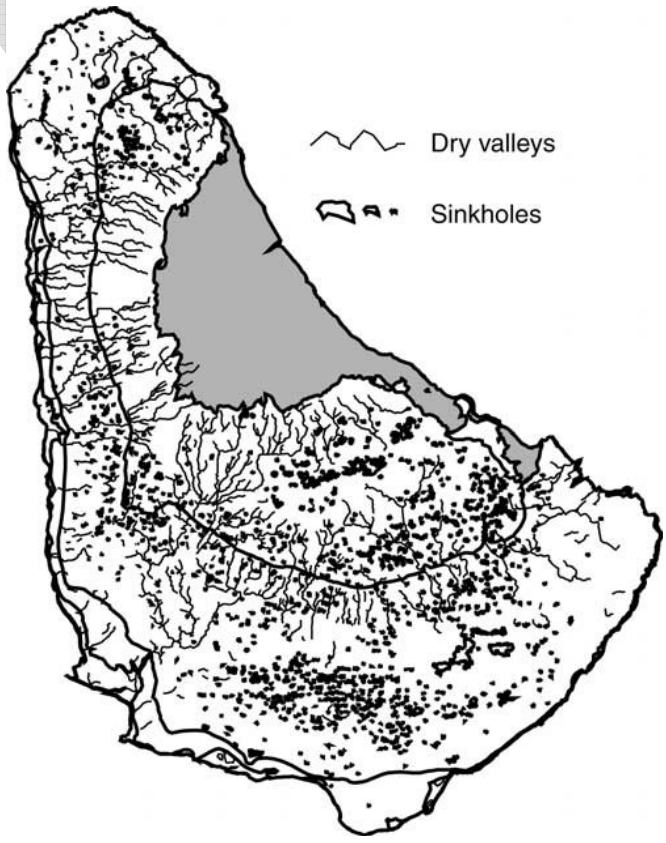


4.4.2 Surface Drainage

Although there is substantial rainfall, most of the rivers in Barbados are dry due to the permeable nature of the coralline karstic limestone. Water finds its way into the underground aquifers via gullies and sinkholes. As a result there are no perennial rivers which may be used for water supply. In the Scotland District due to the relatively impermeable oceanic rocks much of the rainfall is lost through run-off to the sea. At times of intense rainfall however the gullies do become flooded with substantial flows for several hours, often causing localized flooding downstream. The surface drainage system follows a distinct pattern consisting of a primary system of gullies radiating out from the highland areas at the centre of the island and a secondary system of smaller gullies and tributaries at approximately right angles to the primary system. As a result of the geology of the island, gullies are mostly absent in the southern and north-eastern parts of the island. Above the 80m contour, gullies are cavernous and capable of absorbing water at very high rates. Below this elevation the gullies are neither deep nor cavernous, but frequently carry surface runoff into the lower reaches of the drainage system (Wallace Evans 1972).

Actual surface flows within the island are periodic and only at times of high intensity rainfall are significant volumes of water transported in them. Along the south and west coasts of the island, several of the tributary orifices have been canalized to better control the actual discharge of surface runoff during periods of peak flow. Several of these locations are the catchment areas of several interconnected gullies with a common discharge point. At these locations a sand bar often forms across the outlet blocking the discharge water from entering the sea. This results in the accumulation of stagnant polluted water behind the sand bar. The sand bar is often breached at times of heavy rainfall thus allowing the runoff to reach the sea. The bars may sometimes be breached by mechanical methods to alleviate the problems associated with the stagnant waters (eg. stench and mosquito breeding) (Brewster and Mwansa, 2001).

Figure 4: Major karst features - gullies and sinkholes



4.4.3 Groundwater

Groundwater is the only source of potable drinking water on the island and is often located in large collection areas or "reservoirs" within the aquifer. These aquifers are serviced by natural underground streams which have periodic connection to the surface via sink holes. These sink holes serve as a

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source of fissure recharge and probably represent the coral cap caving into cavern tunnels made by underground streams.

Most of the coral cap is situated above the water table and the entire coral cap is in the vadose zone. Above elevations of 60m, groundwater transmission occurs within an integrated drainage net in groundwater stream channels. These underground streams may be divided into catchments based on more or less drainage nets (Procter and Redfern 1984). The aquifers are divided into two hydrologic zones, referred to as the Stream- and Sheet-water zones, depending on whether the aquitard lies above or below sea level. The Stream-water zone constitutes the bulk of the areal extent of the aquifer with the freshwater lenses of the Sheet-water zone primarily occurring within 1 – 2 km of the coast (Jones and Banner, 2003). In the Stream-water zone, groundwater forms a thin layer, a few metres thick at the base of the limestone. In the Sheet-water zone the water table lies close to sea-level and water level variations are typically due to tidal effects whereas on the more landward side level variations are associated with influxes of Stream-water flows. There is little apparent response of water levels to rainfall during years with average or below-average rainfall.

Jones and Banner (2003) report that most recharge is rapid and takes place only during the wettest 1 – 3 months of each year. Recharge is 15-20% of average rainfall above the Second High Cliff, increasing to 25-30% at lower elevations. The higher recharge at lower elevations is thought to be controlled by discrete infiltration of large volumes of water through highly permeable limestone. Recharge events are more likely to occur when soil moisture is high and may thus be a product of multiple small rainfall events or a single large event. Monthly rainfall less than 195 mm is likely to be taken up by evapotransipration processes an thus make an insignificant contribution to recharge. The variation in recharge over time is related more to the distribution of rainfall throughout a given year than variations in total rainfall. Recharge is higher when rainfall is concentrated in a few months of the year usually the peak wet season months of August, September and October (Jones and Banner, 2003).

Groundwater streams may be subject to pollution depending on whether the water has benefited from filtration through the vadose zone or if it has gained entry to the system via the open fissures and suck holes in the coral cap. For the most part, all ground water extraction wells are located in the sheet water zones as far inland from the coast as possible. This is because ground water quality decreases rapidly to the seaward side of supply wells and the coastline also supports the greatest density of residential and tourism facilities.

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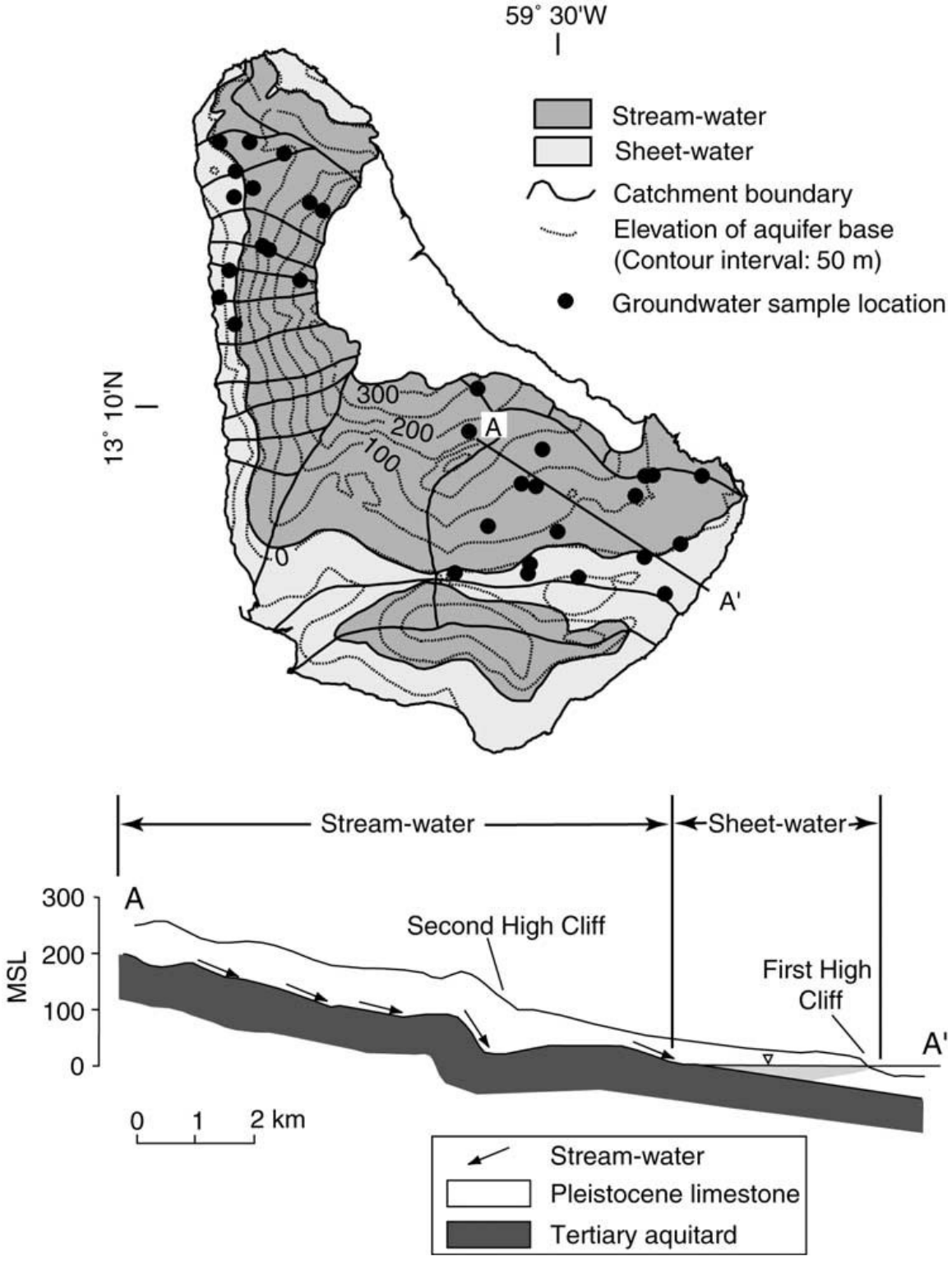
Figure 5: Hydrogeology of Barbados

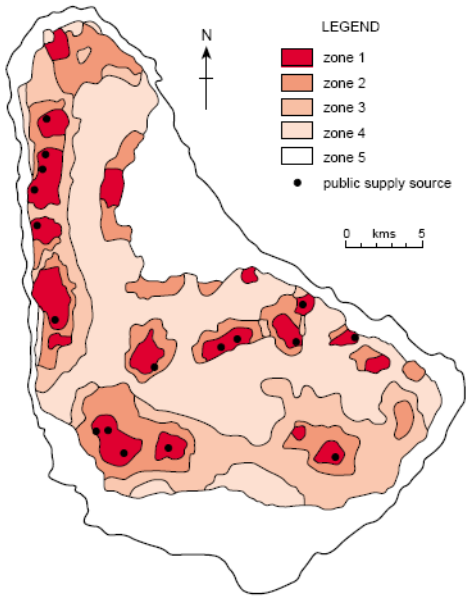


4.4.4 Groundwater protection zones

PRINCIPAL FEATURES OF DEVELOPMENT CONTROL ZONES				
Zone	Definition of Outer Boundary	Maximum Depth of Wastewater Soakaway Pits	Domestic Controls	Industrial Controls
1	300 day travel-time.	none allowed	no new housing. no changes to existing wastewater disposal	no new industrial development.
2	600 day travel-time.	6.5 m	septic tank with separate soakaway pits for toilet effluent and other domestic wastewater. no storm runoff to sewage soakaway pits. no new fuel tanks	all liquid industrial waste to disposal specified by Water Authority, with maximum soakaway pit depths as for domestic waste
3	5-6 year travel-time	13 m	as above for domestic wastewater. fuel tanks to approved leakproof design	
4	extends to all high land	no limit	no restrictions on domestic wastewater disposal, fuel tanks to approved leakproof design	
5	coastline	no limit	no restrictions on domestic wastewater disposal, siting of new fuel storage tanks subject to approval	

Since Barbados is almost totally dependent on groundwater for public water supply and given the hydro-geological characteristics the aquifers are vulnerable to potential contamination by surface land-use activities. These include housing developments and their waste-disposal systems, agricultural practices such as the use of pesticides and fertilizers as well as industrial activities. In 1963 a groundwater protection policy was introduced in and it has formed the basis for aquifer protection since then to prevent contamination of water supply wells. Under the Development Control Zones legislation the country is divided into five zones, around existing and proposed public supply sources. The boundaries of the zones were selected such that no wastewater would reach a public well within 300 days travel time, sufficient to ensure that any contamination would have died off before reaching the intake. Just under 10% of the land area falls within zone 1, 14% and 15% in zones 2 & 3 respectively, 32% in zone 4 and the remainder in zone 5.

Figure 6: Groundwater protection zones



Groundwater-based development control zones on Barbados

The Town and Country Development Planning Office Development Order (1964) was amended to ensure that the water protection policy restrictions on land use were incorporated and controlled through the Physical Development Plan. Any development application falling within Zone 1 must be reviewed by the Barbados Water Authority and the Environmental protection Division before any decision on approval of development can be made. Although the protection measures have generally been successful in protecting public health it is reported that the current policy is coming under mounting pressure.

There are in addition a number of issues associated with the protection policy. The policy was initially developed with a bias towards bacteriological protection rather than chemical protection and thus there is little protection from

agricultural activities, chemical contaminants, industrial waste and some of the emerging pharmaceutical products. Although there have been recommendations for follow-up research and hydro-geological investigations as well as water quality monitoring these have up to now not been fully implemented. The enforcement of the policy has also lapsed at times with one of the more high profile examples being the problem of squatting in zone one areas in Bridgetown. There is a consultancy that is reviewing the groundwater protection policy which is due to report in 2009.

4.5 Water resources management issues

Arising from the Inception Workshop of the 11th July 2008 and previous reports several issues of concern with respect to the management of water resources have been identified. These issues are grouped under broad thematic areas, though some are cross-cutting. The issues identified by th stakeholders attending the Inception Workshop should be compared with the results of the stakeholder consultation exercise carried out as part of the development of the IWRM road Map document. Taken together they reveal a high degree of correlation and consistency with regard to key issues and concerns.

Enabling environment: Policy, legislation and finance

No adopted National Water Policy;

Lack of cross-sectoral coordination framework for plans and policies that impact on water resources;

Ownership of water is unclear legally;

Incomplete and fragmented regulatory framework;

Dependence on Government financing and funding constraints on implementation of policies and programmes;

No cost recovery policy framework;

Lack of comprehensive legislation that addresses inter alia; allocation, water quantity and quality, economic and environmental issues.

Institutions: Government, private sector, community and governance

No properly functioning agency dedicated to water resources management;

Potential conflict of interests between resource management and service provision;

Duplication of institutional effort;

Inefficient water service providers;

Weak sanitation service provision;

Land management and land use change controls;

Compartmental approach to information generation;

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Lack of collegial approach to information sharing among some but not all agencies;

Role of the private sector unclear;

Cost recovery and affordability weak;

Poor value for money service provision;

Weak institutional capacity;

Insufficient human resources;

Little transparency and accountability;

Few mechanisms for stakeholder involvement and public participation;

Allocation and dispute resolution mechanisms are lacking;

Strengthening of enforcement and regulatory capacity is needed.

Management tools:

Poor data collection, monitoring and analysis capacity and routines;

Need to implement demand management approaches;

Weak pollution monitoring and control capacity;

Sporadic public education and awareness;

No performance benchmarking and reporting requirements;

Insufficient use of economic instruments;

No allocation and dispute resolution mechanisms;

Ad hoc application of planning tools;

Sporadic water resource s and supply assessments;

No water information system, routine modelling or forecasting.

Other issues

Increasing localized flooding;

Impact of climate change on water resources and water demand patterns;

Pollution of the offshore environment from land-based sources;

Erosion and run-off in the Scotland District;

Expansion of golf courses;

Power of commercial interests and unions to influence policy application;

Silo based approach to information collection;

Lack of use of rainwater harvesting systems;

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Ageing water infrastructure, poor maintenance and high leakage rates;

Public ignorance of Barbados' water scarcity;

Lack of appreciation for the implications of Barbados' water scarcity.

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5.0 Water Governance

No country exists or operates in isolation and with increasing globalization the web of connections and obligations at the international, regional and between states grows ever denser. So while national policies are formulated to reflect and address national concerns and priorities they are often framed against a backdrop of international and regional conventions and protocols.

5.1 Policy framework

5.1.1 Multi-lateral environmental agreements

Barbados has ratified or acceded to a number of international conventions and agreements which require measures and systems to be implemented at the national level for the protection of the environment. However, like most other regional States, the challenge of developing the institutional capacity to administer these instruments at the local level have led to delays in implementation of these instruments at the national and local levels. The Table 1 below provides a listing of the multi-lateral environmental agreements (MEAs) to which Barbados is party.

Table 1: Multi-lateral Environmental Agreements

Conventions	Effective dates
Convention on Biological Diversity	Sgn 1992 Rtf 1993
Cartagena Convention	Sgn 1984 Rtf 1985
United Nations Framework Convention on Climate Change	Ac 2000 Wef 2005
United Nations Convention to Combat Desertification	Ac 1997
United Nations Convention on Small Island Developing States-Barbados Plan of Action	Adopted 1994
Sgn – signed; Ac – Acceded; Wef – With Effect from; Rtf - Ratified	

The following is a description of the two most relevant MEAs to IWRM.

United Nations Convention to Combat Desertification and Drought (UNCCD)[5]: The UNCCD was ratified by Barbados in 1997 due to the recognition that land management is essential for sustainable development of Barbados. Under the UNCCD countries agree to develop (or adapt existing) strategies, plans or programmes for the conservation and sustainable use of land, and to integrate land management into the agenda of various sectors and sub-national levels of administration and planning. Implementing the objectives of the convention involves the formulation of a National

[5] Note that in the Caribbean SIDs the UNCCD is focused on 'land degradation'. The origin of the Convention (and derivation of the name) was in respect of countries in arid sub-Saharan Africa that were being threatened by desertification. The present interpretation of the Convention now extends to other non-arid countries.

Action Programme (NAP) which is a product of national policy to elevate concerns for land management to the level of planning and action. It recognizes land management as an important national asset that offers the country manifold economic options (Bynoe, 2005). A major thrust of the UNCCD is sustainable land management (SLM) the objective of which is to harmonise the complimentary goals of providing environmental, economic and social opportunities for the benefit of present and future generations, while maintaining and enhancing the quality of the land (soil, water and air) resources.

Barbados completed its National Action Plan to combat land degradation in 2002.

United Nations Framework Convention on Climate Change (UNFCCC): The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. Barbados acceded to the convention in 2000.

Barbados as a country has been active in undertaking several projects aimed at combating and adapting to climate change, notably through the Mainstreaming Adaptation to Climate Change (MACC) project with the Caribbean Community Centre for Climate Change in Belize.

Barbados Programme of Action (1994) for SIDS

Subsequent to the United Nations Conference on Environment and Development (UNCED) Rio 1992, the United Nations Conference on Small Island Developing States (SIDS) was convened due to the recognition that special emphasis needs to be given to these States. The Barbados Programme of Action (BPOA) emerged to guide environmental management in Small Island Developing States and outlined the basis for sustainable development.

National programmes for the management of the environment of SIDS include inter alia:

Prepare and/or review land-use plans in conjunction with agricultural, forestry, mining, tourism, traditional land-use practices and other land-use policies, with a view to formulating comprehensive land-use plans and zoning so as to protect land resources, ensure sustainable and productive land-use and guard against land degradation, pollution and exceeding island carrying capacity;

Encourage appropriate forms of land tenure, improved land administration and a greater appreciation of the integrated nature of land development in order to facilitate sustainable land-use;

Increase attention to national physical planning in both urban and rural environments, focusing on training to strengthen physical planning offices, including the use of environmental impact assessments and other decision-making tools.

Barbados completed its National Assessment Report in 2003.

5.1.2 Regional-level policy frameworks

The St. George's Declaration: The St. George's Declaration on Principles for Environmental Sustainability in the OECS is an important agreement for the conservation of natural resources in the

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sub-region. In this agreement, the Member States of the OECS persuaded that the effective management of environmental resources at local, national, regional and international levels is an essential component of sustainable social and economic development, including the creation of jobs, a stable society, a buoyant economy and the sustaining of viable natural systems on which all life depends.

Although most of the principles address elements of IWRM in some manner, Principles 10 and 11 are of most direct relevance. Principle 10 suggests that Measures will be taken to prevent, reduce and control waste generation and disposal, as well as pollution of land, rivers, sea and the air. The Principle places high emphasis waste management and recycling. Principle 11 addresses the sustainable use of natural resources and outlines among other things that Member States should manage terrestrial, marine and atmospheric resources, organisms and eco-systems in an appropriate manner to obtain the optimum sustainable productivity, while maintaining the integrity of natural and ecological processes and inter-relationships between such systems and processes.

The Cartagena Convention, 1983 (The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) and the Land-Based Sources of Marine Pollution Protocol (1999): Notwithstanding the reliance of the islands of the Caribbean on the marine environment the exploitation, degradation and overexploitation of the sea has plagues the region for decades. The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region was developed to offer some measure of protection to this vital natural resource base. This Convention discusses issues such as pollution from ships, dumping, land-based sources of pollution, sea-bed activities, airborne pollution, specifically protected areas, cooperation between nations in case of emergencies, and environmental impact assessments. This Convention was signed by Barbados in 1984 and ratified in 1985. The *Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (SPAW) (Kingston, 1990) was ratified in 2002; and *The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region* (LBS) (Oranjestad, 1999) has not as yet been ratified by Barbados.

Pollution of the marine environment from land-based sources has been recognized as the most significant stressor on the Caribbean Sea. Hence, the Land-Based sources of Marine Pollution Protocol which complement the convention is one of the three ancillary instruments for attaining the aims coastal and marine resource protection. IWRM in particular watershed protection, prevention of land degradation, prevention of pollution of water courses are key element sot reducing the degradation of the coastal and marine resources from land-based activities.

5.1.3 National level policies

National Strategic Plan: In 2007 the Government of Barbados issued its National Strategic Plan for Barbados 2005 – 2025. Within Goal Four: Strengthening the Physical Infrastructure and Preserving the Environment, Objectives 1.1 "To promote and facilitate the environmentally sustainable use of our natural resources"; 1.2 "To maintain a safe and reliable water supply" and 1.6 "To maintain an efficient land-use policy" all of which impinge on IWRM.

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The Plan then goes on to mention the need to protect water supplies and ensure the efficient and effective management of existing water resources. This is to be achieved through projects and programmes and the setting of national targets.

Draft Water Policy: On two occasions, in 1997 following the Water resource Management Study and again in 2002 a draft water policy framework was prepared that set out a vision for the development and management of water resources. However, the draft has not been adopted.

Groundwater Zoning Policy: This important policy which is implemented through the Town and Country Planning Office working in collaboration with the BWA controls development in areas of groundwater abstraction as a way of protecting groundwater resources. Incorporated into the Zoning Policy is the Revised policy on private sewage and waste water disposal systems, which seeks to control any development or liquid waste disposal systems that could damage water resources.

Environmental and Natural Resources Management Plan: This draft plan (1998) makes provision for the technical evaluation, regulation and monitoring of development projects and incorporates provisions for improvement of the environment.

5.2 Legal framework

Barbados has a large body of legislation which relate to water resources and also to coastal area management. However, the legislative approach has been sector specific in developing the legal and by extension the institutional frameworks that underpin water management. It has been recognized for some time that adjustments to the existing body of legislation are required in order first of all to bring them in line with the relevant international agreements, secondly to promote and operationalise cross-sectoral co-ordination and integration. Over the last decade there have been attempts to address these needs which have resulted in a number of draft Bills but in many cases these proposals have not been enacted into Law. The consequence has been that although there is an acknowledgement of the need for IWRM it has not been possible to put in place the institutional structures that would ensure its operationalisation.

5.2.1 Barbados Water Authority Act (1980)

This Act establishes the Barbados Water Authority. Among its functions are: to manage, allocate and monitor the water resources of Barbados with a view to ensuring their best development, utilization, conservation and protection in the public interest; to prepare details of schemes for the development of water resources and for the supply of water and sewerage systems; to control and regulate the production, treatment, storage, transmission, distribution and use of water for public purposes; to provide such facilities as may be necessary for training and educating its employees and for research. The Crown may acquire land under the Land Acquisition Act (Chapter 228) for any of the Authority's purpose. The Minister after consultation with the Chairman of the Board, may give the Board directions. The Board, with the approval of the Minister may make regulations for the purposes of this Act. The provisions of the Underground Water Control Act (Chapter 283) relating to the control of underground water apply to the control of surface water.

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The outdated provisions of this statute have been noted as serving to frustrate the application of effective water management measures.

Sewerage Regulations, 1980, (S.I. No. 151): The Regulations provide for rules concerning the discharge of water through the public sewer system by domestic premises and industries. Industrial waste water shall not be discharged without a permission from the General Manager of the Water Authority (art. 4). Owners or occupiers of premises are required to connect to the public sewer system (art. 5). Private sewers are to comply with requirements of the general systems (art. 14). Permissions to carry out sewerage works shall be obtained from the General Manager and construction plans be submitted (arts. 16-34). Prohibited discharges are regulated in article 9-11.

Water Services Regulations 1982 (S.I. No. 150): The Regulations concern the regular supply of water to customers by the Water Authority of Barbados. The Authority may enter into contracts or agreements regarding the supply of water for irrigation, industrial, development or other special purposes (regs. 3 and 4). In times of deficiency of water, supply may be restricted by the Authority in accordance with regulation 14. A person to whom water is supplied may be asked to obtain a valuation certificate (reg. 19).

5.2.2 Underground Water Control Act (1953)

This Act provides for the control and use of the underground sources of water supply in the Island. It establishes a Water Board for the purpose of this Act. Licenses from the Board are required for the sinking of wells and for the obstruction of underground water. Sections of the Act deal, inter alia, with conditions of licenses; facilities for inspection; the right of the Board to declare prohibited areas, when in the opinion of the Board the use of any well for the disposal of sewage water or other waste constitutes a danger to health or may lead to the contamination of any source of water whatever. The Board may make regulations for giving effect to this Act.

5.2.3 Three Houses Spring Act (1713), Porey Spring Act (1864)

The first Act allows the inhabitants of the Parish of St Phillip to retain water for use, provided it does not have a negative effect downstream. The second Act allows the vestry of the Parish of St Thomas to construct and maintain works for the collection and delivery of water to persons other than the inhabitants of the parish.

Because of the conflicts generated by these Acts it has in the past been recommended that they should be either reviewed or repealed.

5.2.4 Heath Services Act (1969)

The Minister may divide Barbados into health and sanitation districts. The Minister has the power to construct sewers while Section 19 prohibits the taking of water from public taps without permission.

5.2.5 Marine Pollution Control Act (1998)

This Act makes provision for the control of marine pollution. Release of any pollutant into the environment which violates any of the provisions of this Act is an offence under section 3. There is a

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register of pollutants to be maintained and a programme for the reduction of pollutants. The Act contains discharge standards into the marine environment and thus covers the discharge of wastewaters and sewage.

5.2.6 Coastal Zone Management Act (1998)

This Act makes provision for the preservation and enhancement of designated marine areas of and the protection of beaches of Barbados. For this purpose the Director of the Coastal Zone Management Unit shall prepare for the approval of the Minister a draft coastal zone management plan and a draft order delimiting a coastal zone management area, general preservation matters, coral reef protection, and beach protection.

5.2.7 Soil Conservation (Scotland District) Act (1959)

This Act makes provision with respect to utilization of lands and soil conservation in the Scotland District and for this purpose establishes the Scotland District Soil Conservation Board. The Act also grants powers to the Chief Agricultural Officer to carry out water and soil conservation works and other powers. In the exercise of functions there shall be regard to the provisions of the Coastal Zone Management Act.

5.2.8 Irrigation Act (1967)

This Act allows the Chief Agricultural to order the carrying out of surveys, investigation or research for purposes of ascertaining whether irrigation is requires for specific arable land, or experiment with plans, schemes or equipment for irrigation, or irrigate or cause to be irrigated any land and for that purpose, distribute water, control or operate waterworks or any other device.

5.2.9 Prevention of Floods Act (1951)

This Act makes provision for measures for the prevention of floods in Barbados. The Minister may declare any area to be a flood area and require the execution of flood works in any flood area, having regard to the coastal zone management plan referred to under the Coastal Zone Management Act. Land may be compulsorily acquired in accordance with the Land Acquisition Act.

5.2.10 Pesticides Control Act (1974)

This Act controls the importation, sale, storage and use of pesticides.

5.2.11 Utilities Regulation Act (2001)

This Act provides for the regulation of utility services and defines the functions and powers of the Fair Trading Commission to establish principles of the charging of rates for utility services and standards of services. "Utility services" includes the distribution and supply of water and sewerage services. The Act prescribes various rules applicable to the provision of services and provides for a complaint and appeal procedure. Although, at present the provisions of the Act are not applied to water services though

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there are plans afoot to have BWA subject to regulation by the Fair Trading Commission but this would require an amendment to the Barbados Water Authority Act (Cap 274A).

5.2.12 Draft Environmental Management Act

The draft Act will provide for the wise and sustainable use of the natural environment and resources of Barbados by making provision for the management and protection of the water resources, solid waste management, coastal zone protection, the natural heritage and the development of the Barbados National Park System. It provides regulations for a variety of environmental and developmental themes. The draft Act has been in existence since the early 2000's.

5.3 Institutional Framework

According to the 1997 Water Resources Study (Klohn Crippen Consultants, 1997), subsequent input from both the Inception Workshop and feedback from stakeholders carried out as part of this study the effective implementation of IWRM in Barbados is constrained by the current institutional framework and related factors. These have been identified as:

- Capacity constraints arising from lack of allocation of responsibility to act;
- Institutional constraints on the capacity of organizations to act;
- Lack of standardized environmental management legislation;
- Inadequate safeguarding of watersheds and groundwater;
- Competing and conflicting demands for scarce water resources;
- Lack of regulatory enforcement capabilities;
- Lack of human resources;
- Financial constraints.

It has also been pointed out that there is a need for a clearer demarcation of regulatory powers between the BWA, the Environmental Protection Division of the Ministry of Health, the Coastal Zone Management Unit and the Fair Trading Commission.

The major existing institutional stakeholders in water matters and their responsibilities are listed in the Table below.

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Table 2: Major Institutional Stakeholders

NAME OF STAKEHOLDER	PRESENT ACTIVITIES
Barbados Water Authority – Ministry of Health	Public water supply Wastewater treatment, Water quality monitoring Water resources assessment, management and control Licensing Enforcement of Zone 1 policy Control package treatment plants Public education Demand forecasting Development of potable water and wastewater standards Rain gauging Searches for alternative supplies. Service standards Tariff setting
Environmental Protection Department – Ministry of Environment, Water Resources and Drainage	Water quality monitoring Enforcement of Zone 1 policy Public Health Protection. Control of effluent disposal
Drainage Unit – Ministry of Transport Works and International Transport	Digging and maintenance of drainage wells. Construction Check dam Issue permits for drainage works Rain gauging
Soil Conservation Unit – Ministry of Agriculture and Rural Development	Watershed management Stream flow gauging Water quality monitoring Rain gauging (Scotland District) Soil Conservation
Town and Country Planning Office – Office of the Prime Minister	Land use and development controls Physical Development planning Enforcement of Zone 1 policy
Barbados Agricultural Development & Marketing Corporation	Provision of water for irrigation Water quality monitoring Well development
Land and Water Use Unit – Ministry of Agriculture and Rural Development	Hydrology and Agromet data Irrigation extension and agronomy
Solid Waste Unit	Landfills and solid waste disposal
Environmental Unit – Ministry of Environment, Water Resources and Drainage	Environmental policy and international treaties Environmental education
Meteorological Office – Ministry of Agriculture and Rural Development	Rain gauging (airport) Climate data Weather predictions
Coastal Zone Management Unit – Ministry of Environment, Water Resources and Drainage	Marine and coastal zone monitoring, control & protection Project specific terrestrial water quality monitoring and stream gauging Rain gauging
Fair Trading Commission – Ministry of Trade, Industry and Commerce	No responsibility, as yet
Government Analytical Services -	Analysis of water quality samples

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Ministry of Agriculture and Rural Development	

Effectively BWA is the manager of the country's water resources, the main but not sole user of those resources as well as its own regulator of quality of service and tariffs. However, due to the nature of its business model it is primarily a service provider and dedicates the majority of its resources to that end. It has little control over private or even other public abstractors of water resources. This exacerbates the problems of water resource management. As a result water resources and water catchment management have suffered due to the current arrangements. Although there have been a number of initiatives over the years to improve water management (e.g. use of GIS, National Indicators Programme, etc), the general lack of human resource capacity coupled with financial constraints has limited the institutional capacity to mainstream these initiatives. More recently and as a result of several flooding incidences in October and November 2008, there have been moves to establish a Drainage Authority to address drainage issues.

It has been long recognized by the Management and Board of BWA that a more effective allocation of operational and regulatory functions is required and proposals to this end have been tabled in the past. These have included:

- The establishment of economic and service regulation under the Fair Trading Commission;
- A separate water use, allocation and management regulating body;
- Independent water quality and public health protection and regulation;
- Water service provision operational responsibility by BWA.

There have in the past been suggestions that the BWA should be privatised, something that was included in the Barbados Labour Party's election manifesto in 1994.

5.3.1 Human resources

The BWA employs some 900 people, of this number less than 5% have any tertiary or higher educational qualifications. Much of the lack of trained personnel has been put down to inadequate remuneration, a failure to attract and retain qualified staff and, the lack of a structured training programme. Compounding this is the absence of an approved personnel establishment that makes provision for the necessary technical, engineering and scientific posts. The higher qualified personnel that are employed are overstretched and have to prioritise those aspects of their work that are the most pressing.

As a result the Authority has had to rely on local consulting firms and foreign companies on a project by project basis to supplement its core of technical expertise.

5.3.2 Financial resources

The operations of BWA are primarily funded through water charges to customers. The money raised through the water tariffs must fund both operational costs as well as capital works programmes. However, the funds raised are insufficient to finance projects requiring that loans be secured by and through the Government on BWA's behalf. In addition there exists a significant amount owed to the

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Authority by customers who have not paid their water bills. The vast majority of those in default are ordinary citizens rather than businesses and industry. This limits the ability of the Authority and its scope to act with respect to the maintenance and upgrading of its existing infrastructure. Recent press reports have indicated that the Authority is running its operations at a fiscal deficit and is experiencing in paying certain of its creditors.

All the other institutional stakeholders are part of the Government and therefore their budgets are derived from budgetary allocations to the respective Ministries. This too has its drawbacks in terms of the ability to be pro-active.

5.3.3 Cross-sectoral co-ordination

It is clear from the above Table that whilst there are a wide variety of stakeholders the institutional framework fragments responsibilities across a number of them and allows them to pursue their individual mandates with little or no requirement for cross-sectoral co-ordination. However, with the creation of the Ministry of Environment, Water Resources and Drainage coordination within the Ministry has been put on a more formal basis with monthly heads of section meetings with the Permanent Secretary. There would appear to be an absence of measures to encourage cross-sectoral information sharing and collaboration especially with the likes of the Ministries of Finance and Economic Affairs, Trade Industry and Commerce and, Tourism. Cross-sectoral coordination was commented on by stakeholders consulted during the compilation of this report and is discussed below in Section 7.

5.3.4 Regulatory powers

The regulation of water abstraction theoretically lies with BWA as it empowered to license abstraction and require abstracters' to install water meters on their installation. In reality it is able to exercise little control over private abstractors and many of them do not have water meters installed. There are no record keeping or reporting requirements nor is there a system of determining whether or not a license should be granted or even conditions under which a permit can be withdrawn. In times of drought BWA has no powers at present to regulate or curtail abstraction in the national interest. Allocation and conflict resolution mechanism are also absent.

With respect to drinking water quality BWA is responsible for water quality monitoring and testing and reporting of result to EPD. Although there are no national drinking water quality standards the WHO Drinking Water-Quality guidelines have been adopted along with relevant standards from the US EPA. It is unclear what sanctions are in place for any infractions of the water quality guidelines. It is extremely unlikely that one government agency is going to take another government agency to court or impose fines over any infraction. There is no requirement for the public reporting of water qualities and there is a reluctance to make such information available.

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Barbados is a signatory to the Cartagena Protocol but has yet to adopt the Land-based sources of pollution annex as it is still in the process of putting measures in place to ensure compliance. However, when it does the Annex's discharge standards will come into force. In addition there are provisions in the draft Environmental Management Act for regulating discharges and emissions. At present this is undertaken by the EPD which is the pollution regulating body; it regulates BWA as well as all other institutions and private undertakings. There is however a problem of both capacity to inspect and monitor as well as to ensure compliance. The draft Environment Act, recognising this seeks to put in place self-regulating and reporting mechanisms. At present all maters pertaining to the pollution of groundwater and groundwater quality are treated as highly confidential and as a result there is virtually no information in the public domain. It is unclear whether any Freedom of Information act would address this issue.

With respect to the regulation of the economic, financial and customer services aspects of BWA's activities there was provision in the Utilities Act as well as the Fair Trading Act for the Fair Trading Commission to regulate these aspects of BWA's activities. However, these regulations have never been adopted as they would require an amendment to the BWA Act.. There were proposals in the first half of 2008 to introduce the necessary legislation to give effect to the regulation of BWA but these were withdrawn at the 11th hour. The reason stated was that both BWA and FTC required time to adjust and prepare their respective organisations for such regulation. Whilst this is a reasonable recognition of the potential difficulties involved in regulating utility activities there has been no timescale given by the Government for when these measures will be put in place.

It is clear from this brief overview that although there are some statutory regulatory powers in place they are on the one hand incomplete and on the other there are issues over the capacity to enforce those that are in place. Previous work by BWA and others in Government Departments have recognised this and there is an acceptance that the regulatory institutions need to be broadened and strengthened.

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6.0 Water Resources Assessment

This section gives a brief overview of the current water situation in Barbados and is not intended to be a comprehensive assessment. The outputs from the protection zone consultancy should provide further insights into the water resources but will not be completed until the later half of 2009.

6.1 Water resources

According to the 1997 Water Policy proposal (BWA, 1997) knowledge and understanding of the Water Resources situation in Barbados is greatly hampered by the amount and quality of data and information available and used in making the estimates of both water supply abstractions and demand. Except for rainfall data, there is very little other data which has been collected on an on-going basis. Table 3 provides a breakdown of the Water Resources according to the 1978 and 1996 Water Resources Studies.

Table 3: Breakdown of Available Water Resources

Source	1978 STUDY		1996 STUDY
	Average Rainfall Conditions (1524 mm)	1 in 15 Design Drought Year	Average Rainfall Conditions (1424 mm)
	m^3/day	m^3/day	m^3/day
Groundwater	205,773	137,182	202,591
Surface water	32,682	13,136	15,909
Spring water	8,182	5,909	5,455
Wastewater			30,018
Runoff	2,409	0.0	1,455
Total	**249,046**	**156,227**	**225,410**

Available estimates of the water resources are, therefore, a snap-shots based on project related data collected over one to two-year intervals and generally over long intervals of time, (i.e. Senn, 1946, Tulstrom, 1964, Stanley, 1978.). The water resources of Barbados have been estimated to be 59 Mm^3/year (1996) based on average rainfall, though this differs from the estimations provided in the table above (82.3-90.9 Mm^3). However, as Jones and Banner (2003) have shown inter-annual variation of recharge generally fluctuates in response to El Niño-Southern Oscillation (ENSO) though the relationship is complicated by other factors. In other words estimates of Barbados' water resources and especially groundwater resources must be treated with care and the quoted figures only used as being indicative only.

There has been some concern over saline intrusion as a result of the exploitation of the coastal aquifers but so far this has not become a serious problem. In 2002 and 2003 three West Coast wells had to be

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closed due to high salinity depriving the area of an important supply source and putting severe pressure on BWA to maintain supply in the area serviced by these wells.

6.2 Water demand

The last formal estimation of Barbados' water demand was undertaken in 1997, building on a 1993 study, both carried out as part of the Water Resource Management and Water Loss Study (BWA, 1997). The study suggested that by 2016 the annual water demand could reach 89.4 Mm^3 of which BWA would produce 64.5 Mm^3 and the balance would be from private wells. This amount included an allowance for leakage at an estimated level of 60% of domestic consumption. The total demand therefore exceeds the quoted available resource.

The following table presents a summary of the information on estimated water demands presented in the 1997 study.

Table 4: Estimated Water Demands

Item	Year of estimation	Unit consumption	Projected growth	Amount Mm^3
Domestic consumption including leakage	1993	Metered: 213 l/c/d Un-metered: 148 l/c/d	0.16% per year	57.207
Government Institutions	1993	17 l/c/d	0.16% per year	1.294
Statutory corporations	1993	3 l/c/d	0.16% per year	0.265
Commercial & industrial	1993	37 l/c/d	0.16% per year	3.552
Hotels	1993	678 l/bed night	3% per year	1.466
Cruise ships	1997		0%	0.300
Golf courses	1997		0%	3.200
Agricultural irrigation	1993		1% per year	16.200
Industrial demand	1993		0.16% per year	2.600
Total				86.084

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A more recent but not so in-depth re-evaluation of water demand produced an alternative estimate of 62.288 Mm^3 for the year 2016, see Table 5 which is significantly less than the 1997 estimate. The main difference is in the calculation of the domestic water consumption and losses. What this indicates is the difficulty of making any sort of reliable estimation based on the currently available data generated by the BWA. The projected water demand of Barbados up to 2050 is shown in Figure 6. This includes allowances for reductions in system losses which accounts for the gradual decrease in overall demand. The overall decrease shown masks the growth in demand from tourism and agriculture (related to irrigation).

Table 5: Estimated Water Demand 2016

Item	**Amount Mm^3 (2016)**
Domestic consumption including leakage	28.939
Government Institutions	1.864
Statutory corporations	0.329
Commercial & industrial	4.057
Hotels	5.023
Cruise ships	0.300
Golf courses	2.664
Agricultural irrigation	16.510
Industrial demand	2.600
Total	**62.288**

In an effort to reduce demand the BWA in 2000 introduced a water conservation programme. This consisted of a public education campaign, the distribution of water saving devices to customers (e.g. flow aerators and low flow shower heads) as well as retro-fitting low water use fixtures at a Government school. Efforts were also made to work with the hotel industry to reduce water consumption.

In addition to these measures, there is a requirement that all new buildings must incorporate a rainwater collection system, the size of which is dictated by the floor area. Buildings cannot receive their certificate of completion without this installation. There are however, no requirements for dual reticulation within the buildings or other measures to ensure that such systems are actually utilized.

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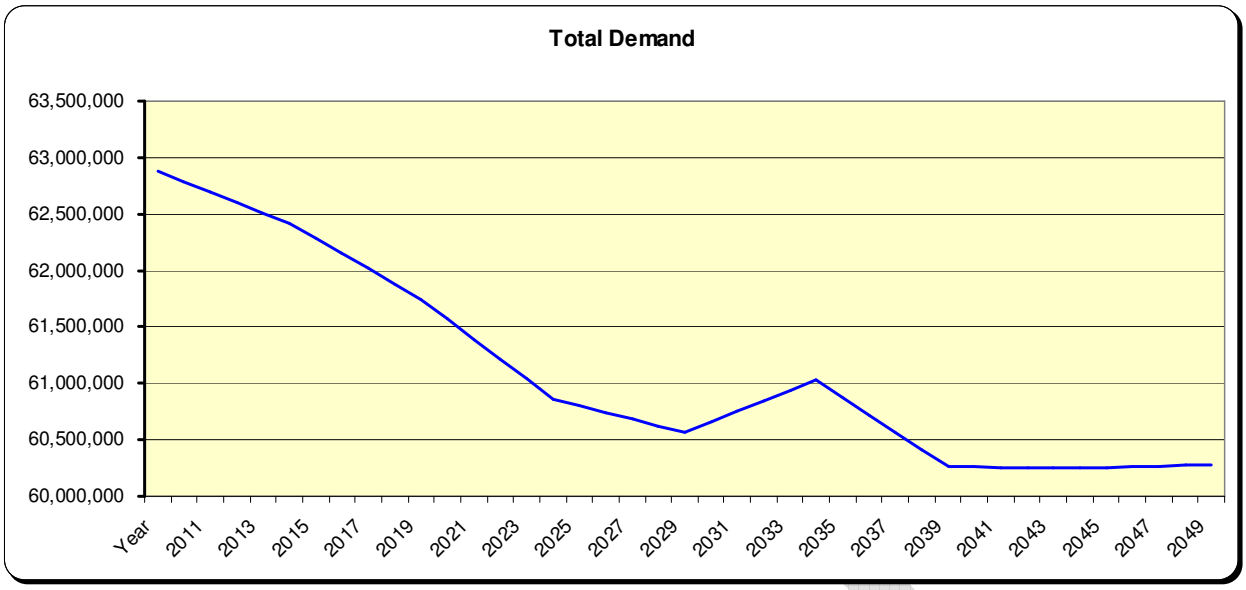
Figure 7: Barbados' projected water demand to 2050



6.3 Water supply

The BWA operates 22 public supply wells and 2 spring sources, distributed across the island, see Figure 6. It has been reported that in 1996 and 1997 production was as high as 0.160 Mm^3 per day, indicating that there is a substantial installed production capacity. However, out of this some 0.55 Mm^3 per day is abstracted from just one source, the Belle Pumping Station in St Michael's Parish. A brackish water Reverse Osmosis desalination plant was commissioned in 2000 with a capacity of 30,000 m^3/day (11M m^3/a) primarily to augment the public water supply in the event of a prolonged drought as well as to meet additional demand arising from increased economic activity. In addition there were some 111 active private wells, according to the 1997 Water loss Study, primarily used for irrigation purposes. The amount licensed for private abstraction is approximately 36,400 m^3/d but since only 30 wells out of the total are metered there is uncertainty over the precise figure being abstracted.

The St Michaels catchment accounts for 59% of all production. This is the most heavily populated catchment with urbanization posing a pollution threat to this important supply source. Of the other groundwater catchments, St Phillip's (Hampton Pumping Station) accounts for a further 23% of production and is also one of the fastest growing centres of urbanization. It also has a heavy agricultural demand. The West Coast catchments account for a further 15% of total production and are also heavily built-up in which tourist facilities are a major component of the urban environment.

There is approximately 98% coverage of potable water supply and 96% of the population receives water direct to their homes. Although the water supply system functions well some parts of the distribution system do experience supply interruptions. This is due mostly to burst water mains as well as leakage from the system. Leakage rates were calculated at some 60% of domestic consumption according to the 1997 Water Loss Study an increase from 40% in 1973. Since 1997 efforts have been made to extend

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household metering to all consumers and introduce volumetric based tariffs in an effort to reduce losses as well as consumption. Some customers also report that they regularly receive water of poor quality. As well as this efforts have been made to replace some of the older trunk mains. In 2008 BWA approached the Government with a request for BB$ 50 million over 5 years in order to continue with its mains replacement programme.

6.4 Wastewater management

Prior to the construction of the Bridgetown Sewage Treatment Plant in 1982, the disposal of sewage in Barbados was effected mainly through the use of package treatment plants at a number of hotels, septic tanks and soakways (shallow wells). The island is now serviced by two municipal sewage treatment plants – the Bridgetown Sewage Treatment System (BSTS) and the South Coast Sewage Treatment System (SCSTS), and several package treatment plants. The West Coast system, which is the focus of this paper, is still in the design phase. Commissioned in 1982, the Bridgetown Sewerage System has an average design flow capacity of 9,000 m^3 a day and services about one eighth of the town of Bridgetown with approximately one thousand five hundred (1500) connections. This is a secondary treatment plant with a short sea outfall.

The South Coast Sewerage System is an advanced preliminary treatment plant commissioned in 2003 with average design flow capacity of 13.54 m^3 a day with approximately three thousand connections when all the connections to the system are completed. Approximately 2% of the urban population is connected to a sewerage system although 99% have access to improved sanitation both in urban and rural areas (UN, 2006). In addition to the existing sewerage systems there are plans to introduce the West Coast Sewerage system though quite when this might commence remains a matter of speculation.

A number of hotels especially on the West Coast still continue to use package sewage treatment plants and have even upgraded their treatment levels to tertiary level and are utilising the treated effluent to irrigate their lawns and plants. The Grantley Adams International Airport is also serviced by a package treatment plant which is currently being used in a water reuse pilot project.

At present the treated wastewater is discharged to the marine environment via long sea outfalls. There are plans as part of the West Coast Sewerage Project to treat wastewater to a water quality that would allow indirect reuse and groundwater augmentation.

6.5 Coastal waters

The coastal near-shore marine communities are of great socio-economic and biological importance being essential to the maintenance of the coastal ecosystem. The main causes of degradation affecting the marine environment arise mainly from deterioration of coastal water quality as they are susceptible to changes such as sediment load, eutrophication, turbidity and pollution loadings. Sedimentation and the effects of suspended material arise mainly from terrestrial run-off entering the coastal environment via water courses, drains and erosion. Terrestrial sedimentation run-off may result from sever rainfall

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events which mobilizes erosion material, debris and pollutants. These are associated with poor land management practices as well as inadequate stormwater management. Other sources of sediment include industrial and domestic sewage effluent.

Eutrophication arises from elevated levels of nutrients, phosphates and nitrates entering the marine environment. These enter the coastal zone through run-off and biological activity as well as groundwater seepage. Groundwater seepage occurs along the entire coastline and is especially rich in nutrients as a result of a high density of coastal properties using suck wells as well as septic tanks with soakaways as the only means of sewage disposal. Surface water run-off from stormwater drains and water courses also adds to nutrient loads.

It is as a result of concerns over the deterioration of the near-shore marine environment and the potential impact on tourism that efforts have been made to introduce sewerage systems to the most densely populated coastal areas.

6.6 Impact of climate change on water resources

There has been a limited amount of work done on the potential effects of climate change on water resources in the Caribbean region. Recently, using the PRECIS model regional scale modelling has served to highlight the possible changes that might be expected (Taylor et al., 2007). Using the outputs it has been possible to extrapolate the potential changes as they might impact Barbados. The impact of changes in precipitation patterns have been assessed using the monthly percentage changes in rainfall for three emission scenarios and indicate that rainfall is significantly reduced during the wet season under all three of the emission scenarios A1B, A2 and B2 (refer to IPCC (2007) for a detailed description of these emission scenarios), see Figure 8. In terms of the impact on the relative length of the wet and dry seasons there appears to be a small amount of change with the dry season being perhaps slightly longer. There is a shift in the number of days between significant rainfall events during the wet season implying that more rain then falls during rainfall events such that the intensity of rainfall increases, even though the overall volume of rain is decreasing. At the same time there is some evidence for an increase in intense tropical cyclone activity since 1970, correlated with increases in tropical sea surface temperatures (ibid). A continued increase in the frequency and intensity of tropical storms and hurricanes would also bring significant quantities of rainfall over short durations.

The potential impact of climate change is a serious and declining situation with respect to water availability. The modelling indicates that in order to make any significant difference the water consumption of every sector would have to be addressed.

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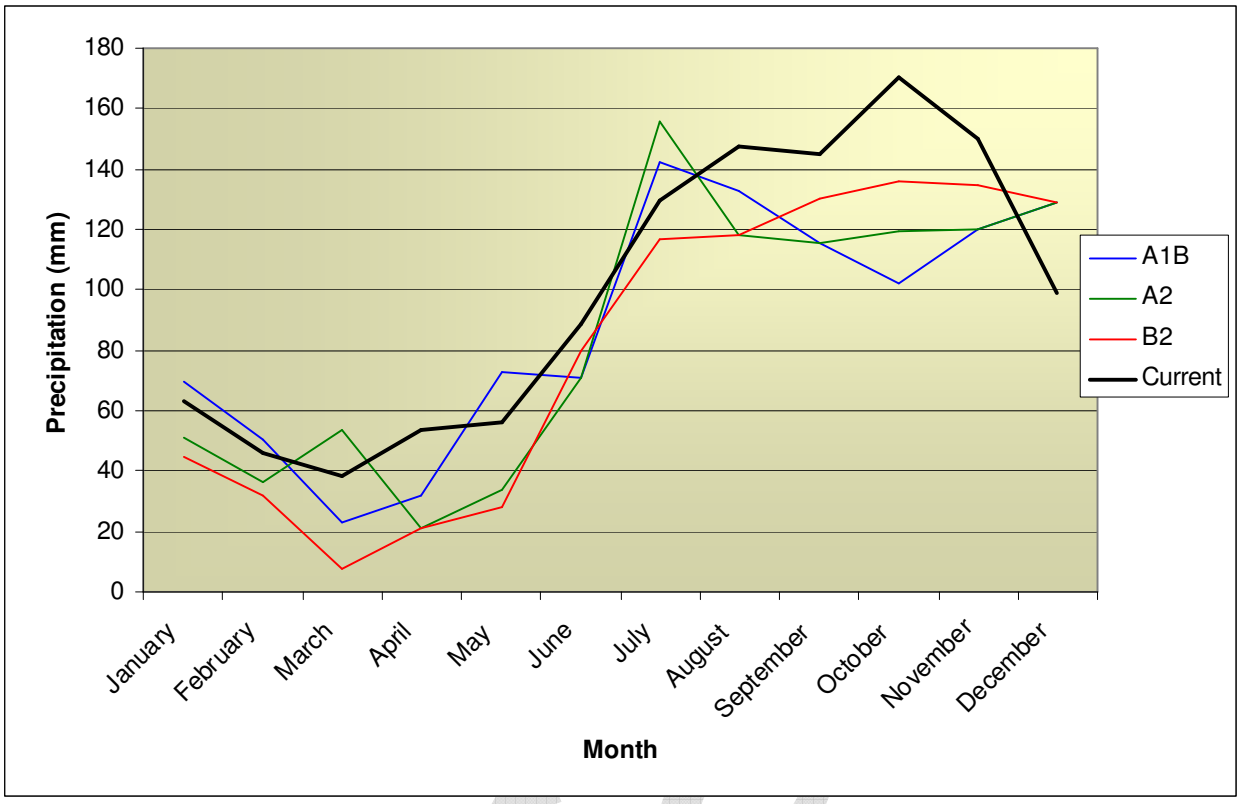
Figure 8: Potential impact of climate change on average precipitation pattern



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7.0 Main findings of an IWRM preliminary assessment

A situational analysis was carried out to examine the key factors influencing water resources management and to characterize the present situation and determine the general approach necessary for IWRM. The situational analysis is based on the output from the Inception Workshop in July 2008, a review of available documentary sources plus the use of a questionnaire data collection instrument (see Annex 1). The questionnaire used was based on a data collection instrument that had been designed and used in Grenada and Union Island, St Vincent and the Grenadines, also for the purpose of compiling an IWRM Road Map in each of those countries. In addition to the use of the questionnaire a number of Key Informants were interviewed, using the questionnaire as the basis for the semi-structured interviews.

A total of 28 questionnaires were sent out by email and each recipient was followed up by phone calls. As a result 15 questionnaires were returned (54% return rate). In addition 9 Key Informants were interviewed. The Key Informants were all senior personnel within their respective organisations. The organisations covered by the Key Informants included Government Ministries, Parastatal Bodies and the Private Sector. The results of the questionnaire together with some of the issues raised in the interviews are reported on the following section. These results together with the outputs from the Inception Workshop are then drawn on in order to compile sections 7.2 to 7.5.

7.1 Outputs from Questionnaires and Interviews

The following is a summary of the questionnaire and interview responses. Where appropriate particular points highlighted by the respondents are presented. For more details on the actual questions contained in the questionnaire see Annex 2.

7.1.1 Need to Review of Current Roles and Responsibilities in IWRM

All respondents felt that there was a need to review the current roles with the overwhelming majority saying that there was a need to split the management of water resources away from the operation of water services. One respondent was of the opinion that the current situation lacked accountability whilst a further two suggested that the BWA was not able to fulfil its current mandate adequately.

7.1.2 Five Most Important Issues

Concerns over the current level of utilisation of water resources and the state of the water services infrastructure accounted for the two most important issues identified and together accounted for 50% of all mentions. Concerns over protection of water resources came third accounting for 19% of all mentions. Issues of costs and cost recovery got 13% and concerns over institutional capacity to

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adequately manage water resources and services 11% of all the issues mentioned. These result correlate very well with the outputs from the Inception Workshop. The issues identified were then:

1st The current utilisation of water resources;

2nd State of the water services infrastructure;

3rd Resource protection;

4th Cost and cost recovery;

5th Institutional capacity.

7.1.3 Proposed changes to water management

a) Water Legislation

Four main suggestions emerged. In descending order of frequency mentioned they were; the need for better enforcement of regulations pertaining to water management; legislation to split water management from service provision; clarification of water resources ownership and the passing/implementation of existing draft legislation; requirements for a national water policy and water master planning.

In interviews the need to address the ownership, access and certain riparian rights associated with water resources were mentioned as constituting a serious problem especially with regard to its impact on agricultural development. The need for legislation to address ownership issues was stressed by a number of those interviewed.

b) Economic regulation

There was an overwhelming sense that sound economic and cost recovery principles had to be applied. Some of the respondents qualified this by saying that this should include social equity considerations to protect those on lower incomes. Others felt that there was a need for more transparency over how tariffs were reviewed and set. In this respect many felt that the Fair Trading Commission should regulate the setting of water tariffs as envisaged in the legislation. Among some respondents there was a feeling that there was too much interference in the setting of water tariffs and that this had led to the current financial position of the BWA.

c) Environmental regulation

Three, interconnected aspects were mentioned. Firstly that there was an urgent need for better data collection, monitoring and enforcement and secondly that in order to do this more resources had to be made available to do this. Lastly it was proposed that the available information should be made more widely available especially to the public. There was some speculation amongst one or two respondents as to whether this would be covered by 'freedom of information' legislation.

d) Water supply

The issues focused on the need to improve the provision of water services by: upgrading the aging infrastructure and tackling leakage and unaccounted for water; improve the efficiency of operation of the

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distribution system together with the introduction of service standard guarantees; the greater use of technology to improve system operations and; end restrictive practices within BWA and allow more private sector involvement. This later point was raised most frequently but not exclusively by respondents from the private sector.

e) Sewerage and sanitation

Only three points were mentioned indicating a high degree of consensus among respondents. The need to look at water reuse and augmentation figure very strongly with a feeling that this was a resource that was otherwise being wasted. There was also a need for greater provision of sewerage systems though opinions were split as to whether this should be through centralised or decentralised systems. The last point was that discharge consents should be set on a more scientific basis.

f) Water pollution control

Four main points were made. The predominant view was that there needed to be better public understanding of pollution issues and how the behaviour of the public impacted on water resources. Coupled with this was a need for better monitoring of the potential pollution of water resources together with legislation setting out water quality standards, methods of measurement, and levels of compliance. The implementation of the draft Environmental Management Act was mentioned by many of the respondents. Lastly, training and provision of personnel in pollution control was seen as a priority need.

g) Water allocation

The respondents identified agreed on four issues. The need for greater transparency in how water resources are allocated to users and thus the need for an independent body that would undertake any allocation. Linked to this the view among the majority of respondents that the understanding of the nations water resources and its behaviour was poor and that much more research, monitoring and modelling was required. The last point mentioned was the need to encourage water reuse especially wastewater reuse.

h) Financing

There was a need seen to explore other financing options for the water service provider to make them less dependent on Government sources for capital works. In this respect privatisation was raised as an issue with opinions being almost equally split for and against though at a pragmatic levels most acknowledged that they did not think that a pure privatisation approach would work. However, most agreed that there was a need to introduce a much more commercially orientated approach and that this needed a strong management lead. Several respondents felt that a new management structure would be needed to achieve this.

i) Cost recovery

This aspect elicited strong feelings with one respondent venturing that there was no cost recovery mechanism. All respondents said that improving cost recovery on an equitable basis was an urgent need and some suggested the need for social tariffs. There was also a recognition that any cost recovery

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system should not reward inefficient management and should also include rewards for efficient use of water by consumers. Political intervention over prices was mentioned by many as a negative factor that needed to be addressed. The metering and billing system was something that required investigation and bringing up to date.

j) Management of water resources

The adoption of IWRM , the regular use of modelling and forecasting and the development of a national water plan were seen as priorities. The need to separate the management from service provision functions was coupled with this. The negative perception of BWA's current performance was mentioned by some as needing to be addressed to improve confidence in the ability of the Authority to provide a good service. The need for more public education to promote understanding of water resources issues was mentioned by many of the respondents.

k) Land management

The current groundwater zoning policy together with land use and management practices were highlighted. With respect to zoning the impact of land use changes and climate change as well as the use of chemicals and practices that lead to greater erosion were identified as being of concern. Land use planning can play a crucial role in pollution control.

l) Institutional arrangements

This elicited a range of responses from the need to privatise BWA to the greater use of regionally based institutions to assist with water management. Again the splitting of functions between resource management and service provision was highlighted. And there was perceived to be a need for better links between planning and economic development.

7.1.4 Water as a sectoral issue

When asked whether water management was treated as a cross-sectoral issue 70% of the respondents said that although it should be treated as a cross-sectoral issue in their opinion it was dealt with as a sectoral issue. The caveat to this was the planning application system in which water matters were considered as part of the process of approval.

7.1.5 Stakeholder relationships

a) Coordination of activities: 50% said this was OK and 35% Poor

b) Information sharing: 65% Poor with the rest equally split between OK and Good.

d) Harmonisation of policies: 70% Poor and 30% OK.

e) Joint working: 40% Poor, 50% OK and 10% Good

Overall it would appear from this that there is room for improvement of the relationships between the various stakeholders in the water sector. It was noted though that individual personal relationships did make a lot of difference and that some stakeholders were much better in their relationships than others.

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7.1.6 Priority threats to water resources

In order of priority Groundwater pollution was seen as the #1 threat followed by Over-abstraction. The third priority was given as Poor Land Management with Climate Change and Drought in 4th position. The remainder, in descending order were Soil erosion, Flooding and Habitat loss last.

7.1.7 National interaction mechanisms

The consensus was that there are very few formal mechanisms for interaction between stakeholders at a national level, most take place at an informal level between individuals. IT was noted though that within the Ministry of Environment, Water Resources and Drainage there had been initiated a formal information sharing mechanism. In this respect it was noted that much of the pressure for putting national interaction and coordinating mechanisms on a more formal footing had been externally driven by processes such as the Rio and Johannesburg summits. The one exception that was mentioned was the formal planning process under the Chief Town Planner.

7.1.8 Mechanisms for Public Participation

With one exception the consensus view was that there are no existing mechanisms for public participation in water management issues. That said the hope was expressed that the proposed Community Councils might be able to fulfil this role. Otherwise there appeared to be a reliance on Town Hall meetings called for specific projects as and when the need arose.

7.1.9 Public awareness of water issues

The public have a very good awareness of water issues with respect to supply matters such as interruptions, bursts or when there is 'brown' water. The other issue concerns the price of water which should be kept low. The feeling was that on other matters such as resource issues, the water situation, the state of the infrastructure and the financial position of BWA there was very little appreciation or understanding. One respondent did point out that they felt that the awareness amongst school children was better.

7.1.10 Is water on the political agenda?

All respondents said that it was but with various qualifiers. Interest seemed to reflect the public concerns noted in section 7.1.9 and as one person put it the political concerns are not always for the right reason. Another respondent pointed out that politicians will reflect the issues that the public raise and that if it is not an issue with the public then it becomes somewhat harder to create traction for an issue such as water management, especially when for the majority of the public water continues to flow when taps are turned on.

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7.1.11 Water governance

The results are summarised in the following table:

Table 6: Water governance results

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
There are multiple institutions that deal with water matters, each with their own legislation, none of which is broad or deep enough.	14%	79%	0%	7%	0%
There are poorly defined responsibilities for Departments and institutions that deal with water matters.	0%	57%	36%	7%	0%
There are no overlapping and conflicting responsibilities for water related matters.	0%	7%	29%	50%	14%
There is little co-ordination between pollution control and water services provision.	7%	57%	21%	7%	0%
There is little co-ordination between those bodies responsible for water quality management and pollution control and those responsible for planning, management and operation of water services.	7%	43%	21%	21%	7%

Part of the spread in the results obtained can be explained by the differing perspectives between the public sector and the private sector respondents.

7.1.12 Integration and co-ordination of functions

Table 7: Integration and coordination functions

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
There are no comprehensive national policies on water resources management	7%	64%	0%	29%	0%
There is a multiplicity of organisations that deal with the management of water resources.	0%	57%	29%	14%	0%
There is a multiplicity of laws each of them dealing with separate aspects of the management of the resource, thus encouraging compartmentalisation.	7%	29%	50%	7%	7%
The institutional coordination between environment and economic development is excellent.	0%	0%	14%	79%	7%
There is an absence of coordination of the competing needs of various sections of the economy on water resources.	14%	64%	15%	7%	0%
The dynamics of water supply and demand are poorly managed.	7%	71%	14%	7%	0%
The legal and regulatory frameworks for managing water matters are very good.	0%	0%	43%	57%	0%
There is an absence of credible frameworks for involving civil society in water management processes or decision-making.	21%	71%	0%	7%	0%
The institutional arrangements for integrated	0%	71%	29%	0%	0%

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water resources management are weak/non-existent					
The provision of water infrastructure is poorly financed.	50%	36%	14%	0%	0%
The mechanisms for the recovery of the cost of water services are inadequate.	36%	57%	7%	0%	0%
The land use planning is excellent.	0%	14%	29%	50%	7%
There is a lack of promotion of the social, economic and environmental values of water.	14%	64%	14%	7%	0%
Pollution prevention and control is poor.	0%	71%	21%	7%	0%

As in the results reported above in section 7.1.11 the divergence in views arises from the different perspectives of the public and private sector. However, the results do correlate and support the results obtained from other questions indicating that there is a good degree of consistency in the answers obtained. Furthermore they show good agreement with the results from documentary sources and the Inception Workshop.

Another aspect that was highlighted both in interviews and through the questionnaires concerned the monitoring, gathering, processing, analysis, availability and accessibility of data not just on water resources but also including aspects such a s demographics, land use, etc. The need for such a national information system has been raised in some quarters as a way of dealing with some of the shortcomings that exist in the current system.

7.1.13 Availability of resources

Table 8: Availability of resources

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Human resources for proper water management are inadequate or lacking.	29%	64%	7%	0%	0%
There is inadequate equipment available.	21%	50%	29%	0%	0%
The financing water resources management is very good.	0%	0%	7%	57%	36%
The technical capabilities available for water resources management are inadequate.	36%	36%	14%	14%	0%
There is a good level of research and development carried out into water resources matters.	0%	0%	14%	43%	43%
The data and information collection, management and assessment infrastructure is inadequate.	21%	57%	7%	14%	0%

Overall the respondents are indicating that there are a number of areas in which the resources available for water resources management are not adequate and that these are issues that need to be addressed.

7.2 Processes and milestones leading to IWRM

7.2.1 National water resources management vision

Barbados does not have an explicit water resources policy that has any official status. There have been attempts in the past to have a policy and a vision articulated and there are versions that exist in draft.

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The policy with respect to water has been variously articulated as according water the recognition as a critical national resource and according it a high priority (sic) and that it should be managed according to IWRM principles. In most instances the drafts address the need for reform of the policy framework rather than seeking to explicitly formulate a water policy that would provide the rationale for that framework.

The closest that there appears to be to a national vision is what is contained in the 2007 National Strategy: (To) protect the island's water supply including, groundwater resources and water in coastal aquifers and; Promote sustainable land management practices. For the most part though the National Strategy focuses on the need to secure water supplies and this would appear to be the main plank of a water policy. However, since that National Strategy was drawn up by the previous administration it may well be subject to revision at some point in the future.

Recent developments in the agricultural field, in particular the proposed Sustainable Agricultural Development Bill will seek to place agricultural development within a legislative context. In developing this, the crucial importance of water management issues has been recognised as constituting a constraint on the realisation of sustainable agriculture in Barbados. Thus from the agricultural sector there is now representation also being made that water management requires attention.

7.2.2 Awareness and support for defining a vision for IWRM

There is a small group of senior officials, technocrats and practitioners who have recognised that there needs to be a water policy for Barbados and that the current institutional situation is unsatisfactory. Indeed this group has been active over a period of time in attempting to introduce such a notion and pressing for institutional reform, though without any noticeable success to date. This would suggest that water matters have as yet to move out of the expert/technocratic field into the political sphere of consciousness and thus attract the necessary degree of salience and urgency.

Issues that have been highlighted include:

- The need to facilitate an IWRM approach;
- Revise the legal framework for water governance;
- Adopt an appropriate institutional framework for efficient management, regulation and enforcement of policies.

7.2.3 Awareness of IWRM

There is a body of stakeholders in Barbados that have some recognition of the need to properly manage water resources and indeed throughout the island among the general population there is an awareness that perhaps the management of water is not as good as it should be. However, much of this awareness among the general public is aimed at the provision of water services rather than management of water as a resource. The appreciation of the need for a more integrated approach to water matters and their management among some senior government officials appears to be ambivalent. On the one hand there

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is some recognition that water is a scarce resource yet often this does not translate into better coordinated actions.

Table 9: Stakeholder IWRM awareness

Level of awareness on the philosophy, concepts, principles and practices of IWRM for the following groups: (Rating: 0 = none; 1 = to a little degree; 2 = to a reasonable degree; 3 = fully)				
Stakeholders	**Rating**			
	0	**1**	**2**	**3**
National level politicians				
High level policy/Decision Makers (National Level)				
Decision makers in agencies responsible for water resources management				
Decision makers in agencies within the water use and water related sectors				
Professionals in agencies responsible for water resources management				
Professionals in agencies within the water use and water related sectors				
Major Water Users (Industry, Agriculture, Tourism etc)				
Water sector consultants				

7.2.4 Existence of an IWRM Plan and contributing partners

An IWRM plan does not exist and there is at this stage no mandate to compile one.

7.2.5 Other Plans likely to contribute to IWRM

The Integrated Coastal Zone Management Plan that falls under the auspices of the Coastal Zone Management Unit and is a statutory requirement has been influential in bringing a greater awareness of the need for more integrated and coordinated approaches to the management of land and marine based resources and practices. In addition recent or on-going studies into different aspects of Barbados' water resources such as the Water Augmentation Study, the Cost-Benefit Analysis of the West Coast Sewerage Master Plan and the re-evaluation of the groundwater zoning policy are all likely to contribute to the critical mass required to bring about the adoption of IWRM policies and practices.

Other plans such as the proposed Environmental Management Plan, the Physical Development Plan and, the National Biodiversity Strategy and Action Plan are all have the potential to create the conditions that are supportive of an IWRM approach.

7.2.6 Special water resources management initiatives

There is the re-evaluation of the groundwater zoning policy that is referred to above. In addition to this at a regional level there is the Integrated Watershed and Coastal Areas Management (IWCAM) project. This is being implemented jointly by the UNDP and UNEP and executed through the Caribbean Environmental Health Institute (CEHI). It is a 5 year project that started in 2006and aims to strengthen the capacity of participating countries to implement an integrated approach to the management of watersheds and coastal areas. The CARIWIN project (Caribbean Water Initiative) is led by McGill University and the Caribbean Institute for Meteorology and Hydrology (CIMH), Barbados. It is a 6 year project started in February 2007 and funded by the Canadian International Development Agency (CIDA). The project aims to improve existing capacity in Jamaica, Guyana and Grenada by offering training courses in IWRM.

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7.2.7 Context of IWRM planning

Barbados has adopted a participatory approach to its planning process and actively seeks to engage and involve stakeholders in decision-making processes. For example the recent Cost-Benefit reappraisal of the West Coast Sewerage Master Plan was guided by a steering committee drawn from a broad cross-section of institutional stakeholders, academics, civil society and the private sector. Previous water policy initiatives have followed similar processes.

7.2.8 Challenges and constraints to IWRM

Water resources management is faced with a umber of challenges at various levels of government. The impetus to continue developing the economy, primarily through the promotion of tourism, the drive for food security and by extension reconfigure the contribution of agriculture to the economy, the need to reduce the reliance on imported fossil fuels creates increasing and competing demands on water resources. At the same time the knowledge, information base and capacity to asses evaluate and manage the resources is severely limited. Institutional capacity is a severe limitation. This situation is not helped by the often overlapping degrees of responsibilities of various agencies that utilise or can access the water resources.

Table 10: Challenges and constraints to IWRM in Barbados

Challenges and Obstacles	Rating
Lack of Good Water Governance	Severe
Fragmented Approach to IWRM:	
Multiple institutions, each with their own piece of legislation and Mandate, none of which is broad or deep enough	Severe
Assigned responsibilities for planning; management and operations affecting quantity to units separate from those responsible for quality management	Severe
Poorly defined responsibilities for departments/section	Severe
Overlap of responsibilities, resulting in duplication	Severe
Cost trade-off between the pollution control and water supply treatment in the same watershed is not evaluated, thus the national investment policies and programmes do not reflect the interrelationships between quality and quantity.	Not severe
Lack of effective integration and coordination hampered by:	
The absence of sound and comprehensive national policies on water resources	Very Severe
The multiplicity of institutions that deal with the management of the resources	Severe
The multiplicity of laws, each dealing with separate aspects of the management of the resources, thus encouraging compartmentalization	Severe
Institutionally divided approach to dealing with environment and development	Severe
Poor management of the dynamics of water supply and demand.	Very severe

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Inadequate legal and regulatory frameworks for managing the resources.	Severe
The absence of a credible framework for involving civil society in the management process	Very Severe
The lack of a proper understanding and awareness of the principles of sustainable development and an appreciation of the inseparable linkages between environmental, social and economic issues.	Severe
Institutional arrangements for integrated water resources management are weak/ non-existent.	Very severe
Lack/inadequate institutional resources	
Lack/inadequate human resources	Very severe
Inadequate equipment	Severe
Inadequate financing	Very severe
Weak technical capabilities/lack of a critical mass for water resources management	Severe
Inadequate Research and Technology	Very severe
Inadequate Data and Information Management Infrastructure	Very severe
Conflict between water supply and demand	Severe
Poor land use planning and soil management in watersheds	Severe
Poor pollution prevention and control	Severe
Limited/poor Stakeholder Participation	Not severe - Severe
Limited/little Public Awareness and Education	Severe
Lack of Promote the economic, social and ecological values of water	Severe
Impact of Climate Change and Sea level Rise	Very Severe

7.3 Policy environment, legislation and institutional frameworks related to the water sector

There is no national water policy for Barbados and there is no specific water resources management plan. The various other policies, legislation, action plans and institutional frameworks that have a bearing on the management of water resources have been described in Section 5 on Water Governance.

From the feedback received via the questionnaires and interviews the need for the updating and streamlining of water and environmental legislation, the development of a National Water Policy and the development of a water resources management strategy were highlighted as being pressing issues. One Key Informant pointed out that the urgency with which resource management issues need to be addressed and the time required to put such measures in place is often under estimated by decision-makers and the political establishment. Again from the feedback received there would appear to be a need to sensitise policy and decision makers of the need for action as it appears to many of those consulted that the symptoms and not the cause of water issues are being focused on.

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The developing agricultural policy environment, mentioned above, is likely to provide an additional impetus for change within the policy environment as it relates to water management. The need for a more explicit framework that governs water ownership, rights, quality, quantity and price would be a prerequisite for the realisation of a national food security policy. Hence the support being given by the agriculture sector for the need for a national water policy that would address water for agriculture and irrigation and its relationship with other sectors of the economy. It is understood that representations by the Ministries of Environment and Agriculture are to be made to the Cabinet through the Ministry of Finance and Economic Affairs that there is a need to revise the policy and legislative framework that governs water management in Barbados. Furthermore several of those interviewed have indicated that the believe that there is a need to recognise the macro-economic linkages between water and other sectors of the economy and to ensure coherence of a water policy with other national policies and development objectives.

7.4 Stakeholder capacity for water resources management

Whilst there is a well established track record of institutional consultation and the inclusion of the private sector in both policy and project formulation the depth of consultation is a function of the available time and resources as well as the perceived need to consult. There can in some cases be something of a tick box approach to consultation at times with stakeholders not being brought on-board at an early enough stage of formulation. There is as well a degree of over-consultation in as much as the actors in the institutional field are limited in number and therefore it is the same people that keep being called upon leading at times to an over-reliance on a few key stakeholders and consultation fatigue.

The water sector in Barbados is dominated by the public sector and there is as a consequence a limited role available to the private sector. The private sector is primarily a provider of goods and to a lesser extent services especially those related to the operation and maintenance of the services infrastructure. In terms of consulting and professional services available there is a reliance on bringing in expertise from outside of the region on a project basis and thus there are few opportunities to build up local or even regionally based expertise within the private sector. A number of the respondents and Key Informants highlighted the limited role available to the private sector suggesting that this was acting as an institutional barrier to the improvement of water resources and services management in Barbados as well as a constraint on competition. A few Informants also raised the subject of the relationship between the BWA and the unions and without them going into detail have indicated that this has in the past circumscribed BWA's ability to act.

It is noticeable that there is an absence of NGOs active in the water sector in Barbados. The reasons for this are not entirely clear but may be due to the perception that Barbados is a relatively well developed country with few overt water problems and a functional water sector. Thus implying that the needs and priorities of other Caribbean SIDS are greater than that of Barbados. The international community is well represented in Barbados and many have their regional offices located on the island. The World Bank does not operate in the Caribbean instead the Inter-American Development Bank and the Caribbean Development Bank fulfils that role. Whilst organisations such as FAO, UNEP, UNICEF

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and others are present they act in a supporting role often seeking to draw on and promote the development of local capacity. At times though there appears to be a degree of overlap in their efforts and lack of co-ordination leading to duplication.

There is a need to broaden the capacity in IWRM to include wider civil society. The public has traditionally regarded the management of water only from a service provision perspective and has little concept of the multi-dimensional nature of water management. This attitude has inadvertently been underpinned by public scepticism of the ability of the service provider and by successive governments treating water related matters almost as state secrets in order to avoid any adverse impacts on the economy and especially the tourism industry.

Hence, obtaining public support for, and appreciation of, the concept, principles and values of IWRM requires:

- An extensive public awareness programme utilising various media to target the various strata of the society;
- Grass roots-level consultation, allowing for extensive dialogue on the subject;
- Consultation on a cross-sectoral basis to obtain views on the critical aspects of water resource management pertinent to the sectors;
- Developing programmes and systems for the resolution of conflict and reaching compromise between the various resource users.

Institutional capacity for IWRM was found to be a challenge. The assessment compared the relative differences in capacity between public sector agencies and private sector groupings. The results are revealed in Table 11 and indicate that the private sector lags behind that of the public sector, for reasons given above.

Table 11: Capacity for water resources management

CAPACITY FOR WATER RESOURCES MANAGEMENT (Rating: 0 = no capacity; 1 = little capacity, needs to be built; 2 = some gaps but is workable; 3 = capacity fully exist)	**Public Sector**				**Private Sector**			
	0	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Policy formulation								
Drafting of laws & regulation								
Preparation of WR assessments								
Preparation of EAs								
Preparation of socio-economic assessments								
Monitoring of water quality								
Monitoring of water availability								
Monitoring of aquatic ecosystems								
Monitoring of pollution loads								
Monitoring of water use								

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Resource use planning, protection and conservation								
Water demand management								
Water allocation								
Conflict mediation								
Information generation, collection, analysis								
Laboratories for testing								
Measuring impacts								
International negotiations								

7.5 Stakeholder assessment

The need for the participation by stakeholders in the IWRM planning process and for their contribution to the formulation of and support for an IWRM plan is a perquisite for ownership and commitment. The identification and screening of stakeholders is an important part of the process and is necessary to avoid the possible exclusion of potential key contributors. It is also recognised that different stakeholders have varying contributions, capacities and interests. In the case of some stakeholders they may wish or require occasional consultation or the dissemination of information whereas others would need to be more closely involved. The process of stakeholder participation is a challenging and demanding exercise and needs to be carefully thought through. Stakeholder identification is just the first step in the process.

A preliminary assessment of relevant and potential stakeholders, their relative interests, potential contribution to the IWRM development process and relative importance has been carried out. The results are presented in Table 12 below.

Table 12: Assessment of relative influence of stakeholders in the IWRM process

Stakeholder	Interests	Priority Influence	Category (1-4)	Capacities	Potential roles in the IWRM Plan
BWA	Quality & quantity	1	HH	Technical	Policy setting, process leadership and data collection
CZMU	Quality & pollution	1	HH	Technical	Policy setting, leadership, data collection & technical support
Environmental Protection Dept	Quality & pollution	1	HH	Technical	Policy setting, data collection & technical support, pollution mitigation
Drainage Unit	Quantity & run-off	1	HL	Technical	Data collection, planning & technical assistance
Soil Conservation Unit	Quantity & watershed	2	HL	Technical	Technical assistance & support
TCPO	Development	2	HH	Technical	Policy setting, land management, development & technical support
Environment Unit	Policy	2	HH	Advisory	Policy setting, leadership & advocacy
Met Office	Quantity	2	LH	Technical	Data collection

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Stakeholder	Interests	Priority Influence	Category (1-4)	Capacities	Potential roles in the IWRM Plan
CIMH	Quantity	2	LH	Technical	Data collection, technical support & assistance
Fair Trading Commission	Quantity, quality & service	1	HH	Technical	Policy setting, finance, standards & technical support
Government Analytical Service	Quality	2	HL	Technical	Standards, data collection & support
Solid Waste Unit	Quality	2	HH	Technical	Technical support
Land and Water Use Unit	Quantity	2	HL	Technical	Data collection & support
BADMC	Quantity	3	HL	Technical	Support
Min of Education & Human Resources	Quantity	4	LL	Advisory	Support with outreach & education
Min of Tourism	Quantity & quality	2	HL	Technical	Policy setting, advocacy & support
Min of Foreign Affairs, Foreign Trade & Int. Business	Policy & International Agreements	3	LH	Advisory	Policy setting & support
Min of Finance, Economic Affairs & Energy	Finance	2	HL	Technical	Policy setting, financing & technical assistance
Min of Social Care, Constituency Empowerment & Urban Development	Affordability	3	HL	Advisory	Advocacy and support
Min of Housing & Lands	Quantity	3	LH	Technical	Support
Barbados Tourism Authority	Quantity & quality	3	HL	Advisory	Technical assistance & tourism issues
Barbados Investment & Development Corp	Quantity & quality	3	HL	Advisory	Development issues & investment support
Barbados Tourism Investment Inc	Quantity & quality	3	HL	Advisory	Development issues & investment support
Bureau of Gender Affairs	Affordability & equity	3	HL	Advisory	Advocacy & support
Central Emergency and Relief Org	Security of supply	3	LL	Technical	Emergency management
Barbados Ports Authority	Quantity & quality	3	LL	Technical	Water availability

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Stakeholder	Interests	Priority Influence	Category (1-4)	Capacities	Potential roles in the IWRM Plan
Dept of Emergency Management	Security of supply	3	HL	Technical	Emergency management
Environmental Health Dept	Quality	2	HL	Technical	Environmental health issues & support
Fire Service	Quantity	2	LL	Advisory	Water availability
Lands & Survey Dept	Development	3	HL	Technical	Land management
National Conservation Commission	Quantity & quality, environment & watersheds	3	LL	Advisory	Land management & support
National Council for Science & technology	Scientific	2	HH	Technical	Cross-sectoral technical input, research & development
National Housing Corp	Quantity & quality	3	HL	Technical	
Natural Heritage Dept	Environment	2	LL	Advisory	Land management & support
Poverty Alleviation Bureau	Affordability & access	2	HL	Technical	Advocacy and support
Sanitation Service Authority	Quality	2	HL	Technical	Technical support
Statistical Dept	Quantity & quality	2	HL	Technical	Standards, data collection, evaluation and dissemination
Barbados Agricultural Society	Quantity & quality	2	HL	Advisory	Agricultural & water management issues & pollution
Barbados Institute of Architects	Quantity & quality	2	HH	Technical	Development issues, standards & private sector issues
Barbados Association of NGOs	Quantity & quality, environment & equity	2	HH	Advisory	Development issues, advocacy & support
Barbados Association of Professional Engineers	Quantity & quality	2	HH	Technical	Development issues, standards & private sector issues
Barbados Chamber of Commerce and Industry	Private sector, Quantity & quality, affordability	2	HL	Advisory	Private sector interests
Barbados Private Sector	Private sector,	3	HL	Advisory	Private sector interests

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Stakeholder	Interests	Priority Influence	Category (1-4)	Capacities	Potential roles in the IWRM Plan
Association	affordability				
Barbados Manufacturing Association	Quantity & quality, affordability	3	HL	Advisory	Private sector interests
Barbados Bureau of Standards	Standards & compliance	2	HL	Technical	Standards
Barbados Hotel and Tourism Association	Quantity & quality	2	HL	Advisory	Hotel industry interests & water management issues

Stakeholder categories:

1. Those who will likely want to participate fully or whose active involvement will determine the credibility of the process;
   - *Those that should serve on the coordinating committee*
   - *Those that should be involved in the planning and development processes*
   - *Those that should be involved in the implementation process*
   - *Those that should be involved in the monitoring and evaluation processes*
2. Those who would likely play a more limited role;
3. Those who would wish simply to be kept well informed;
4. Those who would not want to be involved

Priority/influence rating:

HH – High Priority/High Influence: These stakeholders are the bases for an effective coalition of support for the project

HL – High Priority/Low Influence: These stakeholders will require special initiative if their interest are to be protected

LH – Low Priority/High Influence: These stakeholders can influence the outcomes the project but their priorities are not those of the project. They may be a risk or obstacle to the project

LL – Low Priority/Low Influence: These stakeholders are of least important to the project

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8.0 Strategic directions for IWRM development – The "Roadmap"

8.1 Strategic Directions for IWRM Development – The "Roadmap"

This section presents a roadmap for an IWRM Plan development process for Barbados. The process outlined was primarily derived from the GWP/Cap-Net Training Manual and Operation Guide to development of Integrated Water Resources Management Plans.

In charting a course toward the development of the Integrated Water Resources Management Plan, the purpose of the plan and the specific issues to be addressed must be carefully considered. An IWRM Plan will vary between countries depending on the country circumstance in terms of water availability, demands, conservation issues and future projections. The roadmap will assist drivers of the IWRM Plan development process in identifying and completing the required tasks that will be necessary in development of the Plan.

8.2 Aim and principles of the IWRM plan

The Road-mapping process must be cognizant of the aims of the Plan and the principles that underpin the Plan. These aims are outlined below.

There are three main aims of an IWRM Plan:

- To **heighten awareness** and understanding of the value and benefits of integrated water resources management and vulnerability of human health and the environment from poor Water resources management;
- To **identify and implement actions** to address specific causes of negative impacts and threats on human health and the environment from poor water resources management practices;
- To **mobilize resources and partners**, including the private sector, for implementation of specific projects to address the negative impacts and threats on human health and the environment from poor water resources management practices.

There are some general principles that apply to all IWRM Plans:

(A) Content

The plan should incorporate a commitment to integrated water resources management and set out how this could be effectively implemented;

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- The plan should be comprehensive in scope, reflecting the interdependence and indivisibility of water resources management;
- The plan should be action-oriented;
- A successful IWRM Plan should be selective in the planning phase and focused on a few specific strategies appropriate for the country, rather than addressing all possible strategies. In particular, for those countries with limited resources, an incremental approach to the development of an IWRM plan is considered more realistic and effective (start small and increase gradually);
- Adequate, timely, and sustainable budgets originating from diverse sources are crucial in implementing an IWRM plan;
- An IWRM plan will have international dimensions.

(B) Process

Process and outcome are equally important;

- Continued high-level political commitment throughout the development and implementation phases. This includes having an influential agency or ministry to lead the process for developing the plan as well as having a high profile patron or advocate to promote it such as the Prime Minister or other Minister;
- An inter-sectoral coordinating committee is crucial in putting the plan into practice. Members of such a committee must participate regularly in meetings and have authority to delegate appropriate activities in their sectors;
- Effective monitoring and review of implementation is essential;
- The process should be continuous, with the conclusion of one component of the plan leading to the commencement of another.

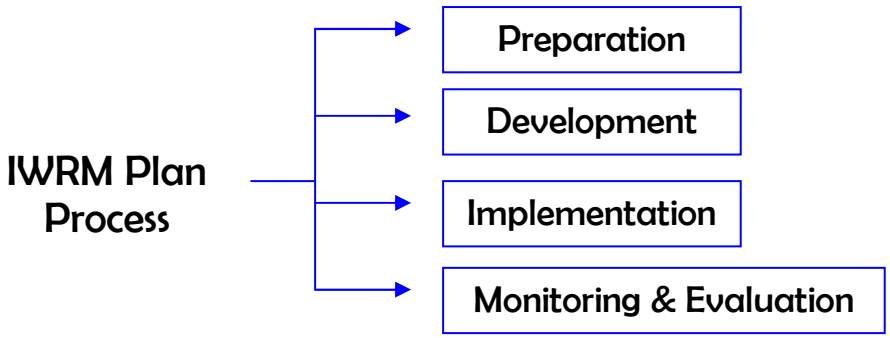
(C) Participation

There should be a broad and intensive consultation process with civil society and the general public.

(D) Transparency

The plan should be a public document.

Broadly there are four main stages in developing an IWRM Plan as illustrated below.



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8.3 IWRM Strategic Directions for Barbados

Implementing IWRM in Barbados will involve a change in the way in which water resources are managed. The existing sectoral system needs to be replaced by a more coordinated approach which will be responsible for the management of water resources in a holistic manner. This will ensure that due consideration is given to the various conflicting uses and allocation of water resources. Successful models of water governance are emerging in the Caribbean, most in notably Jamaica that can serve as guidance to IWRM development processes in other countries. Networking with Caribbean states which have begun the process of implementing IWRM principles at the national level can provide an avenue for technical cooperation amongst countries of the region.

Attaining the goal of implementing IWRM in Barbados will involve four fundamental elements:

- A holistic and comprehensive national policy and plan for the management of water resources;
- An effective legal and regulatory framework for the management of water resources;
- An improved and appropriate institutional and administrative framework for water resources management;
- An enhanced human resource capacity for management of water resources.

These elements are outlined, detailed and subdivided into the various components necessary for attaining IWRM at the national level in Table 13 below.

8.4 IWRM Roadmap actions

The road-mapping exercise should be seen as the 'Preparation' stage that will lay out all the required elements for actual development of an IWRM Plan. The next sections describe **the actions** in the roadmap that Barbados will need to undertake towards preparation of the IWRM Plan for the island.

8.4.1 Process initiation

The IWRM planning process for Barbados commenced in July 2008 with the convening of an inter-sectoral Initiation Workshop. The stakeholders included representatives from the Ministry of Health National Insurance and Social Security, the Barbados Water Authority, the Coastal Zone Management Unit, the Ministry of Agriculture and Rural Development, The Ministry of Environment, Water Resources and Drainage, Central Emergency Relief Organisation, and the Environmental Protection Department. At this meeting it was agreed that there was a need to address the country's water management especially in view of the water scarce nature of the island and the competing needs of various interests and building on previous though uncompleted work in the area of IWRM. This report is a follow on from that meeting and highlights the need to place the IWRM Road Map process on a

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more formal footing. An important first step in this will be to generate the necessary political will and buy-in to ensure that the conditions necessary for success are in place.

At this stage it is recommended that the lead agency drivers, the Barbados Water Authority and the Coastal Zone Management Unit in the Ministry of Environment, Water Resources and Drainage formally engage the Government and donors for financial assistance to mobilize the planning process.

8.4.2 Steering Committee (SC) establishment

A Steering Committee must be established to direct the strategic planning effort and drive the IWRM Plan through all stages of preparation, to ensure that the initiative is both managed effectively and realizes maximum benefit. The SC must include the various authorities and institutions involved in decision making in the water sector, along with other key civil society stakeholders. The constitution of the SC must be carefully balanced and requires long-term commitment from the outset from all participating organisations and entities (government, the private sector and civil society etc).

Terms of reference for the SC: the following are the recommended key tasks for the Barbados IWRM Policy/Plan SC:

- Overseeing and guiding the process of development of the National Water Policy and IWRM plan for Barbados;
- Facilitating broadest stakeholder participation in water policy and IWRM plan development;
- Facilitating full multi-sectoral cooperation and coordination within government departments;
- Integrating the National Water Policy and IWRM Plan, with related policies and strategies such the Integrated Coastal Zone Management Plan;
- Promoting the awareness on the concepts and principles of IWRM at the national and regional levels;
- Overseeing the development of public awareness/public education materials and providing guidance as to relevance and appropriateness;
- Periodic measuring and evaluation of the progress of the policy and plan development process;
- Guiding the implementation of the national water policy and IWRM plan;
- Monitoring and evaluating the implementation of the policy and plan;
- Sourcing financial and human resources required for the development of the policy and plan
- Ensuring that consultations are held in a timely manner and dedicating responsibility to various agencies and personnel
- Finalisation of the policy and plan and presentation to cabinet for approval
- Provide the Process Management Team (PMT) with general guidance and support;
- Review the proposals and reports prepared by the management team;

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- Regularly review progress in implementation;
- Assist the PMT in securing primary data and information;
- Be responsible for coordinating and monitoring the implementation of relevant activities within their respective agency, organisation or community;
- Decide on the composition of the PMT and appoint its members.

SC members: The committee needs to include the authorities and institutions involved in decision making in the water sector, together with a selection of other key stakeholders. The eventual make-up must be carefully balanced and requires a commitment at the outset from all participating organisations (government, the private sector and civil society etc) acceptable to stakeholders. A SC should be established under the chairmanship of the Permanent Secretary of the Ministry of Environment, Water Resources and Drainage with allowances made to co-opt persons with specialist knowledge and other contributions and required. The exact composition of the Sc should be a matter for the Ministry, though it is recommended that its membership should not be too large (less than 10) in order to be effective.

8.4.3 Process management team (PMT) establishment

The Process Management Team (PMT) acts as a secretariat or coordinating body to the SC. The role of the Team is to translate the requirements of the SC into practical measures for action, while at the same time informing the SC on progress and emerging key issues. The PMT will be responsible for managing the participatory planning process and for guiding the activities required for preparation of the IWRM plan. At the first meeting of the SC the members of the PMT should be determined.

Terms of reference for the PMT: the following are the recommended key tasks for the PMT:

- Organize and coordinate the overall strategy process;
- Planning specific activities and meetings;
- Procuring expertise and resources (human and financial);
- Support working groups and other committees;
- Act as a focal point for communication.

PMT members: Team members normally include senior planners from relevant sector agencies (for purposes of bringing different perspectives to bear on the planning process) but may be comprised of consultants or seconded staff. It is recommended that at least one administrative assistant is employed full-time (or alternatively an individual assigned/seconded from the local district office) to provide the necessary level of administrative support to the process.

Frequency of meeting: The PMT should meet as frequently as needed but its workings should be reported to the SC ahead of its meetings.

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Process Management Team

The key to effective performance is the establishment of a *secretariat/ coordinating body/ management team* acceptable to stakeholders, with sufficient authority and resources to coordinate the activities. Team members normally include senior planners from relevant sector agencies for purposes of bringing different perspectives to the planning process but may also be comprised of consultants or staff seconded from certain agencies.

The role of the Team is to translate the requirements of the Steering Committee into practical measures for action, while at the same time informing the Steering Committee on progress and emerging key issues. The Team will be responsible for managing the participatory planning process and for guiding the activities required for preparation of the IWRM plan. Specific tasks of the team should include the following:

- Organizing and coordinating the overall strategy process;
- Planning specific activities and meetings;
- Procuring expertise and resources;
- Supporting working groups and other committees;
- Acting as a focal point for communication.

Table 13: IWRM strategic directions for Barbados

Overall Goal: Implementation of IWRM in Barbados		
Indicators for overall goal		**Means of Verification**
1	Agency for the management of water resources developed and functional	Agency report
2	Adoption of cross-sectoral approaches to the management of water resources	WRM committee meeting reports
Objectives/Results		
1	**A holistic and comprehensive national policy and plan for the management of water resources in Barbados**	
2	**Legal and regulatory framework for the management of water resources developed and enforced**	
3	**Institutional and administrative framework for water resources management improved**	
4	**Capacity and capability for the management of water resources enhanced**	
Result #1: A holistic and comprehensive national policy and plan for the management of water resources in Barbados		
Indicators		

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No	Objectively Verifiable Indicators (OVI)	Means of Verification (MOV)
1	All sectors in Barbados incorporate elements of the Integrated Water Resources Management policy and plan within their own policies, plans and programme by end 2010	Sectoral policies and plans modified
2	Annual budgetary allocation for implementation of the IWRM policy and plan	Annual budget

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	Activities	Responsibility	Time Period	Resources	Assumptions
1.1	**Establish mechanisms for the development and implementation of IWRM in Barbados**	**MoEWRD, BWA**	**6 months**	**Human and Financial**	**Willingness to improve WRM using cross-sectoral approach**
1.1.1	Assess country-specific mechanisms that have been used in similar type activities		1 month	Human	
1.1.2	Determine who should initiate the process			Human	Decision made by political directorate
1.1.3	Establish a lead agency to function as the Secretariat				Decision made by political directorate
1.1.4	Establish a National Inter-sectoral Committee (NIC) for overseeing the development and implementation of IWRM policy and plan (**Guidelines Appendix V**)			Human	Potential members of the NIC are willing to be involved in the development and implementation
1.1.5	Develop and Issue TOR to the NIC	MoEWRD/BWA/ CZMU/CEHI/IW CAM		Human & Financial	
1.1.6	Establish strategy and protocols for consulting on the development and implementation of the Policy and Plan	MoEWRD/BWA/ CZMU/CEHI/IW CAM		Human & Financial	

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1.2	**Develop and implement mechanisms for mobilizing and securing financial and technical resources for the development and implementation of the IWRM policy and plan for Barbados**	**MoEWRD/BWA**	**3 month**	**MoH/BWA/CZMU/CEHI/IWCAM**	**GoB and/or Donors are willing to fund the development and implementation the IWRM Policy and Plan**
1.3	**Assess the context for the IWRM Policy and Plan**	**NIC**	**3months**	**NIC representatives**	**Willingness to improved the management of water resource using a holistic approach**
1.3.1	Undertake a comprehensive review of Barbados' regional and international obligations for water resources management			MoH/BWA/CZMU/CEHI/IWCAM Consultant	
1.3.2	Review existing national and sectoral policies and plans with a view to harmonization with respect to IWRM			NIC Consultant	
1.3.3	Identify key issues that are of public or political interest and other related initiatives			NIC Consultant	

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1.3.4	Determine levels of political support for developing and implementing a national policy and plan			NIC Consultant	
1.3.5	Identify national level stakeholders who are likely to be involved			NIC Consultant	
1.3.6	Identify available resources			NIC Consultant	
1.4	**Develop a Stakeholder Involvement Plan (including the private sector and population at large) for the development and implementation of the IWRM policy and plan**	**NCC**	**3 month**	**NIC Consultant**	
1.4.1	Identify partners within government whose mandates are directly related to the issues of WRM			NIC Consultant	
1.4.2	Identify stakeholders outside government			NIC Consultant	
1.4.3	Conduct a stakeholder analysis	MoEWRD/BWA/ CZMU/CEHI/IW CAM		Human/Financi al	
1.4.4	Summarize Stakeholder Involvement Plan			NIC/CEHI Consultant	

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1.5	**Develop and Implement a Communications Plan for the development and implementation of the IWRM Policy and Plan**	**MoEWRD/BWA/CZMU/CEHI/IWCAM**	**On-going throughout the development and implementation of the policy and plan**	NIC IWCAM	
1.5.1	Determine the communication objectives				
1.5.2	Create a communications map				
1.5.3	Prioritize communications stakeholders				
1.5.4	Develop appropriate communications strategies, messages and materials				
1.5.5	Implement communications strategies				
1.5.6	Develop Communications monitoring indicators				
1.5.7	Conduct on-going assessment of the Communications Plan, including revision				
1.6	**Develop draft policy IWRM**	**NIC**	**3 months**	**MoA/NIC Consultant**	**Stakeholders are willing to assist in the development of the National IWRM Policy**
1.6.1	Develop a framework for the development process for both the Policy and Plan				

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1.6.2	Conducting a Situation Analysis	CEHI/MoEWRD/ BWA/CZMU			
1.6.3	Identify Problems and establish priorities to be address in the policy and plan				
1.6.4	Set management goals, and objectives for the Policy and plan				
1.6.5	Develop a mechanism for ensuring participation and reaching consensus in the development and implementation of the Policy and Plan				
1.6.6	Document the draft policy				
1.6.7	Conduct stakeholder consultation for review and modification of draft policy	BWA/CZMU NIC			
1.6.8	Develop and implement a programme for adopting and implementing the Policy at the national level including political commitment				
1.6.9	Develop and implement a monitoring and evaluation programme for implementing the national policy		On-going throughout the development and implementation of the Policy		

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1.7	**Develop National IWRM Plan based on the National IWRM Policy**	**NIC**	**6 months**	**NIC and other key stakeholders Consultant**	**Stakeholders are willing to assist in the development of the National Plan for IWRM**
1.7.1	Identify and evaluate activities that would give effect to the National Policy on IWRM				
1.7.2	Set targets and indicators for identified activities in the National IWRM Plan				
1.7.3	Developing an Implementation Strategy for the National Plan • Develop a time-line • Define resource requirements • Select milestones • Allocate responsibilities				
1.7.4	Document the National Plan				
1.7.5	Develop and implement a monitoring and evaluation programme for developing the national plan		On-going throughout the development of the Plan		

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1.7.6	Develop and implement a programme for adopting and implementing the Plan at the national level including political commitment				

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Result #2: Legal and regulatory framework for IWRM developed and enforced					
Indicators					
No	**Objectively Verifiable Indicators (OVI)**			**Means of Verification (MOV)**	
1	Legal and regulatory instruments for IWRM in Grenada developed and executed			Available laws	
2	Supporting consultative process conducted			Reports	
3	Cross-sectoral management of water resources			Reports	
	Activities	**Responsibility**	**Time Period**	**Resources**	**Assumptions**
2.1	**Develop the legislative and regulatory framework to give effect to the National IWRM Policy and plan**	**BWA/NIC**	**18 months**	**NIC/ Consultants/Legal Draftsman**	**There is a political will to harmonized the legislative framework**
2.1.1	Review with a view of harmonizing the existing legislation and regulation within the framework of IWRM management policy (This would include the international and regional obligations)	BWA	4 months	Consultant	
2.1.2	Document the draft legislative and regulatory framework		2 moths	Consultants	
2.1.3	Conduct stakeholder consultations on the draft legal and regulatory framework with a view to implementation		3 months	Consultants	
2.1.4	Develop and implement a programme for		6 months	NIC/Consultants	

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	promoting the revised legal and regulatory framework with a view towards implementation and gaining political will and support				
2.1.5	Revise, amend and draft where necessary legislation and regulations to give effect to the IWRM policy within the context of the revised legislative and regulatory framework		18 months	Consultants/Legal Draftsman	
2.1.6	Develop and implement a programme to support the enactment of the revised legislation and regulations for IWRM		9 months	NIC/consultants	

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2.2	**Develop and implement a programme for the effective and efficient enforcement of the revised legislation and regulation for IWRM**	**BWA/CZMU/NIC**	**2 yrs**	**NIC**	**Resources are made available for the effective enforcement of the revised legislation and regulations for IWRM**
2.2.1	Evaluate the environment for enforcing the legislation and regulations for IWRM		1 month	NIC Consultants	
2.2.2	Develop a programme for building capacity for enforcement of the legal framework for IWRM		2 weeks	Consultants	
2.2.3	Develop a programme for mobilizing and securing resources for building capacity for enforcing the legislative and regulatory framework for IWRM		On-going	NIC	
2.2.4	Implement the programme for building capacity for enforcement of the legal framework for IWRM		On-going	NIC/consultants	
2.2.5	Develop and implement a programme for monitoring and evaluating the enforcement of the legislation and		On-going	NIC	

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	regulations for IWRM				

Result #3: Institutional and Administrative Framework for IWRM established					
Indicators					
No	**Objectively Verifiable Indicators (OVI)**			**Means of Verification (MOV)**	
1	Water Resource Agency (WRA) Institution developed and functional			Reports	
2	Joint IWRM programming by stakeholder agencies			Implementation programme status reports	
3	Annual report by institution			Review of annual WRA reports	
	Activities	**Responsibility**	**Time Period**	**Resources**	**Assumptions**
3.1	**Establish Water Resources Agency**	**MoA/BWA/NIC**	**12 months**		**Directed by legislation**
3.1.1	Recruit Director	MoA/NIC	6 months		Funds available
3.1.2	Recruit technical and support staff	Director/NIC	6 months		Funds budgeted
3.2	**Develop and implement mechanisms for coordination, cooperation and collaboration among key stakeholders responsible to achieve IWRM at the national level**	**WRA/MoA/NIC**	**6 months**	**NCC**	**1. Key stakeholders are willing to participate 2. A National Policy and Plan for IWRM developed and is been implemented**
3.2.1	Develop and implement a programme for continued sensitizing of key stakeholders to the need for the integrated approach and their involvement in IWRM		6 months	NIC/Consultants	
3.2.2	Review the various options/approaches		2 months	NIC/Consultants	

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	for coordination, cooperation and collaboration among key stakeholders responsible for IWRM (internationally, regionally and locally)				
3.2.3	Document guidelines and protocols for coordination, cooperation and collaboration among key stakeholders responsible for IWRM		2 months	NIC/Consultants	
3.2.4	Promote the guidelines and protocols coordination, cooperation and collaboration among key stakeholders responsible for IWRM		2 months	NIC/Consultants	
3.2.5	Develop and implement a programme for monitoring and evaluating coordination, cooperation and collaboration among key stakeholders		On-going	NIC	
3.2	**Develop Contingency Plans for Water Related Disaster Management**	**WRA/NIC/CERO**	**1 yr**	**CERO/Consultant NIC**	
3.2.1	Conduct National, sectoral and community stakeholder		6 months	Consultant BWA/NIC	

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	consultations with a view to developing contingency plan for flooding and water sector utility with respect to disaster management				
3.2.2	Develop the framework, guidelines and elements of the contingency plans for disaster related to water			CERO/Consultant	
3.2.3	Mobilize and secure resources for the implementation of the contingency plans for water sector disaster management			NIC/BWA	
3.2.4	Build capacity among key stakeholders for implementing the contingency plans for water sector disaster management and floods			Consultant	
3.2.5	Develop and implement a programme for monitoring and evaluating the implementation of the water sector and floods disaster management		On-going	NIC	

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3.3	**Develop and implement a comprehensive, integrated information system for WRM to support the work of the WRA, key stakeholders, researches**	**WRA/NIC**	**12 months**	**Consultant**	**Key Stakeholders are committed to providing access to their information on water resources to other users**
3.4.1	Conduct an Information and Information Systems Assessment and Audit for water resources in Grenada		3 months	Consultant	
3.4.2	Conduct Stakeholder Consultation on the Finding of Information and Information Systems Assessment and Audit for water resources		1 monthk	WRA/NIC/Consultant	
3.4.3	Conduct Systems Analysis and Design for a comprehensive, integrated information system for water resources to support the work of the WRA, key stakeholders and other researches		3 months	Consultant	
3.4.4	Develop the Information system based on design specifications		3 months	Consultant	
3.4.5	Conduct User Training for the System		1 month	Consultant	
3.4.6	Commission the System			WRA/MoA/Consultants	

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3.4.7	Conduct Post-implementation Audits of the System		6 months (after commission of the system)	Consultant	
3.5	**Develop and implement monitoring programmes for ambient, recreational and potable water supplies to determine impacts on human health and the environment**	**WRA/MoE/BWA/CZMU/EPD**	**On-going**	**WRA/MoE/BWA/CZMU/EPD**	
3.5.1	Design the monitoring programme for impacts on Human Health		1 month	WRA/MoH/EPD/BWA/CZMU	
3.5.2	Design the monitoring programme for impacts on the environment		2 months	WRA/MoH/EPD/BWA/CZMU	
3.5.3	Mobilize and secure resources for implementation of the monitoring programmes			WRA/NIC	
3.5.4	Train key stakeholders to conduct the monitoring			Consultants	
3.5.5	Implement the Monitoring Programme		On-going During the first year	WRA/MoA/MoH NAWASA	

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9.0 Conclusions

Implementing IWRM at the national level is an essential ingredient and prerequisite and sustainable development. Barbados has made great strides in developing its people and economy and is poised to achieve developed nation status, the first Caribbean country to do so. It thus has a responsibility to itself as a nation and to other SIDS to provide an example for good water management. The Barbados Water Authority and the Coastal Zone Management Unit are providing the node, nucleus, leadership and championship for the process. This is advantageous in that both have responsibility for a wide range of cross-cutting issues which include *inter alia*: planning and development, water resources, watersheds, land management, pollution control, public awareness, water supply and sanitation.

Notwithstanding the existing interest in the development of the IWRM policy and plan for Barbados challenges are evident principal among which are dispersed responsibilities among a number of governmental departments and agencies for various aspects of water resource management with no formal means of collaboration. The absence of data and limited research on water resources were evident are both evident and acknowledged as being serious constraints as well as the need for awareness among decision makers and the general public on IWRM. It is also clear that water tough scarce is an under-valued national asset. However, Barbados is fortunate in that it has a body or professional expertise and willingness at a technical level to engage in IWRM. This must though be matched by a similar commitment at a policy and political level. Additionally, some capacity exists among the private and public sectors in IWRM which can be tapped on to expedite the planning process and provide significant input to guide the policy and plan so as to ensure appropriateness to Barbados.

In order to make progress much more will have to be done to secure political support and a commitment from the political and decision-making cadre for instituting the necessary changes to the institutional framework of the water sector. The first step will have to be to engage with politicians, ministers and the Cabinet in order to their support. As a consequence it is probably desirable to set a number of limited goals as a first step towards the realisation of an IWRM Plan. Perhaps the most urgent requirement is twofold: first to build capacity to undertake the management of water resources – as opposed to the operation and maintenance of service provision and secondly but inter-related to gain a better understanding of the current state of water resources through the realisation of the capability for data collection, monitoring and assessment. At the same time there is a growing need to establish a mechanism for cross-sectoral co-ordination as a complement to the better management of water resources. Although it is very desirable that the utility provider, BWA should be placed on a sounder financial footing and at the same time better regulated and made more accountable it has to be recognised that this goal is somewhere in the future and should perhaps be viewed as the next phase of IWRM. For Barbados

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Finally, this assessment has recognised the need to make the transition from a sectoral and service oriented responsibility for water and to develop a collaborating agency with a mandate to implement and execute IWRM as guided by a national water policy and plan. This will involve the synthesis of the institutional and administrative framework, based on existing models with demonstrated track record of success based on the socio-political, economic and cultural climate, supported by the legislative instruments. Raising awareness and education in IWRM at all levels will be important ranging from the high level decision makers to the general public. Building capacity within a water resources agency and among all collaborating agencies and departments that have an input in water resources management is also of utmost importance to enhance sustainability and functionality.

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Appendices

Annex 1: Information Template for Developing IWRM Roadmaps and Plans in Caribbean SIDS

Annex 2: Survey Questionnaire

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Annex 1: Information Template for Developing IWRM Roadmaps and Plans in Caribbean SIDS

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Section A

1 Key Terms in Integrated Water Resources Management

2 Guidelines for Completing the Information Template

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Section B

Reporting Country:

Completed By:

Date Completed:

1 PROCESSES AND MILESTONES LEADING TOWARDS IWRM

A. NATIONAL WATER RESOURCES MANAGEMENT VISION					
What is the National Water Resources Management Vision for your Country?	**There isn't an official Vision.**				
What level of support is there for the Vision at:	**Very High**	**High**	**Medium**	**Little**	**None**
➢ **Political**					
➢ **High Level Policy/Decision making**					
➢ **Technical**					
➢ **Key Stakeholders**					
➢ **General Population**					
What level of awareness is there for the Vision at following Levels:	**Very High**	**High**	**Medium**	**Little**	**None**
➢ **Political**					
➢ **High Level Policy/Decision making**					
➢ **Technical**					
➢ **Key Stakeholders**					
➢ **General Population**					

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B. AWARENESS ON IWRM				
What is the level of awareness on the Philosophy, concepts, principles and practices of IWRM for the following groups: (Please use a rating of 0 = none; 1 = to a little degree; 2 = to a reasonable degree; 3 = fully)				
Stakeholders **See main body of the report**	**(Check (✓) the rating that best applies)**			
	0	**1**	**2**	**3**
➢ National level politicians				
➢ Local level politicians				
➢ High level policy/Decision Makers (National Level)				
➢ Decision makers in agencies responsible for water resources management				
➢ Decision makers in agencies within the water use and water related sectors				
➢ Professionals in agencies responsible for water resources management				
➢ Professionals in agencies within the water use and water related sectors				
➢ Major Water Users (Industry, Agriculture, Tourism etc)				
➢ NGOs in the water sector				
➢ CBOs in the water sector				
➢ Local/community level decision makers				
➢ Water sector consultants				

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C. IWRM PLAN			
Is there a National Water Plan? (Check (✓) the appropriate one)			
	✓		
Existing		Date of Approval:	Title:
Being Developed		Est. Completion Date:	
To be developed in the near future		Est. Start Date:	Expected Period for Preparation
No decision on its development	✓		

If Plan Exists			
Who were the main stakeholders involved in it preparation?			
Who has responsibility for coordinating its implementation?			
Who has responsibility for M&E?			
	Yes	**No**	**Comment**
Is there a portfolio of projects to implement the Plan?			
Is there a programme for capacity building?			
Is there a strategy for sustainable financing of the Plan?			

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D. NATIONAL PROGRAMMES AND PROJECTS							
Are there Programmes and Projects that may impact on IWRM?							
Name of Programme/ Project	**Focus of Programme/ Project**	**Area of focus on IWRM**	**Harmonized with Water Policy/Plan**		**Agencies Responsible for Implementation**	**Funding Source**	**Comments**
			Yes	**No**			
Existing Programme/ Project							
Being Developed/ Contemplated							

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E. OTHER NATIONAL PLANS THAT ARE LIKELY TO CONTRIBUTE TO IWRM						
Are there other Plans that may impact on IWRM? See Main Report						
Name of Plan	**Focus of Plan**	**Area of focus on IWRM**	**Harmonized with Water Policy/Plan**		**Agencies Responsible for Implementation**	**Comments**
			Yes	**No**		
Existing Plan						
Being Developed						
Being Contemplated						

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F. CONTEXT FOR IWRM PLANNING	
• What mechanisms are in place for interaction with stakeholders at the national level?	Stakeholder consultations are on a project basis
• What mechanisms are in place for interaction with stakeholders at the local/community level?	
• How have other National Plans been established?	On a specific Plan basis by invitation
• What are the decision-making arrangements for strategies and plans within different ministries?	
• Who will need to endorse an IWRM Plan? •	Ministers of Health and of Environment
• Which government ministry and/or designated agency will have the central role to play in the development of the IWRM Plan	Ministry of Health
• What are the levels of support for the IWRM Philosophy at the political level?	Low
• What are the levels of support for the IWRM Philosophy at the policy/technical levels?	High
• What are the levels of support for the IWRM Philosophy at the general population level?	Low
• What is the level of political will in ratifying and implementing regional or international obligations related to water resources management?	High
• What are the key issues or concerns related to Water Resources management?	See main Report
• Is there political support to develop a holistic IWRM Plan, or is it necessary to focus on one or two key topics?	Focus on 1 -2 key topics
• Are there interested parties in government to develop an IWRM Plan?	Yes, BWA, EPD & CZMU
• What are the likely resources available to develop an IWRM Plan?	Resources are limited
• Which areas of action will be able to attract sustainable forms of financing?	Infrastructure investment

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G. CHALLENGES AND CONSTRAINTS TO IWRM – See Main Report				
Challenges/Constraints **(Rate the following challenges/constraints using the following:** **0 = Not relevant; 1 = Not Severe; 2 = Severe; 3 = Very Severe)**	**Rating (Check (✓) the rating that best applies)**			
	0	**1**	**2**	**3**
Lack of Good Water Governance				
Fragmented Approach to IWRM:				
➢ Multiple institutions, each with their own piece of legislation and Mandate, none of which is broad and deep enough				
➢ Assign responsibilities for planning; management and operations affecting quantity to units separate from those responsible for quality management				
➢ Poorly defined responsibilities for departments/section				
➢ Overlap of responsibilities, resulting in duplication				
➢ Cost trade-off between the pollution control and water supply treatment in the same watershed is not evaluated, thus the national investment policies and programmes do not reflect the interrelationships between quality and quantity.				
Lack of effective integration and coordination hampered by:				
➢ The absence of sound and comprehensive national policies on water resources				
➢ The multiplicity of institutions that deal with the management of the resources				
➢ The multiplicity of laws, each dealing with separate aspects of the management of the resources, thus encouraging compartmentalization				
➢ Institutionally divided approach to dealing with environment and development				
➢ Poor management of the dynamics of water supply and demand.				
➢ Inadequate legal and regulatory frameworks for managing the resources.				
➢ The absence of a credible framework for involving civil society in the management process				
➢ The lack of a proper understanding and awareness of the principles of sustainable development and an appreciation of the inseparable linkages between environmental, social and economic issues.				
➢ Institutional arrangements for integrated water resources management are weak/ non-existent.				

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Lack/inadequate institutional resources				
➢ Lack/inadequate human resources				
➢ Inadequate of equipment				
➢ Inadequate financing				
➢ Weak technical capabilities/lack of a critical mass for water resources management				
➢ Inadequate Research and Technology				
➢ Inadequate Data and Information Management Infrastructure				
Conflict between water supply and demand				
Poor land use planning and soil management in watersheds				
Poor pollution prevention and control				
Limited/poor Stakeholder Participation				
Limited/little Public Awareness and Education				
Lack of Promote the economic, social and ecological values of water				
Impact of Climate Change and Sea level Rise				

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2 WATER POLICY

A. POLICY ENVIRONMENT			
Is there a National Water Policy? (Check (✓) the appropriate one)			
	✓		
Existing		Date of Publication:	Title:
Being Developed		Est. Completion Date:	
To be developed in the near future		Est. Start Date:	Expected Period for Preparation:
No decision on its development	✓		

B. POLICY COVERAGE		
Area of Coverage (Check all that are relevant)	✓	**Comment**
Water Resources Management		
Water Supply and other Uses		
Promotes the principles of IWRM		
Defines IWRM		**Please state the definition:**
Identifies roles for the Private Sector and Civil Society (NGO, CBO, others)		**Please outline these roles:**
Promotes the Polluter pays principle		
Promotes the user pays principle		

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C. OTHER POLICIES IMPACTING ON IWRM – See Main Report					
Are there other policies that may impact on IWRM?					
Name of Policy	**Area of Focus of Policy**	**Area(s) of focus on IWRM**	**Harmonized with Water Policy**		**Comments**
			Yes	**No**	
Existing Policy					
Being Developed					
Being Contemplated					

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3 NATIONAL WATER LEGISLATION

A. WATER LEGISLATION			
Is there one or more specific Water Laws/Water Code? (Check (✓) the appropriate one)			
	✓		
Existing		Date of Publication:	Title:
Being Developed		Est. Completion Date:	
To be developed in the near future		Est. Start Date:	Expected Period for Preparation:
No decision on its development	✓		

B. COVERAGE OF EXISTING OR PROPOSED WATER LAWS		
For Existing or Proposed Water Laws give the Areas of Coverage (Check (✓) all that are relevant)	✓	**Comment**
Public Hearings		
Stakeholders Participation in IWRM		
Principle of Subsidiarity (Management at the lowest appropriate level)		
Separation been resources management and water service provision		
Participation of Women and other Vulnerable Groups in IWRM		
Private Sector and Civil Society (NGO, CBO, others) participation in IWRM		Please outline how they are expected to participate:
Promotes the Polluter pays principle		
Promotes the user pays principle		
Water Use Efficiency		

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C. REGULATIONS SUPPORTING THE EXISTING WATER LAWS – See Main Report					
Title of Regulations	**Focus of the Regulations**	**Are these Effective? Check (✓) the response that best applies**			**Comment**
		Yes	**No**	**Some What**	
For those Regulations that are not or some what effective, check (✓) one or more of the following reasons					

Reasons	**(✓)**	**Comment**
Regulations insufficiently known by users		
Regulations insufficiently known by the enforcers		
Too complicated to be operational		
Regulations contradict each other		
Sanctions not applied in cases of non-compliance	✓	
Sanctions are inadequate	✓	
Enforcement capacity inadequate	✓	
Monitoring capacity inadequate	✓	
Regulations conflict with traditional, social and cultural norms and values		
Regulations conflict with other laws		
Other:		

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D. OTHER LEGISLATION IMPACTING ON IWRM – See Main Report						
Are there other Legislation that may impact on IWRM?						
Name of Legislation: (Title, No. and Year)	**Focus of Legislation**	**Area of focus on IWRM**	**Harmonized with Water Laws**		**Agencies Responsible for Implementation**	**Comments on effectiveness of the Monitoring, enforcement and resource allocation**
			Yes	**No**		
Existing Legislation						
Being Developed/ Contemplated						

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4. INSTITUTIONAL FRAMEWORK FOR THE WATER SECTOR

A. REGIONAL AND INTERNATIONAL ENVIRONMENT	
What are the driving forces for action at the international level?	The Cartagena Protocol on Land Based Sources of Pollution
What are the driving forces for action at the regional level?	The need to ensure adequate long term water supply. Climate change

C. INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK		
Which Institution has lead responsibility for IWRM?		
Name of Institution	Mandate	Key Responsibilities for IWRM
BWA	Water Resources, supply & sanitation	
Which other Institutions have some responsibilities for IWRM?		
Name of Institution	Mandate	Key Responsibilities for IWRM
CZMU	Pollution control	
EPD	Pollution control	

C. INTER-SECTORAL COORDINATION					
Are there any inter-ministerial commissions, committees or coordinating mechanisms among the institutions involved in IWRM?					
Name of Committee	Secretariat	Mandate	Composition of Committee	Frequency of Meetings	Comments

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Are there any inter-ministerial commissions, committees or coordinating mechanisms among the institutions whose work may impact on IWRM?					
Name of Committee	**Secretariat**	**Mandate**	**IWRM Representation**	**Area of Focus on IWRM**	**Frequency of Meetings**

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D. CAPACITY FOR WATER RESOURCES MANAGEMENT – See Main Report								
(Please rate using the following 0 = no capacity; 1 = little capacity, needs to be built; 2 = some gaps but is workable; 3 = capacity fully exist)	**Public Sector (Check (✓) the rating that best applies)**				**Private Sector (Check (✓) the rating that best applies)**			
Policy Formulation								
Drafting of laws & regulation								
Preparation of WR Assessments								
Preparation of EAs								
Preparation of Socio-economic Assessments								
Monitoring of Water Quality								
Monitoring of Water Availability								
Monitoring of aquatic ecosystems								
Monitoring of Pollution loads								
Monitoring of Water Use								
Resource Use planning, protection and conservation								
Water Demand Management								
Water Allocation								
Conflict mediation								
Information generation, collection, analysis								
Laboratories for testing								
Measuring impacts								
International Negotiations								

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E. TECHNICAL ASSISTANCE FOR IWRM			
Are there any on-going technical assistance programmes/projects that relate to IWRM?			
Name of Programme	**IWRM Focus of the Programme**	**Financing (Amount and Source)**	**Duration**

F. TRAINING		
Are there any on-going Training Programmes that are related directly to IWRM?		
Name of Programme	**IWRM Focus of the Programme**	**Duration**
Secondary Level		
Technical		
Tertiary		
Post-Graduate		

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G. STAKEHOLDERS SCREENING – See Main Report

The following questions must be borne in mind when completing the Stakeholders' Matrix:

- Who are the main stakeholders that would need to be involved in development and implementation of an IWRM plan?
- What are the benefits of stakeholder involvement?
- What are the possible implications of *not* involving stakeholders?
- Which partners within government have the potential to become involved in the IWRM plan process?
- Who has a mandate that is directly related to issues that are likely to be addressed in the IWRM plan?
- Are there partners for whom the relationship is not immediately obvious? **For example**, officials from a Ministry of Finance may have no direct mandate relating to water resources management, but may make decisions that have profound implications for the success of an IWRM plan such as budget allocation and taxes.
- Who might be affected by the IWRM plan?
- What are their interests and positions?
- Who has information and expertise that might be helpful?
- Who has been/is involved in similar initiatives or planning?
- Who has expressed interest in being involved in similar initiatives/efforts before?
- Who else might be interested in preparing the IWRM plan?
- Are there stakeholders who might want to be fully involved, but for some reason can't be involved to the extent that they would like to be? What are those reasons?

You should classify the stakeholders according to the four groups below (1 – 4) and enter this in the Matrix under Category

5. Those who will likely want to participate fully or whose active involvement will determine the credibility of the process;
    - *Those that should serve on the coordinating committee*
    - *Those that should be involved in the planning and development processes*
    - *Those that should be involved in the implementation process*
    - *Those that should be involved in the monitoring and evaluation processes*
6. Those who would likely play a more limited role;
7. Those who would wish simply to be kept well informed;
4. Those who would not want to be involved

For each stakeholder, enter one of the following rating under Priority/Influence:
HH – High Priority/High Influence
HL – High Priority/Low Influence
LH – Low Priority/High Influence
LL – Low Priority/Low Influence

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Stakeholder	Interests	Likely impact of the IWRM Plan	Priority – Influence (HH, HL, LH, LL)	Category (1-4)	Capacities	Potential roles in the IWRM Plan

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5 RESOURCE ANALYSIS

A. WATER RESOURCES – See Main Report				
Source – Present Situation				
Source	**Availability**	**Production**	**Consumption**	**Comment**
Surface				
Groundwater				
Desalination				
RW				
Wastewater Recycled				
Other Supply Augmentation				
Source – Projected (15 years)				
Source	**Availability**	**Production**	**Consumption**	**Comment**
Surface				
Groundwater				
Desalination				
RW				
Wastewater Recycled				
Other Supply Augmentation				

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Consumption – Present Situation					
Source	**Domestic**	**Industrial**	**Agriculture**	**Tourism**	**Environmental Services**
Surface					
Groundwater					
Desalination					
RW					
Wastewater Recycled					
Other Supply Augmentation					
Consumption – Projected 15 years					
Source	**Domestic**	**Industrial**	**Agriculture**	**Tourism**	**Environmental Services**
Surface					
Groundwater					
Desalination					
RW					
Wastewater Recycled					
Other Supply Augmentation					

B. WATER OWNERSHIP			
	Yes	**No**	**Comment**
Water is a common good			
Water is the Property of the State	✓		
Water is a private property			
Ownership can be variable	✓		
Others			

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C. WATERSHED/CATCHMENT										
Name of Watershed	Area	Shared?		Availability	Production	Main Activities in Watershed	Management Arrangement			
		Yes	No				Public	Private	CBO/ NGO	Co-Managed

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B. NATIONAL STATUS OF REGIONAL & INTERNATIONAL AGREEMENTS, CONVENTIONS, OBLIGATIONS AND INITIATIVES FOR IWRM										
Initiative	**Date Signed**	**Date Ratified**	**Plans for Implementation**		**Implementing Agency**	**IWRM Area of Focus (Both in the Initiatives and the Plan)**	**Harmonized within Legal Framework**			**Comments including progress towards implementation**
			Yes	**No**			**Yes**	**No**	**Partly**	

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Annex 2: Survey Questionnaire

Barbados and Integrated Water Resources Management

A Road Map

The United Nations Environment Programme and its national and international development partners are providing support to developing countries in attainment of their commitment under the Johannesburg Plan of Implementation to develop Integrated Water Resources Management (IWRM) and Efficiency Plans. Integrated water resources management is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives. To this effect support is being provided to develop an IWRM **Road Map.**
A 'Road Map' should set out how to move from a Vision of what the Integrated Water Resources Management of Barbados should be to a point where there is a Plan for the implementation of that Vision. In order to do this it is necessary to understand what the problems and deficiencies in the present position are as well as what improvements need to be made. As there can be different perceptions it is important to gather as many points of views from stakeholders as possible.

Your help is therefore requested in identifying the important water issues in Barbados through providing answers to the following questions.

All replies are treated in the strictest confidence but it would help to have some indication of the profile of the person completing the questionnaire.

Which of the following areas do you work in:
Government ☐ Private Sector ☐ Civil Society/Community ☐
International ☐

Number of years relevant experience:_____
Area of work or responsibility:_____

If you have no objections please give your name and email address as we might like to follow up certain aspects with you.
Name _____
Tel: _____
Email _____

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Questions

1 Is there a need to review the current roles and responsibilities for water management and if so why?

2 What in your opinion are the five most important issues with respect to water in Barbados?

3 What changes, if any would you like to see being made to the following:

a) water legislation

b) economic regulation of water

c) environmental regulation of water

d) water supply

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e) sewerage and sanitation

f) water pollution control

g) water allocation mechanisms

h) financing of water infrastructure

i) cost recovery mechanisms

j) the management of water resources

k) land management

l) institutional arrangements

4 Is water seen as a sectoral or a cross-sectoral issue and can you give examples of where it is incorporated into the policies of other sectors of the economy e.g. Tourism, Agriculture, etc.

5 How would you characterise the following between stakeholders in the water sector?

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	Very Good	Good	OK	Poor	Absent
Coordination of activities					
Information sharing					
Harmonisation of policies					
Joint working					

6 Please list who you think are the stakeholders in water management in Barbados

Government agencies and bodies	Civil Society & community groups	Non-governmental organisations	International agencies

7 In your opinion prioritise (1 being the highest priority) the following potential threats to water resources and indicate which agencies are or should be responsible for them.

Threat	Priority	Responsibility
Groundwater pollution		
Poor land management & development control		
Over-abstraction of water		
Soil erosion		
Impact of climate change		
Flooding		
Drought		
Habitat loss and ecosystem deterioration		

8 What mechanisms are in place for interaction between stakeholders at the national level?

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9 What mechanisms are in place for public participation in water matters at local and community level?

10 Which Government Departments and Agencies have a central role in water management?

11 How aware do you think the general public is of water matters?

12 Do you think that water is on the political agenda in Barbados?

13 Governance is an essential part of the management of any sector, how would you assess the present governance of the water sector in Barbados.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
There are multiple institutions that deal with water matters, each with their own legislation, none of which is broad or deep enough.					
There are poorly defined responsibilities for Departments and institutions that deal with water matters.					
There are no overlapping and conflicting responsibilities for water related matters.					
There is little co-ordination between pollution control and water services provision.					

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There is little co-ordination between those bodies responsible for water quality management and pollution control and those responsible for planning, management and operation of water services.					

14 Integration and coordination of functions and responsibilities are important to how well water resources are managed and able to respond to future needs. Please indicate how strongly you agree or disagree with the following.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
There are no comprehensive national policies on water resources management					
There is a multiplicity of organisations that deal with the management of water resources.					
There is a multiplicity of laws each of them dealing with separate aspects of the management of the resource, thus encouraging compartmentalisation.					
The institutional coordination between environment and economic development is excellent.					
There is an absence of coordination of the competing needs of various sections of the economy on water resources.					
The dynamics of water supply and demand are poorly managed.					
The legal and regulatory frameworks for managing water matters are very good.					
There is an absence of credible frameworks for involving civil society in water management processes or decision-making.					
The institutional arrangements for integrated water resources management are weak/non-existent					
The provision of water infrastructure is					

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poorly financed.					
The mechanisms for the recovery of the cost of water services are inadequate.					
The land use planning is excellent.					
There is a lack of promotion of the social, economic and environmental values of water.					
Pollution prevention and control is poor.					

15 Often progress is hampered by a lack of resources. Indicate whether or not you agree with the following statements.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Human resources for proper water management are inadequate or lacking.					
There is inadequate equipment available.					
The financing water resources management is very good.					
The technical capabilities available for water resources management are inadequate.					
There is a good level of research and development carried out into water resources matters.					
The data and information collection, management and assessment infrastructure is inadequate.					

THANK YOU FOR YOUR ASSISTANCE

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