Training Manual

Supporting the Integration of Climate Resilience in the Water Supply Sector in the Caribbean

An initiative of the African, Caribbean and Pacific Group, funded by the European Union, and implemented by:

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The Training Manual was prepared by a team led by HR Wallingford Ltd. in association with JF Clarke Consulting Inc. The lead authors for the Training Manual were Dr Nigel Walmsley, George Woolhouse and Arianna Numi (HR Wallingford), Nicolas Grainger and Judi Clarke (JF Clarke Consulting Inc.), with support from Ms Shanta King (CBD).

Development of the Training Manual followed a consultative process which involved regional organisations and national representatives from across the CDB's Borrowing Member Countries. A first draft was presented at a Regional Workshop / Training of Trainers event held at the CDB Conference Centre, 13-15 June 2018, and this workshop provided valuable guidance and input to support the finalisation of the Training Manual.

We extend our warmest thanks to all those who provided input and support throughout this process. It has resulted in a final document of benefit of the Caribbean Region as a whole, and which can be tailored to individual country situations and contexts. We are also indebted to the case country partners who were actively engaged in piloting and refining the guidance, methods and processes set out in this Training Manual. In particular, this includes national stakeholder teams led by Mr Husbands (NAWASA) in Grenada and Ms Queeley (Ministry of Sustainable Development) in St. Kitts and Nevis.

Thanks also to Helen Stevenson (HR Wallingford) for coordinating the design and production of the publication.

Glossary of terms

Adaptation (to climate variability or change): Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities. An adaptation assessment combines elements of impact and vulnerability assessments by examining the potential impacts of climate change on systems together with the system's vulnerability or capacity to adapt to changing conditions or added stresses.

Adaptive capacity: Ability of a human or natural system to: adapt (i.e., to adjust to climate change including to climate variability and extremes), prevent or moderate potential damages, take advantage of opportunities or cope with the consequences. The adaptive capacity inherent in a human system represents the set of resources available for adaptation (information, technology, economic resources, institutions and so on) as well as the ability or capacity of that system to use the resources effectively in pursuit of adaptation.

Adaptation deficit: Failure to adapt adequately to existing climate risks largely accounts for the adaptation deficit. Controlling and eliminating this deficit in the course of development is a necessary but not sufficient step in the longer-term project of adapting to climate change. Development decisions that do not properly consider current climate risks add to the costs and increase the deficit. As climate change accelerates, the adaptation deficit has the potential to rise much higher unless a serious adaptation program is implemented.

Adaptation option or measure: This term is loosely defined as any discrete action or initiative which supports adaptation to current climate variability or future climate change. Adaptation options can enhance the resilience and / or reduce the vulnerability of systems to climate variability and change or enhance the capacity of the system to adapt to future climate change.

Climate: The characteristics of weather (temperature, precipitation and wind patterns) which occur annually or seasonally, usually averaged over a 30 year time period for planning purposes.

Climate change: This refers to a statistically significant change in either the mean state of the climate or in its variability persisting for an extended period (typically decades or longer).

Climate hazard: A climate hazard is a potentially damaging physical manifestation of climatic variability or change. Examples include: droughts, floods, storms, episodes of heavy rainfall, long-term changes in the mean values of climatic variables and potential future shifts in climatic regimes.

Climate resilient development: Development activities that will deliver benefits under all potential future climate scenarios and can cope with uncertainties over future conditions. It differs from business-as-usual development in actively considering and addressing potential existing and future climate risks.

Climate risk screening: A process of rapidly assessing existing and future climate risks relating to a system such as a proposed investment option. It can be used to identify risks and resilient options for prioritisation. CCORAL (Caribbean Climate Online Risk and Adaptation TooL) is an example of a risk screening tool.

Climate variability: The departure of climate from long-term average values or changing characteristics of extremes. For example, extended rainfall deficits which cause droughts or the prevalence of a greater than average rainfall depth occurring over a season.

Exposure (to climate hazards): The presence of people, livelihoods, environmental services and resources, infrastructure, economic, social or cultural assets in places that could be adversely affected.

Extensive risk: The widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity often of a highly localized nature which can lead to debilitating cumulative disaster impacts. Extensive risk is mainly a characteristic of rural areas and urban margins where communities are exposed to and vulnerable to recurring localised floods, landslides storms or drought. Extensive risk is often associated with poverty, urbanization and environmental degradation.

'Hard' and 'Soft' adaptation: 'Hard' adaptation measures usually imply the use of specific technologies and actions involving capital goods and engineering such as dikes, seawalls and reinforced infrastructure. 'Soft' adaptation measures focus on information, capacity building, policy and strategy development and institutional arrangements.

Impact (of climate hazard): The effect of climate variability or long-term change on the functioning of a system. For example, an intense rainfall event may negatively impact agriculture through crop damage. An impact assessment is the practice of identifying and evaluating in monetary and/or non-monetary terms, the effects of climate change on natural and human systems.

Integrated water resources management (IWRM): A process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

Likelihood (of a hazard occurring): A probabilistic estimate of the occurrence of a single event or of an outcome (for example, a climate parameter) or of an observed trend or projected change lying in a given range. Likelihood may be based on statistical or modelling analyses, elicitation of expert views or other quantitative analyses.

Mainstreaming climate resilience: Refers to the long-term adjustment of decision making processes to include climate resilience concerns. This results in a pervasive improvement of the resilience of strategies, programmes, budgets and individual investments.

Mitigation (of climate change): Refers to implementing policies to reduce greenhouse gas emissions and to enhance the capture and storage of greenhouse gasses.

No / low-regret investments: No-regrets investments will be unaffected by climate change and will deliver benefits under the full range of potential future climate change scenarios. Low-regrets investments are those which may be negatively impacted by climate change to some degree but will still deliver acceptable net benefits under the full range of potential future climate change scenarios.

Projection: A projection is a potential future evolution of a quantity or set of quantities often computed with the aid of a model. Projections are distinguished from predictions in order to emphasize that projections involve assumptions concerning for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.

Resilience: The ability of a social or ecological system to resist, absorb, accommodate and recover from the effects of a (climate) hazard in a timely and efficient manner while retaining the same basic structure and ways of functioning. It reflects the amount of change a system can undergo, the degree to which it can reorganise and the extent to which it can build capacity to learn and adapt.

Risk assessment: Risk is often defined as the combined probability and severity of an event occurring. For example, a highly likely severely hazardous event is considered high risk whereas a highly likely mild event (or unlikely but severe event) is considered medium or low risk. A risk assessment seeks to quantify the level of risk either quantitatively such as in monetary terms or qualitatively such as high, medium or low.

Scenario: A plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections but are often based on additional information from other sources which are sometimes combined with a narrative storyline.

Sensitivity: This is the degree to which a system is affected, either adversely or beneficially, by climate related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise). A sensitivity analysis typically involves gaining an understanding of how varying climate to different extents (e.g., a 20% increase in annual rainfall) affects human or biophysical systems (for example hydropower production).

Standardized Precipitation Index: a widely used index to characterize meteorological drought on a range of timescales.

Uncertainty: An expression of the degree to which a value (e.g. the future state of the climate system) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources from quantifiable errors in the data to ambiguously defined concepts or terminology or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures. For example, a range of values calculated by various models or by qualitative statements, reflecting the judgement of a team of experts.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Note that this is the definition used in the Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC, 2014) which harmonises the definition of vulnerability used by the disaster risk and climate change adaptation communities.

Water security: Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters and for preserving ecosystems in a climate of peace and political stability.

Water supply services: Water supply services refer to the provision of potable water to the general public by public utilities or commercial organisations. This is normally achieved through a collection and treatment of water from groundwater or surface water sources, storage, treatment and distribution using a system of pipes and pumps.

Abbreviations

AF	Adaptation Fund
APUA	Antigua Public Utilities Authority
BCA	Benefit Cost Analysis
CARICOM	Caribbean Community
CARIFORUM	Caribbean Forum
CARIWIG	Caribbean Weather Impacts Group
CARIWIN	Caribbean Water Initiative
CAWASA	Caribbean Water and Sewerage Association Inc.
CCCCC	Caribbean Community Climate Change Centre
CCORAL	Caribbean Climate Online Risk and Adaptation TooL
CCRIF	Caribbean Catastrophic Risk Insurance Facility
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDKN	Climate and Development Knowledge Network
CEDAW	Committee on the Elimination of Discrimination against Women
CEA	Cost Effectiveness Analysis
CEHI	Caribbean Environmental Health Institute now the Environmental Health Unit of the Caribbean Public Health Agency
CIMH	Caribbean Institute of Meteorology and Hydrology
CROSQ	CARICOM Regional Organization for Standards and Quality
EBP	Evidence Based Policymaking
EU-GCCA	European Union Global Climate Change Alliance
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GCM	General Circulation Model
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEF-CReW	Caribbean Regional Fund for Wastewater Management
GEF-IWCAM	Integrating Watershed and Coastal Areas Management in Caribbean Small Islands Developing States
GWOPA	Global Water Operators' Partnership Alliance
GWP-C	Global Water Partnership Caribbean
HAB	Harmful Algal Blooms
IDB	Inter-American Development Bank
IFIs	International Financial Institutions
IISD	International Institute for Sustainable Development
IP	Implementation Plan
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
M&E	Monitoring and Evaluation
MACC	Mainstreaming Adaptation to Climate Change
MCA	Multi Criteria Analysis
MDGs	Millennium Development Goals
NAP	National Adaptation Plans
NAWASA	National Water and Sewerage Authority (Grenada)
(I)NDC	(Intended) Nationally Determined Contributions
NGOs	Non-Governmental Organizations
OECS	Organisation of Eastern Caribbean States
PRECIS	Providing Regional Climates for Impacts Studies
RCM	Regional Climate Model
SCADA	Supervisory Control And Data Acquisition
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SMART	Specific, Measurable, Attainable, Relevant and Timely
SUPSI-IST	Institute of Earth Sciences, University of Applied Sciences of

	Southern Switzerland
SWOT	Strengths, Weakness, Opportunities and Threats
UKCIP	United Kingdom Climate Impacts Program
UKDFID	United Kingdom Department For International Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UN-Water	United Nations inter-agency coordination mechanism for all freshwater and sanitation related matters
USAID	United States Agency for International Development
WHO	World Health Organization

About the Training Manual

Aim and scope

Access to safe, reliable and resilient water supply services contributes significantly to the achievement of national development goals and agendas. Improving the resilience and robustness of water supply services will reduce operational risks associated with climate variability and change and increase the extent to which operational services are able to meet target levels of service.

This Training Manual is intended to support national-level processes in the Caribbean for the integration of climate resilience in the water supply services sector. A generic approach is presented that can be modified and adapted to meet individual country contexts and needs. To support this approach, the Training Manual includes Guidance Materials on good practice methodologies, tools and approaches that are widely applicable in the Caribbean context. Its use aims to internalise and institutionalise good practice.

Application of the Training Manual also aims to strengthen the capacity of national professionals and practitioners responsible for the establishment of robust and implementable climate resilient policies, investment plans and financing strategies.

Target users

The Training Manual is primarily designed for use by institutional agencies and focal points responsible for leading processes to improve the resilience of water supply services. At a minimum, this will include:

- Water Service Providers (utilities / departments);
- Water Management Departments / Agencies;
- Central Ministries (responsible for regulation, climate change, sustainable development, economic development and planning, and finance).

Outline content

The Training Manual contains Guidance Materials and resources that can be used as a basis for several training sessions on topics that are highly relevant for the integration of climate resilience. Nine sections are included in total (see p12 and p13) and each section includes the following resources:

Guidance Materials

- Technical notes.
- Examples from the Caribbean.
- Additional references and resources.

Case examples and other relevant materials

- Good practice case studies.
- Lessons learned from country applications.

Notes for the Trainer / Facilitator

- Notes and considerations.
- Exercises and discussion topics.
- PowerPoint slides.

Outline of the Training Manual and Guidance Materials

The objective of the Training Manual is to support practitioners in how to establish robust and implementable climate resilience water sector policies and investment plans. The Training Manual is structured around nine core sections (described below) that provide methodologies, tools and approaches for each step. In doing so, it guides users through the process of identifying and implementing climate resilience actions and investments. The Manual is presented in a format that can be tailored and adapted for use in different country contexts.

1 Climate resilience

- Define and familiarise with the concept of resilience and related concepts such as hazards, vulnerability, exposure, risks, recovery, and response;
- Understand links and interdependencies between water, climate resilience and gender;
- Understand the climate change projections for your country and the Caribbean;
- Frame climate resilience in the water supply sector: define attributes of climate resilience in water supply systems and define a vision for climate resilient services.

2 Framework for the integration of climate resilience in the water supply services sector

- Present a framework for integrating climate resilience in the water supply sector;
- Familiarise with the structure of the framework and its aims and objectives;
- Contextualise activities and processes within the framework.

3 Introducing WaterRISK: a water sector resilience assessment tool

- Understand relevance, benefits and structure of a self-assessment tool to support a roadmap to strengthen the integration of climate resilience in the water supply sector;
- Understand the inputs, outputs and methodology of the self-assessment tool;
- Learn how to best present the results of the tool and use them to monitor and review progress during the implementation of the roadmap.

4 Screening of legislation, policies, strategies and plans

- Describe the enabling environment for climate resilience in the water supply sector;
- Diagnose national capacity and gaps for the integration of climate resilience and gender-sensitive considerations;
- Set actions and priorities for mainstreaming climate resilience into legislation, policies, strategies and plans and identify key entry points in the national mainstream policy.

5 Climate Risk and Vulnerability Assessment (CRVA)

- > Engage key stakeholders in the water supply sector in the process and methodology of CRVA;
- > Understand the impacts and implications of climate change and climate variability on the water supply sector;
- > Understand current climate risks, and how these risks may change in the future.

6 Prioritising adaptation options for implementation

- > Identify adaptation actions to increase water supply sector resilience, on the basis of information and evidence provided by review of policy, legislation and institutions and assessments of climate risks and vulnerabilities;
- > Use prioritisation tools and analyses (e.g. Multi-Criteria Analysis), as well as expert elicitation and stakeholders consultation, to prioritise investments and adaptation options;
- > Identify potential barriers to implementation and means to manage or mitigate them.

7 Taking options forward for implementation

- > Understand how to better align investment options with national priorities;
- > Develop costings and implementation timeframes for prioritised investments and adaptation actions;
- > Identify entry points for implementation of the investment priorities;
- > Learn good practice for preparing funding proposals.

8 Identifying sources of finance to implement priority adaptation measures

- > Understand the main categories of cost to be financed in a programme of climate resilience for the water supply services sector;

- > Become more familiar with the main sources of funding from both “conventional” sources and specialist climate funds and facilities;
- > Appreciate the considerations involved in choosing financing sources and matching these to the investment priorities identified.

9 Monitoring and evaluation of implemented adaptation measures

- > Agree on monitoring actions and methods to evaluate outcomes and progress of the implemented adaptation (resilience-building) measures;

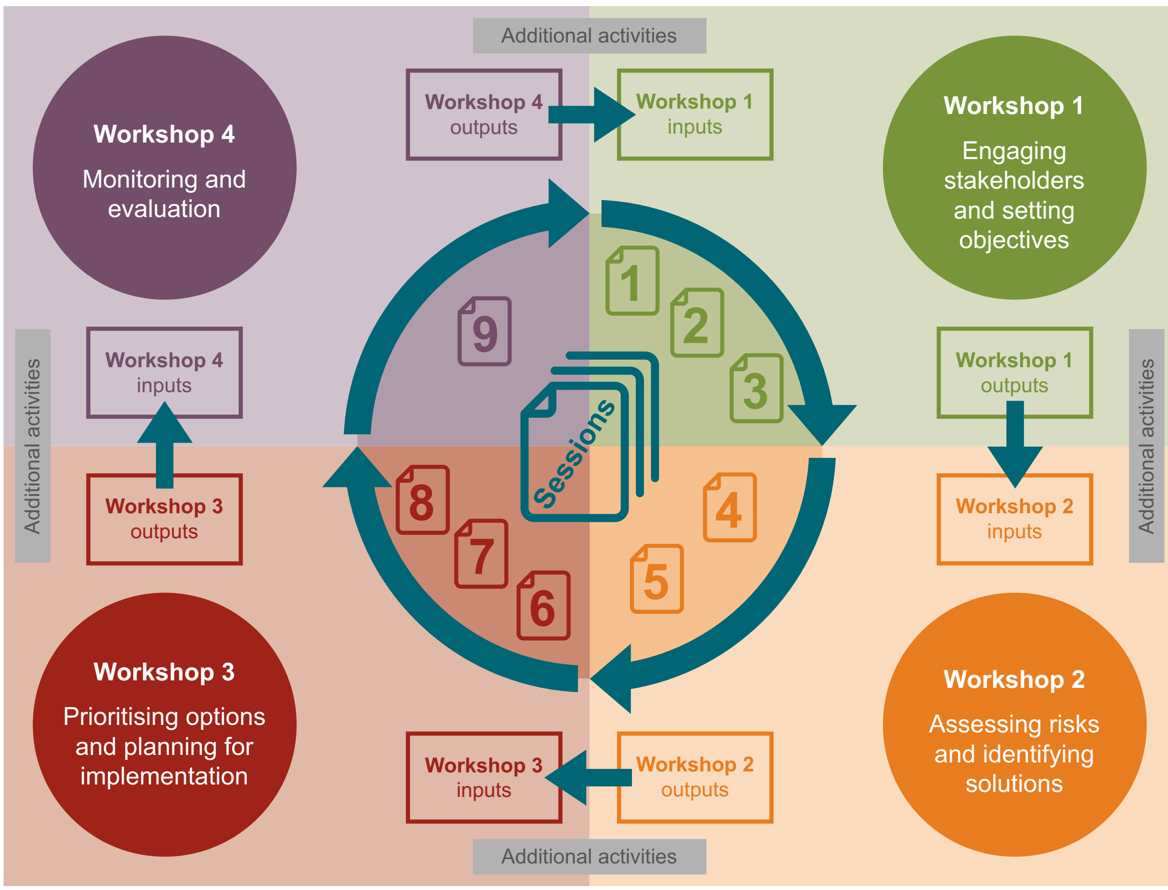
- > Define indicators to monitor progress towards resilience and outcomes of adaptation measures;
- > Understand how to reflect on lessons learned from each planning cycle and how to apply them to the next investment cycle.

Application and use

The Training Manual is anticipated to be used within a wider national process for the integration of climate resilience. Four stages of the process are anticipated (see figure below):

- Engaging stakeholders and setting objectives.
- Assessing risks and identifying options.
- Prioritising options and planning for implementation.
- Monitoring and evaluation (M&E).

The process is envisaged as a cyclical process with each stage having associated preparatory and follow-up activities. M&E would not only be aimed at tracking implementation but also at providing lessons learned for subsequent cycles.



A Workshop is anticipated during each stage with one or more of the training sessions delivered at these Workshops. The aim is to ensure national stakeholders become familiar with methodologies, tools and approaches and that these are then used to advance the overall national process towards climate resilience in the water supply sector. The training sessions help to create common understanding on good practice and are supportive of a collaborative approach for the co-development of action on climate resilience.

The materials in the Training Manual are designed to be readily adapted to reflect different national contexts and needs. To achieve this, it is advisable to use country-specific data and information, case studies, and lessons learned to ensure the training materials are grounded in local institutional contexts and realities.

Finally, the four stage national process is a suggested approach only. It can of course be modified and reshaped to meet country needs and capacity as appropriate. In doing so, the training sessions have been formulated so they can be applied as standalone sessions if required.

How the Training Manual was developed

The Training Manual was developed as part of the Planning for the 'Integration of Climate Resilience in the Water Sector in the Caribbean'[1] project. The main steps involved in developing the Training Manual were:

- Country case study applications undertaken in Grenada and St. Kitts and Nevis.
- Review of case study experiences and lessons learned for regional-wide approaches.
- Outline and draft content developed and shared with key focal points in each country.
- Regional engagement with countries and regional organisations to strengthen the content.
- Preparation of a draft Training Manual.
- Delivery at a Regional Workshop / Training of Trainers event.
- Collation of feedback from participants at the Regional Workshop / Training of Trainers event.
- Final package of Training Manual and Guidance Materials prepared.

The Training Manual was first presented and used during the Training of Trainers Event held in Barbados during 13-15 June 2018. 60 water sector practitioners from over 15 countries were trained in how to use and apply the Training Manual. This version has been updated and finalised based on the valuable comments and feedback received from participants at the event.

1 The Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean project included the development of this Manual and regional training of trainers workshop. In addition, the project provided Climate Risk and Vulnerability Assessments, reviews of policy and plans and investment plans for climate resilience in Grenada, St. Kitts and Nevis. It was part of the wider African Caribbean Pacific – European Union – Caribbean Development Bank Natural Disaster Risk Management (ACP-EU-CDB NDRM) in CARIFORUM Countries Project (July 2014). This was aimed at reducing vulnerability to long-term impacts of natural hazards, including potential impacts of climate change.

Section 1

Climate resilience

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Section 1: Climate resilience

Summary

This section introduces the concept of resilience and explains the meaning of related concepts such as hazards, exposure, risks and recovery. It frames the concept of climate resilience in the context of the water supply sector and of the Caribbean Region. It then explores links and interdependencies between water, climate and gender and the urgency to implement gender-sensitive climate resilient development measures in the region.

Objectives

At the end of this section, participants will be able to:

- Define and familiarise with the concept of resilience and related concepts such as hazards, exposure, risks and recovery;
- Frame climate resilience in the water supply sector: define attributes of climate resilience in water supply systems and set a climate resilient vision to achieve;
- Understand links and interdependencies between water, climate resilience and gender.

Things to know …

- Hurricane impacts, tourism losses and infrastructure damage from sea level rise could amount to US$ 22 billion per year by 2050, representing 10% of current regional GDP.
- The 2017 Atlantic hurricane season saw the passage of two Category 5 storms through the Caribbean Region. Impacted countries include Anguilla, Antigua, Bahamas, British Virgin Islands, Dominica, Puerto Rico, Saint Maarten and Turks and Caicos Islands. Total estimated damage and losses from these two events exceeded US$ 5 billion.
- The Caribbean accounts for seven of the world's top 36 water-stressed countries, and drought is perceived as one of the most significant climate risks by water practitioners in the region.
- These vulnerabilities are often worsened by poor management practices. For example Non-Revenue Water (NWR) levels are usually higher than 30% and often exceed 50%.
- Many islands in the Caribbean have small geographic areas but have high population densities, which places more stress on the already limited water resources.
- Achieving climate resilience requires coordinated action across many levels of intervention: water governance and the Enabling Environment, catchment and water resources management and at the individual water supply system level.
- Inaction is very costly. Increased hurricane damages, loss of tourism revenue and infrastructure damages could cost the region US$ 10.7 billion by the year 2025.

1.1 Section 1: Guidance Materials

1.1.1 Water, climate and development

Caribbean Small Island Developing States (SIDS) are incredibly vulnerable to the effects of natural disasters and climate change, in particular extreme events like tropical storms, droughts, flooding and rising sea levels. Climate change is expected to exacerbate future risks, threatening development progress.

Temperature rise is already being experienced with warm days, warm nights and extreme high temperatures being more frequent [1]. Historical rainfall records show a consistent 0.18 mm/y reduction in rainfall in the Caribbean Region (1900-2000) and the trend is projected to continue. Sea Level Rise, and the increased frequency of wave overtopping and wash-over that are associated with it, are impacting dramatically on the quality of groundwater lenses (as in the case of the Basseterre Aquifer in St. Kitts) as well as on water supply infrastructure, where this is located in coastal areas (wash-out of coastal mains has recently occurred in the Bahamas). Hurricanes keep impacting the region with tremendous consequences (as the 2017 hurricanes season showed) and there has been a substantial increase in most measures (e.g. intensity, frequency and duration) of Atlantic hurricane activity since the early 1980s (see Figure 1-1). Climate models project, on average, a slight decrease in the annual number of tropical cyclones, but an increase in the number of the strongest (Category 4 and 5) hurricanes [1]. The latest Intergovernmental Panel on Climate Change projections predict an increase in peak wind intensity associated with tropical storms from +2.9% to +20 % [2].

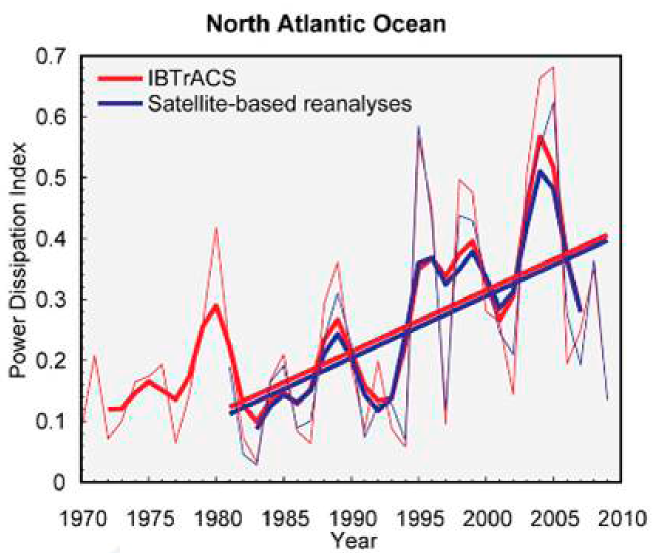


Figure 1-1: Recent variations of the Power Dissipation Index (PDI) in the North Atlantic Ocean

PDI is an aggregate of storm intensity, frequency and duration and provides a measure of total hurricane power over a hurricane season. A strong upward trend can be observed. PDI is calculated from historical data (IBTrACS) and from reanalyses using satellite data. Source: National Climate Assessment website[1].

Rapidly growing water demand, land-use change, urbanisation and tourism are already placing significant strain on the limited freshwater reserves in small island environments, whilst in the Caribbean concern over the status of freshwater availability has been expressed over the past 30 years. In most of the islands and low-lying states there is an extensive shoreline with most development and critical infrastructure located along the coast, making sea level rise and storm surge real threats to be considered. Weaknesses in water governance and management in the region only serve to exacerbate these concerns and both climate and non-climate related challenges are having a significant effect on the region's surface, groundwater and rainwater supply sources.

1 National Climate Assessment website – Changes in hurricanes: https://nca2014.globalchange.gov/report/our-changing-climate/changes-hurricanes#intro-section-2
2 The caribsave climate change risk atlas (CCCRA), 2012

Climate scenarios suggest a continuation of an increase in average temperatures, a lengthening of seasonal dry periods, and increases in frequency of drought occurrences. Current and projected climate impacts are therefore compounding the Caribbean's current challenges to secure watersheds from degradation and pollution from agricultural practices and land conversion (affecting both quality and quantity); and the equitable and reliable delivery of water to meet competing demands from the various sectors of economic activity, i.e. tourism, industry (energy generation, manufacturing), health, agriculture, and domestic consumption.

1.1.2 The cost of inaction

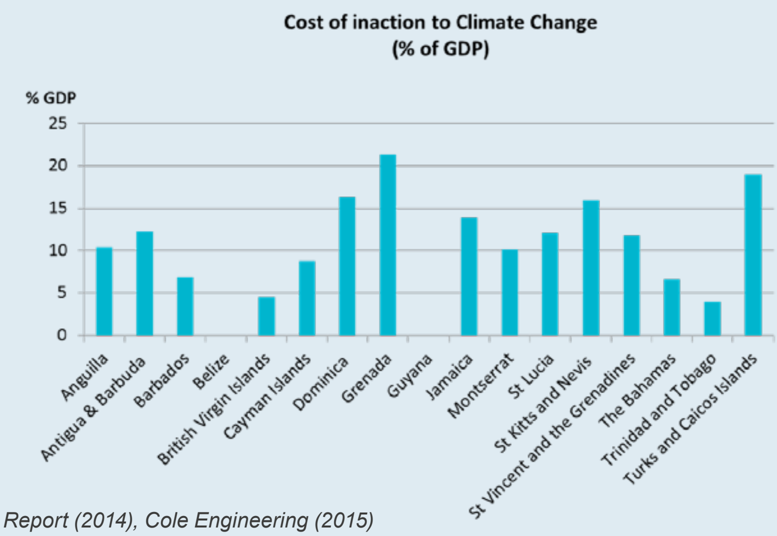
Impacts of a variable and changing climate will indirectly affect society, economic sectors and biodiversity. This is even more true in the small islands of the Caribbean, where most of the population is located in low lying, vulnerable coastal areas. Impacts on the tourism sector, due to coastal erosion, coral bleaching and increased occurrence or intensity of severe weather-related events, may also have drastic consequences on tourism-intensive economies [3].

The region has seen an increase in the number of recorded weather and climate hazards and resultant impacts on biophysical and human systems. Hurricane impacts, tourism losses and infrastructure damage from sea level rise could amount to US$ 22 billion per year by 2050, representing 10% of current regional Gross Domestic Product (GDP) [4]. These figures do not consider the full range of climate hazards faced by the region, which would worsen the actual cost of damage.

The cost of inaction has been estimated to be on average 5-10% of GDP, but is also likely to vary considerably between countries from below 5% of GDP in the British Virgin Islands and Trinidad and Tobago to over 20% of GDP in Grenada [5], see Box 1-1.

Box 1-1: The cost of inaction for the Caribbean

The large upfront overhead costs associated with infrastructural adaptation works are usually a big burden for small islands, since the unit cost of a certain adaptation measure per capita is significantly higher than the unit cost of a similar intervention in a larger territory with a larger population (this scale-reality problem is referred to as "indivisibility" in economics and applies to all forms of development). At the same time, the impact of an extreme event has a disproportionate impact on a small state's GDP. This results in higher adaptation and disaster risk reduction costs.



Source: IPCC AR5 Report (2014), Cole Engineering (2015)

3 Daniel Scott, Murray Charles Simpson and Ryan Sim (2012): The vulnerability of Caribbean coastal tourism to scenarios of climate change related sea level rise, Journal of Sustainable Tourism, 20:6, 883-898

4 Adelle Thomas, Inga Menke, and Olivia Serdeczny (2018), Loss and Damage Costing and Financing Mechanisms: Caribbean Outlook, http://climateanalytics.org/files/lnd_costing_and_financing_mechanisms_caribbean_outlook.pdf

5 Cole Engineering, 2015

In addition to economic losses, Caribbean countries also experience high social impacts from natural disasters. Weather-related events affect many people, and social and psychological impacts of disaster events can remain long after they strike.

1.1.3 Valuing water in all its uses

Water resources in the Caribbean Region include both surface and groundwater sources [6]. The relative importance of each, from an economic perspective, varies from island to island. When groundwater is the primary source of water, as in the Barbados, it has significant economic value. This is contrasted to the Windward Islands whose main water supply comes from surface sources. In some cases, the main water supply source is desalination (Table 1-1). Renewable water resources have been shown to have declined in the Caribbean Region over the period 1970 to 2010, with some countries experiencing a decline higher than 40% (Bahamas, Belize and Antigua and Barbuda) and a consequent increase in the recourse to desalination [7].

Table 1-1: Water supply sources of Caribbean countries

	Surface	Groundwater	Desalination
Anguilla			✓
Antigua and Barbuda			✓
The Bahamas			✓
Barbados		✓	
Belize	✓		
Cayman Islands			✓
Dominica	✓		
Dominican Republic	✓		
Grenada	✓		
Guyana		✓	
Haiti	✓		
Jamaica		✓	
Suriname		✓	
St. Lucia	✓		
St. Kitts and Nevis		✓	
St. Vincent and the Grenadines	✓		
Trinidad and Tobago	✓		
Turks and Caicos			✓

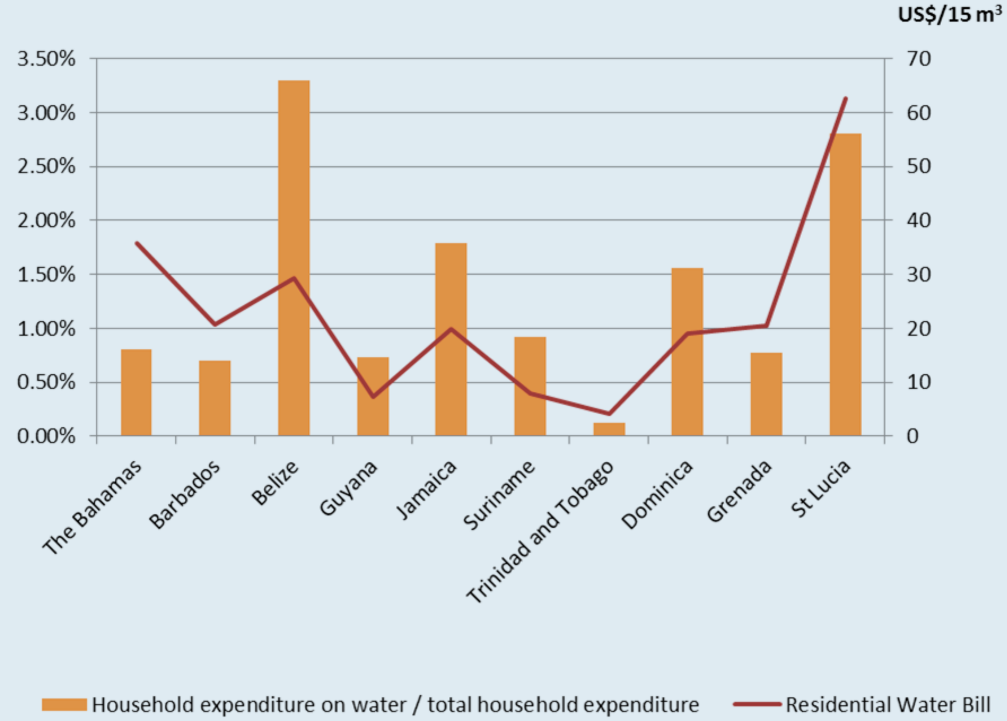
Source: *Cole engineering (2015), World Bank, FAO, others. Note: All countries practice Rain Water Harvesting to varying degrees and in some cases this is the main water supply source (e.g. Carriacou, Petit Martinique). The Main source in the Grenadines is desalination.*

Centuries ago, economist Adam Smith rightly observed that even though water offers far more utility than diamonds – it is essential for life – the price of diamonds far exceeds that of water pound-for-pound. Consequently, low water tariffs that seem to be endemic to much of the Caribbean Region, fail to signal to consumers the scarcity and value of water, and sadly water service providers often admit to high percentages of leakage and wastage in distribution systems.

6 In the Caribbean groundwater sources account for 52% of the water supply, surface water for 36%, desalination 12% and rainwater harvesting for less than 1%.
7 Cole Engineering, 2015

Box 1-2: Water tariffs in the Caribbean

The issue of affordability of water to low-income households has often been addressed in the region charging a fix amount for 10-15 m^3 of water. Consumption that exceeds this amount is then charged at progressively higher unit rates in order to discourage excessive usage. While studies demonstrate that this approach has actually been successful in providing an affordable service, with household expenditure on water services being lower than 3% (except in Belize) and in many cases lower than 1%, it has also been shown that in many countries tariffs do not cover the cost of service and there is scope for their increase.



Source: Castalia, 2017, Governance Position Paper on the Caribbean Water and Sanitation Sector, Cashman (2014). Countries presented are those analysed in the Castalia study.

Water not only plays a major role in maintaining a healthy quality of life but is also a factor of production in many socioeconomic sectors. Climate variability impacts directly on water resources and the services for all economic, social and environmental functions that water supports.

Water supply in the region is mainly important for municipalities. Water for agriculture is also essential, especially in countries like Belize, Guyana and Jamaica (Figure 1-2).

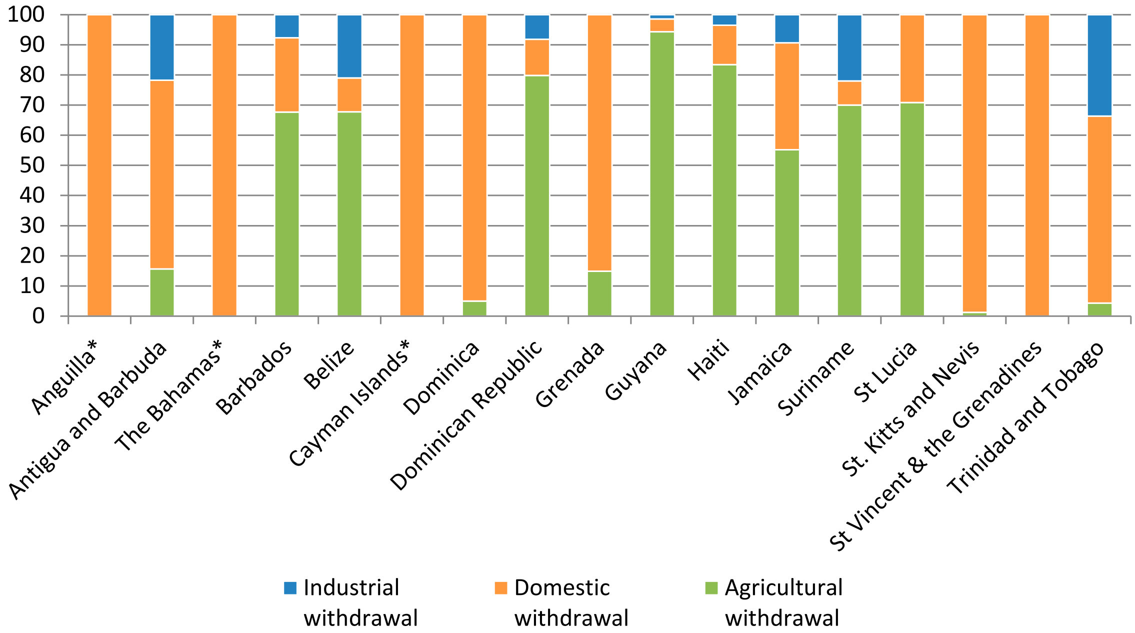


Figure 1-2: Water withdrawal per use category in the Caribbean

Source: Aquastat; (*) data for Anguilla, Bahamas and Cayman islands are approximate and come from CDB (2015) [8]

The impact of heavy rainfall on raw water quality, as well as damage to intake structures and landslides on pipelines and other assets is a perennial concern for most countries in the Caribbean. Drought is also a major concern for water managers, and the impacts of the recent drought conditions, such as those occurred in 2009/10, resulted in widespread disruption to the water sector across the Caribbean.

The Caribbean accounts for seven of the world's top 36 water-stressed countries, and their level of vulnerability to climate hazards is very high, as reflected in the values of water stress levels [9] and Climate Risk Index (CRI) [10]. These vulnerabilities are often worsened by poor management practices: Non Revenue Water (NRW) levels are usually higher than 30% (except in the case of the Cayman Islands and Belize, where NRW is equal to 17% and 24%, respectively) and often exceed 50% (Figure 1-3).

It is estimated that in the last 30 years, storms and droughts in the Caribbean Region have caused US$ 35 million of damage, with a death toll of 6,225 (Figure 1-4).

8 Assessment of the Water Sector in the Caribbean, Caribbean Development Bank, 2015

9 Water stress is measured as the ratio of total annual water withdrawals to total available annual renewable supply. Where not provided in (Gassert, et al., 2013), Water Stress indicative levels were derived from HR Wallingford and (US Army Corps of Engineers, 2004).

10 Measured by means of the Climate Risk Index by (Kreft, et al., 2016) which analyses the quantified impacts (fatalities and economic impacts) of extreme weather events worldwide. Please note that a low score corresponds to high impacts and a high score corresponds to low impacts.

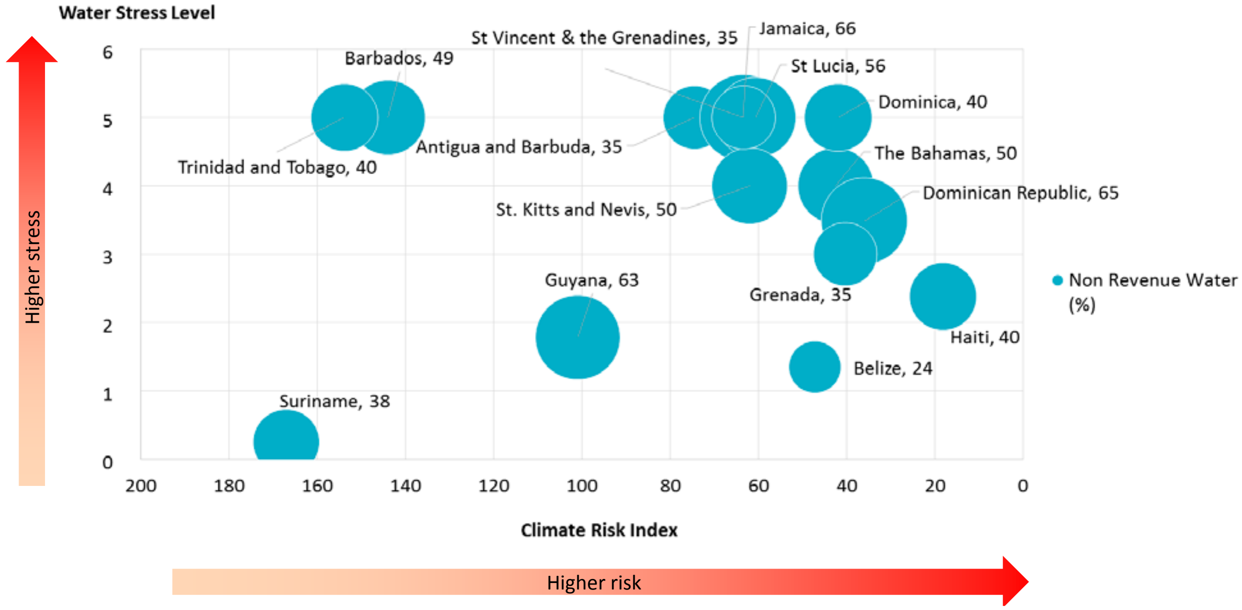


Figure 1-3: Water stress level and climate vulnerabilities in selected Caribbean countries

Source: WSI data from Gassert, et al., 2013 [11]; CRI data from Kreft, et al., 2016 [12] ; NRW data from CARIBSAVE CC Risk Atlas

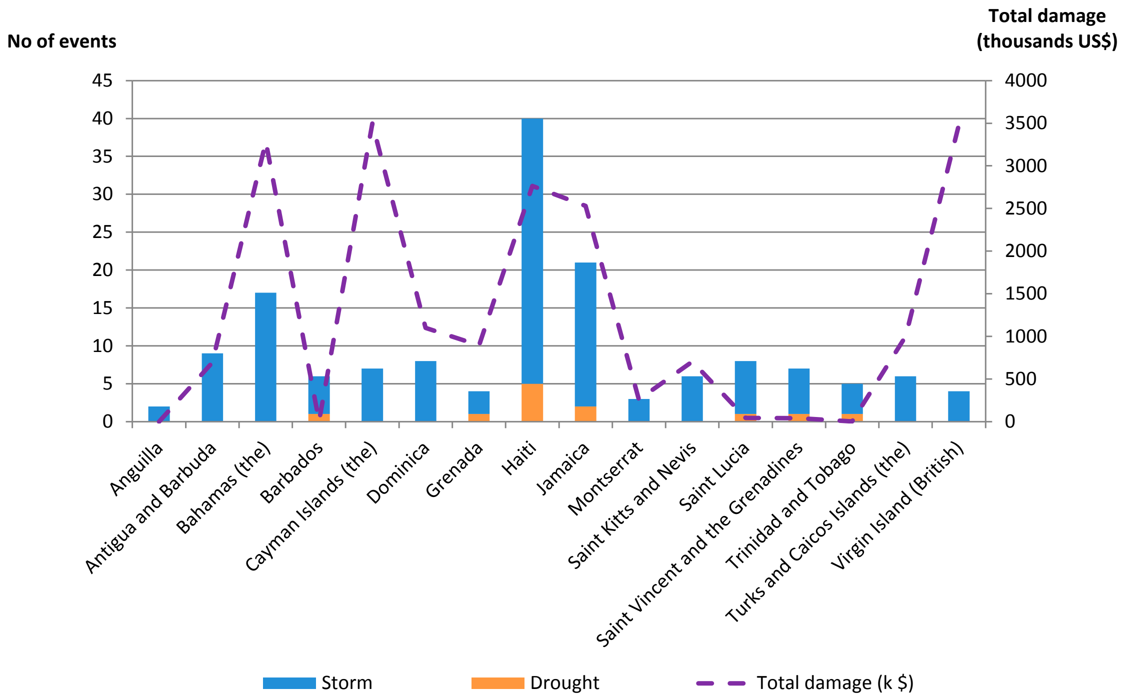


Figure 1-4: Occurrence and economic damage of droughts and storms in the Caribbean in the last 30 years

Source: EMDAT database http://www.emdat.be/result

11 Gassert, F., Reig, P., Luo, T. and Maddocks, A., 2013. Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators - Working paper, Washington, DC: World Resources Institute.

12 Kreft, S., Eckstein, D. and Melchior, I., 2016. Global Climate Risk Index 2017, Bonn: Germanwatch.

Box 1-3: Drought risk and management in the Caribbean

The Caribbean accounts for seven of the world's top 36 water-stressed countries; Barbados is in the top ten. FAO defines countries like Barbados, Antigua and Barbuda, and St. Kitts and Nevis as water scarce, with less than 1000 m^3 freshwater resources per capita per year. The combined effect of higher temperatures, associated with increase in evaporation, and less rainfall means that the Caribbean is likely to experience more intense and frequent droughts.

A survey done by HR Wallingford in 2018 showed that for 11 Caribbean countries the first climate risk perceived by water sector representatives is drought, followed by extreme rainfall events. Two of the most severe Caribbean droughts (based on intensity, extent and economic impact) occurred in 1997-1998 and 2009-2010. The severity of the latter, which impacted Caribbean states during a period of economic recession, led to significant water shortages and resulting use restrictions across the region, which was forced to recognise the urgency for drought planning and management.

Strategic responses to drought events need to be put in place in the region. Strengthening drought early warning systems was recommended to CARICOM after the 2009-2010 drought, whilst the Caribbean Drought and Precipitation Monitoring Network (CDPMN) was launched in January 2009 under CARIWIN. As part of the CDPMN project, significant progress has been made in terms of monitoring drought indicators. Seasonal forecasts are also produced by the Caribbean Climate Outlook Forum (CariCOF) and different capacity building programmes (under CARIWIN, CIMH, SUPSI-IST and USAID) have been undertaken to establish national monitoring networks.

Despite the importance that drought planning has been given in many initiatives across the region, there is usually little follow up in establishing or approving plans for drought management. In some countries, lack of planning to tackle drought risk is evident and existing plans mainly focus on emergency response, which suggests the reactive – rather than proactive – nature of water management.

However, there are countries where drought-relevant policies and plans were put in place; this is for example the case of St. Lucia, which approved and brought into action, in 2009, a plan which sets out the decision-making process to follow during droughts.

Source: FAO (2016), HR Wallingford (2018)

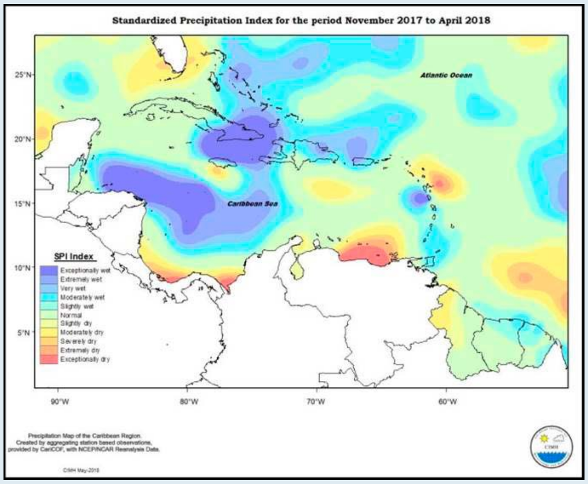


Figure 1-5: Standardised Precipitation Index (SPI) for April 2018, CIMH - SPI is a drought index commonly used for drought monitoring

No single action alone will resolve the many challenges that climate variability and change bring to the water supply services sector. Investments to upgrade, protect and maintain systems infrastructure and assets will be required but it also requires improvements in watershed management, protection and preservation of water sources, effective water policy and strategy, and responsive and responsible users.

1.1.4 Attributes of a climate resilient water supply sector

Box 1-4: What does resilience mean in the context of water supply services?

The word resilience comes from the Latin word resilire which means 'bouncing back'. A resilient system is one that withstands and absorbs disruptions and quickly recovers to the pre-disrupted condition.

Within the context of sustainable water supply services, 'resilience' can be viewed as:

'...the ability to cope with, and recover from, disruption, and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future.' [13]

Resilient operation services can meet agreed levels of service during extreme weather events and future climate change.

Climate resilient water supply services increase the extent to which operational services are able to meet agreed levels of service during extreme weather events and future climate change. Reducing operational risks associated with climate variability and change brings multiple benefits including:

- *maintaining services for people*, including access and acceptable levels of service;
- *protecting the natural environment*, including healthy watersheds and protection of water resources;
- *ability to cope with, and recover from, disruption*, strengthened capacity to absorb and adapt;
- *ability to anticipate*, greater knowledge, understanding and awareness.

In doing so, optimal investments made toward improving the efficiency and resilience of the water supply services sector contribute directly to improving access to safe and reliable water supply services, today and tomorrow.

This concept has been taken a step further in disaster risk recovery, where the concept of 'Building Back Better' (see Box 1-11) is promoting a recovery approach aimed not only at recovery to pre-disrupted conditions, but to rebuild with a higher degree of resilience than prior to the disaster.

Achieving climate resilience requires coordinated and coherent action across a number of areas and levels including water governance and the Enabling Environment, at both catchment and water resources levels, and at the individual water supply system level. A balanced portfolio of investments and complementary support measures across facets of policy and strategy development, water resources and watershed management and water supply systems and services must be developed.

In particular, climate resilience must be applied at a national, catchment and water supply system level and permeate all the aspects involved in water governance, management and operations (Figure 1-6):

- At the national level, the focus is on an Enabling Environment which guides and promotes a proactive approach to the integration of climate resilience.
- At the catchment level, the focus is on water resources and watershed management practices which secure water quantity and quality and are robust to cope with climate variability and climate-induced emergencies.
- At the water supply system level, the focus is on water supply systems that can quickly respond and recover from climate caused disruption and users are engaged in the drive for greater resilience.

13 OFWAT, 2015. Towards resilience: how we will embed resilience in our work, Birmingham: OFWAT.

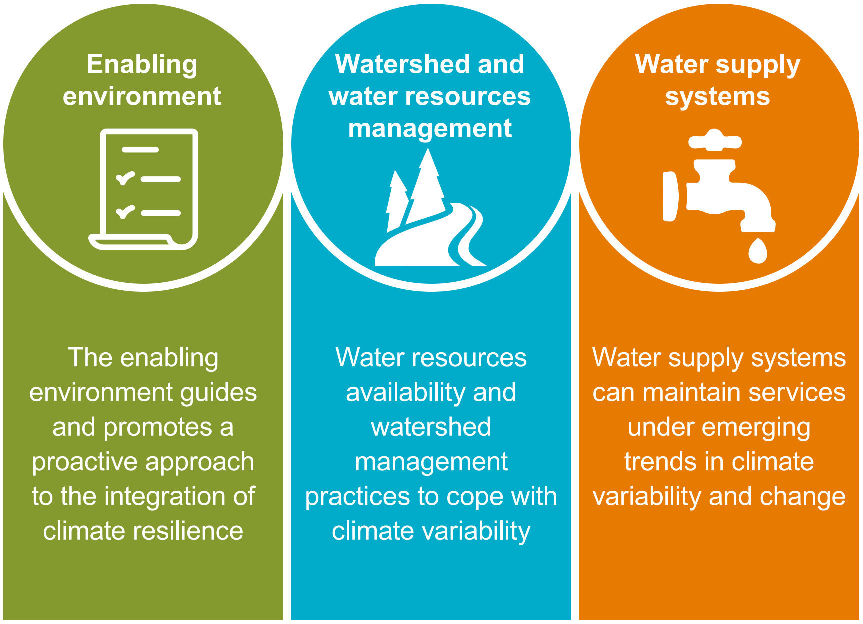


Figure 1-6: Pillars of a climate resilient water sector

A system with strong and effective water policies and governance, watershed management practices and supply system operations will be able to cope better with climate risks and consequent disruptions. It is therefore important that the roadmap towards a climate resilient water supply sector includes intermediate objectives that reflect the multidimensional nature of a fully climate resilient water sector (see Table 1-2).

Table 1-2: Outcomes and outputs needed to implement the vision for a climate resilient water supply sector in the Caribbean

<table>
<tr><th colspan="2">Main outcome</th></tr>
<tr><td colspan="2">Provide access to safe, reliable and resilient water supply services and to reduce operational risks associated with climate variability and change</td></tr>
<tr><th>Intermediate outcomes</th><th>Intermediate Outputs</th></tr>
<tr><td rowspan="3">An Enabling Environment which guides and promotes a proactive approach to the integration of climate resilience</td><td>Clear, harmonised and inclusive institutional roles and responsibilities for water and climate resilience</td></tr>
<tr><td>Climate resilience mainstreamed into national policies and strategies</td></tr>
<tr><td>Capacity and knowledge base built to integrate climate resilient considerations into strategy and planning</td></tr>
<tr><td rowspan="3">Water resources and watershed management practices secure water quantity and quality and are robust to cope with climate variability and climate-induced emergencies</td><td>Strengthened evidence base on water resources status and pressure</td></tr>
<tr><td>Climate resilience and IWRM principles integrated into water resources management</td></tr>
<tr><td>Protected and managed catchments and aquifers</td></tr>
<tr><td rowspan="5">Water supply systems can quickly respond and recover from climate caused disruption and users are engaged in the drive for greater resilience</td><td>Climate resilience mainstreamed into sectoral policies and strategies</td></tr>
<tr><td>Enhanced robustness of water supply systems</td></tr>
<tr><td>Protected and robust critical assets</td></tr>
<tr><td>Aware and engaged users</td></tr>
<tr><td>Dynamic and effective disaster risk management procedures and emergency response plans</td></tr>
</table>

Box 1-5: Climate resilient water supply services: Perspectives from Caribbean water practitioners

As part of the Planning for the 'Integration of Climate Resilience in the Water Sector in the Caribbean' project, representatives from water utilities were asked to complete a survey aimed at (i) better understanding the current status of each country for the integration of climate resilience in the water supply services and (ii) the key challenges and priorities for improving resilience. They were also asked to list their main climate risks, priority actions to address these and potential barriers to implementation.

For most of the respondents success would be represented by the ability to provide a continuous service, which is able to withstand risks posed by climate variability and recover quickly from natural disasters. In some cases water quality was also explicitly mentioned. Users have a central role in the vision of most respondents: in many cases involved and informed users as well as the ability to provide the service and maintain affordability are listed as main characteristics of success.

Main climate risks seemed to be well clear and common to most of respondents. Notably, drought was often mentioned as first risk, followed by changing rainfall patterns, extreme precipitation events, extreme weather events and sea level rise.

Priority actions were often identified in:

- improving infrastructural designs;
- increasing storage capacity;
- exploiting alternative water sources;
- achieving higher water use efficiency (e.g. reduction of losses, users education, water reuse).

More rarely, water resources management and monitoring as well as public education were identified as high priority actions.

Availability of funds was definitely a pressing issue to most respondents, whose majority listed it as the first barrier to success. The lack of information and appreciation of the impacts of climate change, lack of political will, insufficient legislation and planning, fragmented approach of stakeholders were often mentioned. Lack of technical skills and difficult geography and topography were mentioned less often as barriers.

As part of the survey, respondents were also asked to assess different components and aspects of the water supply sector of their country (scoring from 1 = very negative and 5 = very positive). On average, none of the assessment areas was able to score more than 3, with the worst score being assigned to water supply systems and services (see figure below).

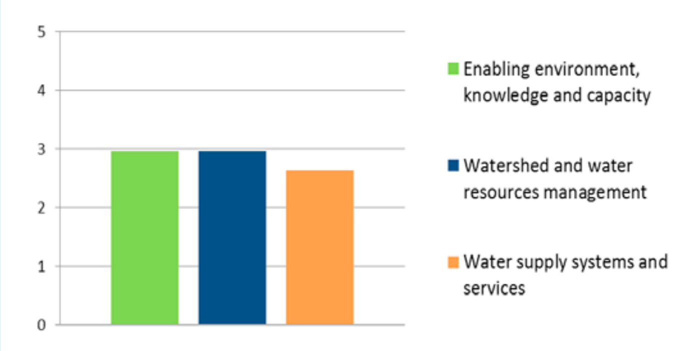


Figure 1-7: Scoring of different components of the water supply sector

Score is from 1 (= very negative) to 5 (= very positive)

Source: HR Wallingford survey among Caribbean countries (2018)

It is important to note that many of the vulnerabilities that exist in the water sector are tied to poor water management practices and strategies, and not to climate change per se. Many Caribbean countries have already embarked on interventions aimed at addressing issues related to water governance, management and climate resilience [14]. However, there is still a lot to do in order to mainstream climate resilience into all aspects of the water supply sector. Action to implement sound, integrated water resources management practices in the region is therefore a fundamental first step.

Box 1-6: IWRM as a tool to support climate adaptation

Since 2005, Global Water Partnership, Caribbean (GWP-C) has convened high-level meetings to address water and development issues in the region, and water security was regarded as needing attention. GWP-C are currently working with regional partners to develop a programme on water security and climate resilience in three key areas:

- Integrating water security and climate resilience in development planning processes;
- Development of partnerships and capacity of institutions and stakeholders to build resilience to climate change through better water management;
- Development of “no regret” investment and financing strategies for water security and climate change adaptation.

These approaches have in common the recognised need for balance between environmental sustainability and social equity in the context of economic growth (including cost-recovery that should ensure reliable long-term operations of water capture and delivery systems) – all of which can be summed up as Integrated Water Resources Management (IWRM).

Although the interpretation of IWRM varies, there is general agreement that it includes concepts of good environmental stewardship, land management policies and practices and water governance in the context of political, socioeconomic, and administrative systems [15]. Its main components include:

- Managing water resources at the lowest possible level (at the river basin or watershed scale);
- Optimising supply;
- Managing demand;
- Providing equitable access to water resources through participatory and transparent governance and management;
- Establishing improved and integrated policy, regulatory and institutional frameworks;
- Utilising an inter-sectoral approach to decision making;
- Integrating management in order to receive multiple benefits from a single intervention.

1.1.5 Inter-sectoral consideration

Water has a cross-cutting nature and as such underpins activities across multiple sectors such as hydropower generation, agricultural production and tourism development. This in turn poses competing demands on water supply systems.

Every development and agricultural activity will need access to water. Energy production through hydropower generation has an impact on water resources. In most of the Caribbean countries, energy has also a significant impact on the water utility costs, whether it is used to produce desalinated water or to pump water to water stressed areas.

14 Fletcher (2018) - Strategic Action Plan for the Water Sector in the Caribbean
15 Eakin, H. and M. C. Lemos (2006), Adaptation and the state: Latin America and the challenge of capacity-building under globalization, Global Environmental Change-Human and Policy Dimensions 16(1): 7-18.

It is therefore essential that a nexus approach to water supply and management is in place. Promoting a continuous dialogue, cooperation and information sharing is a way not only to address competing needs, but also to investigate and exploit synergies and common solutions.

Water and tourism

Tourism contributes significantly to the Caribbean Region's economy and it is estimated that the total contribution of travel and tourism to regional GDP amounted to US$ 57.1 billion (15.2% of GDP)[16] in 2017. This is expected to grow by 3.3% in 2018.

However, the tourism industry is water intensive and makes huge demands on the Caribbean's water resources: visitors can consume up to three times as much as the local population. The willingness of many Caribbean governments to further develop the tourism industry may increase the stress of their country's water supply system. It is therefore vital that water resources and supply planning are integrated and take into account short and long-term development needs as well as priorities of supply during and after extreme events (such as droughts) that could impact continuity of service (e.g. construction of ad-hoc water tanks for cruise ships). Water efficient use in hotels must be encouraged and promoted, e.g. through the use of fiscal incentives, awareness campaigns and certification schemes. Also, access charges to the local water distribution system needs to reflect the economic cost of water provision[17].

Water and agriculture

Water demand for agriculture in the region has declined over the past decade as a consequence of a decline in agricultural production, however, there is still a significant demand for water from rural communities. This is especially true in Guyana, Jamaica and Belize where water demand for agriculture accounts for 95%, 60% and 45% of total demand, respectively. Irrigation is usually limited, with most of the demand being satisfied by rainwater harvesting. However, water scarce countries such as Antigua and Barbuda are experiencing significant challenges in sustaining their agricultural production due to prolonged drought conditions such as the 2018 drought. It is necessary that present and future agricultural demand are estimated and accounted for in water supply planning. Efficient irrigation techniques need to be promoted, together with the use of drought resistant crops where possible. Also, sustainable agricultural practices need to be encouraged (e.g. via the adoption of Payment for Ecosystem Services schemes) in order to preserve water quality.

Water and energy

Water is required for hydropower energy generation, while energy is required for pumping, treating and producing water. Water utilities often face the challenge of high electricity bills, unreliability of supply during extreme weather events and disposal of treatment sludge. The installation of energy efficient devices (e.g. Variable Frequency Drives) or system design (e.g. energy efficient filtration systems) could decrease energy costs for the utility, and free resources to invest in climate resilience.

The use of renewable energy can help increase utilities' profitability, environmental sustainability and reduce their dependence from the grid. Solar power appears to be the most common renewable energy source and should be considered as a means of providing power to the water utility while at the same time feeding excess generation into the national electrical grid and sold to consumers. However, this approach requires a special or legally mandated relationship between the water utility and the electricity utility companies as the latter would need to pay for the generation which is fed into the grid. The survival of solar energy assets to extreme weather events is also a critical factor to be considered and should influence design considerations.

1.1.6 Gender considerations

Understanding links and interdependencies between water, climate resilience and gender is important. The comprehensive integration of climate change resilience in the vulnerability assessment, adaptation and planning processes in the water supply sector must also include the consideration of gender sensitivities.

16 World Travel and Tourism Council, 2018, Travel and Tourism – Economic Impact 2018 Caribbean
17 Cashman and Moore, 2011, A market-based proposal for encouraging water use efficiency in a tourism-based economy

Developing an understanding of the dynamics of gender roles and livelihoods as they relate to water, enables comprehension of how communities are and will be affected by climate change and natural disasters, how communities and households might be able respond or adapt with the resources they have available, and how these conditions can be enhanced and built upon for the development and implementation of successful adaptation strategies.

While there has generally been much attention on gender issues in health, family life and economic opportunities in the Caribbean, only recently has there been a consideration of gender issues and disaster risk management. This work has been supported by the overwhelming evidence from socio-economic indicators that disasters have different impacts on men and women.

In 2007, a Gender Equality Strategy was prepared under the Caribbean Water Initiative (CARIWIN) project. This 6-year project (2006-2012) was aimed at increasing the technical and institutional capacity of Caribbean nations to deliver sustainable and equitable integrated water resources management (IWRM) and provides an excellent basis for this current project. Through CARIWIN, pilot capacity building initiatives in IWRM, aimed at the national, local government and community levels were implemented in Grenada, Guyana, and Jamaica.

The Gender Equality Strategy states: “Ensuring that water management is both integrated and equitable is crucial to ensuring sustainable development and poverty alleviation in the Caribbean. Weaknesses in physical and social infrastructure in water management in countries of the Caribbean have a disproportionate impact on women, especially female heads of households, and contribute to their poverty and health problems. They increase the time and energy needed to perform domestic tasks, and they reduce the time women have available for paid work or other activities. In rural areas, women remain the principal users and conservers of water, but lack opportunities for formal decision-making in water management.”

The United Framework Convention on Climate Change (UNFCCC; adopted in 1992) makes no mention of gender or of women and men as specific stakeholders. However, explicit recognition of the role that women play in water resources management has been made in the third Dublin principle, which states that "Women play a central part in the provision, management and safeguarding of water". Gender is also addressed as part of the Millennium Development Goals (MDGs) and of the SDGs which, through MDG Goal 3 and SDG Goal 5, seek to promote gender equality and empower women and girls.

Importantly, the United Nations Convention to Combat Desertification (UNCCD) (adopted in 1994) goes beyond mainstreaming gender, not only recognizing the role women play in rural sustenance, but also promoting equal participation of women and men; and much later in 2008, the United Nations formally committed to gender mainstreaming within all policies and programs (See Box 1-7).

Box 1-7: 2008 Climate and Gender Update: A Report for the United Nations Secretary-General Ban Ki-Moon

The United Nations is formally committed to gender mainstreaming within all policies and programs. However, gender equality is not yet realized in any society or part of the world. Gender differences are observed in every stratum of social institutions ranging from the family to religious groups or caste systems; political and legal structures; economic and educational institutions; and the mass media. All are permeated with norms and values which inform the economic, social, institutional, and legal constraints which affect women and men's rights to own land, control resources, access technology and education; and thereby also influence the attitudes, contributions, impacts, and individual potential to adapt to climate change.

A number of issues signal the crucial role of gender in understanding the causes of climate change, efforts to mitigate it, and working towards successful adaptation to inevitable climate variability and change:

- Women and men – in their respective social roles – are differently affected by the effects of climate change and variability;
- Similarly, women and men – in their respective social roles – are differently affected by climate protection instruments and measures;
- Women and men differ with regard to their respective perceptions of and reactions to climate change and variability;
- Women's and men's contributions to climate change and variability differ, especially in their respective CO2 emissions;
- Climate protection measures often fail to take into account the needs of large numbers of poor, women, children and elderly members of society, in terms of infrastructure, energy supply, etc;
- The participation of women in decision-making is very low in climate policy and its implementation in instruments and measures.

Source: http://www.climatecaucus.net/chapterongendertext2.htm

1.1.7 Support to major international and regional agreements

Every major international development agreement that has been adopted by the global community over the past five years has recognized the important role that water must play in securing positive outcomes for citizens and ensuring the sustainability of development efforts. This acceptance of the role of water provides an avenue for Caribbean countries to leverage technical and financial support for the water sector.

The Paris Agreement (2015) places unprecedented importance on climate change impacts on the most vulnerable nations. It highlights the actions needed – both nationally and globally – to help people adapt, and solidifies expectations that all countries will do their part to promote greater climate resilience. It also recognises that even the greatest resilience may not completely prevent harm to life and property, and that the global community must find ways to address "loss and damage" in cases where impacts are beyond the limits of adaptation.

In the Caribbean, climate resilience and water security are high on the agenda. At the request of Caribbean Community (CARICOM) Heads of State, the Caribbean Community Climate Change Centre (CCCCC) prepared a Regional Framework for Achieving Development Resilient to Climate Change [18] and an associated Implementation Plan [19]. These documents set out CARICOM's strategic approach for coping with climate change and emphasise the importance of water as a priority sector for attention, particularly as it supports most

18 Caribbean Community Climate Change Centre (CCCCC), 2009, Regional Framework for Achieving Development Resilient to Climate Change (2009-2015).

19 Caribbean Community Climate Change Centre (CCCCC), 2012, Delivering Transformational Change 2011-21, Implementing the CARICOM Regional Framework for Achieving Development Resilient to Climate Change.

other key socioeconomic sectors. Water security therefore plays a pivotal role in promoting and safeguarding economic growth and development from the adverse effects of climate variability and change.

Justifiably, achieving and sustaining water security has risen up in the political agenda in the Caribbean as the demands from economic growth increase and as climate change intensifies. In 2012 the High-level Ministerial Forum of Caribbean Water Ministers emphasised the importance of ensuring long-term water security as a driver for economic and social development. The CARICOM Council of Trade and Economic Development (COTED) called for CARICOM Member States to continue to treat water resources management as an area of critical importance [20]. CARICOM, through its endorsement of the formation of the CARICOM Consortium of Institutions on Water in 2008, has also recognised that the region's ability to compete on a global scale, in areas such as agriculture, industry, and tourism, relies on the continuing availability of sufficient, affordable water of appropriate quality and its consistent and reliable delivery [21].

Box 1-8: Water and climate in international agreements

The third United Nations conference on sustainable development

The outcome document of the third United Nations conference on sustainable development, Rio+20, held in Rio de Janeiro in Brazil in 2012, entitled 'The Future We Want', stated: "We recognize that water is at the core of sustainable development as it is closely linked to a number of key global challenges. We therefore reiterate the importance of integrating water in sustainable development and underline the critical importance of water and sanitation within the three dimensions of sustainable development."

The Samoa Pathway

At the Third International Conference on Small Island Developing States (SIDS) in Samoa in 2014, the international community reflected, "that small island developing States face numerous challenges with respect to freshwater resources, including pollution, the overexploitation of surface, ground and coastal waters, saline intrusion, drought and water scarcity, soil erosion, water and wastewater treatment and the lack of access to sanitation and hygiene. Furthermore, changes in rainfall patterns related to climate change have regionally varying and potentially significant impacts on water supply."

The Sendai Framework for Disaster Risk Reduction

The important role of water in disaster risk reduction was noted in the Sendai Framework for Disaster Risk Reduction, which pledged, "To promote the mainstreaming of disaster risk assessment, mapping and management into rural development planning and management of, inter alia, mountains, rivers, coastal flood plain areas, drylands, wetlands and all other areas prone to droughts and flooding, including through the identification of areas that are safe for human settlement, and at the same time preserving ecosystem functions that help to reduce risks."

The 2030 Agenda for Sustainable Development

The importance of the water sector to the global development agenda was further amplified in Resolution 70/1 of the UN General Assembly on 25 September 2015, entitled 'Transforming our world: the 2030 Agenda for Sustainable Development'. This resolution articulated seventeen Sustainable Development Goals (SDGs) for a fifteen-year global development agenda. The sixth goal, SDG 6, aims to "Ensure availability and sustainable management of water and sanitation for all'.

Source: Fletcher (2018) - Strategic Action Plan for the water sector in the Caribbean

20 Message from Dr. Douglas Slater, Assistant Secretary-General Human and Social Development On the Occasion of WORLD WATER DAY 22 March 2015 (CARICOM Secretariat, Turkeyen, Greater Georgetown, Guyana)

21 A Brief Background to the CARICOM Consortium of Institutions on Water

The UN SDGs, agreed in 2015, include one goal specific to water and sanitation (SDG 6). In addition to improved access to water supply and sanitation this goal covers the entire water cycle, including the management of water, wastewater and ecosystem resources, see Box 1-9 below.

Box 1-9: SDG 6 - Ensure availability and sustainable management of water and sanitation for all

SDG 6 "Ensure availability and sustainable management of water and sanitation for all" contains six sub-targets relating to progress by 2030 in the following aspects:

- universal and equitable access to safe and affordable drinking water;
- access to adequate and equitable sanitation and hygiene for all and end to open defecation;
- improvement in water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and at least doubling recycling and safe release globally;
- substantial increase in water use efficiency across all sectors and ensuring sustainable withdrawals and supply of freshwater to address water scarcity;
- implement IWRM at all levels;
- protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

SDG 6 does not only have strong linkages to all other SDGs, but also the ability to underpin them including (amongst others): SDG 2 – to end hunger, achieve food security and improve nutrition and promote sustainable agriculture; SDG 3 – to ensure healthy lives and promote well-being; SDG 8 – to promote sustained, inclusive and sustainable economic growth; SDG 9 – to build resilient infrastructure; SDG 13 - to take urgent action to combat climate change and its impacts; and SDG 15 - to protect, restore and promote sustainable use of terrestrial ecosystems.

Although the Caribbean countries have above-average status for water supply and sanitation services by global standards, a number of the aims listed above have direct relevance to water and climate challenges in the Caribbean – e.g. pollution, dumping of waste into water courses, release of untreated wastewater, water use efficiency, Integrated Water Resources Management (IWRM), drought management, water reuse, freshwater and aquatic ecosystems. Future climate change and variability will only add to the importance of addressing these issues.

The SDGs also consider means of implementation: SDG 17 is concerned with the creation of partnerships for the implementation of the other 16 SDGs. SDG 17 promotes multi-stakeholder partnerships to strengthen capacity, accelerate action and mobilise financial resources, including involvement of the private sector. Crucially, this can also be a vehicle for the stronger representation of women [22].

22 UN-Water (2015): Means of Implementation: a focus on Sustainable Development Goals 6 and 17. 15 July 2015.

1.2 Section 1: Case examples and other relevant material

1.2.1 Case example: Lessons learned from the 2017 Atlantic hurricane season

Box 1-10: Case example: The Atlantic Hurricane Season in 2017

The Atlantic hurricane season of 2017 was very active, with three major hurricanes: Harvey, Irma, and Maria. These had significant impacts and consequences to economies, especially for SIDS within the Caribbean Region, in particular Antigua and Barbuda, Dominica and Puerto Rico. Other countries that experienced moderate to significant impacts include the British Virgin Islands, St. Marten and Anguilla. Approximately 169,000 people and 75,000 buildings were exposed to wind speeds higher than 156 mph [23]. Wind forces of that strength can destroy a high-percentage of well-constructed homes causing total roof failure and wall collapse making residential areas uninhabitable for weeks or months. The death toll of the 2017 hurricane season in the Caribbean Region is estimated to be 165 [24].

The island of Barbuda was rendered uninhabitable by Irma, with the entire population of approximately 1,800 evacuated to Antigua immediately after the hurricane. Ninety-nine percent of utilities, including electricity, water and communications, were destroyed and 90% of roads were inaccessible [25]. All of the water supply systems within Barbuda were damaged by the Hurricane. Many months later, these services were still not fully restored and estimates range from one to three years before Barbuda will be able to 'return to normal'.

Another devastating Category 5 hurricane, Maria, had devastating consequences for Dominica where 90% of structures have been damaged and 43 of the 44 water supply systems were severely damaged. As of July 2018 some communities still do not have access to water and electricity.

The main impacts on the water sector in Dominica and Barbuda were reported to be related to:

- Water quality: saltwater intrusion in wells due to storm surge and surface contaminants mixed in floodwaters as well as increased turbidity at surface water and desalination plants intakes;
- Infrastructural damages due to landslides, wind speeds and unanchored objects (e.g. containers) that turned into missiles;
- Flooding of electronic equipment;
- Deforestation.

The potential for regional changes in future tropical cyclone frequency, track and intensity is of great interest, especially to small island developing states, as tropical cyclones play a major role in regional water resources. However, there are no credible projections of how cyclone activity (particularly region-specific) will be affected by climate change. The Intergovernmental Panel on Climate Change (IPCC) [26] has stated, "The projections for the 21st century indicate that it is likely that the global frequency of tropical cyclones will either decrease or remain essentially unchanged, concurrent with a likely increase in both global mean tropical cyclone maximum wind speed and rain rates." Without a doubt therefore, the region must focus on improving its resilience, especially in areas of critical services like water supply, which affects livelihoods and the economy as a whole.

23 A remote analysis conducted by the Operational Satellite Applications Programme (UNOSAT) of the UN Institute for Training and Research (UNITAR) on 11th September
24 CRED 2018 (EM-DAT database)
25 OCHA, 2017, Situations Report #6: Dominica Hurricane Maria, United Nations
26 IPCC, 2014

Barbuda Reverse Osmosis (RO) plant: pump station completely destroyed, transformer overturned and roof of the plant damaged.

Source: APUA, 2017

Dominica, Pichelin Intake: the intake structure and the transmission lines have been destroyed by builders and the surrounding area severely deforested.

Source: DOWASCO, 2017

1.2.2 Case example: Building Back Better (BBB)

Box 1-11: Building Back Better to enhance climate resilience of the water supply sector

Building Back Better is one of the four pillars of the Sendai framework for disaster risk reduction 2015-2030; the concept was introduced during the post-2004 Indian Ocean Tsunami reconstruction efforts, which then led to the creation of BBB guidelines aimed at steering recovery and reconstruction activities.

Build Back Better (BBB)

The use of the recovery, rehabilitation and reconstructions phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment [27].

Recovery from a disaster occurs in very peculiar circumstances, usually defined by limited resources and by the immediate priority of restoring people's access to their basic needs. This usually shapes the reconstruction interventions, which tend to be aimed at rebuilding the built environment and infrastructure as they were prior to the disaster. This, however, does not decrease the exposure of communities to hazards that are similar to those they have just experienced. It is therefore key that reconstruction efforts also focus on structural changes and longer-term investment needs, and encompass not only better reconstruction of infrastructure, but also a wider, general process of strengthening resilience. Political and social pressure following a disaster can often unlock more technical and financial resources than during normal conditions, and can be key in providing the right support to long-term risk reduction measures.

Hurricane impacts on water supply systems

Impacts of hurricane events on the water system will vary depending on the hurricane magnitude, but also on other characteristics of the event. For example, Hurricane Ivan, which occurred in 2004, was a dry storm and as such its impact on underground distribution systems was reported to be limited (the absence of abnormal rainfall levels avoided the triggering of landslides). In such cases, exposed distribution lines, supported overland on elevated columns and thrust block may be more subject to damage.

Short-term impacts

Reservoirs: siltation, flooding, deposition of trees and large logs, pollution by dead wildlife.

Treatment plants: non-functioning due to damage to the plant structure or power failure.

Distribution systems: lack of electricity, absence of emergency generators, infrastructure damage (landslides or wind/debris if not buried).

Catchment areas: degradation of the watershed which can lead to reduced rainfall interception and infiltration into the soil, causing increased surface runoff, excessive silting of rivers and reservoirs, and increased incidence of downstream flooding.

Resilience best practices to allow water supply systems to withstand hurricane impacts lie in:

- Robust infrastructure – Building codes standards are followed and provide structural design improvements;

27 United Nations General Assembly. 2016. Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction. Seventy-First Session, Item 19(c). A/71/644.

- Rapid and resourcefulness recovery – Institutional capacity is effective in mobilising recovery and mitigation resources. Measures to contain impacts are planned before the event and quickly activated in its aftermath;
- Redundancy – Water is provided by a diverse set of sources as much as practicable and the water supply network provides adequate redundancy levels;
- Land-use planning – Watersheds are protected and monitored and plans for restoration of their good-status are prepared and activated following a disaster.

Building Back Better lessons from Cayman Islands

Hurricane Ivan impacted the Cayman Islands on 12 September 2004 as a Category 4 hurricane. Impact of Ivan is comparable to that of the 2017 hurricane season. Following the disaster, several lessons have been drawn and incorporated into the Cayman Water Authority operations:

- Update of existing water utility hurricane plan to include not only preparation and direct response but also specific actions for recovery;
- Water supply system shut down prior to the storm allowed to have water available after the storm which affected production capacity;
- Improved building resilience: ensure higher floor elevation in new buildings to avoid flooding from storm surge and provisions for flood barriers in existing buildings;
- Provision of emergency generator for the reverse osmosis plant;
- Installation of sample taps through the distribution system at hurricane shelters and emergency medical centre to monitor water quality.

Source: Hendrik-Jan van Genderen (Water Resources Engineer, WAC) 2018, personal communication

1.2.3 Case example: Supporting implementation of IWRM

Box 1-12: Case example: The implementation of IWRM in the Caribbean

A consortium comprising the Co-operative Programme on Water and Climate (CPWC), the International Water Association (IWA), the International Union for Conservation of Nature (IUCN) and the World water Council have identified small island states, such as those in the Caribbean, as a ‘hotspot’ where climate change effects are felt and where urgent action is needed within the water sector.

The region shares this view and, has developed and implemented a number of initiatives geared towards integrated water resources management (IWRM). IWRM promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Some the important regional initiatives and successes include:

- The assessment of the impacts of climate change on water resources in the Caribbean, conducted under the Mainstreaming Adaptation to Climate Change (MACC) project, which was implemented by the Caribbean Community Climate Change Centre (CCCCC).
- The Integrating Watersheds and Coastal Areas Management (IWCAM) project in thirteen Caribbean SIDS, which aims to strengthen commitment and capacity of the participating countries to implement an integrated approach to watershed and coastal areas management, being implemented by the Caribbean Environmental Health Institute (CEHI).
- The CARICOM Consortium of CARICOM Institutions on Water which is assisting member countries in developing a ‘Common Water Framework’ through:
  - The development of a Common Water Framework for member states.
  - A consolidated work programme for 2011-2012 that reflects all members.
  - A database of water resources projects for the Caribbean.
  - Collation of Country Water Assessments for member states.
- The Global Water Partnership, Caribbean (GWP-C) through its IWRM initiative to address water and development issues in the region, in particular, water security and climate resilience. Their work covers resilience in three key areas:
  - Integrating water security and climate resilience in development planning processes.
  - Development of partnerships and capacity of institutions and stakeholders to build resilience to climate change through better water management.
  - Development of “no regret” investment and financing strategies for water security and climate change adaptation.
- IWCAM has also implemented a number of pilot projects, through which it has:
  - encouraged empowerment and capacity building in communities through the use of its Community-Based Resource Assessment (CBRA) Tool;
  - successfully supported the designation of the Basseterre Valley Aquifer (a major watershed) as a National Park;
  - built the capacity and awareness of regional journalists on integrated watershed management issues;
  - engaged in extensive public education and outreach;
  - identified ‘hotspots’: areas that contain significant sources of pollution, or, sensitive areas at high risk of being contaminated by specific pollutants;
  - built capacity to implement an integrated approach to the management of watersheds and coastal areas in communities.

- CReW+ - The GEF funded Caribbean Regional Fund for Wastewater Management (CReW) is a four-year project that began in 2011. It is funded by the Global Environment Facility (GEF) and implemented by the Inter-American Development Bank (IDB) and the United Nations Environment Programme (UNEP). The project is intended to support the Wider Caribbean Region in addressing tree main challenges related to wastewater management in the region:
  - inadequate policy and legal framework;
  - insufficient financing;
  - Supporting laws and regulations.

1.2.4 Case example: Desalination: climate resilience and risks

Box 1-13: Case example – Desalination: climate resilience and risks

Desalination is usually regarded as a safe, climate-proof source of water. It is the main source of potable water for some countries in the Caribbean, such as Antigua and Barbuda, the Bahamas and the British Virgin Islands, and is extensively used across the region in the tourism sector to decrease the exposure of facilities to the risk of public supply outages. Its application is increasing also in countries which used to rely on freshwater and groundwater, such as St. Lucia and Grenada, in order to cope with impacts of drought and climate variability and to reduce dependency of small islands from water imports.

Energy demand, which accounts for 50-60% of total desalinated water production costs is a significant hurdle to the widespread adoption of desalination. Significant progress has been made towards the reduction of energy consumption: modern Reverse Osmosis (RO) plants can consume less than 3 kWh/m^3, compared to 8.5 kWh/m^3 in 1999. However, the development of standard solutions for desalting seawater by using renewable energy is a widespread goal [28].

The energy costs and CO_2 emissions of desalination plants can be reduced by the use of photo-voltaic (PV) systems, via solar-powered off-grid desalination units or grid-tied PV systems; the latter have the advantage of not only removing the requirement for co-location of the desalination plant and PV systems, but they also allow for selling excess energy back to the grid. This solution was developed in a pilot application, founded by UKDFID and EU-GCCA, in Carriacou (see text box below).

Sea Water Reverse Osmosis (SWRO) in Carriacou project overview

Total budget: US$ 1,250,000 (US$ 750,000 for SWRO and distribution system, US$ 500,000 for powering the SWRO plant, storage tanks and force mains)

Project implementation: CCCCC

Project description

- SWRO plant with a capacity of 300 m^3/d and quality that exceeds WHO standards;
- Tied-in PV system with 150 KW capacity
- Water storage system with capacity of 100,000 gallons of water
- A water distribution system with home connection capability

Key results:

- Modular design is easily expanded to meet growing community demand;
- Successful application for water scarce small islands (such as Bequia in the Grenadines and Petit Martinique);
- Water provided to 4,000 people in Carriacou.

Despite the perception that desalination is a climate-proof technology, intake and return lines can be subject to displacement during storms, and flooding can impact pump operations. Decreased water quality due to sea swells, coastal erosion and sea weeds blooms, coupled with specific design specifications (e.g. open ocean intakes) can impact desalination plants operations.

The phenomenon of Harmful Algal Blooms (HABs) has increased dramatically in recent years and, while there is still uncertainty regarding the reasons of this increase, climatic changes (temperature variations, storms, periodic and long-term effects on oceanographic conditions) as well as manipulation of coastal watersheds for human activities (which increase nutrient-rich runoff from land), are among the factors that can influence the occurrence of HABs [29].

Exposure of desalination operations to water quality related hazards, can be improved through:

- Improvement of the management of the coastal area and of the watershed where the desalination plants are located;
- Design of an observing system for early detection of blooms, exploiting traditional and emerging technologies and remote sensing imagery;
- Accounting for specific solutions at the design stage, such as subsurface intakes as opposed to open water intakes or appropriate pre-treatments.

The Harmful Algal Blooms (HABs) and Desalination: A Guide to Impacts, Monitoring and Management manual (Anderson, Boerlage and Dixon, 2017) provides a useful resource to desalination plant operators regarding HABs' impacts and mitigation strategies.

Water quality degradation impacts in Antigua and Barbuda desalination plants

Antigua and Barbuda relies at 70% upon desalinated water from six facilities, four of which have ocean intakes. While the offshore location of the intakes usually guarantees continued operations even during sea swell conditions, the severity of sea swells in 2017 has surpassed that of previous years, affecting plants operations and causing disruption of service and the need to introduce water delivery scheduling. Checks of the intake lines have indicated that some anchors need to be refastened and intake screens cleaned.

Source: (Mr Ivan Rodrigues 2018, personal communication, 3 April)

APUA RO intake line: concrete anchors shifted and line displaced.

Source: APUA

28 Bognar, K., Blechinger, P., Behrendt, F., Seawater desalination in micro-grids: an integrated planning approach, 2012
29 Anderson, Boerlage and Dixon, 2017, The Harmful Algal Blooms (HABs) and Desalination: A Guide to Impacts, Monitoring and Management manual

1.2.5 Relevant material and other resources

Box 1-14: Relevant material and other resources

Loss and Damage Costing and Financing Mechanisms: Caribbean Outlook (2018)

This paper provides insights into loss and damage in the Caribbean Region, as well as discussion on the Association of Small Island States (AOSIS) proposals of an international insurance pool to provide compensation to countries affected by climate change and in particular sea level rise.

Available at http://climateanalytics.org/files/lnd_costing_and_financing_mechanisms_caribbean_outlook.pdf

Water Security and Services in the Caribbean (Cashman, 2014)

This paper provides an overview of the major factors influencing the water security facing the Caribbean Region and how the emerging concerns are being addressed.

Available at https://publications.iadb.org/handle/11319/5823

Drought characteristic and management in the Caribbean (FAO, 2016)

The report reviews information on drought characteristics and management in the Caribbean Region, identifies the relevant national and regional agencies and focal points involved in drought management and brings together information on their work at national and regional level.

Available at: http://www.fao.org/3/a-i5695e.pdf

The water-energy-food nexus in Latin America and the Caribbean Global Canopy Programme (Bellfield, H., 2015)

The report explores the theme of the Water Energy Food (WEF) nexus, with a focus on water conflicts, trade-offs, climate change and future trends to improve the WEF security. It collates some case studies from the Latin-America.

Available at: http://www.iwa-network.org/wp-content/uploads/2017/03/The-Water-Energy-Food-Nexus-in-LAC-April-2015-lower-res.pdf

Strategic Action Plan for the Water Sector in the Caribbean – under development (CWWA, 2018)

1.3 Section 1: Notes for the trainer / facilitator

1.3.1 Notes and considerations

- Facilitators should review the material and become familiar with all content before presenting.
- It is important that participants understand that building resilience (adaptation to climate change) is a process that involves all stakeholders in the water sector, as well as stakeholders of other related sectors such as energy, agriculture and tourism.
- Emphasize that key terms reviewed in Section 1 will be further explained as the training progresses from one section to the next.

1.3.2 Exercises and discussion topics

<table>
<tr><th colspan="2">Group Session 1</th></tr>
<tr><td>Title

Creating a vision for climate resilience.</td><td>Type

Exercise, in groups of appropriate number.</td></tr>
<tr><td colspan="2">Objectives

Collect and share participants views and opinion regarding what a climate resilient vision for 2030s of the water supply sector in their country would look like.</td></tr>
<tr><td colspan="2">Link with other materials

Section 1 technical notes of the Training Manual.</td></tr>
<tr><td>Duration

1 hour.</td><td>Materials needed

Flipchart and post-its.</td></tr>
<tr><td colspan="2">Preparation

The trainer should cover Section 1 Guidance Materials before involving participants in this exercise.</td></tr>
<tr><td colspan="2">Description of tasks and instructions

Step 1: Introduction to the activity (in plenary) (10 mins)
■ Give some background to the activity based on the information provided in the Training Manual for Section 1.
Step 2: Visioning (in groups) (35 mins)
■ Answer the following questions:
- Where do we want to be by 2030?
- What are the characteristics of a resilient water supply sector?
■ List the 2 main barriers and suggest how these can be overcome.
■ List at list one thing that is currently working (e.g. a specific project, a policy, a framework etc.) and catalysing change towards climate resilience.
Step 3: Plenary session (15 mins)
■ Each group will summarise its findings to the others.
■ Commonalities and differences will be highlighted by the facilitator.</td></tr>
<tr><td colspan="2">Following the workshop

■ Report on findings of the exercise emphasising common challenges, objectives and best practices.</td></tr>
</table>

Section 2

Framework for integration: a national process

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Section 2: Framework for integration: a national process

Summary

This section introduces a national process for the integration of climate resilience in the water supply services sector and practical steps to move the integration process forward. It provides participants with a common, collective approach to the establishment of robust and implementable climate resilient policies and investment plans and to identify potential financing for their effective implementation. The process is centred around four workshops, each requiring preparatory and follow up activities. The workshops capitalise on the nine sections in the Training Manual and participants learn how to map the Guidance Materials and technical notes onto the overall Framework process.

Objectives

At the end of this section, participants will be able to:

- Become familiar with a national process that supports the integration of climate resilience;
- Understand the phases of the Framework and how the process will develop over time;
- Appreciate the key outputs and deliverables from each phase, and the role stakeholder workshops will play in the overall process;
- Appreciate which technical sections will be covered in each workshop, and the inputs and outputs from each workshop;
- Explore and become familiar with the relevant Guidance Materials for each workshop.

Things to know …

- The Framework for integration is presented as a national process centred on four key stages:
    - Engaging stakeholders and setting objectives;
    - Assessing risks and identifying options;
    - Prioritising options and planning for implementation;
    - Monitoring and evaluating progress.
- The Framework is an iterative process, each phase should be adapted to respond to the needs and priorities identified in the previous phase. Do not be afraid to shift the emphasis and content within each phase in order to maximise relevance to specific national circumstances.
- The Framework is a repeatable process, not a one-off. Repeating the application of the Framework periodically will allow process to be measured towards resilience and the identification of new investment priorities.
- During each phase, a workshop is anticipated to bring stakeholders together to advance the national process, and each workshop incorporates one or more of the training sections outlined in the Training Manual.
- The duration of the Framework process and workshops presented here can be extended, if resources allow, to provide more depth and detail to the analysis and outputs.

2.1 Section 2: Guidance Materials

2.1.1. Catalysing change

Improving climate resilience in the water services sector is a long process and national commitment is required from the outset and right through to the monitoring of implementation outcomes and results to ensure the intended long-term benefits are realised and sustained. The process should not be viewed as a burden on resources, but as an opportunity to improve the resilience of water services in the face of climate change for the benefit of soci0-economic growth and development.

This section sets out a Framework for integrating climate resilience in the water supply services sector at a national level. The Framework consists of a series of four national workshops with attendant preparatory and follow up activities leading to the development of investment plans for improving climate resilience as well as enhanced knowledge and capacity for national stakeholders. Each workshop incorporates one or more of the technical sections in the Training Manual. The Framework is envisaged as a cyclical process where the implementation of identified actions is monitored, the benefits recorded and investment plans are updated.

The integration of climate resilience in the water supply sector is more than just investment in physical assets. It requires action in policy, planning, management and operation, all at the same time. It requires commitment and capacity to make long term and sustained changes, and to realise the long term benefits in the face of a changing climate. Catalysing change and improving climate resilience is therefore an iterative process to move action forward on all these fronts.

Box 2-1: Catalysing change

Integrating climate resilience in the water sector should build on IWRM approaches and promote the coordinated and resilient development and management of water, land, and related resources, in order to maximize and safeguard the resultant economic and social benefits in an equitable manner, without compromising the sustainability of vital ecosystems. It is not just about managing physical resources, but also about reforming systems and processes to enable users at all levels - women as well as men - to benefit from those resources, both now and into the future. In doing so, it should not only consider the current context but also take a 'foresight' approach of looking at what lies ahead for the region, and the implications of this for water sector planners and decision makers.

Adopting a climate resilient approach should reinforce the achievement of broader national goals and objectives. In practice this means giving water and climate resilience an appropriate place on the national agenda, creating greater climate resilience (and vulnerability) awareness among decision-makers responsible for economic policy and strategy, applying a 'climate lens' to water-related planning and management (in all sectors), and creating more effective channels for communication and shared decision-making on climate resilience between government agencies, organizations, interest groups and communities. As a cross-cutting theme it may also need to encourage thinking "outside the box" of traditional sectoral definitions and processes.

2.1.2. Designing a national process

A Framework for integration to guide the national process has been developed, centred on four key stages:

- Engaging stakeholders and setting objectives;
- Assessing risks and identifying options;
- Prioritising options and planning for implementation;
- Monitoring and evaluating progress.

During each phase, a workshop is anticipated to bring stakeholders together to progress the national process, with each workshop incorporating one or more of the technical sections. The Framework is envisaged as a iterative process with each workshop having associated preparatory and follow-up activities, with implementation progress and results monitored and evaluated throughout. Each phase in the Framework builds on the previous phase towards the overall objective of developing and implementing an investment plan for climate resilience.

The process should be adjusted to meet individual country needs and circumstances. Likewise, the material presented in the technical sessions should be reviewed and adapted to reflect the national context. Where possible, it is advisable to use national case studies, data and lessons learned to ensure the material is highly relevant to national stakeholders and 'grounded' in country-specific realities. The process should be aligned with relevant initiatives to avoid duplication and fill unmet needs.

The Framework is a repeatable process, not a one-off. Repeating the application of the Framework periodically will allow process to be measured towards resilience and the identification of new investment priorities. No specific guidance is provided on how frequently the Framework should be revisited, and this will likely depend on the timescales defined in the investment plan. Revisiting the Framework at five-year intervals would provide an opportunity to re-appraise priorities once short-term investments have been implemented and medium-term investments are in the planning phase.

Box 2-2: Benefits of the approach

The overall outcome is anticipated to be:

- Improvement in the sustainable levels of service in the water supply sector during and after extreme weather events such as droughts and improved long term sustainability of water supply services.

The outputs from the process are anticipated to be:

- Stakeholders are aware of and understand the risks posed by climate change;
- Stakeholders have increased capacity to assess climate risks, identify adaptation options, develop investment plans to support resilience and access finance for implementation;
- Climate Risk and Vulnerability Assessments (CRVAs) are available to inform climate resilient decision-making;
- Improved ability for stakeholders across the water sector to work together to identify options to manage climate risks;
- Investment plans are prepared, financed and implemented leading to improved resilience in the water sector for example:
  - Reduced incidence of water interruptions and disruptions (associated with severe weather);
  - Reduced incidence of drought-related water rationing (and other emergency restrictions);
  - Increased coverage of reliable supply to remote and vulnerable communities;
  - Reduced incidence of water quality contraventions.

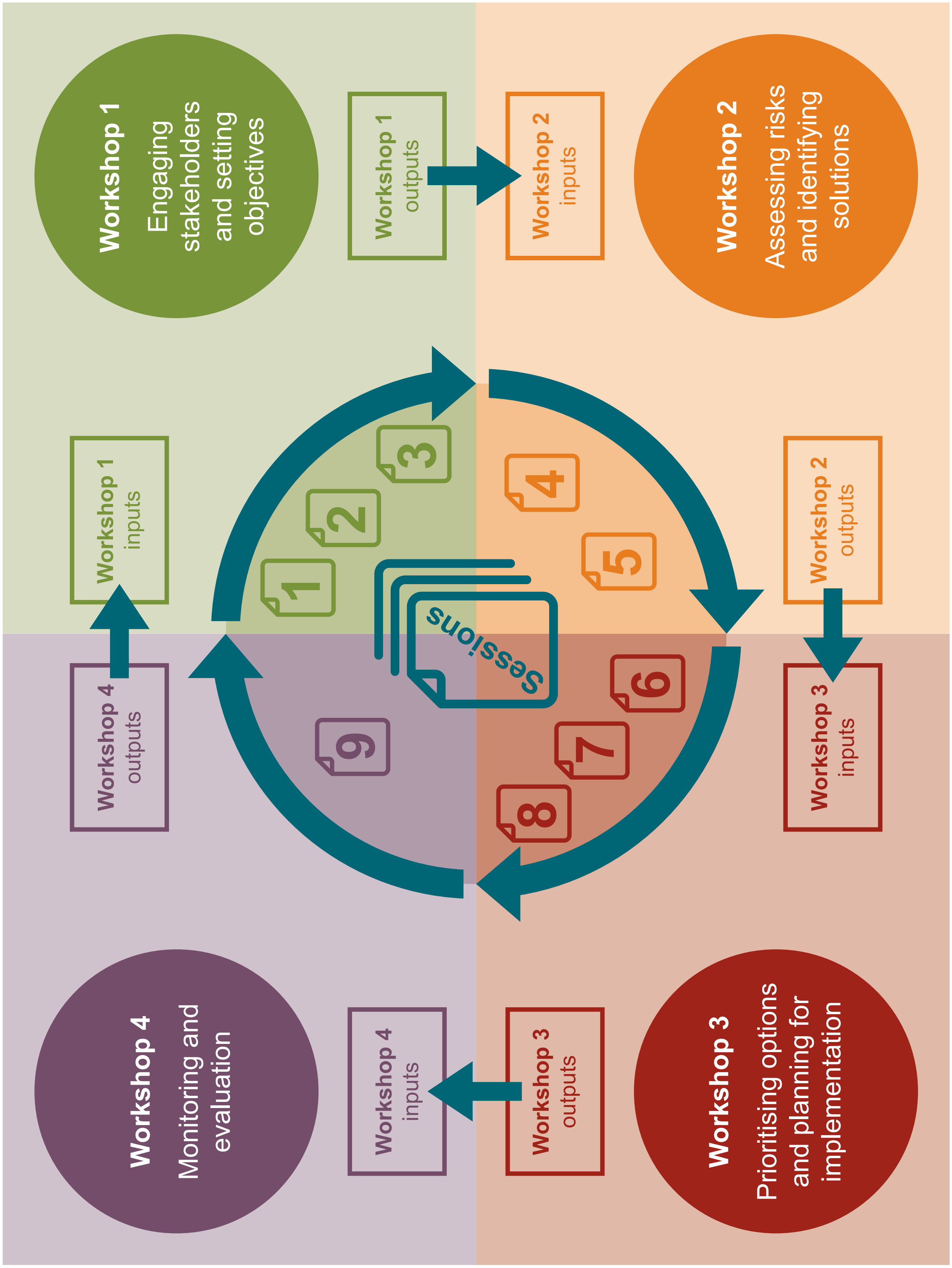


Figure 2-1: Framework for integration including four workshops

	Workshop 1 Engaging stakeholders and setting objectives	Workshop 2 Assessing risks and identifying solutions	Workshop 3 Prioritising options and planning for implementation	Workshop 4 Monitoring and evaluation
Sections	1 2 3	4 5	6 7 8	9
Materials prepared in advance of workshop	■ Stakeholder analysis and engagement plan ■ Draft Framework implementation plan and timeline	■ Draft mapping of institutional landscape in the water sector ■ Characterisation of the water sector and desk based assessment of climate risks	■ Outline structure for Investment Plan ■ Review of appropriate financing sources	■ Draft M&E system
Key workshop activities	■ Raise awareness and understanding of climate resilience ■ Introduce stakeholders to the Framework and Training Manual ■ Agree Framework implementation plan and objectives ■ Apply ***WaterRISK*** tool	■ Screening of policies and plans ■ Climate Risk and Vulnerability Assessment (CRVA) ■ Identification of preliminary adaptation options	■ Prioritisation and organisation of adaptation options ■ Scoping the Investment Plan ■ Identifying and reviewing sources of finance	■ Consultation on finalising the Investment Plan ■ Scoping the M&E system for the Investment Plan
Outputs following workshop	■ Workshop 1 report ■ Finalised Framework implementation plan and timeline ■ ***WaterRISK*** application report	■ Workshop 2 report ■ Screening of policies, legislation and plans report ■ Climate Risk and Vulnerability Assessment (CRVA) ■ Preliminary adaptation actions	■ Workshop 3 report ■ Draft Investment Plan and financing strategy prepared	■ Workshop 4 report ■ Investment Plan and financing strategy finalised and adopted by implementing agencies ■ Monitoring and evaluation system finalised ■ Implementation of Investment Plan and M&E system

Figure 2-2: Overview of the four workshops including preparatory and follow up activities

2.1.3. Preparatory steps

In order to initiate and apply the process, the lead agencies and focal points responsible for leading the process will need to complete a number of preparatory actions prior to a first workshop:

Stakeholder analysis and management plan

- The water sector is highly connected to other sectors, notably tourism, health, energy and agriculture, and therefore careful and managed stakeholder engagement is required to tackle cross cutting water and climate issues. A stakeholder analysis exercise is needed to identify relevant stakeholders from across the water supply services sector, their mandate, role within the water sector and level of interest and influence in the Framework process. A stakeholder engagement plan is then required which sets out the anticipated role of the each stakeholder within the process (for example as a core implementing agency or a consultee through the process). The water sector cuts across into central national planning, development control and disaster risk management. Therefore a broad and carefully considered stakeholder management process is required to ensure that all relevant stakeholders have the right level of input in the Framework process at the right time. Boxes 2-3 and 2-4 provide further guidance on stakeholder analysis and engagement, while references to more detailed source materials are provided in Section 2.1.6.

Building a national team

- Build a national level team that will be collectively responsible for driving the process forward at an operational level. This should involve the national representatives from the training of trainers event. The national team should be in a position to have the influence and resources to drive the process forward (for example the ability to convene stakeholders from across the sector, and time and resources to prepare investment plans).

Obtaining political support

- Garner political support from high level policymakers such as permanent secretaries within the Ministry/ies responsible for water supply and water resources management, as well as utility general managers and their board members. This will be required to ensure that internal resources and staff time can be diverted onto this initiative and that the final outputs gain the necessary high-level endorsement.

Preparing for the first workshop

- Make all key stakeholders aware of the process as defined in the stakeholder engagement plan. This will include preparing and disseminating briefing notes on the process and planning for implementation of the first workshop.

Box 2-3: Stakeholder analysis and engagement plan

Stakeholder analysis is a well-established tool that provides a systematic approach to understanding the interests and influence of identified stakeholders in water security and climate resilience. It is used in this phase of the Framework to provide the following outputs: (1) a formal appraisal of roles, responsibilities and objectives of the identified stakeholders and (2) an understanding of how stakeholders can benefit or obstruct the application of the Framework and how the Framework application may benefit stakeholders.

The analysis typically involves identifying relevant stakeholders and characterising them with the following attributes using a table:

- Category – for example government, private sector, community groups;
- Organisation or agency name;
- Mandate and role in the water sector and climate change adaptation – how does the stakeholder relate to the water sector and other stakeholders;

- Role within the Framework process – what level of involvement is anticipated (for example; decision making, championing and leadership within organisations, providing opinions and guidance, receiving and disseminating information);
- Influence in the Framework process – how influential the stakeholder is in supporting or blocking the Framework process implementation and sustainability;
- Interest in the Framework process – how supportive and committed the stakeholder is to the success of the Framework process.

Section 2.2 provides an example stakeholder analysis for Grenada (note that influence and interest are not included). The influence and interest of the stakeholders will determine their role in the Framework process, and how they are managed and engaged.

	High influence	Low influence
High importance	Key stakeholders to engage for driving through application of the Framework	Key stakeholder who may be under-represented; ensuring participation and protection of interests is important
Low importance	Low importance stakeholders must be managed carefully as their priorities may not align with the Framework	Non-key stakeholders who should be involved in wider consultation

Following stakeholder identification and analysis, a good understanding of the stakeholder base will have been achieved. Stakeholder engagement is the final step in the process of operationalising the stakeholder base to fulfil its intended function. The form of engagement is likely to fall into four categories, as follows:

- Decision making – A small subset of key stakeholders may be engaged in decision making processes themselves.
- Championing – All stakeholders champion the cause to some extent by representing their organisation in the stakeholder base. However, as an explicit role championing involves promoting the Framework application and main activities in related organisations.
- Steering the Framework – Some stakeholders may be consulted for their views in order to maintain the legitimacy of the Framework application and steer the work in useful directions. This advisory role does not carry as much power over the process as a direct role in decision making.
- Dissemination – A wider stakeholder base will be consulted in order to gather opinions and disseminate the ongoing work to organisations outside the core stakeholder base.

A stakeholder management plan should be developed which builds on the analysis to define who, what, when, where and how the identified stakeholders will be involved in the Framework process. This might be as part of a steering group or implementing team, as participants at workshops, or as part of wider dissemination of activities.

Box 2-4: Stakeholders in the water sector

The water sector is highly connected to other sectors, notably tourism, health, energy and agriculture. It also cuts across into central national planning, development control and disaster risk management. An indicative and non-exhaustive list of potential stakeholders is shown below.

Stakeholder	Typical role in the water sector
Water services provider (likely to be the lead organisation in the CRVA)	Provision of reliable, safe, sustainable and affordable water supplies (and wastewater services). In most cases a corporate body or a department of government.
Ministry responsible for water services provision	Oversight of water services provision where no independent regulator exists.
Water supply regulatory agency (if separate from Ministry)	Independent regulator for water service provision (often this is absent and the role is taken by a parent ministry).
Water resources management agency (if separate from Ministry)	Independent regulator for water resources management (in many cases this responsibility rests with a parent ministry or is split between government departments).
Department of Agriculture	Farming community as water users and land stewards (particularly if operating upstream of intakes / within aquifer recharge areas). Management / regulation of irrigation schemes.
Department of Forestry (and Department of National Parks)	Land management function in Crown Lands and other forested areas (national park protection).
Physical planning department	Land use zoning and development permitting.
Environmental Health Department	Regulation of Environmental Health issues such as drinking water quality, pollution control, wastewater regulation and marine / freshwater environmental water quality issues.
Ministry of Finance	Oversight of major investment programmes in the water sector.
Meteorological Office	Provision of weather information, climate outlooks and climate change projections to support operational planning in the water sector.
Disaster Management Office	Planning for disasters and coordinating efforts to restore services (including water) following a disaster.
Ministry of Works	Management of road infrastructure and major construction programmes (road access required for water sector activities, often impacted during disasters).
Electricity utility (and parent Ministry)	Provision of reliable electricity supply for water sector operations (and oversight of the energy sector as a whole).
Chamber of Commerce	Representative of business interests (in the context of reliable and safe water supplies and wastewater services).
Community groups	Representatives of local or thematic issues (youth and gender).
Major water users	Large businesses which depend on substantial public or private supplies (for example breweries, bottlers, distillers, or very significant hotels, cruise ship terminals etc).

2.1.4. Outputs and deliverables

Implementing the Framework is centred around four workshops. Each workshop will require preparatory activities and follow up activities, and a set of deliverables should be produced through the process. It will be important to clearly define the deliverables at the start of the Framework process so the national team and stakeholders have a common understanding of what will be produced. Although the workshops form the 'backbone' of the process, it is important to note that the bulk of the analytical work and detailed development of investment plans and other outputs will occur outside the of workshops.

The schematic below provides an indicative list of the deliverables which the Framework process will likely produce. Note that although a large number of deliverables are listed here, most are interim deliverables which inform the Framework process. The main and final deliverables, on which the lasting impacts of the process will be judged, is the Investment Plan and its successful implementation.

Preparation				Following
■ Stakeholder analysis and engagement plan. ■ Draft implementation plan and timeline for the national process.	→	Workshop 1	→	■ Workshop report covering a synthesis of workshop activities and outcomes. ■ Finalised implementation plan and timeline for the national process. ■ ***WaterRISK*** application report providing a preliminary scoring and identification of the broad priorities to be addressed.
■ Draft mapping of institutional landscape in the water sector and the key policies, plans, legislation and regulation governing the sector, as well as any recent initiatives of relevance. ■ Characterisation of the water sector and desk-based assessment of climate risks, in order to inform the participatory CRVA assessment, including a simple inventory of data availability and gaps to support the CRVA and climate change projections for the water sector.	→	Workshop 2	→	■ Screening report for policies, plans, legislation and regulation and recommended actions for improving the Enabling Environment. ■ CRVA report including potential actions to increase climate resilience.
■ Synthesized long list of potential actions to increase climate resilience, organised and fleshed out in preparation for multi-criteria analysis ■ Outline structure for an Investment Plan to incorporate the prioritised actions ■ Initial review of appropriate financing options for the various types of adaptation options identified in workshop 2.	→	Workshop 3	→	■ Workshop 3 report ■ Draft Investment Plan and financing strategy prepared, including how investments will be integrated within organisation's strategic plans and annual plans / budgets.
■ Draft M&E system prepared for Investment Plan, including Log Frame.	→	Workshop 4	→	■ Finalise Investment Plan and financing strategy. ■ Finalise and implement M&E system (this is expected to trigger periodic reviews against progress, and adjustment of the Investment Plan. ■ Begin implementation of Investment Plan (preparing concept notes, conducting pre-feasibility and feasibility studies, making business cases etc).

2.1.5. Process timeline

A typical national process is likely to be 12 months or so. The timeline should include a meaningful inception phase of approximately 2-months and each workshop will require approximately 1½ months of pre-preparation and further 1½ of follow-up activities. Follow-up after the final workshop will likely require a longer period in order to finalise the Investment Planning process and putting an effective M&E system in place. An illustrative timeline is shown in Figure 2-3 below.

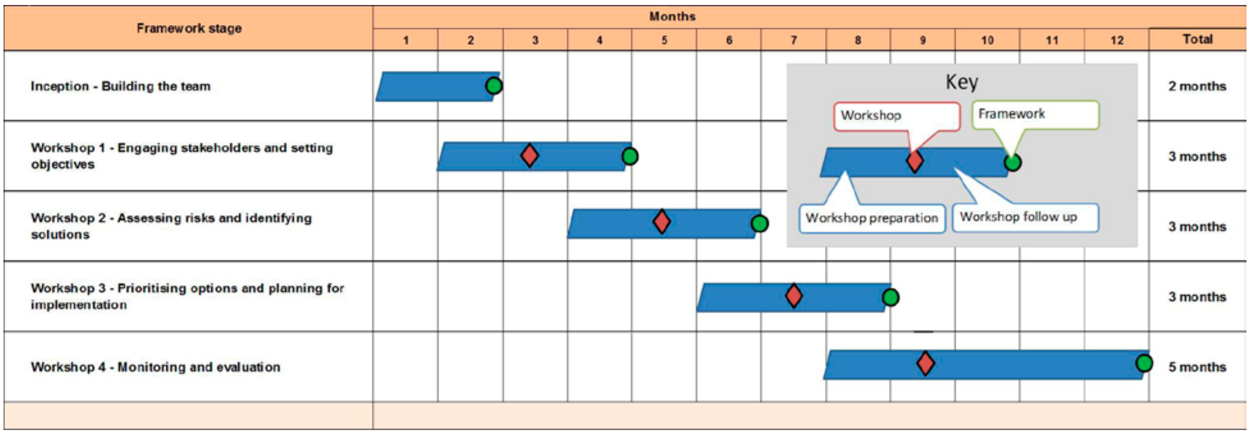


Figure 2-3: Illustrative timeline for the roll-out of the national process

This timeline is considered to be the minimum required in order to work through the process and achieve the Framework outputs. If resources and the availability of personnel allows, the depth and detail of the process could be improved by extending the workshop durations from 2 to 4 days, and providing a longer duration to allow for more in-depth activities between workshops, such as bilateral meetings and analytical studies on priority issues. As such, each national application of the Framework should be tailored such that the resources deployed to undertake the process is proportional to the anticipated depth and detail of the outputs.

2.1.6. Relevant material and other resources

Box 2-5: Relevant material and other resources

Achieving Development Resilient to Climate Change: A Sourcebook for the Caribbean Water Sector. Global Water Partnership-Caribbean (GWP-C and CCCCC, 2014).

Available at: https://www.gwp.org/en/Caribbean-Water-and-Climate-Knowledge-Platform/Water-and-Climate-Funding/x/

Catalyzing Change: A handbook for developing integrated water resources management (IWRM) and water efficiency strategies (GWP Technical Committee, 2004).

Available at: https://www.gwp.org/en/learn/KNOWLEDGE_RESOURCES/Global_Resources/Catalyzing-Change-Handbook1/

Tools for Institutional, Political, and Social Analysis of Policy Reform. A Sourcebook for Development Practitioners (Holland, J., 2007, The World Bank, Washington D.C., USA).

Available at: http://hdl.handle.net/10986/6652

Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners (UNDP-UNEP Poverty-Environment Initiative, 2011).

Available at: http://www.undp.org/content/undp/en/home/librarypage/environment-energy/climate_change/adaptation/mainstreaming_climatechangeadaptationintodevelopmentplanningagui.html

2.2 Section 2: Case examples

2.2.1. Workshop 1: Engaging stakeholders and setting objectives (example invitations and agendas)

Dear Participant

Re: Integration of Climate Resilience in the Water Services Sector:

Invitation to Workshop 1 – Engaging stakeholders and setting objectives

Background

A national process to integrate climate resilience in the water services sector is on-going. The overall process aims to strengthen the capacity of national practitioners, to support the establishment of robust and implementable climate resilient policies and investment plans and to identify potential financing for their effective implementation, see box below.

Box 2-6: Integrating climate resilience in the water services sector

Outputs:

- Stakeholders are aware of and understand the risks posed by climate change;
- Improved ability for stakeholders across the water sector to work together to manage climate risks;
- Stakeholders have increased capacity to assess climate risks, identify adaptation options, develop investment plans to support resilience and access finance for implementation;
- Investment plans are prepared, financed and implemented leading to improved resilience in the water sector for example:
  - Reduced incidence of water interruptions and disruptions (associated with severe weather);
  - Reduced incidence of drought related water rationing (and other emergency restrictions);
  - Increased coverage of reliable supply to remote and vulnerable communities;
  - Reduced incidence of water quality contraventions.

Outcomes:

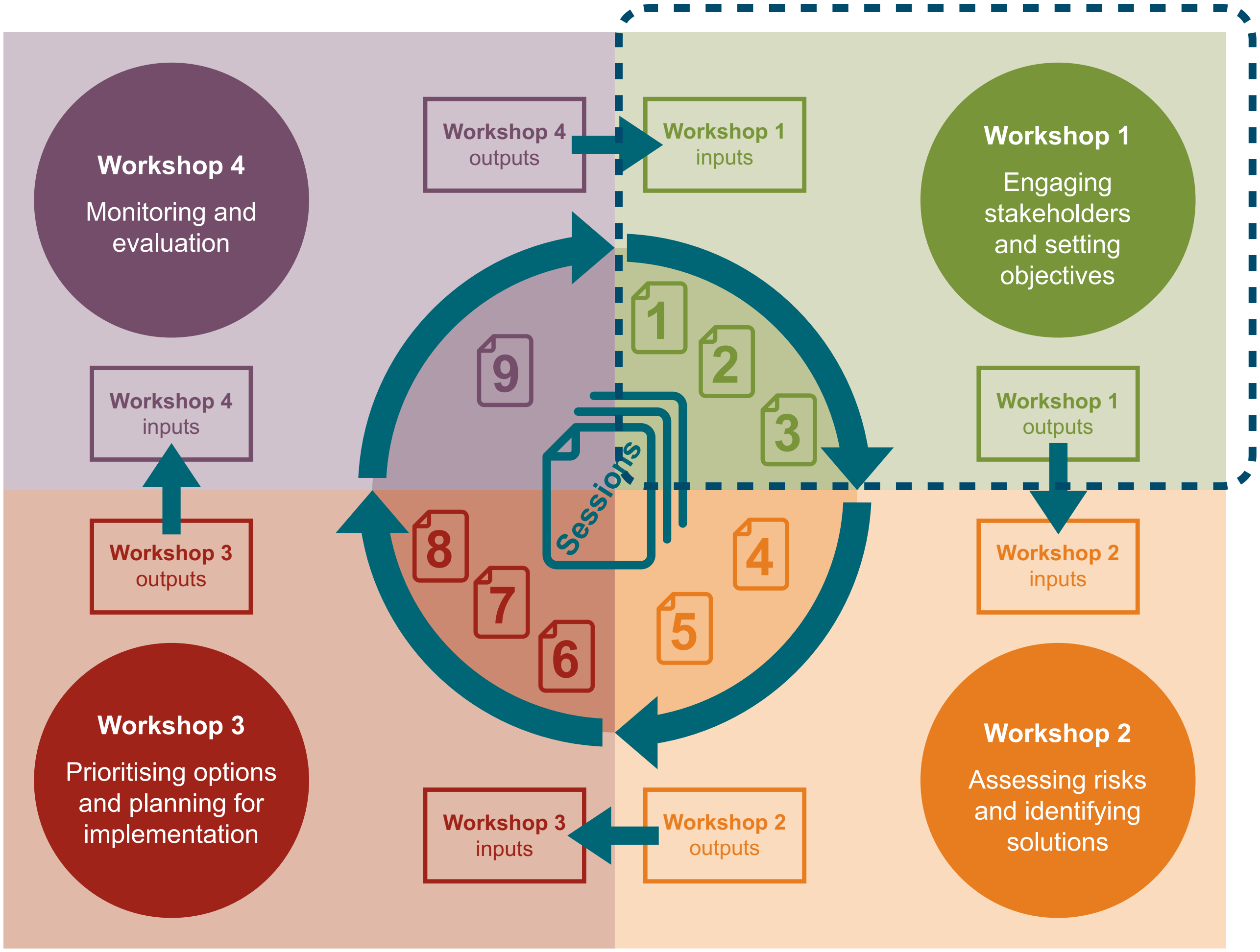
- Improvement in the resilience and robustness of water supply services to reduce operational risks associated with climate variability and change, and improved long term sustainability.

Workshop objectives

This workshop is the first of four in the application of the Framework. It will engage stakeholders on the Framework process and outputs, apply the ***WaterRISK*** resilience screening tool and develop a vision for a climate resilient water sector.

Specifically, this workshop covers the following sections from the Training Manual, see schematic below:

- Section 1: Climate resilience
- Section 2: Framework for integration: a national process
- Section 3: ***WaterRISK***: a water sector resilience assessment tool



Date and venue

This workshop is a 2 day event to be held **[insert date and time]** at the **[insert venue]**.

Training Manual and Guidance Materials

Participants have been provided with a Training Manual which covers the technical aspects of the Framework process. This workshop is based around the first three sections in the Training Manual. Participant should familiarise themselves with the Training Manual in advance of the workshop, particularly Sections 1-3.

Preparation in advance of the workshop

Participants should consider the following questions in advance of the workshop:

- What does climate resilience mean in terms of your organisation's role and mandate?
- What types of climate impacts are being felt in the water sector? How are these impacting society, economic activity and the environment?
- Is climate resilience being measured, if so what indicators are used?
- How can the ***WaterRISK*** tool be applied?
- What initiatives are already underway to increase climate resilience and what lessons have been learned?
- What are the strategic objectives for the water sector? Is there a long term vision which incorporates climate resilience?

Yours sincerely

Draft agenda – Day 1

The objective of Day 1 is to introduce the status of climate resilience in the Caribbean water sector and to highlight the challenges that will be faced if action is not taken. Participants will be introduced to a Framework for the Integration of climate resilience as a national process to catalyse change. The Training Manual and Guidance Materials supporting implementation of the Framework will then be introduced.

No. / Time	Session title	Objectives / Content	Reference materials
1.0 08:30-09:00	Registration	■ Registration list ■ Welcome pack / Final Agenda / List of Participants	Training Manual and Guidance Materials Expectations form / Evaluation form
1.1 09:00 - 10:30	Introduction	■ Welcome and introductions ■ Opening remarks ■ Purpose and objectives ■ Optional - Keynote speaker on the issues of climate resilience in the water sector	
10:30 - 11:00	Tea break		
1.2 11:00 -13:00	Climate resilience issues in the Caribbean	■ Presentation giving an overview of climate resilience in the Caribbean water sector ■ Open discussion on challenges and needs. ■ Defining a vision for climate resilience in the Caribbean water sector ■ Plenary discussion	Training Manual – Section 1
13:00 - 14:00	Lunch break		
1.3 14:00 – 15:00	A Framework for the Integration of Climate Resilience	■ Present a framework for integrating climate resilience in the water supply sector; ■ Familiarise with the structure of the framework and its aims and objectives; ■ Question and answer session	Training Manual – Section 2
1.4 15:00 – 15:30	Introduction to Training Manual and Guidance Materials	■ Presentation on the structure and content of the Training Manual ■ Structure and content of the Training Manual, quick reference guide ■ Question and answer session	Training Manual / All
15:30 - 16:00	Tea break		
1.5 16:00 – 17:00	WaterRiSK: a self-assessment tool	■ Introduction to ***WaterRISK*** ■ Briefing on how it will be applied on Day 2	Training Manual / Section 3
1.6 17:00-17:30	Round-up Day 1, and preparations for Day 2		Participants to familiarise themselves with the Training Manual and Guidance Materials

Draft agenda – Day 2

The objective of Day 2 is to introduce and apply the ***WaterRISK*** assessment tool in order to score resilience across the Enabling Environment, water resources management and water supply systems. This will provide a 'learning by doing' approach to capacity development and will help to identify the high level issues to focus on in more detail in the following workshop. The workshop closes with a planning session for the following workshop.

No. / Time	Session title	Objectives / Content	Reference materials
2.0 08:30-09:00	Registration	■ Registration list	Training Manual and Guidance Materials Expectations form / Evaluation form
2.1 09:00 - 09:30	Recap on Day 1 and introduction to Day 2	■ Welcome ■ Opening remarks ■ Recap on Day 1 activities ■ Purpose and objectives	
2.2 09:30 - 10:30	Introducing ***WaterRISK***	■ Introduction to the tool ■ Purpose and benefits ■ Structure and how to apply	Training Manual Section 3 ***WaterRISK*** Manual and case studies
10:30 - 11:00	Tea break		
2.3 11:00 -13:00	Applying ***WaterRisk*** (part 1)	■ Case study examples of ***WaterRISK*** application ■ Briefing participants on Group work ■ Group application of ***WaterRISK*** (part1)	Training Manual Section 3 ***WaterRISK*** Manual and case studies
13:00 - 14:00	Lunch break		
2.4 14:00 – 16:00	Applying ***WaterRisk*** (part 2)	■ Continue group application of ***WaterRISK*** ■ Presentation and discussion of findings ■ Identifying priority areas for action based on ***WaterRISK***	Training Manual Section 3 ***WaterRISK*** Manual and case studies
16:00 - 16:30	Tea break		
2.5 16:30 – 17:30	Wrap up and briefing on the next steps	■ Identify deliverables to be produced by national team (workshop report, completed ***WaterRISK*** applications) ■ Briefing on workshop 2 objectives, logistics and participant preparatory activities	

2.2.2. Workshop 2: Assessing risks and identifying solutions (example invitations and agendas)

Dear Participant

Re: Integration of Climate Resilience in the Water Services Sector:

Invitation to Workshop 2 – Assessing risks and identifying solutions

Background

A national process to integrate climate resilience in the water services sector is on-going. The overall process aims to strengthen the capacity of national practitioners, to support the establishment of robust and implementable climate resilient policies and investment plans and to identify potential financing for their effective implementation, see box below.

Box 2-7: Integrating climate resilience in the water services sector

Outputs:

- Stakeholders are aware of and understand the risks posed by climate change;
- Improved ability for stakeholders across the water sector to work together to manage climate risks;
- Stakeholders have increased capacity to assess climate risks, identify adaptation options, develop investment plans to support resilience and access finance for implementation;
- Investment plans are prepared, financed and implemented leading to improved resilience in the water sector for example:
  - Reduced incidence of water interruptions and disruptions (associated with severe weather);
  - Reduced incidence of drought-related water rationing (and other emergency restrictions);
  - Increased coverage of reliable supply to remote and vulnerable communities;
  - Reduced incidence of water quality contraventions.

Outcomes:

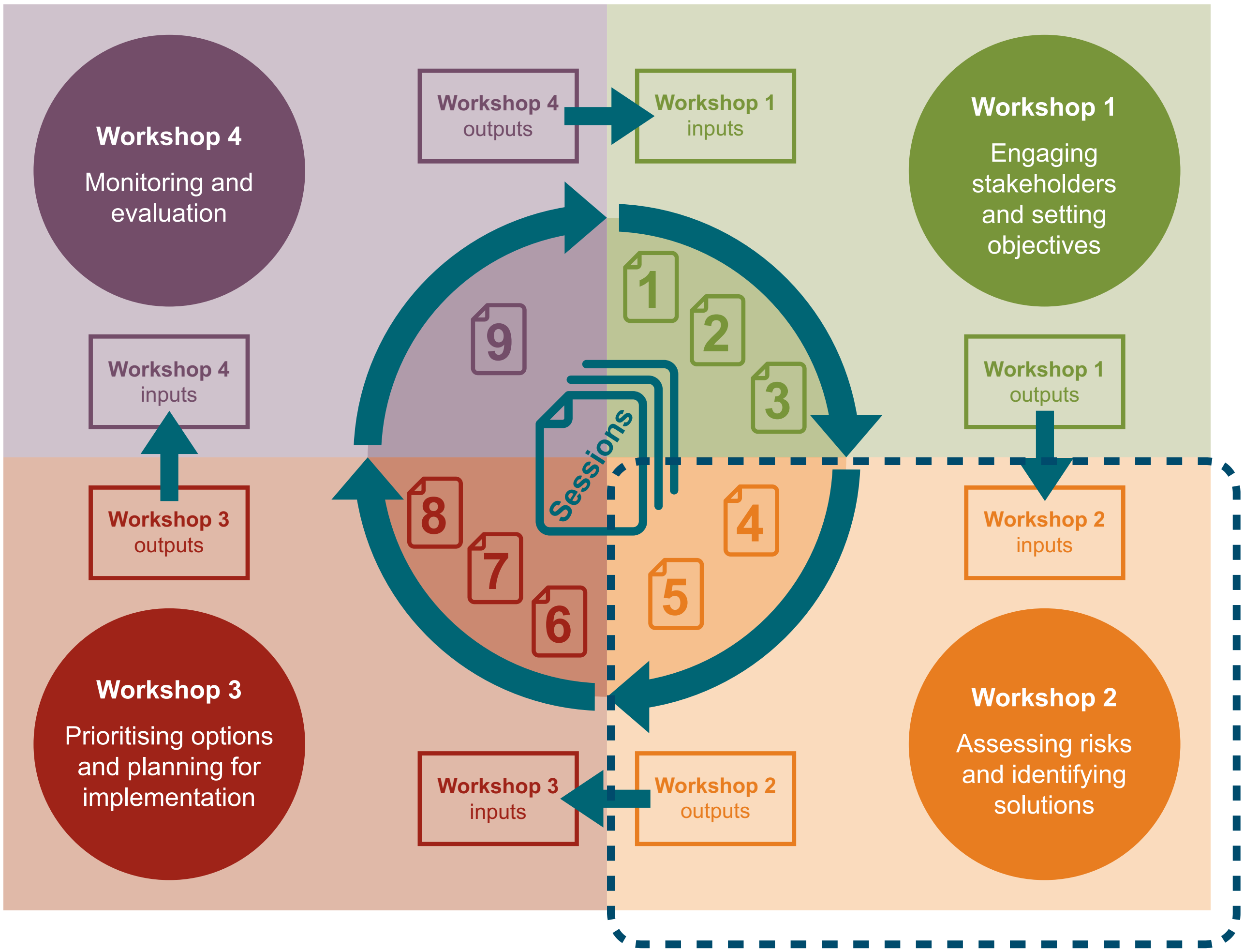
- Improvement in the resilience and robustness of water supply services to reduce operational risks associated with climate variability and change, and improved long-term sustainability.

Workshop objectives

This workshop is the second of four workshops in the process. The first workshop engaged stakeholders on the overall national process and outputs, applied the ***WaterRISK*** self-assessment screening tool and developed a vision for a climate resilient water sector. The objectives of this workshop will be to build on these previous steps by screening policies and plans and assessing climate risks in more detail. A range of options to manage climate risks and increase resilience will also be identified.

Specifically, this workshop covers the following sections from the Training Manual, see schematic below:

- Section 4: Screening of Legislation, Policies, Strategies and Plans
- Section 5: Climate Risk and Vulnerability Assessment (CRVA)



Date and venue

This workshop is a 2 day event to be held **[insert date and time]** at the **[insert venue]**.

Training Manual and Guidance Materials

Participants have been provided with Guidance Materials which cover the technical aspects of the overall national process. This workshop is based around Sections 4 and 5. Participants should familiarise themselves with the Guidance Materials in advance of the workshop.

In addition participants will need to have a thorough understanding of the policy and plans which guide their organisation's mandate, and the climate risks facing their activities.

Preparation in advance of the workshop

Participants should consider the following questions in advance of the workshop:

- What are the policies, plans, legislation and regulations which govern your organisation's mandate?
- How effective are these in supporting climate resilience, what are the barriers and how can they be overcome?
- How do climate hazards impact on the water sector, how severe are these impacts and how often do they occur? Are the impacts acceptable or not?
- What measures can be taken to reduce impacts to acceptable levels?

Yours sincerely

Draft agenda – Workshop 2 / Day 1

The objective for Day 1 is firstly to introduce the participants to the workshop in the context of the series of workshops under the Framework to integrate climate resilience in the water services sector. Secondly, participants will review the institutional landscape in the water sector and the policies, plans, legislation and regulations, and identify recommendations to improve climate resilience.

No. / Time	Session title	Objectives / Content	Reference materials
1.0 08:30-09:00	Registration	■ Registration list ■ Welcome pack / Final Agenda / List of Participants	Training Manual and Guidance Materials Expectations form / Evaluation form
1.1 09:00 - 10:30	Introduction	■ Welcome and introductions ■ Opening remarks ■ Purpose and objectives ■ Recap of previous workshop	
10:30 - 11:00	Tea break		
1.2 11:00 -13:00	Screening of policies and plans (Part 1)	■ Presentation giving an overview of the screening of policies and plans section ■ Presentation on the institutional and legislative environment (to be prepared by the national team) ■ Group exercise – Describe Enabling Environment	Training Manual – Section 4
13:00 - 14:00	Lunch break		
1.314:00 – 15:00	Screening of policies and plans (Part 2)	■ Group exercise – Mapping the institutional environment	Training Manual – Section 4
1.415:00 – 15:30	Screening of policies and plans (Part 3)	■ Group exercise – Review the role of Climate Resilience and gender-sensitive considerations in legislation, policies, strategies and plans	Training Manual – Section 4
15:30 - 16:00	Tea break		
1.516:00 – 17:00	Identifying actions to improve climate resilience through legislative and institutional measures	■ Discussion of strengths and weaknesses of legislative and institutional environments to support resilience ■ Synthesis of recommendations for improving the legislative and institutional environment and overcoming barriers to implementation	Training Manual – Section 4
1.617:00-17:30	Round-up Day 1, and preparations for Day 2	■ Recap of day's activities and briefing on day 2	Participants to familiarise themselves with the Training Manual and Guidance Materials

Draft agenda – Workshop 2 / Day 2

The objective of Day 2 is to conduct a participatory CRVA on water supply systems, in order to identify a set of potential adaptation options to increase resilience to climate risks. These options will be taken forward to workshop 3 for further refinement before integration into an investment plan. The workshop closes with a planning session for the following workshop.

No. / Time	Session title	Objectives / Content	Reference materials
2.0 08:30-09:00	Registration	■ Registration list	Training Manual and Guidance Materials Expectations form / Evaluation form
2.1 09:00 - 09:30	Recap on Day 1 and introduction to Day 2	■ Welcome ■ Opening remarks ■ Recap on Day 1 activities ■ Purpose and objectives	
2.2 09:30 - 10:30	Climate impacts on water supplies	■ Presentation of climate impacts on water supplies and the risks posed by climate change ■ Plenary discussion on risks and needs	Training Manual Section 5
10:30 - 11:00	Tea break		
2.3 11:00 -13:00	Climate Risk and Vulnerability Assessment (part 1)	■ Briefing on approach to complete the Risk Assessment Matrix ■ Participants begin Risk Assessment in Plenary (or groups if numbers are sufficiently large)	Training Manual Section 5
13:00 - 14:00	Lunch break		
2.4 14:00 – 16:00	Climate Risk and Vulnerability Assessment (part 2)	■ Continue group completion of Risk Assessment Matrix ■ Presentation and discussion of findings	Training Manual Section 5
16:00 - 16:30	Tea break		
2.5 16:30 – 17:30	Wrap up and briefing on the next steps	■ Identify deliverables to be produced by national team (workshop report, completed CRVA report, long list of adaptation options to take into workshop three) ■ Briefing on workshop 3 objectives, logistics and participant preparatory activities	

2.2.3. Workshop 3: Prioritising options and planning for implementation (example invitations and agendas)

Dear Participant

Re: Integration of Climate Resilience in the Water Services Sector:

Invitation to Workshop 3 – Prioritising options and planning for implementation

Background

A national process to integrate climate resilience in the water services sector is on-going. The overall process aims to strengthen the capacity of national practitioners, to support the establishment of robust and implementable climate resilient policies and investment plans and to identify potential financing for their effective implementation, see box below.

Box 2-8: Integrating climate resilience in the water services sector

Outputs:

- Stakeholders are aware of and understand the risks posed by climate change;
- Improved ability for stakeholders across the water sector to work together to manage climate risks;
- Stakeholders have increased capacity to assess climate risks, identify adaptation options, develop investment plans to support resilience and access finance for implementation;
- Investment plans are prepared, financed and implemented leading to improved resilience in the water sector for example:
  - Reduced incidence of water interruptions and disruptions (associated with severe weather);
  - Reduced incidence of drought related water rationing (and other emergency restrictions);
  - Increased coverage of reliable supply to remote and vulnerable communities;
  - Reduced incidence of water quality contraventions.

Outcomes:

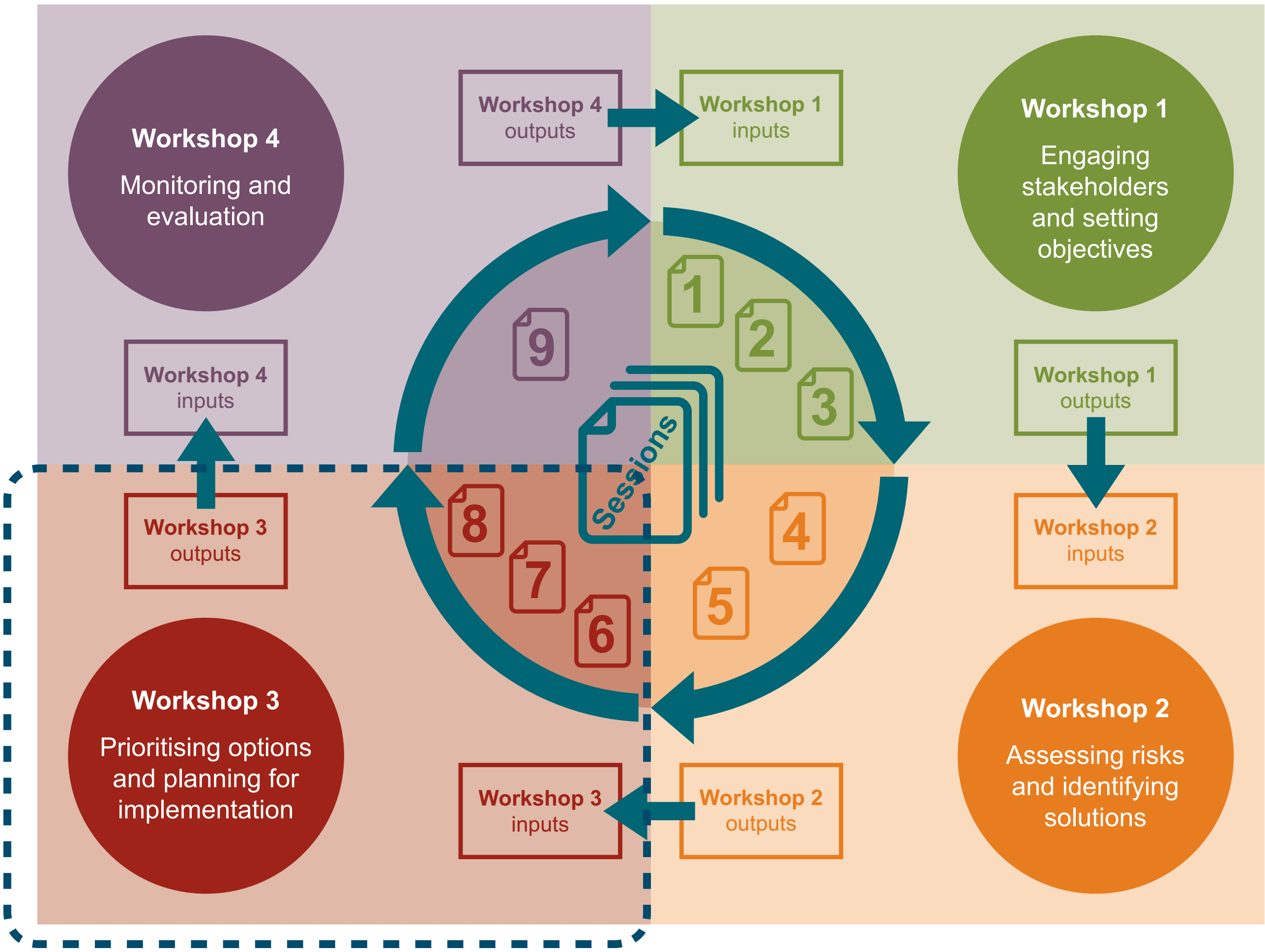
- Improvement in the resilience and robustness of water supply services to reduce operational risks associated with climate variability and change, and improved long-term sustainability.

Workshop objectives

This workshop is the third of four in the application of the Framework. The first workshop engaged stakeholders on the Framework process and outputs, applied the ***WaterRISK*** resilience screening tool and developed a vision for a climate resilient water sector. The second workshop screened policies and plans, and assessed climate risks in more detail. This workshop will prioritise adaptation options identified in workshop 2 and set out the steps for taking these forward for implementation.

Specifically, this workshop covers the following sections from the Training Manual, see schematic below:

- Section 6: Prioritising Adaptation Options for Implementation
- Section 7: Taking Options Forward for Implementation
- Section 8: Identifying Sources of Finance to Implement Priority Adaptation Measures



Date and venue

This workshop is a 2 day event to be held **[insert date and time]** at the **[insert venue]**.

Training Manual and Guidance Materials

Participants have been provided with a Training Manual which covers the technical aspects of the Framework process. This workshop is based around Sections 6, 7 and 8 in the Training Manual. Participants should familiarise themselves with the Training Manual in advance of the workshop, particularly Sections 6 to 8.

In addition participants will need to have a thorough understanding of the adaptation options identified in workshop 2.

Preparation in advance of the workshop

Participants should consider the following questions in advance of the workshop:

- What criteria should be used to prioritise adaptation options?
- What are the steps required to take adaptation options from concept to 'bankable' projects?
- How can adaptation options be drawn together into an investment plan, and how can this be coordinated and integrated in implementing agencies plans and budgets?
- What sources of finance have been successfully drawn on in the past? What new opportunities are on the horizon?
- What are the criteria to access the various financing streams?

Yours sincerely

Draft agenda – Day 1

The objective for Day 1 is to review and validate adaptation options identified during workshop 2, and to prioritise these using a Multi Criteria Analysis (MCA). The scoring criteria for the MCA will be determined by the participants and the MCA applied to derive a prioritised set of adaptation options.

No. / Time	Session title	Objectives / Content	Reference materials
1.0 08:30-09:00	Registration	■ Registration list ■ Welcome pack / Final Agenda / List of Participants	Training Manual and Guidance Materials Expectations form / Evaluation form
1.1 09:00 - 10:30	Introduction	■ Welcome and introductions ■ Opening remarks ■ Purpose and objectives ■ Recap of previous workshop	
10:30 - 11:00	Tea break		
1.2 11:00 -13:00	Review of adaptation options identified in workshop 2	■ Presentation of adaptation options ■ Plenary discussion on gaps and overlaps, refinement of adaptation options list	Adaptation options from workshop 2
13:00 - 14:00	Lunch break		
1.3 14:00 – 15:30	Multi Criteria Analysis (part 1)	■ Briefing on MCA ■ Plenary session to determine MCA criteria and weighting Group exercise – Completion of MCA in workshop setting ■ Presentation of results	Training Manual – Section 6
15:30 - 16:00	Tea break		
1.4 16:00 – 17:00	Review of prioritised adaptation options	■ Discussion of prioritised list of adaptation options, strengths and weaknesses of approach, and how these can be structured and organised into an investment plan	Training Manual – Section 6
1.5 17:00-17:30	Round-up Day 1, and preparations for Day 2	■ Recap of day’s activities and briefing on day 2	Participants to familiarise themselves with the Training Manual and Guidance Materials

Draft agenda – Day 2

The objective of Day 2 is to identify how the prioritised adaptation options can be taken forward from concept stage through to a 'bankable' project proposal which is able to secure financing for implementation. In addition, the likely sources of finance will be reviewed and specific opportunities for securing finance will be discussed in detail.

No. / Time	Session title	Objectives / Content	Reference materials
2.0 08:30-09:00	Registration	■ Registration list	Training Manual and Guidance Materials Expectations form / Evaluation form
2.1 09:00 - 09:30	Recap on Day 1 and introduction to Day 2	■ Welcome ■ Opening remarks ■ Recap on Day 1 activities ■ Purpose and objectives	
2.2 09:30 - 10:30	Taking options forward	■ Presentation on steps for taking the options forward for implementation ■ Plenary discussion on barrier and opportunities to implementation	Training Manual Section 7
10:30 - 11:00	Tea break		
2.3 11:00 -13:00	Developing an investment plan	■ Presentation on a draft structure for an investment plan ■ Plenary discussion on structure, and potential implementation modalities of investment plan and integration into budgets and plans for implementing agencies	Training Manual Section 7
13:00 - 14:00	Lunch break		
2.4 14:00 – 16:00	Financing options	■ Presentation on recent and upcoming opportunities for finance at a national level (ministry of finance?) ■ Presentation on emerging opportunities (for example the GCF) ■ Plenary discussion on country experience with accessing finance and how to overcome barriers	Training Manual Section 8
16:00 - 16:30	Tea break		
2.5 16:30 – 17:30	Wrap up and briefing on the next steps	■ Validation of deliverables to be produced by national team (investment plan scope, financing plan) ■ Briefing on workshop 3 objectives, logistics and participant preparatory activities	

2.2.4. Workshop 4: Monitoring and evaluation (example invitations and agendas)

Dear Participant

Re: Integration of Climate Resilience in the Water Services Sector:

Invitation to Workshop 4 – Monitoring and evaluation

Background

A national process to integrate climate resilience in the water services sector is on-going. The overall process aims to strengthen the capacity of national practitioners, to support the establishment of robust and implementable climate resilient policies and investment plans and to identify potential financing for their effective implementation, see box below.

Box 2-9: Integrating climate resilience in the water services sector

Outputs:

- Stakeholders are aware of and understand the risks posed by climate change;
- Improved ability for stakeholders across the water sector to work together to manage climate risks;
- Stakeholders have increased capacity to assess climate risks, identify adaptation options, develop investment plans to support resilience and access finance for implementation;
- Investment plans are prepared, financed and implemented leading to improved resilience in the water sector for example:
  - Reduced incidence of water interruptions and disruptions (associated with severe weather);
  - Reduced incidence of drought related water rationing (and other emergency restrictions);
  - Increased coverage of reliable supply to remote and vulnerable communities;
  - Reduced incidence of water quality contraventions.

Outcomes:

- Improvement in the resilience and robustness of water supply services to reduce operational risks associated with climate variability and change, and improved long term sustainability.

Workshop objectives

This workshop is the fourth of four in the application of the Framework. The third workshop prioritised adaptation options identified in workshop two and set out the steps for taking these forward for implementation, through an investment plan. This workshop will develop a M&E system which will be used to assess progress on the implementation of the investment plan.

Specifically, this workshop covers the following sections from the Training Manual, see schematic below:

- Section 9: Monitoring and Evaluation of Implemented Adaptation Measures

Date and venue

This workshop is a 1.5 day event to be held **[insert date and time]** at the **[insert venue]**.

Training Manual and Guidance Materials

Participants have been provided with a Training Manual which covers the technical aspects of the Framework process. This workshop is based around Section 9 in the Training Manual. Participant should familiarise themselves with the Training Manual in advance of the workshop, particularly Section 9.

In addition participants will need to have a thorough understanding of the draft investment plan prepared following workshop three.

Preparation in advance of the workshop

Participants should consider the following questions in advance of the workshop:

- What M&E systems are already being applied? How successful are these?
- What are the measurable ‘results’ which the investment plan is seeking to generate?
- What are the broader indicators of a resilient water sector?
- How can the M&E system adapt to changing priorities in future?

Yours sincerely

Draft agenda – Day 1

The objective for Day 1 is to review and validate the draft Investment Plan drawn up following workshop 3 and present and refine the draft M&E system prepared in advance of the workshop. This includes examining the results framework and indicators.

No. / Time	Session title	Objectives / Content	Reference materials
1.0 08:30-09:00	Registration	■ Registration list ■ Welcome pack / Final Agenda / List of Participants	Training Manual and Guidance Materials Expectations form / Evaluation form
1.1 09:00 - 10:30	Introduction	■ Welcome and introductions ■ Opening remarks ■ Purpose and objectives ■ Recap of previous workshop	
10:30 - 11:00	Tea break		
1.2 11:00 -13:00	Draft Investment Plan	■ Presentation of draft Investment Plan ■ Plenary discussion on Investment Plan and validation of investments, roles and responsibilities ■ Agreement on steps for finalisation	Draft investment plan prepared following workshop 3
13:00 - 14:00	Lunch break		
1.3 14:00 – 15:00	M&E systems – success factors	■ Presentation the importance of a successful M&E system ■ Plenary discussion on experience with M&E systems and characteristics of successful M&E	Training Manual – Section 9
15:00 - 15:30	Tea break		
1.4 15:30 – 17:00	Draft M&E system for Investment Plan	■ Presentation of draft M&E system ■ Discussion on results framework and validation of indicators	Training Manual – Section 9 Draft M&E system prepared following workshop 3
1.5 17:00-17:30	Round-up Day 1, and preparations for Day 2	■ Recap of day's activities and briefing on day 2	Participants to familiarise themselves with the Training Manual and Guidance Materials

Draft agenda – Day 2

The objective of Day 2 is to agree the roles and responsibilities in implementing the Investment Plan and M&E system and agree the next steps following the workshop.

No. / Time	Session title	Objectives / Content	Reference materials
2.0 08:30-09:00	Registration	■ Registration list	Training Manual and Guidance Materials Expectations form / Evaluation form
2.1 09:00 - 09:30	Recap on Day 1 and introduction to Day 2	■ Welcome ■ Opening remarks ■ Recap on Day 1 activities ■ Purpose and objectives	
2.2 09:30 - 11:00	M&E and Investment Plan roles and responsibilities	■ Presentation and validation of roles and responsibilities within Investment Plan	Draft Investment Plan and M&E system prepared following workshop 3 Training Manual Section 9
11:00 - 11:30	Tea break		
2.3 11:00 -12:00	Developing an action list for implementation	■ Presentation on the next steps towards implementation ■ Agreement on actions and timeline	Draft Investment Plan and M&E system prepared following workshop 3 Training Manual Section 9
2.4 12:00 – 12:30	Wrap up and briefing on the next steps	■ Wrap up session to gather feedback on the process encourage momentum in the implementation process (keynote closing session)	

2.2.5. Case example: Stakeholder analysis in Grenada

Category	Organisation/agency	Remit / role in water sector and/ or climate change adaptation	Project relevance
Government Department/ Local Authority, Quasi-Government Organization	**Ministry of Health and Social Security** - in particular the Environmental Affairs and Environmental Health (public health) Departments.	**Mission:** To promote and provide health services, that are appropriate, accessible, equitable and sustainable, by utilizing suitably qualified and motivated staff committed to excellence and professionalism. To encourage the improvement, protection, maintenance and preservation, of our fragile ecosystems on a sustainable basis. ■ Regulatory body for water resources that can enforce law; ■ Responsible for public health and water quality, treatment and disposal of liquid waste: - Public Health Act CAP. 263 (1925); - Public Health Regulations Sec.15 (1958); - Water Quality Act No. 1 (2005); - National Water Policy. ■ Conducts periodic monitoring of non-NAWASA managed freshwater sources (rural springs) and sanitary surveys of catchment areas; ■ Repository of data from NAWASA's monthly monitoring of water resources.	■ Data / information provider; ■ Participation in "Training of trainers"; ■ Wants to supply Grenadians with potable water and provide wastewater treatment and disposal services within the context of climate change; ■ Responsible for the management, valuation, regulation and preservation of the water resources with the aim of ensuring their best development, utilization, conservation and protection in the public's interest which would inform climate change adaptation. Key role in awareness raising and using decision support tools from project.
	Ministry of Agriculture, Fisheries and Forestry - in particular the Forestry Division and the Land Use Division.	■ The Ministry of Agriculture's Forestry Division is responsible for the protection of water catchments; ■ Implementing integrated watershed management practices, however a significant portion of lands comprising the watersheds is privately owned. The Irrigation Management Unit within the Land Use Division is responsible for the provision of water for agricultural purposes (handled separate to the domestic supply operations), and development of irrigation infrastructure for agricultural lands within the Ministry of Agriculture's domain.	■ Data / information provider; ■ Participation in "Training of trainers"; ■ Key agency in implementation of recommended measures in watershed areas - such as changes in farming practices.
	Ministry of Finance in particular the Department of Energy and Sustainable Development.	■ Relevant responsibilities include: - Economic planning; - Budgeting; - Debt management; - Economic policy formation; - Resource mobilisation; - Energy. Supporting decision-making processes in the public and private sectors.	■ Data / information provider; ■ Resource mobilisation for adaptation measures in water sector.
	Ministry of Communications, Works, Physical Development, Public Utilities, ICT and Community Development - in particular the Physical Planning Unit.	■ Relevant responsibilities include: - Implementation of Road Maintenance Programme; - Ongoing preventative maintenance of all Roads, Bridges and Government Buildings; - Provision of engineering and architectural support to Government / ministries, non-Ministerial Departments and Statutory Bodies; - Management of Road Network.	Understanding of whether any strategic partnerships are in place between government ministries and NAWASA with regards to ensuring the resilience of the water sector to external shocks is maintained or enhanced.

Category	Organisation/agency	Remit / role in water sector and/ or climate change adaptation	Project relevance
	National Water and Sewerage Authority (NAWASA)	■ The main abstractor, given the responsibility for the management of the resource through the National Water and Sewerage Authority Act (1990); ■ Capture, treatment and supply of drinking water, and sanitary disposal of sewage; ■ In conjunction with the Ministry of Health, NAWASA is responsible for monitoring the quality of freshwater and implements a regular programme of sampling and bacteriological analyses of treated waters. Responsible for reverse osmosis plants in Carriacou and Petit Martinique.	Main Project Stakeholder.
	Meteorological Office (GrenMet)	■ Presently the Grenada Meteorological Service instrumentation and observing practices are in accordance with the World Meteorological Organisation surface station standards. Observing practices began at Maurice Bishop International Airport in 1984 and in 1986 24-hour observations was introduced; ■ Telecommunications in the provision of our data and services are done through using: Fax, Telephone, Internet, etc.	■ Data / information provider: - Climate and weather data; - Agro-met summaries. Participation in Training.
	National Disaster Management Agency (NaDMA)	The National Disaster Office overseas the work of the District Disaster Committees which function in seventeen districts established along electoral boundary lines inclusive of Carriacou and Petite Martinique. These District Disaster Committees are patterned according to the National Structure and is headed by a District Disaster Coordinator who is assisted by a deputy and consists of eight management committees with responsibility for the areas of Shelter Management, Safety and Security, Health and Welfare, Public Education and Information, Emergency Works and Transportation, Supplies Management, Damage and Needs Assessment and Telecommunications.	■ Data / information provider. Dissemination of information.
Private Sector and Non-Governmental Organizations	**Grenada National Organization of Women (GNOW)**		■ Can provide local knowledge. Key agency in implementation of recommended measures related to women.
	River Antoine Estate (Rum Distillery)	Potentially could be a major customer of NAWASA based on the amount of water used in their distillation process.	■ Can provide insight to any issues (climate or non-climate related) which they have experienced in receiving sufficient water supply from NAWASA.
	Grenada Breweries Limited	Potentially could be a major customer of NAWASA based on the amount of water used in their operations.	■ Can provide insight to any issues (climate or non-climate related) which they have experienced in receiving sufficient water supply from NAWASA.

2.2.6. Case example: Lessons learned from IWRM processes

Box 2-10: IWRM in the Caribbean – Successes, challenges and lessons learned

Over the last decade, much work has taken place in the Caribbean to implement an IWRM approach for water management. Despite the fact that the Caribbean Region has shown considerable understanding of, and sensitivity to, the need for IWRM, so far efforts to embed the framework into national policies and legislation have yielded few tangible benefits. It is therefore appropriate to ask: what progress has been made towards implementing an integrated approach to water management in the Caribbean, and are there any lessons that can be learned? What emerges is that the implementation of IWRM is problematic and that the road to realization has to be built on incremental change.

Successes

- Over the last decade, the most successful IWRM interventions have been those that addressed specific issues identified by 'stakeholders' at national and community levels. These projects were carried out by local partners, contributing to their success and to capacity building. The availability of funding was an important factor in promoting IWRM interventions. Projects that had a specific set of objectives and deliverables to be achieved over the short to medium term were most likely to result in positive change.
- There are examples in which external influence, predominately in the form of funding and grants, has brought about some change. In such cases, funding was conditional on the adoption or implementation of changes in institutional frameworks or the Enabling Environment. This suggests that governments cannot be wholly influenced or controlled by external influences.

Challenges

- Public participation remains a key challenge; in spite of growing water related issues, consumers have shown little appetite for change. Suggestions of privatisation, or even management contracts, have generally been met with opposition from many quarters. Customers have little influence over the service provider, or any way of holding them to account. This appears to be concomitant with the weak regime for consumer protection in the Caribbean, and little understanding by the general public of their entitlements to quality service; however, it is clearly not in line with one of the Dublin Principles on which IWRM is based – the importance of stakeholder involvement, and a participatory approach to water management involving users at all levels.
- Evidence also indicates that the lack of public interest in change is compounded by the perceived political risks of change. The risks arise from raising water rates, improved collection of unpaid bills, de-politicising investment decisions, loss of political patronage, and changes in employment levels. In contrast, the potential benefits arising from more efficient service provision are less visible, often long-term and in conflict with the five year political cycle, and difficult to quantify and convey to an electorate. The incentives for politically-driven reform are low.

Conclusions

- The greatest impacts have been through specific 'demonstration' projects, usually at the community or watershed level. The tangible benefits that have emerged serve as testaments to the effectiveness and importance of IWRM. The message that IWRM works best when it addresses real issues that resonate with people's everyday experiences with water and their environment is reinforced. This also suggests that approaches that seek the wholesale implementation of IWRM will seldom 'fit', and that more incremental approaches that are specific to each country, combined with international financial contributions, may be more successful.

Source: Adapted from 'Cashman (2018) An overview of the challenges facing IWRM in the Caribbean. Article for the Global Water Forum http://www.globalwaterforum.org/2018/02/11/an-overview-of-the-challenges-facing-iwrm-in-the-caribbean/ accessed 21 May 2018)'

2.3 Section 2: Notes for the Trainer / Facilitator

2.3.1. Notes and considerations

- The overall goal is to prioritise activities and investment options, and to ensure these are financed and implemented, and the Framework is based on successful pilot study applications in Grenada and St. Kitts and Nevis and the lessons learned from these.
- Be aware that the Framework is 'good practice' rather a fixed and rigid methodology that needs to be strictly adhered to. It is intended to guide and steer a process for the integration of climate resilience by highlighting the key steps in a diagnostic process to generate knowledge and evidence to inform decision-making on addressing climate resilience
- Some countries may have already started various aspects of the process and political, institutional, technical and human contexts vary widely across the region. The Framework process should therefore be tailored accordingly to meet individual countries circumstances, in terms of entry points, institutional landscape and timescales.
- It is important to note that different countries will also have their own development planning processes and the intention is to reinforce these rather than to duplicate or overlay parallel processes.
- Draw out country experiences and attitudes on existing processes that aim to integrate climate resilience (e.g. what has worked well, and what has not) and demonstrate how good practice examples map onto different elements of the framework
- Seek out opportunities for peer-to-peer exchanges between countries. Do some countries in the region already have elements of 'good practice' that reflect those in the Framework? Typically, which elements are currently covered? And what are the main gaps and room for improvements?
- Identify the entry points for reform and investment. Review recent and ongoing initiatives which could be built on or, aligned with the application of the Framework. These might include national planning initiatives such as national strategies or multilateral processes such as the National Adaptation Planning (NAP) process. Doing so will maximise the benefits and avoid parallel processes.
- Draw up an implementation timeline and specific goals for the Framework. The national team will need to put together an implementation plan for scheduling the workshops, working through the sections in the Training Manual and defining specifically what outputs are expected and by when.
- Secure resources to procure specialist support. Workshops may require logistical support or specialist input during the workshop or in preparing investment plan documents. This may require staff time from government agencies or funding to support contracted support. Development partners may be able to offer some support in this respect.

2.3.2. Exercises and discussion topics

Group Session 1	
Title Refining the contextualising the Framework.	**Type** Plenary discussion.
Objectives To refine and if possible come to a consensus on what the Framework should specifically produce or achieve following the implementation of the workshops.	
Link with other materials None.	
Duration 20 mins.	**Materials needed** Flipchart and post-its.
Preparation ■ Flip chart or PowerPoint slide with the indicative outputs and outcomes of the Framework process from the Section 2 Guidance Materials.	
Description of tasks and instructions **Step 1: Introduction to the activity** ■ Explain that this exercise is designed to help refine the Framework process and its objectives. Present the objectives to the participants and ask participants whether they reflect their priorities. **Step 2: Group Exercise** ■ Open the floor to a facilitated discussion, noting key points. **Step 3: Plenary session** ■ Summarise the findings and provide examples of how the objectives could be refined to respond to identified priorities. Provide comment on the likely feasible scope of any refinement to the objectives within the broad scope of the Framework.	
Following the workshop ■ Adjust the Framework objectives where possible to reflect stakeholder priorities.	

Group Session 2

Title	Type
SWOT analysis for integrating climate resilience.	Group working exercise.

Objectives

To assess the strengths, weaknesses, opportunities and threats to the successful implementation of the Framework for the Integration of Climate Resilience and realisation of the benefits.

Link with other materials

None.

Duration	Materials needed
60 mins.	Flipchart and post-its.

Preparation

- Prepare four sheets of flip chart paper, one for each quadrant of the SWOT analysis. Provide post it notes for each quadrant.

Description of tasks and instructions

Step 1: Introduction to the activity

- This activity is designed to help identify the strengths, weaknesses, opportunities and threats to the implementation of the Framework process. Items to consider may include:
  - Strengths – What past successful initiatives can the Framework learn from, and what are the lessons learned;
  - Weaknesses – What might limit the successful outputs from the process (for example resources / information / availability of key staff / translation of plans into action);
  - Opportunities – What ongoing or planned initiatives could support (or be supported by) the Framework;
  - Threats – What external factors might disrupt the successful implementation of the Framework (for example staff turnover / climate hazards / change in policy).

Step 2: Group Exercise

- Divide the participants into four groups, each group begins at one of the quadrants and spends 5-10 minutes discussing and noting points on post it notes which are stuck on the quadrant. Ensure each group uses a different coloured pen to identify responses. Groups rotate around the quadrants discussing notes from other groups and adding their own.

Step 3: Plenary session

- A rapporteur from each group summarises the findings in a plenary session of 5-10 minutes, inviting discussion on those elements which occur regularly and actions which can be taken to minimise risks to the Framework process.

Following the workshop

- Report on significant findings.

Section 3

WaterRISK: a water sector resilience assessment tool

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Section 3: *WaterRISK*: a water sector resilience assessment tool

Summary

This section provides an introduction to the main concepts behind ***WaterRiSK*** and considerations for its application and use. ***WaterRiSK*** is a self-assessment approach for water supply sector stakeholders to support the development of a roadmap to strengthen the integration of climate resilience in the water supply services sector. It also provides a means to communicate the sector's needs to non-specialists and to monitor and review progress during implementation of the roadmap.

Objectives

At the end of this section, participants will be able to:

- Become familiar with ***WaterRiSK*** as a tool to assess the integration of climate resilience in the water supply sector;
- Understand the structure and content of the ***WaterRiSK*** approach;
- Understand how they can use and tailor the tool to benefit the national process of the integration of resilience.

Things to know …

- ***WaterRiSK*** is a collaborative and participatory assessment tool to evaluate the strengths and weaknesses of current practice and identify opportunities and priorities to enhance the integration of climate resilience in the water supply sector.
- ***WaterRiSK*** ensures that stakeholders become fully familiar with the multi-disciplinary nature of addressing climate resilience and it stimulates the collation and sharing of knowledge and evidence.
- ***WaterRiSK*** is structured around the three 'pillars' of the national Enabling Environment, water resources and watershed management and water supply systems, recognising their equal importance for the resilience of the sector.
- A key strength of the ***WaterRiSK*** tool is to summarise the findings into a highly visual, easily digestible format and, in doing so, is good at communicating challenges and needs to non-specialists.
- ***WaterRiSK*** can be used as a starting point for a more detailed evaluation of priorities and options as well as a means to monitor progress over time.
- The assessment approach is designed to be generically applicable across the region but its application and use can be tailored to country-specific contexts as required.

3.1 Section 3: Guidance Materials

3.1.1. About *WaterRiSK*

Purpose and objectives of *WaterRiSK*

WaterRiSK is a self-assessment approach to support the integration of climate resilience in the water supply services sector in the Caribbean. ***WaterRiSK*** aims to identify the strengths and weaknesses of current practices and to identify opportunities and priorities to enhance the integration of climate resilience.

WaterRiSK is intended for use by national teams comprising representatives with interests in, and influences on, the safe and secure provision of water supply services. This will include water service providers and water management departments alongside many other stakeholders such catchment management agencies, land-use planners, regulators, funders and water users, amongst others.

WaterRiSK can be used to provide a preliminary rapid assessment of baseline conditions based largely on expert elicitation or as a more in-depth assessment drawing on detailed climate risk and vulnerability studies, where these are available. As a participatory self-assessment approach, ***WaterRiSK*** aims to strengthen capacity among stakeholders to identify actions and priorities and its application brings a number of benefits to national teams, including:

- Highlighting the diverse characteristics and multi-disciplinary nature of a climate resilient water supply services sector;
- Encouraging a questioning mode of analysis with respect to gaps and needs in relation to the Enabling Environment, watershed and water resources management and water supply systems;
- Facilitating common agreement among stakeholders on actions and measures necessary to integrate and strengthen climate resilience;
- Providing a start point for the elaboration of roadmaps and investment plans to catalyse change, and a means to monitor and track progress over time.

The ***WaterRiSK*** assessment results in a high-level overview and summary that can be used to underpin the preparation of a roadmap to catalyse change. ***WaterRiSK*** provides a structured framework and systematic approach for assessing baseline status and future needs for the integration of climate resilience. It presents findings in an easily digestible format that communicates climate resilience needs to technical and non-technical stakeholders alike. Its application also aims to stimulate the sharing of knowledge and information and the establishment of a collective evidence base on which to base informed decisions.

Assessment levels

WaterRiSK recognises that no single action alone will resolve the many challenges that climate variability and change bring to the water supply services sector. It is predicated on the need for a balanced portfolio of investments and complementary measures across aspects such as policy and strategy development, water resources and watershed management and water supply systems and services.

The ***WaterRiSK*** self-assessment process is therefore structured around three pillars of interest, each of which is critical to the integration of climate resilience, namely:

- **National-level / Enabling Environment**
  This pillar examines the effectiveness of the Enabling Environment in guiding and promoting a proactive approach to the integration of climate resilience. It considers institutional roles and responsibilities, national policies and strategies, and institutional capacity and knowledge base;
- **Catchment-level / Watershed and water resources management**
  This pillar examines vital water resources availability and watershed management practices for securing water source quantity and quality, and how robust these are to cope with climate variability and climate-induced emergencies;

- **Water supply system level**
  This pillar examines the extent to which water supply systems can maintain services under emerging trends in climate variability and change, the extent to which critical infrastructure and assets are protected against extreme weather related damage, and the degree to which water users are actively engaged in the drive for greater resilience.

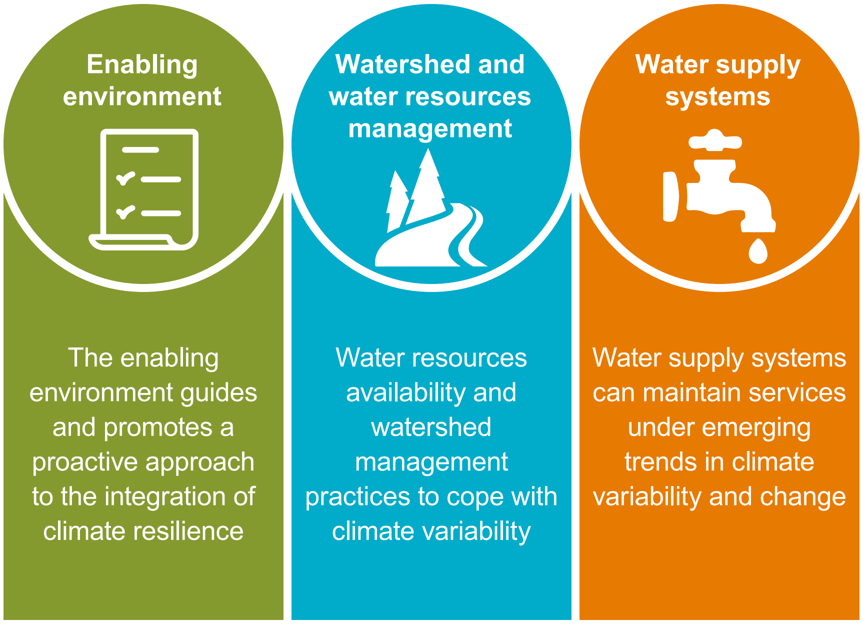

Figure 3-1: The three pillars of *WaterRiSK* assessment

WaterRiSK structure

The WaterRiSK assessment process is structured around key questions articulated for each of the three pillars. Each pillar addresses sub-clusters of considerations (more specific questions) related to good practices for the integration of climate resilience. A schematic representation of this structure is shown in Figure 3-2, while more comprehensive information can be found in Sections 3.4.1 and 3.4.2.

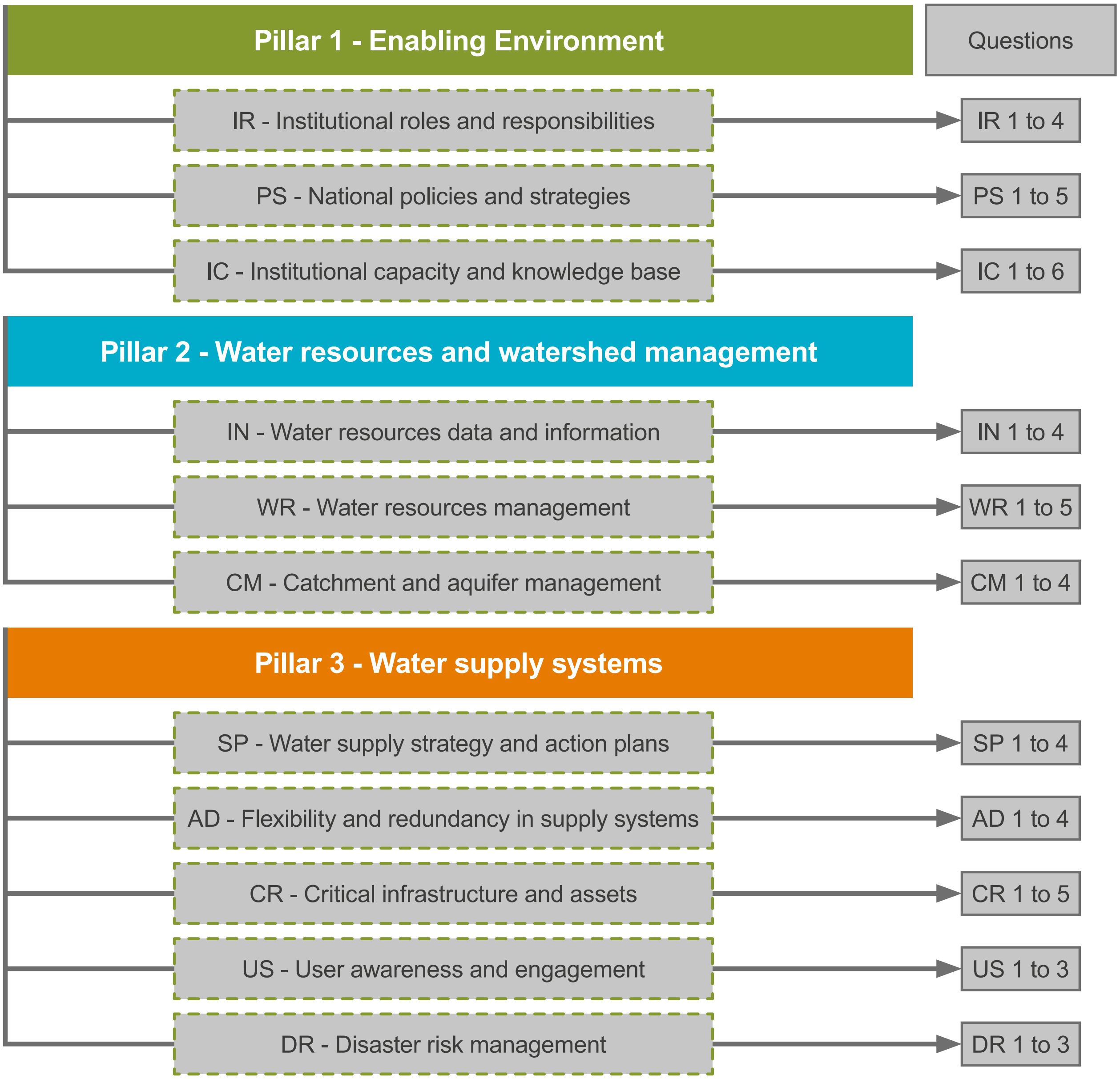

Figure 3-2: Structure of *WaterRiSK*

Box 3-11: *WaterRiSK*: responding to regional needs and introducing the conceptual framework to Caribbean water sector stakeholders

The tool was developed by HR Wallingford as part of the Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean project through a mix of top-down and bottom-up approaches. A top-down approach was used to develop a framework which can answer the needs of the region as identified as part of the project, and that is applicable to the whole region. A bottom-up approach was then used to strengthen the tool and to incorporate lessons learned from both national and regional activities rolled-out as part of the project. In particular, the conceptual framework at the basis of ***WaterRiSK*** has been introduced to water sector stakeholders in the Caribbean as part of different activities.

Regional survey – April 2018

A survey was sent out in March 2018 to water sector focal points from 11 different BCMs. This was used for a quick regional characterisation of the water sector. Respondents were asked to rank from 1 to 5 different aspects of the three pillars.

ToT Workshop – June 2018, Barbados

The concept of the three pillars of resilience was used through different parts of the workshop e.g. to group adaptation actions to improve water sector's resilience, or as the basis of group and panel discussions. The ***WaterRiSK*** tool was also formally introduced during an ad-hoc session. Prior to the workshop, participants were asked to answer, individually, a subset of questions of ***WaterRiSK*** (filling the Evidence, gaps and needs and Recommended actions cells). Their answers were then used as a starting point for group discussions during the workshop, where each group was assigned one specific pillar. The discussion was centred on producing a vision for each pillar, identify good case examples across the region, and discuss barriers to implementation. Internally, the answers submitted by the participants were reviewed to identify whether these were well understood or if more clarity was needed in asking the question. This analysis, together with the feedback collected during the workshop, informed a review of the questions and the introduction of a scale of responses in order to avoid ambiguities.

National Workshop – July 2018, Antigua and Barbuda

The concept of the three pillars of resilience was also used to support workshop activities during the project inception workshop in Antigua and Barbuda. As part of an icebreaker exercise, participants were asked to define which should be the characteristics of a climate resilient water sector and to group their answers based on the three pillars. During the workshop they were also asked to identify which other projects and initiatives, as well as policies, strategies and plans are in place to improve the resilience of the water sector, and to which pillar of resilience they correspond to.

Lessons learned

- Stakeholders reacted well to the concept of the three pillars and were able to shape their thinking in this sense;
- Adaptation actions can be broadly grouped into the three pillars, which therefore confirm to be a good conceptualisation of the needs of the sector;
- The tool can be used not only as a full assessment, but also as a communication and engagement tool, to be shaped according to specific activities' needs.

3.1.2. *WaterRiSK* as a tool to support the national process for integrating climate resilience in the water supply sector

The approach is informed by region-wide needs and is designed to be applicable to the whole region. At the same time it recognises country-specific needs: its application and final use can be tailored to country-specific contexts. For this reason its use as part of the national process (see Section 2) is not prescriptive; instead, the flexibility of the tool allows for its use at different stages of the process and with different purposes, according to the specific needs and capacity of each country context.

For example, the tool can be used as a stand-alone quick baseline assessment, to be reviewed and strengthened when new supporting evidence becomes available. It may also be used as a way to capture and present the evidence acquired as part of the national roll-out process in an easy format.

WaterRiSK is also meant to support the formulation of a resulting framework, of strategic indicators and targets and to review and monitor progress towards the integration of climate resilience in the water supply services sector. More details on the use of the tool as part of an M&E system are provided in Section 9 of this Manual.

Where there is not enough capacity to complete a full assessment, the questions in the tool can still be used to guide the screening of current practices in any of the assessment pillars (e.g. as recommended in Section 4 of this Manual). The conceptual framework of the tool can also support the roll-out of consultation and engagement activities, as well as visioning exercises (see Box 3-1).

The use of the tool to support different outcomes of the national roll-out process are shown in Figure 3-3.

Completing the assessment

The following paragraphs, summarise the main tasks involved in the completion of the full assessment. Full details on the workshop activities, the facilitation process and the identification and grouping of participants are provided as part of the ***WaterRiSK*** Manual, provided in the E-Annex of this document.

Identification of participants

As a participatory self-assessment process the application of the ***WaterRiSK*** approach and completion of the questionnaire should draw on a wide body of knowledge and expertise. It is important that the team as a whole represent different interests in the water sector and that the stakeholders are brought together to jointly complete the assessment and to collectively agree the findings and results. The development of a stakeholder map can support the identification of institutions/individuals to be involved.

Primary stakeholders are likely to be representatives from Water Service Providers (utilities/departments), Water Management Departments/Agencies and Ministries responsible for water resources and water services. But other interests should also be included. Climate Change Units (or focal points) and Disaster Risk Management Agencies bring specialist knowledge on risk and vulnerability. Ministries with responsibility for Finance and Economic and Development Planning are highly relevant as are other sectoral interests such as Agriculture, Environment, Forestry and Tourism. Likewise, Community Based Organisations can ground discussions in the realities on-the-ground and the Private Sector may have a role in catalysing change or bringing new and innovative solutions to the table.

Collectively, this ensures different perspectives are reflected in the assessment: not only technical and operational challenges but also wider resource management perspectives and the important aspects of investment financing. The development of a stakeholder map can support the identification of institutions/individuals to be involved.

	Workshop 1 Engaging stakeholders and setting objectives	**Workshop 2** Assessing risks and identifying solutions	**Workshop 3** Prioritising options and planning for implementation	**Workshop 4** Monitoring and evaluation
Sections	1 2 3	4 5	6 7 8	9
Materials prepared in advance of workshop	■ Stakeholder analysis and engagement plan ■ Draft Framework implementation plan and timeline	■ Draft mapping of institutional landscape in the water sector ■ Characterisation of the water sector and desk based assessment of climate risks	■ Outline structure for Investment Plan ■ Review of appropriate financing sources	■ Draft M&E system
Key workshop activities	■ Raise awareness and understanding of climate resilience ■ Introduce stakeholders to the Framework and Training Manual ■ Agree Framework implementation plan and objectives ■ Apply ***WaterRISK*** tool	■ Screening of policies and plans ■ Climate Risk and Vulnerability Assessment (CRVA) ■ Identification of preliminary adaptation options	■ Prioritisation and organisation of adaptation options ■ Scoping the Investment Plan ■ Identifying and reviewing sources of finance	■ Consultation on finalising the Investment Plan ■ Scoping the M&E system for the Investment Plan
Outputs following workshop	■ Workshop 1 report ■ Finalised Framework implementation plan and timeline ■ ***WaterRISK*** application report	■ Workshop 2 report ■ Screening of policies, legislation and plans report ■ Climate Risk and Vulnerability Assessment (CRVA) ■ Preliminary adaptation actions	■ Workshop 3 report ■ Draft Investment Plan and financing strategy prepared	■ Workshop 4 report ■ Investment Plan and financing strategy finalised and adopted by implementing agencies ■ Monitoring and evaluation system finalised ■ Implementation of Investment Plan and M&E system
	■ Introduce the pillars of a resilient water supply sector and the need for multi-disciplinary investments. ■ Articulate a Vision and a results framework, as well as indicators and targets. ■ Quick baseline assessment of capacity and potential priorities ■ Knowledge and information sharing.	■ Questioning analysis for the screening of policies, plans and strategies. ■ Collation of findings from expert elicitation and CRVA analyses. ■ Performance scoring and strengthen evidence that supports it.	■ Starting point for drafting the outline for Investment Plan programmes. ■ Convey how the investment programmes will improve baseline conditions and support the achievement of the vision.	■ Review/refine high level indicators. ■ Preparation of a high level M&E system. ■ Present assessment results as a country report card.

Figure 3-3: *WaterRiSK*: Suggested applications to support the national roll-out process

Box 3-1: Performance scoring and assigning relevance

Two categories of scoring are required. Firstly, a grading that indicates the degree to which the integration has been achieved to-date and, secondly, a score for the relevance of the question asked (as not all not questions may be relevant or applicable to every country). The questions should be answered in sequence, one cluster at a time (i.e. firstly IR 1-4, secondly PS 1-5, thirdly IC 1-6, etc.).

Performance score

- Each question is scored between 1 and 5, whereby 1 is the lowest (more negative) grading and 5 is the highest (more positive) grading.
- For each question a list of possible responses is provided among which the respondent needs to choose the one that better describes the existing conditions.

Relevance

- Similarly, for each question, the team should also record the relevance and priority of actions taken to address the challenges identified, ranging from a low to a high priority as follows:
  - '1 - low' – not relevant and not urgent
  - '2 - low/medium' – some relevance, but not urgent
  - '3 - medium' – relevant, and some urgency
  - '4 - medium/high' – relevant, and urgent
  - '5 - high' – highly relevant, and urgent

3.1.3. Completing the assessment table

An assessment table is completed that captures: (i) Evidence supporting the score chosen and highlighting gaps and needs, (ii) Recommended action, (iii) Question ID, (iv) Performance score and (v) Relevance score. When completing the tables the following considerations are relevant:

- The level of detail included will depend on its specific use - i.e. is it used as a preliminary rapid assessment of baseline conditions or as a more in-depth assessment.
- Where available, the evidence should reference existing policy reviews, sector studies, risk and vulnerability assessments or similar.
- Maximum use of secondary sources of information and literature is advised.
- Expert elicitation and judgment can also be used to supplement evidence and to fill gaps.
- Where reliable evidence is not available, this should be highlighted as part of the recommendations for action to improve the availability of knowledge and information.
- The 'Recommended actions' are intended as a start point for the elaboration of roadmaps and investment priorities to catalyse change rather than being an endpoint themselves.
- They serve as a way to stimulate discussion on potential measures and options and to gain collective consensus and agreement on the general way forward.
- It can also be beneficial to capture indicators that substantiate each action's outputs as these could also serve as a means to crystallise targets and desired outcomes, and therefore serve as a means to monitor progress.

Table 1-1: Example of *WaterRiSK* assessment table
(the full template table can be found in the E-Annex)

Evidence, gaps and needs	Recommended actions / M&E indicators	Question ID	Perf.	Relev.
IR - Institutional roles and responsibilities				
		IR1		
		IR2		
		IR3		
		IR4		
PS - National policies and strategies				
		PS1		
		PS2		
		PS3		
		PS4		
		PS5		
Etc. Etc.				
		Etc.		

3.1.4. Presentation of findings

Rose diagrams

Rose (or spider) diagrams can be used to show and communicate the performance under each cluster. Figure 3-4 shows an illustrative example of this, where the average performance of each cluster is shown.

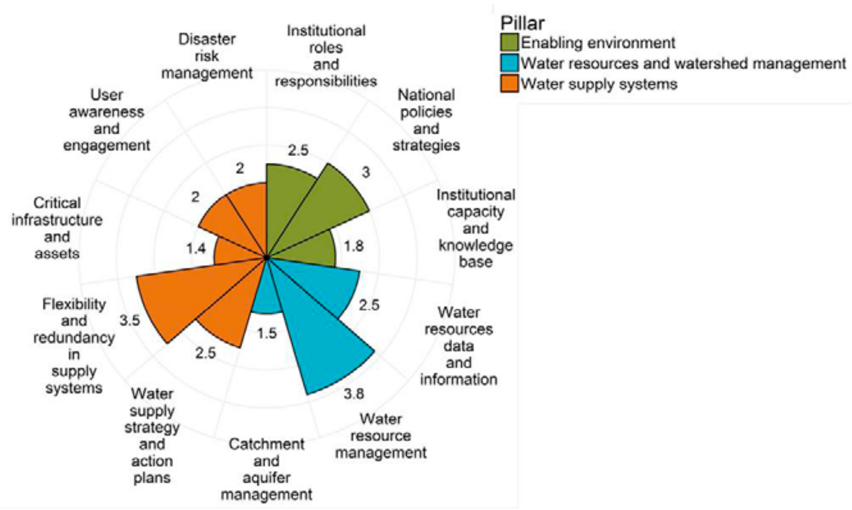

Figure 3-4: Illustrative example of *WaterRiSK* results

Prioritisation plots

Prioritisation plots can be produced which highlight high priority actions. An illustrative example is shown in Figure 3-5 for Pillar 1 on the Enabling Environment. The four quadrants represent different combinations of low to high performance and low to high relevance. Actions with a low performance and high relevance are typically the highest priorities. The prioritisation plots are intended to stimulate further discussion on priorities rather than be cast in stone.

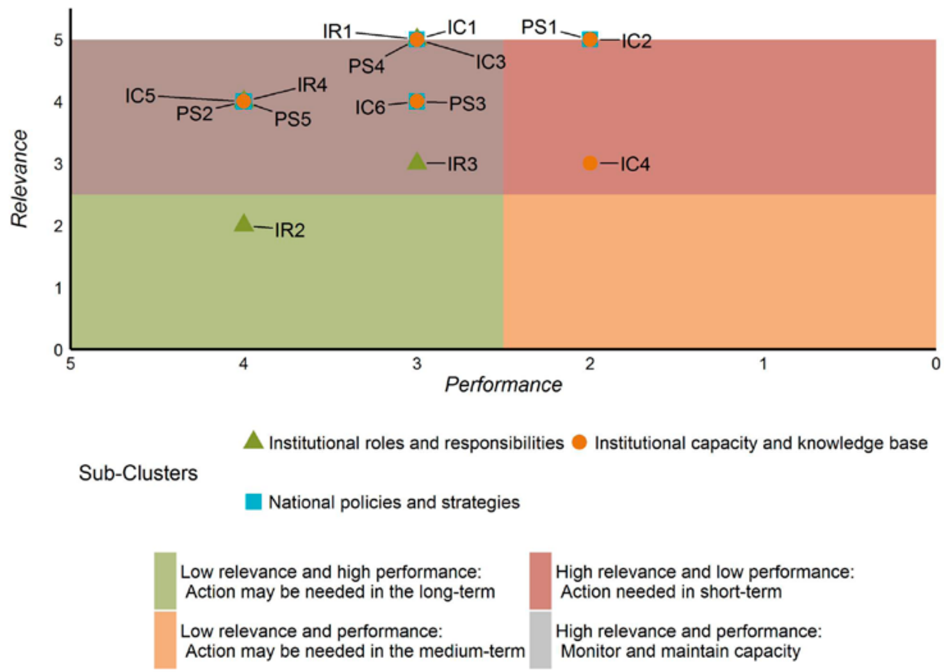

Figure 3-5: Illustrative example of *WaterRISK* priority areas

Monitoring progress

The progress towards a vision or the improvements from the previous planning cycle can also be shown and communicated, as shown in Figure 3-6. The assessment will highlight improvements with respect to the previous planning cycle, areas where progress has not been made and also areas where performance has declined, maybe due to impacts of extreme events or poor maintenance or monitoring.

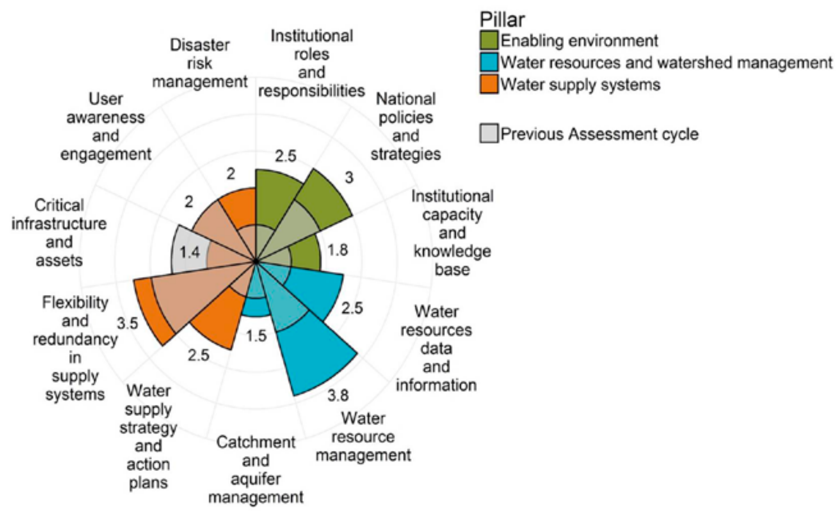

Figure 3-6: Illustrative example of *WaterRiSK* monitoring results

3.2 Section 3: Case examples and other relevant material

3.2.1. Case example: Application to case study countries

WaterRiSK was applied to the case study countries of Grenada and St. Kitts. This highlighted that most of the problems as well as strengths are common to the countries analysed, which suggests, that the region faces common challenges. In particular the biggest gaps belong in the water supply systems level, which talks to the ability to maintain levels of service and protect infrastructure from climate variability and extremes, as well as to the level of engagement of water users in the drive for greater resilience. Major gaps are also present in watershed management practices.

When analysing the combined scoring of performance and relevance, commonalities can also be observed and many actions are suggested to be as high priority for more than one country.

National level/ Enabling Environment

- The indicators of this level have been plotted on the basis of their performance and relevance scoring for the case studies. This showed that indicators like PS1 (which refers to the presence of high-level goals and targets related to climate risks) and IC2 (which refers to the level of dissemination of climate risk data and information for policy and decision making) always score with a low performance and high relevance, which means that action would be needed in the short term. In some cases mainstreaming of gender considerations (PS3) and of recommendations from CRVAs in the formulation of strategies and plans (IC4) also come across as high priority.

Catchment level/ Watershed and water resources management

- The indicators of this level have been plotted on the basis of their performance and relevance scoring for the case studies. This showed that indicators like WR4 (vulnerability of surface water quality and quantity to future climate trends), CM2 (effects of poor watershed management on water quality and quantity) and CM3 (impacts of extreme events on watershed) always score with a low performance and high relevance, which means that action would be needed in the short term to improve the performance of watershed in maximising water quantity and quality under climate variability.

Water supply system level

- The indicators of this level have been plotted on the basis of their performance and relevance scoring for the case studies. This showed that indicators like SP4 (supply/demand balance), AD2 (adaptability of supply systems to maintain levels of service under extreme weather events), AD3 (levels of NRW), and US3 (consultation processes) and many indicators belonging to the CR sub-cluster (critical infrastructure and assets) always score with a low performance and high relevance, which suggests that action in these fields would be needed in the short term to improve the performance of water supply systems.

3.2.2. Case example: using the *WaterRiSK* conceptual framework to guide panel and group discussions

The tool lends itself to different uses and can be useful to support workshop activities and group discussions. This was done as part of the Training of Trainers workshop held in Barbados, in June 2018, where the tool was used to capture the answers of a panel discussion titled "What are the most critical areas that need to be addressed to improve climate resilience in the region?". The three pillars were used to organise the answers and main points arising from the discussion, as shown in the picture below.

3.2.3. Case example: analyse the water supply sector through a climate resilience lens: use of *WaterRiSK* to stimulate a questioning mode of analysis

WaterRiSK is structured on a "climate lens" approach. This is an analytical method that stimulates a questioning mode of analysis. A climate lens should be applied during the formulation of strategies and plans for the water sector, but its retrospective application is also beneficial in order to identify areas in the existing governance landscape where climate resilience focus can be strengthened during policy review and reformulation.

One of the objectives of ***WaterRiSK*** is to facilitate knowledge sharing among stakeholders as well as help mainstream climate resilience related concepts in practitioners, mind-set. Each participant of the Training of Trainers workshop held in Barbados in June 2018 was asked, prior to the workshop, to answer a set of questions from the ***WaterRiSK*** assessment, identifying good practice, main gaps and potential actions to increase performance.

Five working groups were then defined, each focusing on one ***WaterRiSK*** pillar, and participants were asked to present their findings to the group answering three questions:

1. Vision

- Enabling Environment (1 group) - What should the Enabling Environment look by 2030?
- Watershed and water resources management (2 groups) - How should watershed and water resources management be managed by 2030?
- Water supply system (2 groups) - What would a resilient system be in 2030?

2. Case examples

- Which good case examples have you identified that would help achieve this vision?

3. Barriers to implementation

- What are the two main barriers to implementation?

The exercise triggered very stimulating discussions and enabled participants to collaborate on defining a vision and identify good practice across the region. It was highlighted by participants that the research needed to answer the questions increased their understanding of the subject and also made them think how climate resilience considerations could be applied to aspects that, at present, do not include them.

All the presentations provided by participants as part of this exercise are provided in the E-Annex folder "Country contributions to the Training of Trainers event".

3.2.4. Relevant material and other resources

Box 3-2: Relevant material and other resources

HR Wallingford, 2018. *WaterRiSK*: a self-assessment tool to support the integration of climate resilience, Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean, RT012 R02-00. Report produced for the Caribbean Development Bank.

The report was developed by HR Wallingford (2018) as part of the Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean project. It illustrates the full methodology suggested to apply the tool, provides supporting templates and materials and example applications to case studies.

3.3 Section 3: Notes for the trainer / facilitator

3.3.1. Notes and considerations

- The collaborative approach of using national teams and workshop approaches to apply ***WaterRiSK*** is intended to ensure that a collective, balanced view is taken, that draws on a range of stakeholder perspectives, and not just that of the water service provider itself.
- Likewise, the inherent structure of ***WaterRiSK*** ensures that these perspectives are considered at different levels of interest - national, catchment and supply system levels – and across policy planning, management and operational levels.
- A key strength of the ***WaterRiSK*** tool is to summarise the findings from more detailed assessments into a highly visual, easily digestible format and, in doing so, is good at communicating challenges and needs to non- specialists (e.g. those within the Ministry of Finance and external development partners).
- Rather than being an end point in itself, ***WaterRiSK*** is a starting-point for a more detailed evaluation of priorities and options as well as a means to monitor progress over time.
- It is important to recall that the different islands will have different perspectives on the relevance of each of the questions – for example, islands that are mostly reliant on groundwater or desalination sources will find the questions related to surface water use of little relevance and should be scored accordingly.
- During the group sessions, it is important to draw out perspectives and attitudes from different stakeholder groups (e.g. regulators, water managers, water service providers) to ensure the full breadth of issues are considered.
- Seek out opportunities for peer-to-peer exchanges between different groups to explore which elements of ‘good practice’ are already in place, and what are the main gaps and room for improvements.

3.3.2. Exercises and discussion topics

Please see the ***WaterRiSK*** Manual for detailed instructions on the roll-out of workshop sessions for the full assessment. Example group activities are also shown in Section 3.2 of this Chapter.

Group Session 1	
Title Application of ***WaterRiSK***.	**Type** Exercise, working in groups.
Objectives Apply the ***WaterRiSK*** assessment to define the baseline status and needs of the integration of climate resilience in the sector.	
Link with other materials ■ ***WaterRiSK*** manual (E-Annex) and Section 3 of this Training Manual. ■ ***WaterRiSK*** assessment tool (questionnaire and excel spreadsheet).	
Duration 4 hours.	**Materials needed** Excel spreadsheet, ***WaterRiSK*** questions hand-out.
Preparation See ***WaterRiSK*** Manual for details on selecting participants, preparing for and facilitating the workshop.	
Description of tasks and instructions **Step 1: Introduction to the activity (in plenary) (15 mins)** ■ Give some background to the activity. ■ Divide participants into at least three groups, on the basis of their expertise (governance level, catchment management level and water supply operations level). **Step 2: Scoring (in groups) (2 hours)** ■ Each participant presents their findings to the group in no more than 5 mins. Other participants are able to comment and feed-in on the scoring and assessment table. ■ The group will reach a consensus on the scores, whereby the score is not an average of the score of each participant but a consensus on an agreed score. ■ During the discussion, groups should identify priority areas and potential actions for improvement. ■ If the session is aimed at identifying high-level indicators to monitor the integration of climate resilience in the sector, groups should be asked to identify and discuss these as part of the assessment. **Step 3: Discuss and review the scoring (in plenary) (1.5 hours)** ■ Groups will now present their assessment in plenary, and welcome inputs from other groups not only to confirm/validate the scoring but also to include additional suggestions and a different perspective to their assessment. **Step 4: Plenary session (15 mins)** ■ The facilitator will wrap-up and highlight main points and outcomes of the workshop session. ■ Deliverables to be produced by national teams will be identified (workshop report, completed ***WaterRiSK*** applications).	
Following the workshop ■ Complete (if not done already) ***WaterRiSK*** application and where available collate evidence to support assessment. ■ Report on ***WaterRiSK*** assessment results, priority areas, identified challenges.	

3.4 Section 3: Annexes

3.4.1. *WaterRiSK*, summary table of pillars, sub-clusters and questions

Pillars	Sub-clusters	Questions	Description
Enabling Environment	Institutional roles and responsibilities	IR1	Institutional framework
		IR2	Roles and responsibilities
		IR3	Multi-stakeholder forums
		IR4	Goals and targets
	National policies and strategies	PS1	Climate challenges
		PS2	Principles and practice
		PS3	Gender-sensitive approaches
		PS4	Wider engagement
		PS5	Regional/international agreements and commitments
	Institutional capacity and knowledge base	IC1	Institutional capacity
		IC2	Generation and dissemination of policy-relevant information
		IC3	Knowledge base
		IC4	Climate risk and vulnerability assessments
		IC5	Consensus on priorities
		IC6	Risk management processes
Water resources and watershed management	Water resources data and information	IN1	Water resources data collection
		IN2	Water use trends
		IN3	Climate scenarios and variables
		IN4	Monitoring and review
	Water resources management	WR1	Integrated water resources management
		WR2	Water resources management and allocation
		WR3	Water resources status and pressures
		WR4	Surface water vulnerability
		WR5	Groundwater vulnerability
	Catchment and aquifer management	CM1	Integrated watershed management
		CM2	Water quality
		CM3	Impacts of extreme events
		CM4	Green Infrastructure solutions
Water supply systems	Water supply strategy and action plans	SP1	National water supply strategy
		SP2	Long-term planning
		SP3	Climate trends
		SP4	Supply/demand balance
	Flexibility and redundancy in supply systems	AD1	Maintaining service standards
		AD2	Adaptability of supply systems
		AD3	Non-revenue water
		AD4	Water storage provision
	Critical infrastructure and assets	CR1	Water intakes and sources
		CR2	Pipelines networks and distribution systems
		CR3	Water treatment plants and facilities
		CR4	Storage facilities and tanks
		CR5	Pumping stations

Pillars	Sub-clusters	Questions	Description
Water supply systems	User awareness and engagement	US1	Communication, education and awareness
		US2	Behavioural change
		US3	Consultation processes
	Disaster risk management	DR1	Early warning systems
		DR2	Emergency procedures and plans
		DR3	Contingency plans

3.4.2. *WaterRiSK* assessment questionnaire

Pillar 1 - Enabling Environment

IR - Institutional roles and responsibilities

Effective legal frameworks with clearly defined institutional roles and responsibilities provide a foundation for effective and coordinated action to enhance climate resilience. The often complex and inter-connected institutional landscape for enhancing the resilience of water supply services cuts across many spheres of activity including water resources management, infrastructure, environment and different economic sectors, as well as climate change adaptation and disaster risk reduction. Representation and engagement of a wide range of stakeholders in policy formulation, decision-making and coordinated action is therefore critical.

Questions for consideration:

- **IR1 - Institutional framework**
  Q. To what extent is there a comprehensive, updated and coordinated legal framework for dealing with water rights, water supply and wastewater disposal (water, land-use, environmental health, solid waste management acts etc.)?

Score	Description
5	Comprehensive - This is effectively in place and followed in practice. It clearly identifies institutional roles and responsibilities.
4	Largely in place - This is in place but may be outdated/not followed in practice and/or does not reflect present context and challenges.
3	Moderate - This is in place but does not provide an all-embracing, consistent framework for water governance.
2	Limited - Elements are disjointed and do not provide a clear distinction of institutional roles and responsibilities.
1	None - The legal framework is not comprehensive: many key aspects of water rights, supply and wastewater disposal are not covered.

- **IR2 - Roles and responsibilities**
  Q. To what extent do institutional roles and responsibilities clearly embrace climate change adaptation, disaster risk reduction and climate compatible development in a coordinated manner (environmental agencies, disaster risk management departments, adaptation policies etc.)?

Score	Description
5	Clearly articulated - The existing institutional landscape is complete, coordinated and joined-up. It sets clear roles and responsibilities in institutional mandates for climate change adaptation, disaster risk reduction and climate compatible development.
4	Roles clear but limited coordination - The above mentioned aspects are addressed by different agencies but in a disorganised and uncoordinated manner. Reforms may be underway to improve this situation.
3	Moderate - Some of the above mentioned aspects are addressed but the level of coordination is not adequate.
2	Limited - Roles and responsibilities are insufficiently defined or not addressed, and coordination is either lacking or inadequate.
1	None - These aspects are either neglected or not addressed.

- **IR3 - Multi-stakeholder forums**

Q. To what extent are multi-stakeholder forums used to inform coordinated decision-making in relation to identifying and managing climate risks?

Score	Description
5	Strong, coordinated process - Multi-stakeholder forums that discuss climate risks and vulnerabilities in the sector are a key component of the decision making process; they are regularly held and provide recommendations for adaptation planning, as well as serving as a knowledge sharing platform among stakeholders.
4	Significant - Multi-stakeholder forums that discuss climate risks and vulnerabilities in the sector are only occasionally held. However, when they happen, they provide recommendations for adaptation planning and serve as a knowledge sharing platform among stakeholders.
3	Moderate - Multi-stakeholder forums are occasionally held but there is no framework to use them as means to provide recommendations for adaptation planning.
2	Limited - Multi-stakeholder forums are rarely held and are not used to produce recommendations for adaptation planning.
1	None - Multi-stakeholder forums are not used.

- **IR4 – Goals and targets**

Q. To what extent are there clear goals and targets for strengthening climate resilience and an effective monitoring and evaluation (M&E) system to measure progress towards?

Score	Description
5	Clear targets and effective monitoring systems - National water policies and strategies include specific targets in relation to climate resilience and climate resilience is a significant element in the enterprise risk management process of the water utility/departments. M&E systems are in place and function well, as well as channel investments and capacity development measures to apply these into practice.
4	Clear targets but limited monitoring - National water policies and strategies set specific targets to measure progress towards climate resilience but monitoring systems are limited in their effectiveness (e.g. due to finance and capacity constraints).
3	Moderate - National water policies set targets to measure progress but may not be specifically related to climate resilience. Monitoring systems are limited or not designed to report on climate resilience.
2	Limited - National water policies and strategies include some targets but these are not explicitly related to climate resilience, and monitoring systems are limited or non-existent.
1	None - No national level goals and targets exist for strengthening the climate resilience of the sector.

PS - National policies and strategies

Policies and strategies provide an overall vision of the objectives and outcomes for the sector and the principles by which these will be achieved. Managing risks arising from climate vulnerability and change should be firmly embedded within policy frameworks and the principles by which these risks will be managed articulated in associated strategies and plans for action. IWRM as a tool to support adaptation provides many of the underlying principles and practices on which to build on. Water policies and strategies should be fully aligned with national development agendas while also supporting other regional or international commitments such as the achievement of the SDGs.

Questions for consideration:

- **PS1 – Climate challenges**
  Q. To what extent do water supply policies and strategies express the need for action on climate risks and how well is this articulated?

Score	Description
5	Good articulation - Sectoral policies and strategies are up-to-date and explicitly address climate risks and the need to reduce sector vulnerability to these.
4	Reasonable articulation - Sectoral policies and strategies address climate risks and vulnerabilities but could be updated or improved.
3	Moderate - Sectoral policies and strategies make some mention of climate risks and vulnerabilities but this is rather incomplete and requires reform.
2	Limited - Sectoral policies and strategies do not mention climate risks and vulnerabilities and are largely out of date.
1	None - Sectoral policies and strategies either do not exist or are largely out of date.

- **PS2 – Principles and practice**
  Q. To what degree do national water supply policies and strategies align with IWRM principles and processes?

Score	Description
5	Very high degree - IWRM strategies and plans exist and are implemented. Sectoral ministries actively promote and implement the IWRM approach, providing the necessary management instruments and procedures.
4	High degree - IWRM strategies and plans exist and responsibilities for IWRM implementation are set. Necessary management instruments and procedures are missing but reform is undergoing to implement these.
3	Moderate - IWRM strategies and plans exist but are not fully implemented. Mandates for implementation of IWRM are not clearly outlined.
2	Limited - Sectoral policies and plans recognise in principle the importance of IWRM but this is not translated into actions and institutional mandates.
1	None - IWRM is not part of/mentioned in sectoral policies and plans.

- **PS3 – Gender-sensitive approaches**
  Q. To what extent do water supply policies and strategies encapsulate gender-sensitive approaches and plans to address climate risks?

Score	Description
5	Highly comprehensive - Gender-sensitive approaches and plans to address climate challenges are identified in sectoral policies. Action plans address issues related to gender and equitable access to water, including recommendations regarding gender-disaggregated data collection. Recommendations are implemented.
4	Largely comprehensive - Gender-sensitive approaches and plans to address climate challenges are identified in sectoral policies. Action plans address issues related to gender and equitable access to water, including recommendations regarding gender-disaggregated data collection, but full implementation is pending.
3	Moderate - Sectoral policies and strategies recognise the relevance of gender-sensitive considerations in relation to water and climate but this is not translated into actual recommendations.
2	Limited - National policies incorporate gender-sensitive approaches and plans to address climate challenges and risks, but this has not been translated into sectoral water policies and plans.
1	None - National and sectoral policies do not encapsulate linkages between gender and water or gender and climate.

- **PS4 – Wider engagement**
  Q. To what degree do processes for the development of water sector policies and strategies engage with and consult climate experts (e.g. climate focal points, NAP leads/coordinators)?

Score	Description
5	Very high degree - Climate experts are key members of the panel (or similar) involved in the development of water sector policies and strategies.
4	High degree - There are well-defined processes in place to engage and consult climate experts thorough the formulation process of water sector policies and strategies, even if they are not part of the key expert panel.
3	Moderate - Climate experts are engaged and consulted in the formulation of water sector policies and strategies, even if no specific procedure for the consultation process is in place.
2	Limited - Climate experts are only occasionally consulted in the formulation of water sector policies and strategies.
1	None - Climate experts are not consulted during the formulation of water sector policies and strategies.

- **PS5 – Regional/international agreements and commitments**
  Q. To what degree do water supply policies and strategies align with regional and international agreements and commitments on climate change action (e.g. Paris Agreement, SDGs, Sendai Framework)?

Score	Description
5	Very strong alignment - Sectoral policies align with regional and international commitments and set targets and actions to support their achievement. Sectoral plans are informed by regional/international best practices and lessons learned for climate change action.
4	Strong alignment - Sectoral policies align with regional and international commitments and set targets and actions to support their achievement. Benefitting from regional/international best practices and lessons learned for climate change action could be improved.
3	Moderate - Sectoral policies have some alignment with regional and international commitments but this could be improved, including targets and actions to support their achievement at a sectoral level.
2	Limited - Sectoral policies have some alignment in principle with regional and international commitments but these are not explicit or not well articulated.
1	None - Sectoral policies and strategies have no link with regional and international frameworks on climate change action.

IC - Institutional capacity and knowledge base

Emerging trends in climate variability and change bring additional risks to water supply services and these trends need to be assessed within an overall risk management framework. Institutional capacity to lead and coordinate CRVAs and to integrate these within existing strategy and planning processes is central to understanding and addressing priority risks. Engagement of a wide range of stakeholders is necessary to capitalise upon specialist knowledge (e.g. climate experts, scientists, commissions) and to secure coordinated action to address risks. Paucity of policy relevant data and information is often a constraint.

Questions for consideration:

- **IC1 – Institutional capacity**
  Q. To what degree is institutional expertise and capacity (e.g. within water service agencies and water management departments) available to support the identification and prioritisation of actions to address climate risks and vulnerabilities in the water supply sector?

Score	Description
5	Excellent expertise and capacity - Technical as well as management and operational staff are trained on climate impacts and their links to the water sector; training activities also focus on CRVAs. A comprehensive framework exists that allows to develop and exploit this capacity for the identification and prioritisation of actions.
4	Good expertise and capacity - Technical as well as management and operational staff are trained on climate impacts and their links to the water sector but training activities also focus on CRVAs. However, a comprehensive framework that allows to develop and exploit this capacity for the identification and prioritisation of actions is missing.
3	Moderate - Training on climate impacts and their links to the water sector is developed but is not rolled out at multiple staff levels (e.g. it targets technical staff only) and/or does not cover CRVAs. A comprehensive framework exists that allows to exploit this capacity for the identification and prioritisation of actions.
2	Limited - Training on climate impacts and their links to the water sector is developed but is not rolled out at multiple staff levels (e.g. it targets technical staff only) and/or does not cover CRVAs. Also, a comprehensive framework that allows to develop and exploit this capacity for the identification and prioritisation of actions is missing.
1	None – None or a very limited number of persons has knowledge of CRVAs as it relates to the water sector. A framework to develop capacity is absent.

- **IC2 – Generation and dissemination of policy-relevant information**

  Q. To what degree is adequate data collected, analysed and disseminated for use in making informed decisions on climate risks and vulnerabilities?

Score	Description
5	Very high degree - High quality climate data are stored electronically and updated on an information system and readily available in an accessible format to policy makers. They are aware of the existence of the electronic platform and are adequately supported in accessing it (e.g. tutorials, user guide, helpdesk support).
4	High degree - High quality climate data are stored electronically and updated on an information system as well as readily available in an accessible format to policy makers. The level of support in accessing the data is, however, not sufficient.
3	Moderate - Quality climate data are collected and analysed, however access to data is limited (e.g. no electronic platforms, multiple responsible agencies, not adequate support).
2	Limited - Some climate data are collected but access is limited and data quality is questionable/data gaps are significant.
1	None - There is no or very limited access to climate information, data and analysis. The few available data are of questionable quality/data gaps are significant.

- **IC3 – Knowledge base**

  Q. Is the available knowledge base (e.g. best practices, existing frameworks, tools, funding opportunities, data sources) sufficient to support the identification and prioritisation of actions to address climate risks and vulnerabilities in the water supply sector?

Score	Description
5	Very sufficient - Knowledge exchange initiatives (e.g. forums, workshops, conferences, webinars) are undertaken with appropriate frequency and target a wide audience. Knowledge exchange platforms (e.g. websites, blogs, databases, water practitioners communities) are maintained and are accessible to support the availability of continual and up to date information. Available knowledge base is extensively exploited by stakeholders to support identification and prioritisation of actions to address climate risks.
4	Largely sufficient - Knowledge exchange initiatives are undertaken with appropriate frequency and target the right audience. Available knowledge base is exploited by stakeholders to support identification and prioritisation of actions to address climate risks.
3	Moderately - Knowledge exchange initiatives are undertaken regularly but either frequency or type of audience involved are not adequate to produce widespread, tangible benefits.
2	Limited - Knowledge exchange and awareness initiatives occur sporadically and stakeholders are generally unaware of available knowledge to support the identification and prioritisation of actions to address climate risks and vulnerabilities.
1	None - Knowledge exchange and awareness initiatives related to water sector climate risks and vulnerabilities are absent and most of the stakeholders are not aware of available knowledge to support the identification and prioritisation of actions to address climate risks and vulnerabilities.

- **IC4 – Climate risk and vulnerability assessments**

  Q. To what extent do climate risk and vulnerability assessments (CRVAs) have a strong influence on the formulation of strategies and plans for the water supply service improvements?

Score	Description
5	Very significant - CRVAs for all critical assets are undertaken as an essential part of the formulation of strategies and plans for the water supply sector, which are then shaped on the basis of the CRVAs outcomes and recommendations.
4	Significant - CRVAs are undertaken for most of the critical assets and they influence the formulation of water sector strategies and plans.
3	Moderate - CRVAs are usually undertaken for some critical assets but their influence on the formulation of water sector strategies and plans is limited.
2	Limited - CRVAs are only sporadically undertaken and their influence on the formulation of water sector strategies and plans is very limited.
1	None - No CRVAs have been undertaken for the sector.

- **IC5 – Consensus on priorities**

  Q. To what extent have priority climate risks and vulnerabilities in the water supply services sector been identified and agreed amongst all stakeholders?

Score	Description
5	Full agreement - Priority climate risks and vulnerabilities in the water supply sector are clear to water governance institutions and stakeholders and addressed in national adaptation strategies and action plans (NASAPs).
4	Significant agreement - Priority climate risks and vulnerabilities in the water supply sector are well clear to water governance institutions and stakeholders; their incorporation into a NASAP is under development.
3	Moderate - Priority climate risks and vulnerabilities in the water supply sector are well clear to water governance institutions and stakeholders however, no adaption plan exists or is under development.
2	Limited - Priority climate risks and vulnerabilities in the water supply sector are still unclear but there is on-going discussion between water governance institutions and stakeholders to increase their consensus over the subject.
1	None - Priority climate risks and vulnerabilities in the water supply sector are not identified and there are no initiatives aimed at finding consensus about what they are.

- **IC6 – Risk management processes**
  Q. To what extent is climate risk explicitly mainstreamed into existing risk management frameworks and planning processes for the water supply services?

Score	Description
5	Fully mainstreamed - Climate risk is an integral component of existing risk management frameworks and planning processes, and is implemented effectively.
4	Largely mainstreamed - Climate risk is an integral component of existing risk management frameworks and planning processes, but needs effective implementation.
3	Moderate - Climate risk is a component of some existing risk management frameworks and planning processes, but could be extended or improved.
2	Limited - Climate risk is largely absent from existing risk management frameworks and planning processes.
1	None - Climate risk assessment is not considered.

Pillar 2 - Water resources and watershed management

IN - Water resources data and information

The degree to which adequate data is collected, analysed and disseminated for use by water sector planners and managers is key to providing an understanding of current resource availability. 'Stationarity' in hydro-meteorological conditions can no longer be assumed and long-term measurement is essential to identify trends and to monitor changes. Data and information need to be collated, analysed and made available in formats that are accessible and readily usable by planners and managers to ensure that informed decisions can be made on sustainable water allocation and management.

Questions for consideration:

- **IN1 – Water resources data collection**
  Q. To what extent is routine data collection and analysis sufficient to make informed decisions on water availability and water allocation?

Score	Description
5	Readily available and sufficient - A hydrological monitoring system is operational and has sufficient coverage. Data undergoes thorough quality checks and is easily accessible by users.
4	Available – A hydrological monitoring system is operational and has sufficient coverage. Data undergoes thorough quality checks but is not easily accessible by users.
3	Moderate - A hydrological monitoring system is in place but its coverage is insufficient and the quality can be variable.
2	Limited - A very limited number of hydrological monitoring stations are operational and the data collected does not undergo quality checks or used for further analysis.
1	None - A hydrological monitoring system is not in place.

- **IN2 – Water use trends**
  Q. To what extent is data and information collected and analysed on water use, including how this is influenced by a changing climate?

Score	Description
5	Comprehensively - Information on disaggregated water use is collected at an appropriate spatial and temporal scale; the information is analysed and used to inform planning and projections on future demands and how these will be affected by a changing climate.
4	Available but not for a changing climate - Information on disaggregated water use is collected at an appropriate spatial and temporal scale; the information is analysed and used to inform planning but climate change is not considered in the analyses.
3	Moderate - Information on disaggregated water use is collected but the spatio-temporal scale is not adequate to develop an informed analyses – climate change is not considered.
2	Limited - Some information is collected/analysed but it is either of low quality or outdated – climate change is not considered.
1	None - No information is available on water use.

- **IN3 – Climate scenarios and variables**
  Q. To what extent are regionally downscaled climate scenarios and associated climatic variables readily available for use in water supply planning and management?

Score	Description
5	Comprehensively - Downscaled projections are available and the majority of the stakeholders are aware and able to access them; knowledge sharing initiatives are undertaken to ensure a wider level of awareness and encourage discussion over the uses of the projections for the sector.
4	Available - Downscaled projections are available and the majority of the stakeholders are aware and able to access them.
3	Moderate - Downscaled projections are available but only a limited number of stakeholders are aware on how to access these.
2	Limited - Downscaled projections are available but stakeholders are mostly unaware of their existence/use.
1	None - No downscaled projections have been produced for the country.

- **IN4 – Monitoring and review**
  Q. To what extent are water resources monitoring systems implemented and maintained, and used to periodically review the long-term status of water resources?

Score	Description
5	Comprehensively - Water resources monitoring systems in place and data actively used to review the status of water resources.
4	Available but under-used - Water resources monitoring systems in place but data is not used to review the status of water resources.
3	Moderate - Water resources monitoring systems in place but data can only be partially used to review the status of water resources.
2	Limited - Inadequate or poorly maintained water resources monitoring systems and data cannot be used to review the status of water resources.
1	None - No monitoring systems in place.

WR - Water resources management

An essential first step to improve climate resilience in the water sector is to promote greater integration of land and water management. This includes coherence and coordination of current approaches to climate risks including drought and flood prevention, water quality and pollution control, and other aspects of natural disaster risk management. Progress with the formulation and implementation of IWRM and maximising the use of IWRM as a process to promote coordinated approaches; joined up thinking to adaptation planning is key. This process should include consultations and participation by multiple stakeholders which are involved in land and water management.

Questions for consideration:

- **WR1 – Integrated water resources management**
  Q. To what extent are the principles and practices of IWRM implemented as part of the overall water resources management framework (e.g. watershed management of water resources, optimisation of supply, demand management, participatory processes, integrated policies and regulatory frameworks, inter-sectoral approaches to decision making)?

Score	Description
5	Comprehensively - Water resources management framework is based on IWRM principles and practices, and under effective implementation.
4	Largely used - Water resources management framework is based on IWRM principles and practices and implementation is gaining momentum.
3	Moderate - Water resources management framework is based on IWRM principles and practices but is not under implementation.
2	Limited - Water resources management framework in place but does not reflect IWRM principles and practices.
1	None - Limited or inadequate water resources management framework in place.

- **WR2 – Water resources management and allocation**
  Q. To what extent does water resources management and allocation take account of the impacts of climate change on water availability and water quality?

Score	Description
5	Comprehensively - Water resources management and allocation makes use of the most recent climate change projections to estimate impacts on water availability and quality and includes estimate of uncertainties (e.g. projected rainfall/temperature changes used to predict future quantity and quality of supply).
4	Largely incorporate - Water resources management and allocation makes use of the climate change projections to estimate impacts on water availability and quality but could be improved.
3	Moderate - Water resources management and allocation incorporates some climate change considerations.
2	Limited - Water resources management and allocation is limited and does not include climate change consideration.
1	None - No water resources management and allocation is undertaken.

- **WR3 – Water resources status and pressures**
  Q. To what extent is there good understanding of the current status of water resources and pressures from climatic (and non-climatic) stressors?

Score	Description
5	Comprehensively – Studies based on reliable good quality data are regularly undertaken and updated as necessary to estimate the safe yield of water resources and the effects of a broad range of climatic and non-climatic stressors. This understanding is shared with relevant stakeholders and decision makers.
4	Largely known – Studies have been undertaken to estimate the safe yield of water resources and the effects of a broad range of climatic and non-climatic stressors. However, these are sometimes outdated and/or their outcomes are not appropriately shared with relevant stakeholders.
3	Moderate - Some studies have been undertaken to estimate the safe yield of water resources and the effects of some stressors on this. However, the range of stressors considered is not comprehensive.
2	Limited - Some studies have been undertaken to estimate the safe yield of water resources and the effects of stressors; lack of high quality, reliable data is however a major constraint.
1	None - The safe yield of water resources, as well as the impacts of climatic and non-climatic stressors are unknown.

- **WR4 – Surface water vulnerability**
  Q. To what extent is the quality and availability of surface water sources for current and future water supply services vulnerable to trends in climate variability and change?

Score	Description
5	Highly resilient - Supporting evidence shows that surface water quality and availability to meet current and future water supply services are resilient to climate variability and change.
4	Largely resilient - Supporting evidence shows that surface water quality and availability to meet current and future water supply services are largely resilient to climate variability and change.
3	Moderate - Supporting evidence shows that surface water quality and availability are resilient to meet current service provision but may not be for the future.
2	Limited - Supporting evidence shows that surface water quality and availability are extremely vulnerable to the effects of climate variability and change.
1	None - No evidence exists to prove vulnerability or resilience of surface water quality and availability to climate variability and change.

- **WR5 – Groundwater vulnerability**

  Q. To what extent is the quality and availability of groundwater sources for current and future water supply services vulnerable to trends in climate variability and change?

Score	Description
5	Highly resilient - Supporting evidence shows that groundwater quality and availability to meet current and future water supply services are resilient to climate variability and change.
4	Largely resilient - Supporting evidence shows that groundwater quality and availability to meet current and future water supply services are largely resilient to climate variability and change.
3	Moderate - Supporting evidence shows that groundwater quality and availability are resilient to meet current service provision but may not be for the future.
2	Limited - Supporting evidence shows that groundwater quality and availability are extremely vulnerable to the effects of climate variability and change.
1	None - No evidence exists to prove vulnerability or resilience of groundwater quality and availability to climate variability and change.

CM – Catchment and land-use management

The long term resilience of water supplies depends on well protected and managed watersheds. Protecting and managing natural land cover, development, agriculture and other human uses maintains the quality and reliability of water sources. Watershed management, monitoring and control are critical to maintaining the quantity and quality of surface and groundwater sources. Watershed management measures can help address the threat of drought (e.g. by promoting infiltration) and reduce rapid runoff from storm events thereby alleviating problems with flooding and the siltation of surface water intakes. They also bring benefits to multiple sectors in terms of flood risk, erosion reduction and enhanced opportunities for sustainable use of upper watershed lands (e.g. for sustainable ecotourism).

Questions for consideration:

- **CM1 – Integrated watershed management**
  Q. To what extent is Integrated Watershed Management (IWM) (e.g. land-use planning, community based actions, hydrological and economic considerations) an integral part of national strategies and plans to protect water resources and maintain water services?

Score	Description
5	Fully integrated - National strategies and plans define a comprehensive and integrated approach to watershed management and protection, promoting the use of innovative technologies and tools. The approach is successfully implemented and objectives achieved.
4	Largely integrated - National strategies and plans define a comprehensive and integrated approach to watershed management and protection, and implementation is gaining momentum.
3	Moderate - National strategies and plans define a comprehensive and integrated approach to watershed management and protection, but implementation lacks momentum.
2	Limited - National strategies and plans define an approach to watershed management and protection but this is fragmented and needs improvement.
1	None - There is no prescribed approach to watershed management.

- **CM2 – Water source quality**
  Q. To what extent do good watershed management practices (e.g. managing unsustainable agricultural practices, solid waste dumping, uncontrolled urbanisation, industrial pollution, deforestation etc.) protect and preserve the quality of surface and groundwater sources?

Score	Description
5	Comprehensively - Buffer zones protecting water resources from polluting activities are in place and enforced. Sustainable farming techniques encouraged, and land-use appropriately managed. Indicators are regularly collected to monitor their effectiveness.
4	Largely - Buffer zones protecting water resources are in place even if not always enforced. Sustainable farming techniques encouraged and land-use managed to a certain extent.
3	Moderate - Buffer zones protecting water resources are in place even if not always enforced. But a comprehensive approach to watershed protection regulations is missing.
2	Limited - In some cases buffer zones are present but enforcement is a challenge and a comprehensive approach to watershed protection regulations is missing.
1	None - Illegal farming, lack of land-use control and polluting activities strongly impact water resources quality.

- **CM3 – Impacts of extreme events**
  Q. To what extent are the quality and quantity of surface and groundwater sources resilient to extreme events?

Score	Description
5	Highly resilient – Back up treatment and sources are planned for, in place and resorted to during/after extreme events. Also, time to repair infrastructural damage (e.g. to treatment plants, intakes) is recorded and reduced as much as possible in order to maintain levels of service.
4	Resilient – Back up treatment and sources are planned for, in place and resorted to during/after extreme events. However, time to repair infrastructural damage (e.g. to treatment plants, intakes) is not explicitly recorded.
3	Moderate – Back up treatment and sources are planned for, in place and resorted to during/after extreme events but only in key supply areas. Time to repair infrastructural damage (e.g. to treatment plants, intakes) is not explicitly recorded.
2	Limited – Back up treatment and sources are usually not in place which increases the time needed to restore safe access to water.
1	None - Back up treatment and sources are not in place and the time needed to restore safe access to water is too high.

- **CM4 – Green Infrastructure solutions**
  Q. To what extent are nature-based solutions (e.g. wetland restoration, reforestation, water harvesting, flood bypasses, mangroves protection) used to reduce the vulnerability of water resources and supply systems?

Score	Description
5	Often used – The implementation of green infrastructure solutions is encouraged by policy and decision-makers as well as communities. Where feasibility studies demonstrate their effectiveness (compared to standard grey infrastructure solutions) these are the preferred option. Appropriate monitoring produces supporting evidence to improve designs.
4	Some use – The implementation of green infrastructure solutions is encouraged by policy and decision-makers as well as communities. Some pilot applications exist, which are monitored to improve design and for potential upscaling of their benefits.
3	Moderate – The implementation of green infrastructure solutions is encouraged in theory but some barriers to implementation hinder their widespread application to reduce the vulnerability of water resources and supply systems.
2	Limited – Knowledge regarding green infrastructure solutions is limited and these are only sporadically considered.
1	None – Green infrastructure solutions are neither considered nor implemented to reduce the vulnerability of water resources and supply systems.

Pillar 3 - Water supply systems level

SP - Water supply strategy and action plans

Understanding the impacts of climate hazards on service standards is the starting point for setting climate resilience goals and targets, while appropriate planning and management allows for the development of actions to achieve these targets. Measures which manage existing climate variability can provide immediate benefits but also perform under a broad range of future climate conditions. Long-term strategic planning is essential as a basis for the prioritisation of investments and funding needs.

Questions for consideration:

- **SP1 – National water supply services strategy**
  Q. To what extent is a national water supply strategy and action plan available and guides future needs and investment priorities?

Score	Description
5	Available and adopted - A national water strategy and action plan is available and under implementation which explicitly addresses medium and long-term climate induced vulnerabilities.
4	Available - A national water strategy and action plan is available and under implementation but does not necessarily addresses medium and long-term climate induced vulnerabilities.
3	Moderate - A national water strategy and action plan has been drafted but there are barriers to its formal adoption / A national water strategy and action plan has been adopted but is outdated and does not address climate induced vulnerabilities.
2	Limited - A national water strategy and action plan does not exist at present but it is under development.
1	None - A national water strategy and action plan does not exist and is not being developed.

- **SP2 – Long-term planning**
  Q. To what extent do strategies and plans for water service provision take a long-term perspective (e.g. to 2030), including future trends in social and economic development?

Score	Description
5	Comprehensively – More than 10 years horizon, including future projections of social and economic development trends.
4	Largely – More than 10 years horizon, with some consideration of future trends in social and economic development.
3	Moderate – Between 5 and 10 years horizon, with some consideration of future trends in social and economic development.
2	Limited – 5 years or less and / or a general lack of consideration of future trends in social and economic development.
1	None – No long-term plans and / or no consideration of future trends in social and economic development.

- **SP3 – Climate trends**
  Q. To what extent do long-term strategies and plans for water service provision take account of emerging trends in climate variability and change?

Score	Description
5	Comprehensive – Long-term (>10 years) sectoral strategies exist, are regularly updated and take account of emerging trends in climate variability and change.
4	Largely comprehensive – Long-term (>10 years) sectoral strategies exist, to some extent take account of emerging trends in climate variability and change but could be updated or improved.
3	Moderate – Long-term (>10 years) sectoral strategies exist but take account of emerging trends.
2	Limited – Only short term (~3 years) sectoral strategies exist and do not take account of emerging trends in climate variability and chance.
1	None – Sectoral strategies do not exist.

- **SP4 – Supply/demand balance**
  Q. To what extent are strategies and plans for water service provision informed by basin water budgets and water supply/demand balances, including the impacts of future climate variability and change on these balances?

Score	Description
5	Well informed – Water supply/demand balances are developed for all watershed/ systems, factor in the impacts of future climate variability and change and provide key evidence to inform sectoral strategies and plans.
4	Informed – Water supply/demand balances are developed for key watersheds/ systems and factor in the impacts of future climate variability and change.
3	Moderate – Water supply/demand balances have been developed for selected watersheds/systems but they do not factor in the impacts of future climate variability and change.
2	Limited –Water supply/demand balances largely unavailable.
1	None – Water supply/demand balances not available.

AD - Flexibility and redundancy in supply systems

Degrees of redundancy and flexibility amongst available water sources can be used to enhance the robustness of water supply systems and to maintain acceptable levels of service under extreme weather events and changing climate trends. Short-term stresses on a system can also be enhanced through additional water storage provision to act as a buffer during periodic outages or maintenance tasks. Demand-side measures are also important to enhance resilience. Reducing water losses helps to reduce abstraction from surface and groundwater sources and in doing so provides greater resilience when source yields may be declined during periods of low flow or drought.

Questions for consideration:

- **AD1 – Maintaining service standards**
  Q. To what extent are levels of service reduced or compromised due to the impacts of climate variability and extreme weather events?

Score	Description
5	Not compromised – Only extreme climate-related events cause failure of supply and this occurs rarely.
4	Slightly compromised – Climate-related events occasionally cause some failure of supply to entire water supply areas.
3	Moderately compromised – Climate related events sometimes cause failure, including to high priority water supply areas.
2	Very compromised – Climate-related events regularly cause significant failure of supply to entire water supply areas.
1	Extremely compromised – Climate-related events regularly cause complete failure of supply to entire water supply areas.

- **AD2 – Adaptability of supply systems**
  Q. To what extent do flexibility and adaptability exist amongst water sources and supply systems to maintain acceptable levels of service under extreme weather events and changing climate trends?

Score	Description
5	High adaptability – Most of the water supply systems are interconnected and allow water source augmentation. Back-up water and energy sources for key assets are present and can maintain appropriate levels of services during extreme or changing climate conditions.
4	Good adaptability – Key water supply systems are interconnected and allow water source augmentation. Back-up water and energy sources for key assets are present but may not be able to maintain appropriate levels of services during extreme or changing climate conditions.
3	Moderate – Some supply systems are interconnected and allow for selected water source augmentation. Back-up water and energy sources are not always present and this can impact on levels of service.
2	Limited – Most of the supply systems are isolated and water transfers or source augmentation are not available and this has impacts on levels of service.
1	None – Most of the supply systems are isolated and water transfers or augmentation are not possible.

- **AD3 – Non-Revenue Water (NRW)**
  Q. To what extent do system losses and leakages exacerbate problems associated with maintaining service standards (e.g. continuity, pressure levels) during extreme weather events (e.g. drought periods)?

Score	Description
5	Not a significant factor – NRW levels are lower than 15 %, and are not considered a significant factor in maintaining services levels even during extreme weather events.
4	Slightly – NRW levels are between 15-30 % and targeted improvements could help to maintain services levels during extreme weather events.
3	Moderately – NRW levels are between 30-40% and exacerbate services levels particularly during extreme weather events.
2	Significantly – NRW levels are between 40-60% and / or losses and leakages high and exacerbate services levels even during average weather events.
1	Extremely – NRW levels are higher than 60% and / or losses and leakages unacceptable.

- **AD4 – Water storage provision**
  Q. To what extent is water storage provision sufficient to buffer the effects of extreme weather events and changing climate trends?

Score	Description
5	Very sufficient – Storage capacity is sufficient to meet current and future needs, including anticipated impacts of climate change, and structural design is adequate to withstand extreme events.
4	Largely sufficient – Storage capacity is largely sufficient to meet current and future needs, including anticipated impacts of climate change, but structural design could be improved to withstand extreme events.
3	Moderate – Storage capacity and structural design is sufficient for present day purposes but does not account for the impacts of future climate change.
2	Limited – Storage capacity is largely insufficient, even for present conditions, and structural design could be improved to withstand extreme events.
1	None – Storage capacity is largely non-existent and/or structural design inadequate.

CR - Critical infrastructure and assets

Caribbean islands are amongst the most heavily exposed locations on earth to natural hazards. Flooding, landslides and high sediment loads in water sources frequently damage water infrastructure leading to loss of service. This creates a heavy financial burden for repair costs. In many cases, these issues are further exacerbated by ageing water infrastructure and low levels of investment in replacement and rehabilitation. A more comprehensive approach to risk management for water infrastructure coupled with increased investment in asset management is often therefore necessary.

Questions for consideration:

- **CR1 – Water intakes and sources**
  Q. How would you rate the vulnerability of water intakes and sources (surface and groundwater sources) to the impacts of extreme weather (e.g. turbidity, flooding)?

Score	Description
5	Not vulnerable – water intakes and sources function effectively and without interruption under extreme weather events.
4	Slightly vulnerable – water intakes and sources mainly function effectively with only occasional interruption under extreme weather events.
3	Moderately vulnerable – water intakes and sources suffer periodic interruption under extreme weather events.
2	Very vulnerable – water intakes and sources suffer regular interruption under regular conditions and even more so during extreme weather events.
1	Extremely vulnerable – water intakes and sources suffer regular interruption even under normal conditions.

- **CR2 – Pipelines networks and distribution systems**
  Q. How would you rate the vulnerability of water distribution systems to loss or damages due to impacts of extreme weather events (e.g. storms, floods, landslides, heatwaves)?

Score	Description
5	Not vulnerable – water distribution systems are adequately designed and constructed to withstand the impacts of extreme weather events.
4	Slightly vulnerable – water distribution systems are largely well designed and constructed but need some updates to withstand the impacts of extreme weather events.
3	Moderately vulnerable – only a limited number of water distribution systems are adequately designed and constructed to withstand the impacts of extreme weather events.
2	Very vulnerable – water distribution systems are only designed and constructed to withstand the impacts of non-extreme weather events.
1	Extremely vulnerable – water distribution systems lack appropriate design and are poorly constructed.

- **CR3 – Water treatment plants and facilities**
  Q. How would you rate the vulnerability of water treatment plants to the impacts of extreme weather events (e.g. turbidity, low flows, flooding)?

Score	Description
5	Not vulnerable – water treatment plants function effectively and without interruption under extreme weather events.
4	Slightly vulnerable – water treatment plants mainly function effectively with only occasional interruption under extreme weather events.
3	Moderately vulnerable – water treatment plants suffer periodic interruption under extreme weather events.
2	Very vulnerable – water treatment plants suffer regular interruption under regular conditions and even more so during extreme weather events.
1	Extremely vulnerable – water treatment plants suffer regular interruption even under normal conditions.

- **CR4 – Storage facilities and tanks**
  Q. How would you rate the vulnerability of storage facilities (tanks and reservoirs) to the impacts of extreme weather events (e.g. storm and wind damage, flooding)?

Score	Description
5	Not vulnerable – storage facilities are adequately designed and constructed to withstand the impacts of extreme weather events.
4	Slightly vulnerable – storage facilities are largely well designed and constructed but need some updates to withstand the impacts of extreme weather events.
3	Moderately vulnerable – only a limited number of storage facilities are adequately designed and constructed to withstand the impacts of extreme weather events.
2	Very vulnerable– storage facilities are only designed and constructed to withstand the impacts of non-extreme weather events.
1	Extremely vulnerable– storage facilities lack appropriate design and are poorly constructed.

- **CR5 – Pumping stations**
  Q. How would you rate the vulnerability of pumping stations to damage or power outages during extreme weather events (e.g. flooding or storm damage to power supplies)?

Score	Description
5	Not vulnerable – pumping stations function effectively and without interruption under extreme weather events.
4	Slightly vulnerable – pumping stations mainly function effectively with only occasional interruption under extreme weather events.
3	Moderately vulnerable – pumping stations suffer periodic interruption under extreme weather events.
2	Very vulnerable – pumping stations suffer regular interruption under regular conditions and even more so during extreme weather events.
1	Extremely vulnerable – pumping stations suffer regular interruption even under normal conditions.

US - User awareness and engagement

Water users have a critical role to play in strengthening climate resilience. Engagement is important to establish effective and productive relationships and to enable shared understanding of goals and commitment to change. Communication, education and awareness initiatives help to clarify the main challenges and seeking input from users in the decision making process builds trust and promotes collaborative stewardship. An engaged community is more likely to be proactive and change its behaviour in response to threats posed by climate change, for example by improving the outcome of demand-side initiatives. Reduced conflict can also bring greater support and acceptance of potential investment options and complementary measures (e.g. increased tariffs to fund system resilience enhancement investments).

Questions for consideration:

- **US1 – Communication, education and awareness**
  Q. To what extent are users informed of challenges posed by climate variability and change and of the actions undertaken by water service providers to address these?

Score	Description
5	Well informed – Public awareness campaigns regarding climate variability and change are regularly rolled-out. Monitoring and Evaluation activities as part of these campaigns have confirmed their effectiveness.
4	Largely informed – Public awareness campaigns regarding climate variability and change are regularly rolled-out but their effectiveness is unknown.
3	Moderate – Some public awareness campaigns regarding climate variability and change are developed but they have limited outreach or are only used during emergency situations.
2	Limited –Occasional public awareness campaigns are developed but largely neglect climate variability and change.
1	None - Not informed and no public awareness campaigns are developed.

- **US2 – Behavioural change**
  Q. To what extent are users educated and incentivised to adopt good practices to minimise vulnerability of the water supply service to climate change (e.g. demand side conservation measures, pollution reducing behaviours)?

Score	Description
5	Well educated and incentivised – Engagement and educational campaigns are developed to communicate the value of water and the operational challenges facing water supply services. Strong incentives to influence behaviour change in place and behavioural change observed and monitored.
4	Reasonably educated and incentivised – Engagement and educational campaigns are developed to communicate the value of water and the operational challenges facing water supply services. Some incentives to influence behaviour change in place but effectiveness is unknown.
3	Moderate – Engagement and educational campaigns are occasionally developed to communicate the value of water and the operational challenges facing water supply services. Incentives may be limited.
2	Limited – Engagement and educational campaigns are sporadic and incentives largely non-existent.
1	None - Educational campaigns and incentives not used.

- **US3 – Consultation processes**
  Q. To what extent are users consulted regarding the identification of options and investments to manage and mitigate risks associated with climate variability and change?

Score	Description
5	Extensive consultation – Users and community consultation is a key component of decision making and is regularly put in place as part of the identification of options and investments to mitigate climate risks in the sector.
4	Good consultation– A wide range of users/communities are usually consulted as part of water sector development/adaptation projects and their recommendations contribute to final decision making.
3	Moderate –Users/communities are consulted as part of water sector development/adaptation planning but this is rather ad hoc and not formalised.
2	Limited – Only some users/communities are consulted as part of water sector development/adaptation projects but their views are not necessarily taken on board for implementation.
1	None – No consultation.

DR - Disaster risk management

Dynamic disaster risk management procedures and emergency response plans are better able to respond to changing trends in climate risks. Periodic review and the incorporation of lessons learned, nationally and also regionally, from past events will ensure they remain effective and up-to-date. Whilst early warning systems and emergency plans enhance preparedness in advance of an event, contingency plans underpinned by well-trained and resourced emergency response teams are needed to manage post-event situations and to facilitate rapid recovery.

Questions for consideration:

- **DR1 - Early warning systems**
  Q. To what extent is information from Early Warning Systems (EWS) effective in increasing preparedness and reducing risks to water supply services from extreme weather events?

Score	Description
5	Highly effective - EWS for relevant hazards are in place, fully operational and integral part of planning and management of responses to extreme weather events.
4	Largely effective - EWS for relevant hazards are in place but are not always used as an integral part of planning and management of responses to extreme weather events and/or some agencies lack knowledge to effectively use the information.
3	Moderate - Some EWS are in place, however specific procedures for their use to plan and manage responses to extreme weather events are lacking and financial and/or capacity barriers hinder their effective implementation.
2	Limited - Some EWS information is available but is incomplete or not utilised.
1	None - EWS are not in place.

- **DR2 - Emergency procedures and plans**
  Q. To what extent do emergency procedures and plans adequately address water supply services and potential impacts from extreme weather events?

Score	Description
5	Very adequate - Emergency procedures for water supply services are operational and implementation is effective, including periodic updating with lessons learned as necessary.
4	Largely adequate - Emergency procedures for water supply services are operational and implementation is usually effective.
3	Moderate - Emergency procedures for water supply services are not fully operational or not always effective (e.g. due to lack of capacity and/or resources).
2	Limited - Emergency procedures address water supply services to limited extent, but these are outdated or their implementation is ineffective.
1	None - Emergency procedures and plans do not address water supply services.

- **DR3 – Contingency plans**
  Q. To what extent are contingency plans and mobilisation resources in place to effectively reinstate water supply services following the failure, loss or damage of water infrastructure or other assets following extreme weather events?

Score	Description
5	Highly effective - Contingency plans in place to provide emergency water supply services and recovery of water supply systems, and have proven to be effective in the past.
4	Largely effective - Contingency plans in place to provide emergency water supply services and recovery of water supply systems, but practical barriers may prevent their effectiveness (e.g. lack of equipment, personnel, coordination).
3	Moderate - Contingency plans address some aspects of the recovery needs of water supply services but need revising or updating.
2	Limited - Contingency plans are limited in their scope for addressing the recovery needs of water supply services.
1	None - Contingency plans are not in place.

Section 4

Screening of legislation, policies, strategies and plans

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Section 4: Screening of legislation, policies, strategies and plans

Summary

The Enabling Environment consists of the legislation, policies, strategies and plans within which the water sector operates. An Enabling Environment that is able to guide and promote a proactive approach to the integration of climate resilience is an important prerequisite to set a country on a more resilient development pathway.

This section provides guidance on the screening of relevant legislation, policies, strategies and plans with respect to how well they integrate and promote climate resilience and gender sensitivity in the water supply sector. Findings of this screening will then inform the identification of complementary actions in support of options and investments to increase resilience in the sector.

Objectives

At the end of this section, participants will be able to:

- Describe the characteristics of an Enabling Environment for climate resilience in the water supply sector;
- Diagnose national capacity and gaps for the integration of gender-sensitive climate resilience in water sector legislation, policies, strategies and plans;
- Set actions and priorities for mainstreaming climate resilience into legislation, policies, strategies and plans and identify key entry points in their national context.

Things to know …

- Caribbean countries identified improvement of communication, multi-disciplinary collaboration, training of public and policy makers, and development of exercises about impacts of climate change for multiple sectors as possible actions to enhance the Enabling Environment.
- Water regulation and enforcement mechanisms must be implemented or strengthened in most of the Caribbean countries in order to provide regulatory empowerment of, and incentives for, utilities to pursue climate resilience.
- Responsibilities for water resources management and the provision of water services should be separate and independent.
- National water policies should be based on the principles of Integrated Water Resources Management (IWRM), as well as reflect answers to current challenges and incorporate future climate scenarios.
- Programmes, policies, plans and strategies related to climate resilience and adaptation of the water sector should promote gender-sensitive, equitable access to water supply services and the benefits this brings and be supported by an overarching guidance for gender mainstreaming at a national, cross-sectoral level.

4.1 Section 4: Guidance Materials

4.1.1 Introduction

The aim of this section is to train participants in the screening of relevant legislation, policies, strategies and plans with respect to how well they integrate and promote gender-sensitive climate resilience in the water supply sector. Findings of this screening will then inform the identification of complementary actions in support of options and investments to increase resilience in the sector.

Th section covers the main steps of the screening exercise and in particular:

- explains what the Enabling Environment is and why it is important to analyse its capacity to mainstream climate resilience in the water supply sector;
- focuses on the existing legal and governance framework of the water sector in the country, and on the assessment of the current capacity to incorporate and mainstream gender-sensitive climate resilience;
- aims at identification of options and entry points for the above mentioned issues into national water supply governance.

A work flow diagram of the section is shown in Figure 4-1.

In order to guide the assessment, supporting material is provided in Annex 4.4. This material should support the completion of the assessment and inform more comprehensive reporting.

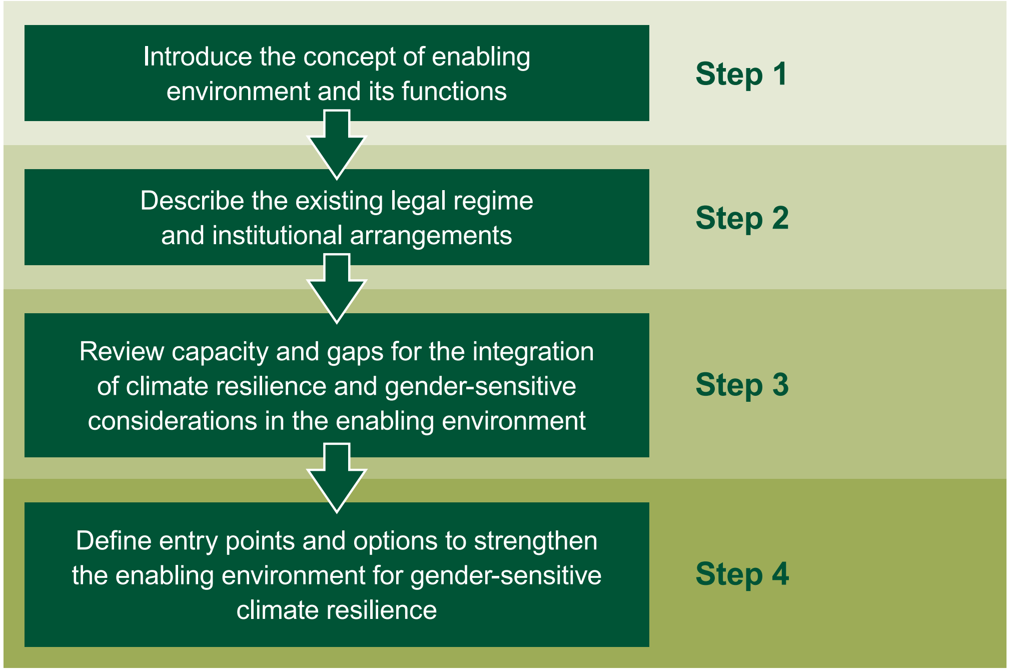


Figure 4-1: Section 4 work-flow: Screening of legislation, policies, strategies, plans

4.1.2 Step 1: Introducing the concept of Enabling Environment and its functions

This section sets the context for the screening approach and is aimed at defining the Enabling Environment, as well as the type of entry points, for mainstreaming climate resilience in the water supply sector.

Functions of the Enabling Environment

In the present context the Enabling Environment refers to the general system of policies, laws, institutions and regulations within which water is managed and used. The quest for water supply resilience is influenced and constrained by this wider socio-political framework. Multi-scale (national and regional) [1] policies and legislations effectively define the rules of the game for stakeholders to play their role for enhancing climate resilience in the water supply sector. Creating the right Enabling Environment also makes it possible to define responsibilities for action, channel investments, promote multi-sectoral collaboration and enable practical management tools.

In particular, as schematised in Figure 4-2, the Enabling Environment for the water supply sector consists of [2]:

- the broad economic and legal foundations, political economy and prevailing cultural attitudes in the country or specifically in the water supply sector;
- specific laws, policies, and strategies for the development and regulation of water resources and supply services;
- the institutional structure of the sector and relationships among actors;
- regulatory arrangements and enforcing mechanisms.

Barriers and gaps in any of these components could compromise the uptake of mainstreaming climate resilience in the water supply sector.

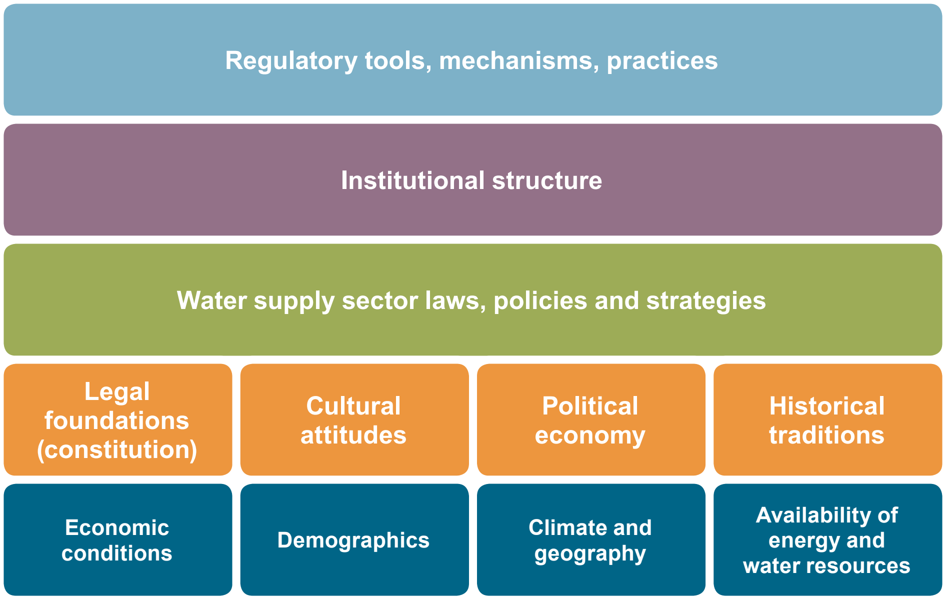


Figure 4-2: Water Sector Enabling Environment

Source: Based on (Mumssen and Triche, 2017) [3]

1 Regional here means supra-national (e.g. Caribbean rather than island/national level).

2 The definition of the exact boundaries of the Enabling Environment may differ. Other studies, for example, describe the “Enabling Environment” as the political will and information services, separating it from the aspects of “policy and planning” and “programmes and projects” (Pervin et al, 2013). The definition reported in this manual has been chosen as more comprehensive and suitable for the overall goal of the assessment.

3 Mumssen, Y. U., and Triche, T. (2017). Status of Water Sector Regulation in the Middle-East and North Africa. Washington, DC: Wolrd Bank.

What should the Enabling Environment for climate resilience look like?

An Enabling Environment for mainstreaming climate resilience in the water supply sector is one that creates the condition for a country to strategically plan and design water supply services which can cope with and quickly recover from the adverse effects of climate variability and change.

The Enabling Environment should guide and promote a proactive approach to the integration of climate resilience and this can be achieved through a series of intermediate outputs:

Clear, harmonised and inclusive institutional roles and responsibilities for water and climate resilience

Effective legal frameworks with clearly defined institutional roles and responsibilities provide a foundation for effective and coordinated action to enhance climate resilience. The often complex and inter-connected institutional landscape for enhancing the resilience of water supply services cuts across many spheres of activity including water resources management, infrastructure, environment and different economic sectors, as well climate change adaptation and disaster risk reduction. Representation and engagement of a wide range of stakeholders in policy formulation, decision-making and coordinated action is therefore critical.

Climate resilience mainstreamed into national policies and strategies

Policies and strategies provide an overall vision of the objectives and outcomes for the sector and the principles by which these will be achieved. Managing risks arising from climate vulnerability and change should be firmly embedded within policy frameworks and the principles by which these risks will be managed and should be articulated in associated strategies and plans for action. IWRM as a tool to support adaptation provides many of the underlying principles and practices on which to build. Water policies and strategies should be fully aligned with national development agendas while also supporting other regional or international commitments such as the achievement of the SDGs.

Capacity and knowledge base built to integrate climate resilient considerations into strategy and planning

Emerging trends in climate variability and change bring additional risks to water supply services and these need to be assessed within an overall risk management framework. Institutional capacity to lead and coordinate climate risk and vulnerability assessments and to integrate these within existing strategy and planning processes is central to understanding and addressing priority risks. Engagement of a wide range of stakeholders is necessary to capitalise upon specialist knowledge (e.g. climate focal points) and to secure coordinated action to address risks. Paucity of policy relevant data and information is often a constraint.

Implementing climate resilience for the Caribbean water supply sector: practical challenges and considerations

Where basic elements of accepted water governance, are absent or incomplete, reforms can pose a demanding political and administrative agenda. Caribbean countries are typically small, with closely-knit societies, which presents both opportunities and challenges. Compact size can make it easier to arrive at national consensus on climate challenges and how they can be addressed. It can also enable better coordination between different parts of national administrations, both through formal inter-departmental committees and informal networks. Cumbersome formal institutions may not be necessary, appropriate, nor feasible.

However, it is important that national governments are not overloaded with new and demanding agendas: policy ambitions need to be tailored to available capacity in the short and medium terms. Countries should draw fully on regional sources of advice and experience on water reforms, such as the CDB, CCCCC, the Caribbean Water and Wastewater Association, and GWP-Caribbean, amongst other sources.

The integration of climate resilience in the Enabling Environment will be inevitably associated with wider considerations as it relates to wider water governance issues and practices in the region. It has been recognised that ownership, regulation, institutional arrangements and policy implementation are all areas that would need strengthening and improvement.

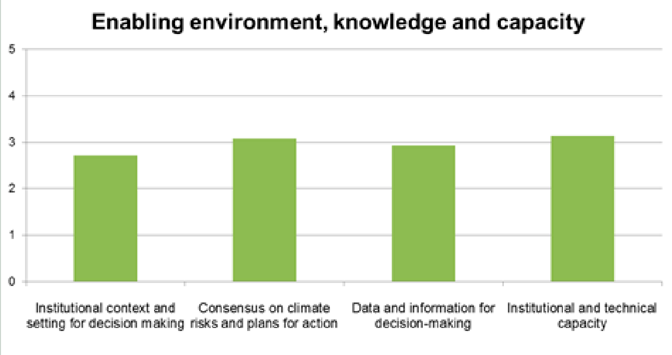
Certain precepts of good water governance are often advocated and increasingly applied. These include: sufficient managerial, operational and financial autonomy for the water services provider; a separation of water resources management from the provision of water supply services; independent regulation of water services, etc. These reforms, which have independent merit, are even more beneficial in the pursuit of gender-sensitive climate resilience for water, for which enhanced water resources management and an efficient, well-resourced and accountable service provider would seem essential.

Box 4-1: The water supply sector Enabling Environment in the Caribbean

As part of the project Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean, water practitioners in the region were asked to complete a survey on the current status of the integration of climate resilience in the water supply services of their country and the key challenges and priorities for improving resilience. One section of the survey was explicitly aimed at assessing the effectiveness of the Enabling Environment for climate resilience and in particular to expand on:

- The level of incorporation of climate resilience into policy-making, strategy, legislation, regulation and other relevant practices;
- The understanding and consensus on climate risks and vulnerabilities and the level of coordinated action to address these;
- The availability of sufficient knowledge base to support identification and prioritisation of actions;
- The existence of effective capacity to identify, plan and take actions to improve climate resilience.

Respondents highlighted that there is space for improvement in the incorporation of climate resilience into policy making, strategy, legislation and regulation: the score given to the institutional context and setting for decision making sub-category was in effect the lowest (see figure below). Other areas scored slightly higher. It was highlighted that the level of institutional and technical capacity is, per se, sufficient, but lacks of the appropriate Enabling Environment. Improvement of communication, multi-disciplinary collaboration, training of public and policy makers, development of exercises about impacts of climate change for multiple sectors were identified as possible actions to enhance the Enabling Environment.



Mainstreaming climate resilience – not just mentioning it

Mentioning climate change and climate resilience in policies and plans, does not suffice to mainstream these themes in the Enabling Environment. Instead, it is important that the response to climate related challenges in the water sector is built into key government institutions and policies, and that the sense of ownership by stakeholders and government staff is maximised. For this reason, strengthening the mainstreaming of climate resilience into policies, plans and strategies must be a country-driven process. The ownership process requires that a country's representatives come together and analyse and assess the unique context of their country / sector, its capacity to mainstream climate resilience, and identify main options and entry points to improve or undertake this.

Part of the ownership process consists in the identification of country and context specific entry points for mainstreaming climate resilience. Entry points are often key processes or actions in relevant policy, planning and/or financial cycles which will help to integrate and tailor climate resilience actions to a country-specific or even sector-specific context. The choice of the entry point depends on what type of mainstreaming activity is identified for implementation:

- ***National, local or sectoral water planning frameworks and policy cycles.*** In this case climate resilience is an integral part of the water supply sector planning process from the start. Entry points for integration can specifically be represented by:
  - Annual, medium and long-term water sector strategic, adaptation and development plans;
  - Annual and medium-term expenditure and budgetary frameworks.
- ***Stand-alone climate change and adaptation policies and strategies*** which serve as pilot strategies, to be then mainstreamed in other sectoral and national plans. This approach is used in order to test approaches to climate resilience before investing significant resources in integrating them into regular planning, as well as a way to address climate resilience as a stand-alone issue in order to highlight its importance.
- ***Investment plans and specific projects in the sector***, which have been developed in isolation from the climate resilience context but which aim to increase the capacity to cope with and recover from impacts of existing and future climate variability.

An Enabling Environment to promote gender-sensitive considerations

The Caribbean Water Initiative (CARIWIN) project (2006-2012) identified that when it comes to the domain of water, there are very segregated roles for women, men and children. During times of water scarcity or drought, when water must be accessed from community faucets, water trucks, irrigation ditches, rivers and wells, women's responsibilities in sourcing and allocating water for domestic use tend to be significantly increased.

Due to the different impacts of disasters on men and women, it has been recognised that higher involvement of women in decision making processes for disaster and drought management should be encouraged (see 'Regional Comprehensive Disaster Management Strategy and Programming Framework 2014-2014' developed by CDEMA, and UNDP).

Programmes, policies, plans and strategies related to climate resilience and adaptation of the water sector should promote gender-sensitive, equitable access to water supply services and the benefits these bring; at the same time, the absence of consideration of gender-issues may reflect maladaptive practices in terms of resilience of the water resources sector.

4.1.3 Step 2: Describe the existing legal regime and institutional arrangements

Existing legal regime

The first step of the screening must be aimed at understanding the policy framework and legal regime for governing water rights, water supply and wastewater disposal. Information and evidence material must be collated on the main policies, strategies, legislative and regulatory instruments that govern water, also with the aim of highlighting outdated or missing elements.

Table 4.1 provides a checklist of the main aspects that should be covered by water governance, with examples of the policy or regulatory instruments in place to address each of these aspects. A template table is provided in Annex 4.4.1 in order to support the completion of the assessment. This table should be completed by the trainer prior to the training on the basis of research and literature review while a workshop session (see Group Session "Overview of existing water sector legislation, policies, strategies and plans") will help to fill knowledge gaps and cross-check collated evidence.

Table 4-1: Water sector legislation, policies, strategies and plans overview

Water governance aspect	Policy/Regulatory instrument
Nation-wide comprehensive water management	National water policies, IWRM policies, fit for purpose legal and regulatory regime governing water abstraction and water pollution; economic and financial instruments to “stiffen” the policy mix
Land-use	Development planning laws, land-use policies etc.
Environmental Health	Public health acts, potable water quality standards laws etc.
Solid waste management	Solid waste management act, Strategies etc.
Disaster Risk Reduction	Emergency management and contingency plans
Climate change adaptation	National and sectoral climate change adaptation strategies
Other sectors policies	National policies for energy, tourism, agriculture

Institutional arrangements

The often complex institutional landscape for water management and regulation necessitates coordination and joined-up policymaking across many spheres of activity including climate change adaptation, disaster risk reduction, and climate compatible development [4]. In order to understand if institutional roles are clear and cover all the relevant aspects of water supply provision and management it is important to put together a comprehensive picture of all the institutions that play a role in water supply and service management, describing what their role and responsibilities are, how they coordinate with each other, if the overall institutional and coordination framework has proven to be effective or if there are gaps to be addressed.

When collecting information regarding the existing institutional landscape, one should be asking which body or institution is responsible for managing:

- Water supply services;
- Environmental pollution;
- Health and sanitation;
- Water resources and watershed management;
- Land development;
- Climate change and resilience and adaptation;
- Disaster risk management;
- Regulation of water services;

4 Climate compatible development is development that minimises the harm caused by climate impacts, while maximising the many human development opportunities presented by a low emissions, more resilient, future. It moves beyond the traditional separation of adaptation, mitigation and development strategies. Instead it emphasises climate strategies that embrace development goals and strategies that integrate the threats and opportunities of a changing climate (CDKN, 2010).

The Section 4.4.1 provides a checklist and assessing tool to guide trainees in this part of the assessment. This table should be completed by the trainer prior to the training on the basis of research and literature review while a workshop session (see Group Session Overview of existing institutional landscape) will help to fill knowledge gaps and cross-check collated evidence.

Box 4-2: Case example: complex institutional landscape in St. Kitts and Nevis

The country is a federation of the two islands, and combines federal structures for some overriding functions, with separate legislatures and ministries in each island for a range of delegated functions. Both islands have their own Water (Services) Departments, which function within their respective supervising Ministries. Each island also has separate institutions responsible for disaster management.

In both islands, no single agency has a clear mandate for the holistic management of water resources and watershed areas. While in Nevis a Strategic Framework for Water Resources Management study has recently been completed, this has not happened for St. Kitts.

The complex formal institutional structures are not ideal for coordination and best practice sharing among the two islands, and therefore complicate the tasks of adaptation and data collection and sharing, which hinders efforts to mainstream climate resilience in water supply sector governance.

Source: Adapted from 'HR Wallingford. (2017a). Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - St. Kitts and Nevis - Task 1 - Climate Risk and Vulnerability Assessment Report. Wallingford, UK: HR Wallingford'

The following questions are also relevant in order to frame the specific arrangements of water governance and whether these put specific barriers to the integration of gender-sensitive climate resilience in the sector:

- Which utility or authority is responsible for water provision and wastewater disposal?
- Is the utility acting in monopoly?
- Is the utility government-owned? How much autonomy does it have, especially in terms of tariff-setting powers?
- Does the utility have responsibilities for water resources and catchment management?
- What is the utility's annual budget?
- Which mechanisms are in place for staff appointment?
- Does the utility have operational targets and strategic objectives?
- Which is the time-horizon of the water utility investment and strategic plans?

At the end of this review it should be clear what are the main gaps and uncertainties characterising the institutional landscape, which institutional roles are not covered and which ones need strengthening. The analysis should also focus and highlight whether there are specific challenges in applying in practice what is recommended “on paper”, e.g. whether policies tend to be drafted but never adopted, or if institutional mandates are not applied in practice and why.

4.1.4 Step 3: Review capacity and gaps for the integration of climate resilience and gender-sensitive considerations in the Enabling Environment

Review the role of climate resilience in legislation, policies, strategies and plans

After putting together a comprehensive picture of the policy, planning and regulatory context, as well as of the institutional arrangements and responsibilities, the role of climate resilience in these arrangements and the capacity for its mainstreaming need to be assessed. This can be done using the so-called “climate lens” approach (see Box 4-3).

Box 4-3: Applying a "climate lens"

This is an analytical method that stimulates a questioning mode of analysis. A climate lens should be applied during the formulation of strategies and plans for the water sector, but its retrospective application is also beneficial in order to identify areas in the existing governance landscape where climate resilience focus can be strengthened during policy review and reformulation.

Source: Adapted from 'GWP and UNICEF, 2015, WASH Climate Resilient Development'

The ***WaterRiSK*** questions for Pillar 1 – Enabling Environment can be used to guide the assessment. Sections 4.42 and 4.43 present this set of questions and the assessment table respectively. For each question, supporting evidence needs to be provided, as well as considerations as it relates to main gaps and needs. The evidence collected as part of Step 2 of this section will support the completion of the assessment table. Where supporting evidence is not available consultation with/among stakeholders should fill the gaps. It can also be decided to assign a performance and relevance score to each question if time allows. The paragraph below is dedicated to guide the review of gender-sensitive considerations.

Review the role of gender-sensitive considerations in legislation, policies, strategies and plans

In order to encourage gender-mainstreaming at a sectoral level it is necessary that an overarching guidance for gender mainstreaming is adopted at a national, cross-sectoral level. For this reason, the first step of the role of gender-sensitive considerations in the sector, focuses on the analysis of gender mainstreaming efforts undertaken by the country; in particular, the following questions should be answered:

- Is the country committed to any international and regional conventions that speak to gender and universal human rights?
- Have efforts on a national level been undertaken in order to achieve:
    - gender equality;
    - eradicating gender-based violence;
    - strengthening families;
    - increasing women’s empowerment opportunities.

After answering these overarching questions, it is necessary to review key relevant national policies, plans and strategies of relevance to climate change and water resources in order to discern the ways in which issues of gender were considered – or not - and identify actions to increase the role of gender-sensitive consideration.

Gender-sensitive climate screening of relevant policies, plans and strategies in the water sector can be carried out in accordance with the approach in Women Matter: Gender, Development and Public Policy [5], which advocates that all policy must be subjected to the following questions:

- Does this programme, policy, regulation or law affect men / women predominantly?
- Does it create a barrier to men’s / women's equality?
- Does it promote equality?
- What changes would have to be made to promote equality?

These guiding questions can therefore be used to evaluate key relevant policies, plans and strategies in each country to discern the ways in which lack of gender considerations reflect maladaptive practices in terms of resilience in the water resources sector.

A case example for the gender-sensitive review is shown in the Case Example in Section 4.2.4 - "Gender-sensitive review of key relevant policies, plans and strategies in Grenada".

5 Muzychka, M., 1995, Women Matter: Gender, Development and Policy. St John's: Provincial Advisory Council on the Status of Women, Newfoundland and Labrador

4.1.5 Step 4: Define entry points and options to strengthen the Enabling Environment for gender-sensitive climate resilience

Box 4-4: What is climate resilience mainstreaming?

Climate resilience mainstreaming in the context of this framework means integrating climate-related considerations into water supply sector objectives (policies, plans and strategies) and planning and decision-making processes.

A capacity and gaps assessment, covered in Step 3, is the first step towards the identification of improvement and adaptation options. Based on the assessment and screening undertaken, a workshop session should be used to ask participants to identify possible actions that would strengthen the incorporation of gender-sensitive climate resilience considerations into water supply sector governance. Once again, the ***WaterRiSK*** tool can be used to support this step: for each question, or only for those with the highest priority, gaps, needs and recommended actions can be specified (see assessment table in Section 4.4.3).

It is also crucial that recommended actions are tailored to the national context and rely on context-specific entry points.

For example, in some cases the creation of a regulatory body for the water sector may need brand-new policies, framework and regulations. In other cases it may be possible to exploit the existence of independent regulation for other sectors (e.g. energy, transportation) to incorporate or structure water sector regulation. Sometimes, ongoing national processes create entry points and make the case for substantial water governance reforms, as in the case of the water utility reform implemented in Jamaica in 1998 where the establishment of an Office of Utilities Regulation triggered a wide Water Sector Reform (1998) whose main aim was to improve operations and delivery of water supply and sewerage service of the National Water Commission (see Case Example 4.2.1).

The case example in Section 1.7 summarises key actions to strengthen gender-sensitive climate resilience mainstreaming into water sector policies in Grenada, as identified in HR Wallingford (2017) [6] while Box 4-5 below provides examples of gender-sensitive measures to mainstream in climate resilience considerations.

Box 4-5: Strengthening the Enabling Environment: examples of gender-sensitive measures

- Provide gender disaggregated data and evidence on the impacts of climate change to show how men and women are affected differently by climate variability and change (e.g. direct impacts such as water shortages, food insecurity, land-use changes; indirect impacts such as access to energy, changes in employment opportunities, increased migration);
- Assessment of vulnerabilities and inequalities between men and women before, during and after a disaster event via the collection of sex-disaggregated data for baseline and situational analysis;
- Conduct a gender-analysis on the social impacts of current policies on adaptation and mitigation and how they may benefit or adversely affect men and women in different ways;
- Improve institutional capacity in key agencies to implement gender sensitive policy or gather gendered data.

Source: Adapted from 'Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - Grenada, Task 2 - Screening of policies, plans and strategies (HR Wallingford, 2017)'

6 HR Wallingford. (2017b). Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - Grenada, Task 2 - Screening of policies, plans and strategies. Wallingford, UK: HR Wallingford.

4.2 Section 4: Case examples and other relevant material

4.2.1 Case example: National Adaptation Strategy (NAS) to address climate change in the water sector in Belize

The NAS was developed in 2009 by the Government of Belize with the support of the Mainstreaming Adaptation to Climate Change project (MACC). The time-horizon of the action plan goes from 2009 to 2018 and the total cost for implementation is estimated to be US$ 4.5 million. The strategy identified five key adaptation actions to be implemented over a period of 10 years.

The NAS is informed by a technical review of climate change issues facing the sector, policy and legislation review, institutional capacity analysis and an economic review of the current status of the water sector.

While some of the actions have been accomplished as of today, most of them are still under development. Barriers to implementation have been identified in capacity and financing, while success factors relate to the will and determination from water stakeholders to implement and coordinate.

A list of the actions and a description of their status as of June 2018 is showed below.

ACTION 1 (US$ 1800): Establish an agency to execute integrated water resources management.	Executed through NIWRA that is housed in the Hydrology Unit but still needing capacity building to proceed with its mandate.
ACTION 2 (US$ 2100): Strengthen the existing human resource capabilities and capacities in the water sector for improved management practices.	Further strengthening is needed but the water sector players are willing.
ACTION 3 (US$ 150 000): Formalize the legal mandate and operations of the National Climate Change Committee (NCCC).	The NCCC was on pause but has been re-established recently. Coordination among the national planners with oversight from the Ministries of Finance and Economic Development remains the country's focus.
ACTION 4 (US$ 140 000): Strengthen the trans-boundary relationships to cover the impacts of climate change on the water sector.	The Mexico-Belize relationship remains with focus on the Rio Hondo shared watershed. A Guatemala-Belize relationship through NGO relations remains for the shared watershed. Further strengthening is needed.
ACTION 5 (US$ 310 000): Increase public awareness and education on water culture and climate change.	This is an ongoing series of activities as a result of stakeholder ownership.

Source: Presentation given by Belize representatives at the Training of Trainers workshop, 2018.

4.2.2 Case example: The institutional environment in the water sector in Jamaica

Following the Water Sector Reform implemented in 1998, a Ministry of Water was established, a Water Sector Policy prepared (2002), and a Water Sector Strategy and Action Plan developed (2004). The legal and regulatory environment was also reformed and now includes a utility regulator and a Water Resources Authority responsible for water abstraction licensing and monitoring.

The Jamaican institutional environment also gives specific attention to climate change related issues through:

- Jamaica UN Framework Convention on Climate Change (1992)
- Creation of the position for a Minister for Climate Change (2012)
- Establishment of a Climate Change Policy Framework (2015)
- Establishment of a legalisation framework which is integrated with the National Development Goals/ Plans and the Vision 2030
- Sector specific climate change strategies for 7 vulnerable sectors

Lessons learned from the Jamaica experience [7] highlight the importance of:

- Improvement and enforcement of the building codes to increase the capacity of Rainwater Harvesting (RWH) to mitigate drought impacts;
- Appropriate planning for national disasters such as hurricanes
- Drain maintenance, especially in flood prone areas
- Greater awareness of efficient agricultural practices
- Focus on solid waste disposal and management
- Adequate financing and budget to improve climate resilience
- Increase the drive to use renewable forms of energy
- Improving the protection on the coastal and marine waters
- Fostering regional and international support
- Education and awareness

Source: GWP-C. (2011). Water Utility Reform - The Jamaica Experience. Port of Spain - Trinidad: GWP-C.

7 Source: Presentation given by Jamaica representatives at the Training of Trainers workshop, 2018.

4.2.3 Case example: Analysis of institutional landscape and legal regime for the water supply sector in Grenada

Outcome

There is a comprehensive Enabling Environment but a lack of coherent implementation and updating. Many proposals for legislative, institutional and policy reforms have been initiated for the Grenada water sector, but few have been fully implemented. These are underpinned by the draft National Water Policy (2007), which has not been formally adopted. Suggested reforms cover, among others, water sector regulation, tariff reviews and climate resilience. The Strategic Plan of NAWASA is currently being updated, and should take consideration of climate resilience within its objectives.

Should these recommendations and plans be implemented, governance of the sector would become stronger and the Enabling Environment for water sector climate resilience would be strengthened.

Evidence

Table 4-2: Summary table of analysis of institutional landscape and legal regime for the water supply sector in Grenada

Water sector	Institutions	Legal regime: policy, strategies, laws
Water supply services	■ Responsible ministry: Ministry of Communications, Works, Physical Development, Public Utilities, ICT and Community Development (MCWDUI) ■ Operational responsibility: NAWASA, government owned	Draft National Water Policy (2007): still not formally adopted NAWASA Strategic Plan (2009-2014)
Water resources and watershed management	■ Ministry of Agriculture, Lands, Forestry and Fisheries (many responsible departments) ■ NAWASA	Roadmap toward IWRM Planning (2007)
Regulation of water services	■ No independent regulator; tariffs are set by NAWASA and must be approved by Government	No explicit regulation act
Health and sanitation	■ Ministry of Health and Social Security- Environmental Health Department	WHO Drinking Water Guidelines No legal regime for surface and groundwater pollution or water abstraction licencing
Environmental pollution	■ Solid Waste Management Authority (overseen by Ministry of Finance) ■ Environmental Health Dpt.	Solid Waste Management Act (2001) and Strategy (2003)
Disaster risk management	■ National Disaster Management Agency (within office of Prime Minister) ■ National Disaster Committee and other national and local committees ■ Drought Early Warning and Information Systems Committee	Emergency Powers Act, National Disaster Act. Other national sectoral acts
Land-use and development	■ Physical Planning Department, under the Ministry of Communications	Land and Marine Management Strategy (2011), Environmental Assessment and Environmental Management Framework (2015)
Climate change, resilience and adaptation	■ Ministry of Finance trough Project Coordination Unit	Strategic Program for Climate Resilience

Source: *Adapted from 'Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - Grenada, Task 2 - Screening of policies, plans and strategies. Wallingford, UK: HR Wallingford'*

4.2.4 Case example: Gender-sensitive review of key relevant legislation, policies, strategies and plans in Grenada

Outcome

The review for Grenada highlighted that while the country has made measurable progress in the consideration of gender issues within the development process, a number of critical gaps still exist in governance and institutional arrangements to truly mainstream gender into national planning and climate change adaptation.

Commitments to international conventions	National level efforts (studies, policies, institutions) for gender sensitive considerations
■ Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW, 1990) ■ Beijing declaration and platform for Action coming out of the Fourth World Conference on Women ■ Inter-American Convention on the Prevention, Punishment, and Eradication of Violence against Women (2000) ■ Brasilia Consensus (2010)	■ Gender programming by Gender and Family Affairs Division ■ Domestic Violence Unit and Social Services Division ■ Grenada National Organisation of Women ■ Gender Equality Policy and Action Plan (GEPAP) (2014) ■ Country Gender Assessment for Grenada (Baksh, 2014) ■ Growth and Poverty Reduction Strategy (2014-18): gender equity as a priority

Review of the role of gender into development, water and climate related policies

Policy	Gender considerations	Notes
Grenada National Hazard Mitigation Policy (2003)	Absent	
Draft National Water Policy (2007)	Absent	Further information needed to discern if one gender is the primary user of water in certain social circumstances.
Strategic Program for Climate Resilience (2011)	Present	One entire section is devoted to climate change impacts and gender.
Grenada Vision 2030 Development Plan (2012)	Absent	No explicit mention of gender considerations but attention given to marginalised groups and other areas that are known to have gender disparities (such as agriculture and disaster management).
Public Private Partnerships Policy (PPP) (2014)	Absent	No explicit mention of gender considerations but PPPs are aligned with the Government's development objectives. So one might suggest that gender sensitivity issues are implicit.
Disaster Vulnerability Reduction Project (2015)	Present	Gender is identified as a cross-cutting theme in the project document to be addressed under the project. In particular, the Resettlement Policy Framework component of the project, provides an opportunity for gender-sensitive actions.
National Sustainable Development Plan 2030 Grenada (2015)	n/a	Still going through public consultation

Policy	Gender considerations	Notes
National Agriculture Plan 2015-30	Absent	Several farmers' organizations and NGOs contribute to the development of the agriculture sector by assisting in the production and marketing processes – such as the Grenada Network of Rural Women Producers (GRENRWP)
Draft National Adaptation Plan (2017)	n/a	Document not publicly available

International commitments

Beijing declaration

Brasilia Consensus

CEDAW

Inter-American Convention on the Prevention, Punishment, and Eradication of Violence against Women

National efforts

Country Gender Assessment for Grenada

Domestic Violence Unit and Social Services Division

Gender Equality Policy and Action Plan (GEPAP)

Gender programming by Gender and Family Affairs Division

Grenada National Organisation of Women

Growth and Poverty Reducation Strategy

Incorporation of gender considerations into development, water and climate related policies

Strategic Program for Climate Resilience (2011)
Disaster Vulnerability Reduction Project (2015)

Source: Adapted from 'HR Wallingford (2017b)'

4.2.5 Case example: Options to strengthen mainstreaming of gender-sensitive climate resilience in Grenada

The screening of legislation, policies, strategies and plans in Grenada allowed for the recommendation of options to strengthen different sectors of the Enabling Environment for mainstreaming climate resilience [8]. These have been prioritised by stakeholders, factored according to national priorities and incorporated within an Investment Plan for Climate Resilient Water Supply Services [9].

Key actions to strengthen the Enabling Environment for climate-resilience have been identified, among others, in:

- Updating and full enactment of draft National Water Policy; incorporating the goal of climate resilience;
- Comprehensive revision of legislation relating to water management and creation of new institutions;
- Review and update of catchment management policy;
- Working groups among water management agencies to improve coordination and communication;
- Development of water resources and supply strategic master plan for mainland Grenada;
- Tariff review;
- Key actions to strengthen the Enabling Environment for gender-sensitive considerations in the water sector have been identified, among others, in:
    - The adoption of a Gender Equality Policy and Action Plan as the overarching guidance for gender mainstreaming into sectoral programmes, policies, plans and strategies;
    - Ensuring policies, institutions and coordinating mechanisms for DRM are integrated, gender-sensitive, cognisant of the differing vulnerabilities of communities.

8 HR Wallingford. (2017b). Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - Grenada, Task 2 - Screening of policies, plans and strategies. Wallingford, UK: HR Wallingford

9 HR Wallingford. (2018). Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - Grenada, Task 3 - Investment Plan for Climate Resilient Water Supply Services . Wallingford, UK: HR Wallingford.

4.2.6 Relevant material and other resources

Box 4-6: Relevant material and other resources

Achieving development resilient to climate change: a sourcebook for the Caribbean water sector (GWP-C, 2014)

The sourcebook offers users a framework for enhancing climate resilience throughout the decision making cycle. Ultimately, the sourcebook is intended to stimulate the identification and implementation of investments to enhance climate resilience, thereby underpinning sustainable development and growth in the region.

Available at: https://www.gwp.org/en/gwp-caribbean/

Integrated water resources management in the Caribbean: The challenges facing Small Island Developing States (GWP, 2014)

This paper looks at the progress made towards adopting an integrated approach to water management in the Caribbean, providing examples of initiatives and an evaluation of their outcomes and relative successes.

Available at: https://www.gwp.org/globalassets/global/toolbox/publications/technical-focus-papers/04-caribbean_tfp_2014.pdf

Regional briefing on National Adaptation Plans: Caribbean in focus (UNEP, 2017)

This document is based on the consultations and discussions which took place at the National Adaptation Plan (NAP) training workshop for the Caribbean, held in Georgetown, Guyana, from 31 May to 2 June 2017. It aims to provide a brief overview of the NAP experiences of Caribbean countries, and highlight emerging issues, challenges and opportunities.

Available at: http://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/regional-briefing-on-naps--caribbean-in-focus-.html

Water Sector Model Policy and Model Water Act for countries within the Organisation of the Eastern Caribbean States (OECS, 2013)

The Organisation of Eastern Caribbean States (OECS) has developed a model water policy and model legislation, which can form the basis for its member states to revise and update their existing institutional frameworks.

Available in E-Annex

4.3 Section 4: Notes for the trainer / facilitator

4.3.1 Notes and considerations

The identification of adaptation actions to mainstream the role of resilience in the Enabling Environment needs to be based on a thorough analysis of the existing legal and governance framework of the water supply sector in the country, and on the assessment of the current capacity to incorporate and mainstream climate resilience and gender considerations. This analysis should strongly rely on:

- Desk based review of existing policy, legislation, planning and policy documents;
- Synthesis of completed reviews and recommendations;
- Stakeholders consultation (for example through workshops, focus group sessions and one-on-one meetings);
- Diagnostics analysis and identification of options and priorities.

Where existing studies and assessment are available, they should support the assessment.

As part of the assessment, the facilitator should:

- Identify and engage relevant stakeholders;
- Conduct preliminary research, literature review and document collation;
- Organise a workshop that will be aimed at:
  - Filling the gaps of preliminary research regarding national laws and policies which govern the water supply sector and other related sectors (such as land-use, solid waste management);
  - Filling the gaps of preliminary research regarding the main institutions operating in the water supply sector, their roles and responsibilities;
  - Reviewing the role of climate resilience and gender-sensitive considerations in existing legislation, policies, strategies and plans.
  - Identifying actions to strengthen the national Enabling Environment for climate resilience and to define entry points in the national context.

Box 4-7: Data request

As part of the assessment it may be required to submit a data request to relevant stakeholders, in order to access specific documents or reports. An example data request, built as part of the project planning for the Integration of Climate Resilience in the Water Sector in the Caribbean, is shown in Section 4.4.4.

- Ideally the trainer will be able to collect information and relevant literature regarding water sector policies and relevant institutions so that the Session will build on this information.
- Numerous initiatives at policy formulation and institutional reform have been proposed or initiated across the region, but in many cases full implementation does not follow. It will be important to discuss with participants the barriers to full implementation and what has been learned from successful and unsuccessful initiatives in the Enabling Environment.
- It is suggested that the ***WaterRiSK*** tool is used to support Step 3 and 4 of the presented assessment methodology (see relevant sections in this chapter). However, the facilitator can decide to use the tool as a full assessment, or as a guiding principle to identify relevant questions to ask during the assessment. This decision will also be influenced by the time available to complete the assessment.

4.3.2 Exercises and discussion topics

Group Session 1	
Title Describe the Enabling Environment.	**Type** Exercise, working in groups of appropriate number.
Objectives To encourage participants to become familiar with the concept of the Enabling Environment for integrating climate resilience and describe how they think this looks like for the water supply sector in their country.	
Duration 30 mins.	**Materials needed** Flipchart and post-its.
Description of tasks and instructions **Step 1: Introduction to the activity** ■ Explain the background to the activity to the group, based on the information provided in the Training Manual for Section 4. **Step 2: Group Exercise** ■ Using their flipchart, ask participants to answer one or more of the following questions, writing their responses down on post-its: - What do you think the main characteristics of the Enabling Environment for mainstreaming climate resilience into the water supply sector are? - What should the Enabling Environment look like by 2030? - What are the main barriers to implementation? **Step 3: Plenary session** ■ Ask each group to present its findings to the others. ■ Identify and highlight recurring patterns.	
Following the workshop ■ Report on the outcomes of the session as part of the "screening of laws, policies, plans and strategies" report.	

Group Session 2

Title	Type
Identify adaptation options to strengthen the role of gender-sensitive climate resilience in the Enabling Environment.	Assessment, working in plenary.

Objectives

- Strengthen the results of the desk based review of water sector legislation, policies, strategies and plans and of the existing institutional landscape.
- Identify adaptation actions to mainstream gender- sensitive climate resilience into the Enabling Environment.

Link with other materials

Checklists for screening, ***WaterRiSK.***

Duration	Materials needed
3 hours.	■ Flipchart for the facilitator. ■ Assessment table from Section 4. ■ ***WaterRiSK.***

Preparation

- Overview of existing water sector legislation, policies, strategies and plans.
- Overview of existing institutional landscape.
- It is possible that training participants are not aware of gender-related national and international commitments of their country. It is therefore the role of the trainer to inform participants to prepare material in advance or to complete some preliminary research in order to provide participants with the relevant information.

Description of tasks and instructions

Step 1: Introduction to the activity

- Explain the background to the activity to the group, based on the information provided in the Training Manual for Section 4.

Step 2: Review role of climate resilience

- With the support of the ***WaterRiSK*** tool, national teams should apply a climate lens approach to the legislation, policies, strategies and plans of the water supply sector. The assessment should be driven by answering the questions in the tool trying to strengthen available evidence, identify needs and adaptation actions as well as entry points.

Following the workshop

- Report on the findings of the review which includes:
  - Completed checklists of the screening;
  - Insights from the review of climate and gender sensitive considerations;
  - List of recommended adaptation actions to strengthen the Enabling Environment.

4.4 Section 4: Annexes

4.4.1 Checklist for screening

Table 4-3: Overview and diagnosis of existing legal regime – Checklist

Water governance aspect	Policy/ Regulatory instrument	Status Absent Outdated/Under development Present	Additional notes (Date of publication, date of completion date if under development, weak points, barriers to implementation etc.)
Nation-wide comprehensive water management			
Land-use			
Environmental health			
Solid waste management			
Disaster Risk Reduction			
Climate change adaptation			
IWRM			
Other…			

Table 4-4: Description of the existing institutional landscape - Checklist

Competencies	Regulatory body/ institution	Status Absent Outdated/Under development Present	Additional notes (Other responsibilities, interaction with other agencies, reform under planning etc.)
Water supply services			
Environmental pollution			
Health and sanitation			
Water resources and watershed management			
Land-use and development			
Climate change and resilience and adaptation			
Disaster risk management			
Regulation of the water services			
Other…			
Other…			
Other…			

4.4.2 *WaterRiSK* assessment questionnaire

Pillar 1 - Enabling Environment

IR - Institutional roles and responsibilities

Effective legal frameworks with clearly defined institutional roles and responsibilities provide a foundation for effective and coordinated action to enhance climate resilience. The often complex and inter-connected institutional landscape for enhancing the resilience of water supply services cuts across many spheres of activity including water resources management, infrastructure, environment and different economic sectors, as well as climate change adaptation and disaster risk reduction. Representation and engagement of a wide range of stakeholders in policy formulation, decision-making and coordinated action is therefore critical.

Questions for consideration:

- **IR1 - Institutional framework**
  Q. To what extent is there a comprehensive, updated and coordinated legal framework for dealing with water rights, water supply and wastewater disposal (water, land-use, environmental health, solid waste management acts etc.)?

Score	Description
5	Comprehensive - This is effectively in place and followed in practice. It clearly identifies institutional roles and responsibilities.
4	Largely in place - This is in place but may be outdated/not followed in practice and/or does not reflect present context and challenges.
3	Moderate - This is in place but does not provide an all-embracing, consistent framework for water governance.
2	Limited - Elements are disjointed and do not provide a clear distinction of institutional roles and responsibilities.
1	None - The legal framework is not comprehensive: many key aspects of water rights, supply and wastewater disposal are not covered.

- **IR2 - Roles and responsibilities**
  Q. To what extent do institutional roles and responsibilities clearly embrace climate change adaptation, disaster risk reduction and climate compatible development in a coordinated manner (environmental agencies, disaster risk management departments, adaptation policies etc.)?

Score	Description
5	Clearly articulated - The existing institutional landscape is complete, coordinated and joined-up. It sets clear roles and responsibilities in institutional mandates for climate change adaptation, disaster risk reduction and climate compatible development.
4	Roles clear but limited coordination - The above mentioned aspects are addressed by different agencies but in a disorganised and uncoordinated manner. Reforms may be underway to improve this situation.
3	Moderate - Some of the above mentioned aspects are addressed but the level of coordination is not adequate.
2	Limited - Roles and responsibilities are insufficiently defined or not addressed, and coordination is either lacking or inadequate.
1	None - These aspects are either neglected or not addressed.

- **IR3 - Multi-stakeholder forums**

Q. To what extent are multi-stakeholder forums used to inform coordinated decision-making in relation to identifying and managing climate risks?

Score	Description
5	Strong, coordinated process - Multi-stakeholder forums that discuss climate risks and vulnerabilities in the sector are a key component of the decision making process; they are regularly held and provide recommendations for adaptation planning, as well as serving as a knowledge sharing platform among stakeholders.
4	Significant - Multi-stakeholder forums that discuss climate risks and vulnerabilities in the sector are only occasionally held. However, when they happen, they provide recommendations for adaptation planning and serve as a knowledge sharing platform among stakeholders.
3	Moderate - Multi-stakeholder forums are occasionally held but there is no framework to use them as means to provide recommendations for adaptation planning.
2	Limited - Multi-stakeholder forums are rarely held and are not used to produce recommendations for adaptation planning.
1	None - Multi-stakeholder forums are not used.

- **IR4 – Goals and targets**

Q. To what extent are there clear goals and targets for strengthening climate resilience and an effective monitoring and evaluation (M&E) system to measure progress towards?

Score	Description
5	Clear targets and effective monitoring systems - National water policies and strategies include specific targets in relation to climate resilience and climate resilience is a significant element in the enterprise risk management process of the water utility/departments. M&E systems are in place and function well, as well as channel investments and capacity development measures to apply these into practice.
4	Clear targets but limited monitoring - National water policies and strategies set specific targets to measure progress towards climate resilience but monitoring systems are limited in their effectiveness (e.g. due to finance and capacity constraints).
3	Moderate - National water policies set targets to measure progress but may not be specifically related to climate resilience. Monitoring systems are limited or not designed to report on climate resilience.
2	Limited - National water policies and strategies include some targets but these are not explicitly related to climate resilience, and monitoring systems are limited or non-existent.
1	None - No national level goals and targets exist for strengthening the climate resilience of the sector.

PS - National policies and strategies

Policies and strategies provide an overall vision of the objectives and outcomes for the sector and the principles by which these will be achieved. Managing risks arising from climate vulnerability and change should be firmly embedded within policy frameworks and the principles by which these risks will be managed articulated in associated strategies and plans for action. IWRM as a tool to support adaptation provides many of the underlying principles and practices on which to build on. Water policies and strategies should be fully aligned with national development agendas while also supporting other regional or international commitments such as the achievement of the SDGs.

Questions for consideration:

- **PS1 – Climate challenges**
  Q. To what extent do water supply policies and strategies express the need for action on climate risks and how well is this articulated?

Score	Description
5	Good articulation - Sectoral policies and strategies are up-to-date and explicitly address climate risks and the need to reduce sector vulnerability to these.
4	Reasonable articulation - Sectoral policies and strategies address climate risks and vulnerabilities but could be updated or improved.
3	Moderate - Sectoral policies and strategies make some mention of climate risks and vulnerabilities but this is rather incomplete and requires reform.
2	Limited - Sectoral policies and strategies do not mention climate risks and vulnerabilities and are largely out of date.
1	None - Sectoral policies and strategies either do not exist or are largely out of date.

- **PS2 – Principles and practice**
  Q. To what degree do national water supply policies and strategies align with IWRM principles and processes?

Score	Description
5	Very high degree - IWRM strategies and plans exist and are implemented. Sectoral ministries actively promote and implement the IWRM approach, providing the necessary management instruments and procedures.
4	High degree - IWRM strategies and plans exist and responsibilities for IWRM implementation are set. Necessary management instruments and procedures are missing but reform is undergoing to implement these.
3	Moderate - IWRM strategies and plans exist but are not fully implemented. Mandates for implementation of IWRM are not clearly outlined.
2	Limited - Sectoral policies and plans recognise in principle the importance of IWRM but this is not translated into actions and institutional mandates.
1	None - IWRM is not part of/mentioned in sectoral policies and plans.

- **PS3 – Gender-sensitive approaches**
  Q. To what extent do water supply policies and strategies encapsulate gender-sensitive approaches and plans to address climate risks?

Score	Description
5	Highly comprehensive - Gender-sensitive approaches and plans to address climate challenges are identified in sectoral policies. Action plans address issues related to gender and equitable access to water, including recommendations regarding gender-disaggregated data collection. Recommendations are implemented.
4	Largely comprehensive - Gender-sensitive approaches and plans to address climate challenges are identified in sectoral policies. Action plans address issues related to gender and equitable access to water, including recommendations regarding gender-disaggregated data collection, but full implementation is pending.
3	Moderate - Sectoral policies and strategies recognise the relevance of gender-sensitive considerations in relation to water and climate but this is not translated into actual recommendations.
2	Limited - National policies incorporate gender-sensitive approaches and plans to address climate challenges and risks, but this has not been translated into sectoral water policies and plans.
1	None - National and sectoral policies do not encapsulate linkages between gender and water or gender and climate.

- **PS4 – Wider engagement**
  Q. To what degree do processes for the development of water sector policies and strategies engage with and consult climate experts (e.g. climate focal points, NAP leads/coordinators)?

Score	Description
5	Very high degree - Climate experts are key members of the panel (or similar) involved in the development of water sector policies and strategies.
4	High degree - There are well-defined processes in place to engage and consult climate experts thorough the formulation process of water sector policies and strategies, even if they are not part of the key expert panel.
3	Moderate - Climate experts are engaged and consulted in the formulation of water sector policies and strategies, even if no specific procedure for the consultation process is in place.
2	Limited - Climate experts are only occasionally consulted in the formulation of water sector policies and strategies.
1	None - Climate experts are not consulted during the formulation of water sector policies and strategies.

- **PS5 – Regional/international agreements and commitments**
  Q. To what degree do water supply policies and strategies align with regional and international agreements and commitments on climate change action (e.g. Paris Agreement, SDGs, Sendai Framework)?

Score	Description
5	Very strong alignment - Sectoral policies align with regional and international commitments and set targets and actions to support their achievement. Sectoral plans are informed by regional/international best practices and lessons learned for climate change action.
4	Strong alignment - Sectoral policies align with regional and international commitments and set targets and actions to support their achievement. Benefitting from regional/international best practices and lessons learned for climate change action could be improved.
3	Moderate - Sectoral policies have some alignment with regional and international commitments but this could be improved, including targets and actions to support their achievement at a sectoral level.
2	Limited - Sectoral policies have some alignment in principle with regional and international commitments but these are not explicit or not well articulated.
1	None - Sectoral policies and strategies have no link with regional and international frameworks on climate change action.

IC - Institutional capacity and knowledge base

Emerging trends in climate variability and change bring additional risks to water supply services and these trends need to be assessed within an overall risk management framework. Institutional capacity to lead and coordinate CRVAs and to integrate these within existing strategy and planning processes is central to understanding and addressing priority risks. Engagement of a wide range of stakeholders is necessary to capitalise upon specialist knowledge (e.g. climate experts, scientists, commissions) and to secure coordinated action to address risks. Paucity of policy relevant data and information is often a constraint.

Questions for consideration:

- **IC1 – Institutional capacity**
  Q. To what degree is institutional expertise and capacity (e.g. within water service agencies and water management departments) available to support the identification and prioritisation of actions to address climate risks and vulnerabilities in the water supply sector?

Score	Description
5	Excellent expertise and capacity - Technical as well as management and operational staff are trained on climate impacts and their links to the water sector; training activities also focus on CRVAs. A comprehensive framework exists that allows to develop and exploit this capacity for the identification and prioritisation of actions.
4	Good expertise and capacity - Technical as well as management and operational staff are trained on climate impacts and their links to the water sector but training activities also focus on CRVAs. However, a comprehensive framework that allows to develop and exploit this capacity for the identification and prioritisation of actions is missing.
3	Moderate - Training on climate impacts and their links to the water sector is developed but is not rolled out at multiple staff levels (e.g. it targets technical staff only) and/or does not cover CRVAs. A comprehensive framework exists that allows to exploit this capacity for the identification and prioritisation of actions.
2	Limited - Training on climate impacts and their links to the water sector is developed but is not rolled out at multiple staff levels (e.g. it targets technical staff only) and/or does not cover CRVAs. Also, a comprehensive framework that allows to develop and exploit this capacity for the identification and prioritisation of actions is missing.
1	None – None or a very limited number of persons has knowledge of CRVAs as it relates to the water sector. A framework to develop capacity is absent.

- **IC2 – Generation and dissemination of policy-relevant information**
  Q. To what degree is adequate data collected, analysed and disseminated for use in making informed decisions on climate risks and vulnerabilities?

Score	Description
5	Very high degree - High quality climate data are stored electronically and updated on an information system and readily available in an accessible format to policy makers. They are aware of the existence of the electronic platform and are adequately supported in accessing it (e.g. tutorials, user guide, helpdesk support).
4	High degree - High quality climate data are stored electronically and updated on an information system as well as readily available in an accessible format to policy makers. The level of support in accessing the data is, however, not sufficient.
3	Moderate - Quality climate data are collected and analysed, however access to data is limited (e.g. no electronic platforms, multiple responsible agencies, not adequate support).
2	Limited - Some climate data are collected but access is limited and data quality is questionable/data gaps are significant.
1	None - There is no or very limited access to climate information, data and analysis. The few available data are of questionable quality/data gaps are significant.

- **IC3 – Knowledge base**
  Q. Is the available knowledge base (e.g. best practices, existing frameworks, tools, funding opportunities, data sources) sufficient to support the identification and prioritisation of actions to address climate risks and vulnerabilities in the water supply sector?

Score	Description
5	Very sufficient - Knowledge exchange initiatives (e.g. forums, workshops, conferences, webinars) are undertaken with appropriate frequency and target a wide audience. Knowledge exchange platforms (e.g. websites, blogs, databases, water practitioners communities) are maintained and are accessible to support the availability of continual and up to date information. Available knowledge base is extensively exploited by stakeholders to support identification and prioritisation of actions to address climate risks.
4	Largely sufficient - Knowledge exchange initiatives are undertaken with appropriate frequency and target the right audience. Available knowledge base is exploited by stakeholders to support identification and prioritisation of actions to address climate risks.
3	Moderately - Knowledge exchange initiatives are undertaken regularly but either frequency or type of audience involved are not adequate to produce widespread, tangible benefits.
2	Limited - Knowledge exchange and awareness initiatives occur sporadically and stakeholders are generally unaware of available knowledge to support the identification and prioritisation of actions to address climate risks and vulnerabilities.
1	None - Knowledge exchange and awareness initiatives related to water sector climate risks and vulnerabilities are absent and most of the stakeholders are not aware of available knowledge to support the identification and prioritisation of actions to address climate risks and vulnerabilities.

- **IC4 – Climate risk and vulnerability assessments**
  Q. To what extent do climate risk and vulnerability assessments (CRVAs) have a strong influence on the formulation of strategies and plans for the water supply service improvements?

Score	Description
5	Very significant - CRVAs for all critical assets are undertaken as an essential part of the formulation of strategies and plans for the water supply sector, which are then shaped on the basis of the CRVAs outcomes and recommendations.
4	Significant - CRVAs are undertaken for most of the critical assets and they influence the formulation of water sector strategies and plans.
3	Moderate - CRVAs are usually undertaken for some critical assets but their influence on the formulation of water sector strategies and plans is limited.
2	Limited - CRVAs are only sporadically undertaken and their influence on the formulation of water sector strategies and plans is very limited.
1	None - No CRVAs have been undertaken for the sector.

- **IC5 – Consensus on priorities**
  Q. To what extent have priority climate risks and vulnerabilities in the water supply services sector been identified and agreed amongst all stakeholders?

Score	Description
5	Full agreement - Priority climate risks and vulnerabilities in the water supply sector are clear to water governance institutions and stakeholders and addressed in national adaptation strategies and action plans (NASAPs).
4	Significant agreement - Priority climate risks and vulnerabilities in the water supply sector are well clear to water governance institutions and stakeholders; their incorporation into a NASAP is under development.
3	Moderate - Priority climate risks and vulnerabilities in the water supply sector are well clear to water governance institutions and stakeholders however, no adaption plan exists or is under development.
2	Limited - Priority climate risks and vulnerabilities in the water supply sector are still unclear but there is on-going discussion between water governance institutions and stakeholders to increase their consensus over the subject.
1	None - Priority climate risks and vulnerabilities in the water supply sector are not identified and there are no initiatives aimed at finding consensus about what they are.

- **IC6 – Risk management processes**
  Q. To what extent is climate risk explicitly mainstreamed into existing risk management frameworks and planning processes for the water supply services?

Score	Description
5	Fully mainstreamed - Climate risk is an integral component of existing risk management frameworks and planning processes, and is implemented effectively.
4	Largely mainstreamed - Climate risk is an integral component of existing risk management frameworks and planning processes, but needs effective implementation.
3	Moderate - Climate risk is a component of some existing risk management frameworks and planning processes, but could be extended or improved.
2	Limited - Climate risk is largely absent from existing risk management frameworks and planning processes.
1	None - Climate risk assessment is not considered.

4.4.3 Step 3 and 4, assessment table

Question ID	Perf.	Relev.	Evidence, gaps and needs	Recommended actions
Step 3				Step 4
IR - Institutional roles and responsibilities				
IR1				
IR2				
IR3				
IR4				
PS - National policies and strategies				
PS1				
PS2				
PS3				
PS4				
PS5				
IC - Institutional capacity and knowledge base				
IC1				
IC2				
IC3				
IC4				
IC5				
IC6				

4.4.4 Example data request

Data requests from governments, utilities and other stakeholders

How to complete this data request:

- This has been issued to the water services department as the lead stakeholder for the consultant team. It is anticipated that the water services department may need to liaise with other departments for some data and information;
- Please complete the data request form by filling in the yellow cells in the boxes below to indicate the level of data availability and the responsible stakeholder;
- Please return the completed request to the consultant team members **NAME**, **EMAIL**, **PHONE NUMBER;**
- The consultants would be grateful if you could return this by **DEADLINE**;
- The consultants will then schedule a telephone call during the week **DEADLINE** to discuss the data in detail, how we can utilise it, and how to transfer it so the consultants team can progress work on Tasks 1, 2 and 3 of the consultancy.

Where necessary, the consultants would be pleased to clarify any data requests and if required to discuss further with stakeholders the specific availability and accessibility of these items (see contact details in the covering email).

Task 2. Assessment of relevant policies, plans, strategies, legal and regulatory framework, etc.

These data requests are needed for:

- Assessing what needs to be done to create the “Enabling Environment” to support climate-resilient water infrastructure;
- Assessing the scope for mainstreaming climate resilience in the management of water and the creation of water infrastructure;
- Assessing the current degree of coordination between relevant agencies, and how far roles, responsibilities and policies need to be reformed to deal with current and expected climatic challenges;
- Assessing the powers and roles of regulatory bodies in water, power, environmental and other relevant sectors;
- Assessing the coherence of current policies on disaster management, drought mitigation, and other aspects of national risk management;
- Assessing to what extent gender is factored into the policy and legislative framework and the determination of how proposed resilience measures within the water sector could be designed to reflect gender sensitivity.

Documents / data requested	Data not available	Limited data available	Good data available	Please add any additional notes on the data and which organisation holds the data
Copies of relevant policies, laws and regulations pertaining to water resources management, water services, water abstraction and pollution, other environmental practices, disaster risk management (inc. flooding, coastal defence and drought)				
Any recent Integrated Water Resourcess Management Plans, and/or assessment of the extent of IWRM in practice				
National Adaptation Plans and reports on implementation				
Papers on climate resilience, water sector strategy, Disaster Risk Management and other relevant topics produced by international and regional agencies active in the East Caribbean (e.g. CDB, IADB, CCCCC, World Bank, EU, EIB, GWP-C)				
Current organograms of relevant official departments and agencies, showing links between them, identities of key individuals, and indications of their human and financial resources				

Section 5

Climate Risk and Vulnerability Assessment (CRVA)

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Section 5: Climate Risk and Vulnerability Assessment (CRVA)

Summary

This section provides guidance on how to conduct a participatory Climate Risk and Vulnerability Assessment (CRVA) for the water sector. A properly completed CRVA provides a comprehensive and prioritised analysis of current and future climate risks facing water resources and supplies.

The CRVA exercise is a foundation for the design of climate change adaptation policies and identification of assets requiring more detailed quantitative assessment. On completion of the CRVA, stakeholders should be able to use the results from the assessment to begin the process of identifying potential adaptation options which could be implemented to enhance the resilience of the sector to a changing climate.

Objectives

At the end of this section, participants will be able to:

- Engage stakeholders in the water sector in the process/methodology of the CRVA;
- Identify impacts and risks of climate variability and climate change on the water sector;
- Assess how climate risks may change in the future;
- Identify preliminary adaptation options.

Things to know …

- Climate change projections for the Caribbean state that that there will be rise in sea levels, increase in the intensity of tropical storms and hurricanes, an increase in average annual temperature and decrease in average annual rainfall.
- The Caribbean is experiencing an increase in the frequency of extreme weather events as evidenced by the increase in intense rainfall events (Eastern Caribbean – 2013), impacts of drought (regional – 2015) and the damages and losses caused during the 2017 Atlantic hurricane season.
- Higher temperatures and reduced precipitation will result in reduced runoff, increased evaporation and decreased soil moisture. This could therefore have negative implications on aquifer groundwater recharge and thus overall water availability.
- The 2017 Atlantic hurricane season saw the passage of two Category 5 storms through the Caribbean Region. Impacted countries include Anguilla, Antigua, Bahamas, British Virgin Islands, Dominica, Saint Maarten and Turks and Caicos Islands. Total estimated damage and losses from these two events exceeded US$ 5 billion.
- Inaction is very costly. Increased hurricane damages, loss of tourism revenue and infrastructure damages could cost the region US$ 10.7 billon by the year 2025.
- Sea level rise will have significant impacts on settlements and infrastructure in low-lying coastal regions and it will also add the risk of groundwater saline intrusion which could have serious implications for water resources by affecting the availability and quality of freshwater.
- Many islands in the Caribbean have small geographic areas but have high population densities which places more stress on the already limited water resources.

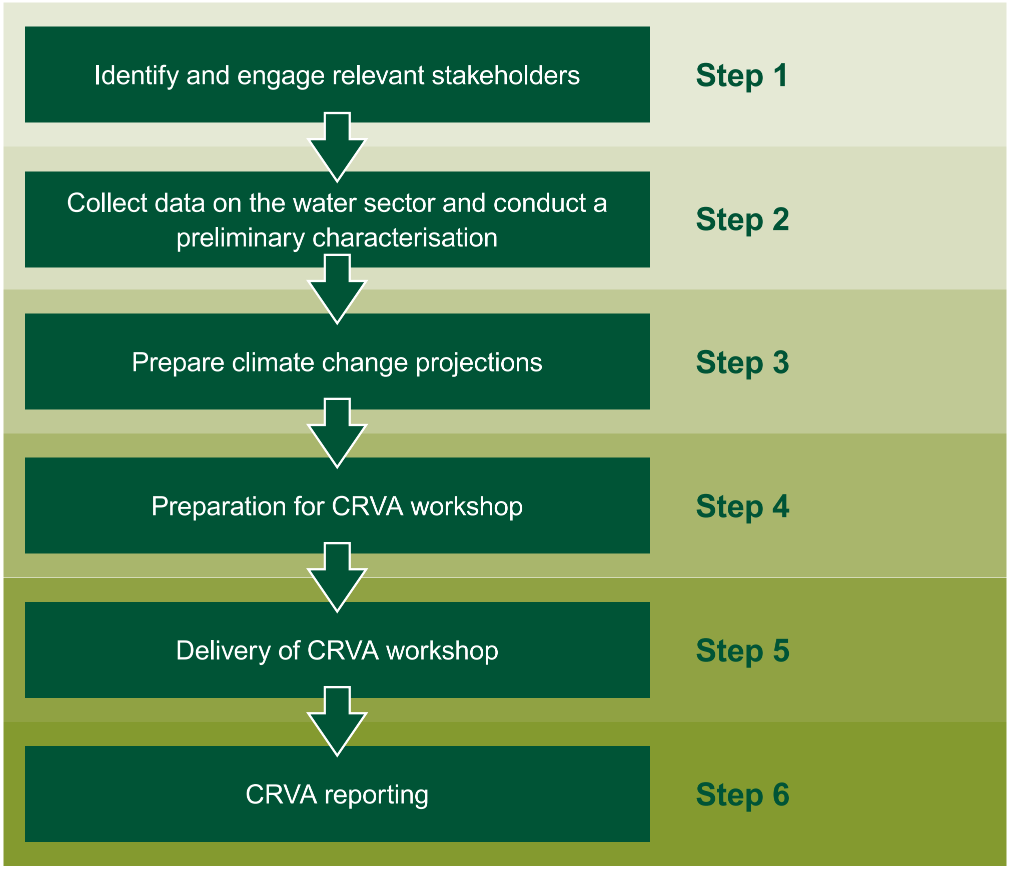
5.1 Section 5: Guidance material

5.1.1 Introduction and overview of CRVA steps

The Climate Risk and Vulnerability Assessment (CRVA) is a tool which is used to assist users/policymakers to systematically characterise risks and identify adaptation actions to enhance resilience to a changing climate and extreme weather events. The completed CRVA forms a basis for more detailed prioritisation of feasible adaptation actions and the level of investment required to implement these.

This section provides trainers with a summary of the necessary processes to be followed in order to conduct a participatory CRVA and also provides trainers with the necessary skills to train other key personnel in this process. It should be noted that a variety of approaches for CRVA exist depending on the scope and scale of the required assessment. The approach adopted here is participatory, focussed on a one day workshop with associated preparatory and follow up activities. It builds on existing information and complements this with insights from stakeholders in a workshop environment, and therefore does not require additional fieldwork or primary data collection. The lessons learned during the course of the CRVA exercise can be used as a foundation for the design of climate change adaptation policies and to identify specific assets that would require a more quantitative, evidence based assessment.

The following table provides an overview of the CRVA process. Each step is then elaborated with further guidance in the sections below.



5.1.2 Step 1: Identify and engage relevant stakeholders

Step 1 involves scoping the CRVA exercise, including stakeholder mapping, engagement and agreement on the boundaries of the CRVA. The following activities are anticipated:

- Based on stakeholder mapping identify institutions in the water sector and analyse their respective roles within the sector;
- Identify a lead organisation and focal point for the CRVA. The lead organisation will be the main user of the CRVA outputs, and the focal point will be the champion for the CRVA within the organisation. This may be the water service provider or responsible ministry;
- Working with the lead organisation, prepare a list of stakeholders to participate in the CRVA. This may include relevant government departments, power utilities and representatives of water consumer interests;
- Plan a one day workshop to conduct the participatory CRVA exercise;
- Agree on the boundaries of the CRVA analysis with the focal point (spatial extent, future planning horizon, water supply or water and wastewater together) (see Figure 5-1).

Sector	■ Water supply (private/municipal) ■ Water resources (total availability and quality) ■ Wastewater services
Cause of risks	■ Focus on climate related risks (drought / flood / storm) and associated impacts (turbidity / pollution / outage / infrastructure damage) ■ Need to consider non-climate vulnerability factors (land-use management, pollution, consumer behaviour)
Risks to what?	■ Impact on key performance indicators (utility / departments) ■ Wider impacts on economic / social / environmental objectives ■ Focus on high priorities (critical infrastructure / vulnerable communities / economic sectors / sensitive ecosystems)
Time frame	■ Existing risks - these need to be addressed now, if they are impacting on the objectives of the stakeholders ■ Future risks - 2030s is a reasonable planning horizon, but climate change becomes more dramatic further in the future

Figure 5-1: Example of boundaries to be established for CRVA process

5.1.3 Step 2: Collect data on the water sector and conduct a preliminary characterisation

It is important to collate information prior to running a CRVA workshop in order to provide a snapshot of the water sector and a synthesis of existing data and information which will help participants in the CRVA to identify and assess risks. It is anticipated that the following information will be collated prior to the CRVA workshop:

- Information on the policies, plans legislation and regulations relevant to the water sector;
- Water utility organisational chart;
- Water utility strategic plans / investment plans / key performance indicators and other relevant goals;
- Water supply and wastewater catchment, source and asset maps, and schematics;

- Water utility operational performance data (production, consumption, leakage, outage, water quality, demand restrictions, major disruption to services etc.). Figure 5-2 provides an example of annual production and consumption data for Grenada;
- Information on the impacts of recent event hazard events (in terms of impact on key goals, such as continuity of supply, water quality, damage and rehabilitation costs);
- Information on national development trends which may impact on the water sector (for example population growth, major planned developments, irrigation schemes etc.).

Section 5.4.1 provides an example of a data request form which can be used as a starting point to discuss data availability and access with stakeholders.

The trainer should familiarise themselves with this material in advance of the workshop and prepare a presentation which gives an overview of the water sector for the workshop.

In addition, relevant maps and schematics should be collated to support completion of the risk matrix during the workshop.

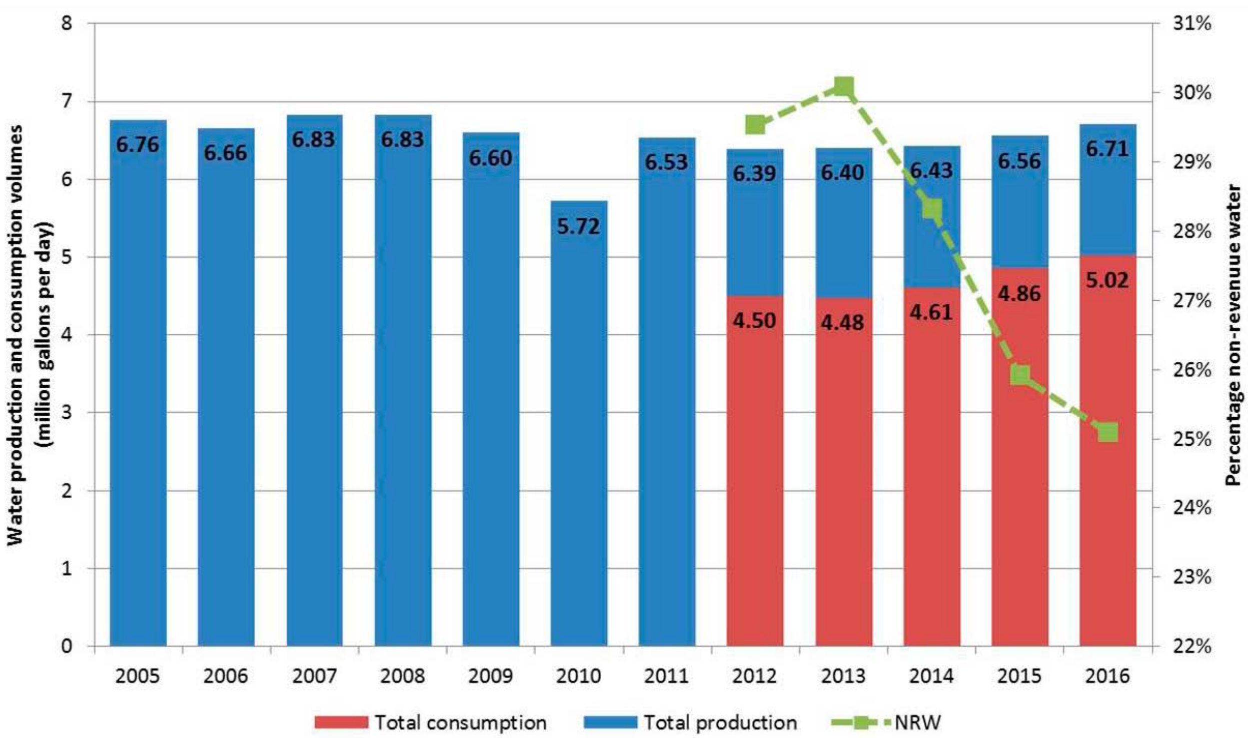


Figure 5-2: Annual water production and consumption from 2005 to 2016

Source: CRVA for Grenada - Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean

5.1.4 Step 3: Prepare climate change projections

A simple set of climate change projections are required to inform the participatory CRVA workshop. Box 5.1 provides an overview of possible sources of climate projections, although liaison with relevant national and regional specialists is required in order to ensure that the most up to date information is used. In the Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean project a set of simple climate change projections was developed based on existing information; an excerpt from the Grenada case study is provided in Section 5.4.2.

It may be helpful for the national climate change focal point to present the nationally recognised climate change projections at the workshop. It is recommended that any climate change scenarios used should be aligned with projections which have been used in the preparation of the National Communications to the UNFCCC or approved by institutions such as the Caribbean Institute for Meteorology and Hydrology and the Caribbean Community Climate Change Centre.

Box 5-1: A summary of climate information sources

In recent years there have been a number of platforms which share climate information that are aimed at helping decision makers to understand the potential impacts that climate will have on the country and, by extension, the water sector. Below are a few sources of climate information which can be used as a reference for the CRVA process.

The climate change projections for the Caribbean anticipate that the following will occur:

- Consistently warmer temperatures;
- Less annual rainfall on average;
- Increase in the intensity of tropical storms and hurricanes;
- Increase in the frequency of intense rainfall events;
- Sea level rise.

CARIBSAVE Climate Change Risk Atlas

The CARIBSAVE Risk Atlas is one source which could be used as it relates to climate change projections for the Caribbean. This information is derived from a combination of observed climate data sources, and climate model projections of future scenarios using an ensemble of 15 General Circulation Models (GCMs) and the Regional Climate Model (RCM) PRECIS based on the following IPCC standard "marker" scenarios:

- A2: A "high" emissions scenario;
- A1B: A medium-high scenario, where emissions increase rapidly in the earlier part of the century but then plateau in the second half;
- B1: A "low" emissions scenario.

Climate Change Knowledge Portal

The World Bank's Climate Change Knowledge Portal is supported by the Global Facility for Disaster Risk Reduction and Recovery. The Portal contains environmental, disaster risk, and socio-economic datasets, as well as synthesis products, such as the Climate Adaptation Country Profiles, which are built and packaged for specific user-focused functions such as climate change indices for a particular country.

CARIBBEAN Weather Impacts Group

The CARibbean Weather Impacts Group (CARIWIG) project was funded by the Climate and Development Knowledge Network (CDKN), and gives access to climate data that have been downscaled, making them relevant for use in the Caribbean Region. The project also provided tools that allow decision-makers to better understand the potential impacts of drought, tropical storms, rainfall and temperature changes. Caribbean decision-makers, researchers and scientists can access the data freely, through the CARIWIG website.

5.1.5 Step 4: Preparation for CRVA workshop

The following preparatory activities are anticipated to prepare for the CRVA workshop:

- Confirm attendees, finalise agenda and ensure logistical arrangements are in place;
- Confirm any other speakers (for example the climate change focal point could present the climate change scenarios and a representative of the utility could give an overview of the water service providers long term vision and risks to achieving the vision);
- Prepare presentational material and supporting hard copies of maps and schematics which can be used to facilitate discussions during completion of the risk matrix;
- Prepare risk matrix template (Section 5.4.3 provides a template for the Risk Assessment Matrix, and Section 5.4.4 provides an example completed Risk Matrix) and agree this with the focal point (although it can be adapted during the workshop).

5.1.6 Step 5: Delivery of CRVA workshop

The CRVA workshop is the main element within the CRVA process and is used to complete the Risk Assessment matrix. The following sessions are anticipated (Section 5.4.5 provides an example agenda for the CRVA workshop, and the CRVA exercise is elaborated in Section 5.2.3):

- Registration and welcome (CRVA focal point);
- Introduction to the CRVA and objectives for the day (trainer);
- Climate change projections and potential impacts on the water sector (trainer / climate change focal point);
- Plenary discussion on risks facing the sector and investment needs;
- Group session – completion of the CRVA Risk Matrix and identification of preliminary adaptation actions;
- Workshop evaluation, wrap-up and next steps (trainer).

5.1.7 Step 6: CRVA reporting

The trainer should complete a report of the CRVA process which includes:

- Overview of the objectives and method;
- Stakeholders involved;
- Overview of the characterisation of the water sector to provide background context;
- Completed risk matrix and preliminary adaptation actions;
- Recommended next steps towards prioritising and preparing adaptation actions for implementation.

5.1.8 Building the evidence base through technical studies

The CRVA provides a rapid overview of climate risks, but does not provide the detailed quantitative information required to support significant investment decisions. For example, the CRVA may highlight drought risk as a key concern. A subsequent hydrological and water supply system modelling study would be able to provide more quantitative information on the level of risk, and could test the performance of adaptation options such as additional reservoirs. More detailed studies can be used to close knowledge gaps and as such they represent low regrets actions which support climate resilience.

Technical studies could potentially include the following:

- Water balance modelling to understand water supply and demand and identify future areas for investment;
- Mapping vulnerability hotspots such as land degradation, saline intrusion, network leakage, drought impacts;
- Agricultural water modelling to understand crop requirements and potential changes over time with a changing climate;
- Ground model development and comprehensive flood hazard mapping. This can be used to identify assets exposed to flood risk and project changes in future flood risk with new developments;

- Sea level rise and coastal inundation modelling to track the assets exposed to storm surge and long term sea level rise;
- Coastal erosion modelling under a range of protection scenarios (e.g. the use of hard engineering as well as soft engineering solutions);
- Water system network modelling (drinking water and drainage) to plan investments in network improvements and identify areas to target for efficiency improvements;
- Landslide susceptibility mapping, overlaid with water supply system assets.

However, caution should be exercised when proposing ambitious technical studies as data requirements may be relatively high and a clear understanding of the risks posed by insufficient data on the quality of the study outcomes should be gained at the project concept stage. Box 5-2 presents an example of some of the data-related challenges faced during a flood mapping project in the Caribbean.

Box 5-2: Challenges in technical studies, an example from Caribbean flood risk mapping

The CARICOM Regional Organisation for Standards and Quality (CROSQ) undertook a study into flood hazard mapping at national scale for Trinidad and Tobago, St. Vincent and the Grenadines and Montserrat. This was carried out to provide a national level map for screening flood risk and for supporting revision to building development codes.

The challenges associated with data requirements included:

- Insufficient rainfall data to be able to generate robust design storm rainfall profiles to apply to hydraulic models. This was a function of both insufficient data collection as well as overlapping institutional roles (for example agricultural and meteorological departments).
- Inadequate ground survey data to be able to accurately model flood pathways. The project made use of satellite-based ground elevation data in the absence of a higher resolution and spatially consistent data sets. This limited the level of detail at which the resulting flood maps could be utilised.

Future flood risk mapping projects should ideally run preliminary feasibility studies to gather and assimilate all available rainfall data as well as to carry out a comprehensive ground survey prior to undertaking flood modelling work.

Source: Lumbroso, D.M., Boyce, S., Bast, H. and Walmsley, N. 2011. The challenges of developing rainfall intensity-duration-frequency curves and national flood hazard maps for the Caribbean. The Journal of Flood Risk Management, 4 (1). pp. 42-52. (2011) http://eprints.hrwallingford.co.uk/605/

Some of the potential challenges when commissioning new studies include:

- How will the outputs be used? The institutional environment must be able to absorb and utilise the results of the study otherwise it will become shelved or even forgotten. The concept of using technical studies as evidence to directly influence policy is not new (see Box 5-3). For example, if flood mapping is being undertaken, consideration will need to be given on how it will be incorporated into the development control system, used for strategic flood risk planning and whether wider institutional strengthening is needed in parallel to technical studies.
- Who is going to use the results? Technical studies may make use of modelling and mapping tools developed by specialist consultants. Recipient planners may not have the technical capacity to use such tools or interpret their results, or the tools themselves may be prohibitively expensive for recipients to maintain. Clear consideration should be given as to what level of capacity development is required / desirable to make use of technical tools and results.

- Who is going to undertake the technical studies? National level planners require an understanding of technical tools and methods in order to develop project concepts and outline terms of reference. However, expecting planners to undertake a technical role is unrealistic and such work should be the remit of technical specialists.
- What data are available to support the study? Taking a phased approach in which a feasibility study / methodology to gauge the data requirements will avoid wasting resources on studies which are technically unfeasible.
- What is the significance of the study for the economy, society and the environment? The ambition and scale of the study should be proportional to the potential economic, social and environmental impacts of the systems under consideration. This ensures that limited resources are being utilised proportionally to the problems under consideration.
- What is the most appropriate modelling technique for impact and vulnerability assessment? There is a diverse range of assessment approaches available. Detailed quantitative modelling depends on the availability of suitable models and sufficient data (observed and climate change information) to derive meaningful results. Quantitative models are generally sector specific (although hydrological models for river systems are a fundamental part of many water-related sector activities). A lack of data may mean that simpler qualitative approaches and expert elicitation methods using stakeholder approaches are the only viable methods.
- What specific components need to be included or excluded from the assessment, in order to meet its objectives? For example, does the assessment require the use of future population and other socio-economic data to estimate future risks, or is it only concerned with sensitivity to the climate? Should the assessment include anticipated adaptation, including autonomous adaptation and existing sector policies, or should it provide a baseline without these included? Does it need to include monetisation of potential impacts or risks, or will a qualitative description be sufficient? Will it include an evaluation of actions for increasing resilience or adaptation to climate change?

Box 5-3: Evidence based policy making (EBP) relevant to developing countries

Studies and research which address knowledge gaps should be used to support evidence based policy-making. Bearing this in mind, policy makers should provide the demand for knowledge and evidence to respond to knowledge gaps. Technical specialists should then focus on the needs of policy makers and other decision makers by targeting research activities to respond to these needs.

EBP is a discourse or set of methods which informs the policy process rather than aiming to directly affect the eventual goals of the policy. It advocates a more rational, rigorous and systematic approach. The pursuit of EBP is based on the premise that policy decisions would be better informed by available evidence and should include rational analysis

Source: Sutcliffe, S and Court, J., 2005, Evidence-Based Policymaking: What is it? How does it work? What relevance for developing countries? Overseas Development Institute http://www.odi.org.uk/publications/2804-evidence-based-policymaking-work-relevance-developing-countries

In addition to filling knowledge gaps, studies can build the capacity and understanding of staff engaged in undertaking or managing such studies. However, they are likely to be more time consuming and costly than collating current evidence and should include these collation activities to avoid duplication of effort. A wide range of approaches exist and often these are tailored on a case by case basis depending on the questions being answered and the information and data available to undertake these studies. Approaches range broadly from qualitative and stakeholder led through to quantitative modelling studies.

Table 1.3 below provides a summary of some of the most common technical modelling approaches which are used to assist in water related planning for water resources, wastewater management and flood risk assessment. This table is intended to provide a high level overview of these types of techniques and signposts for further information. Undertaking such studies will require specialist input to ensure they are technically feasible and offer value for money. It should also be noted that modelling can be undertaken as a one off study and the results used to inform decision making, such as planning major infrastructure. However, it is more sustainable if built into a broader programme of capacity building whereby modelling tools are continually maintained and developed as decision support tools to aid planners in providing objective and evidence based decisions.

Table 5-1: Summary of technical modelling tools for water related planning and decision making

	Description and purpose	Data requirements	Links to other technical studies	Modelling tools used	Including climate change
Climate change modelling	Representation of the global or regional climate system. Allows understanding of the changes over time of climate variables such as temperature, rainfall and extremes such as floods and droughts.	Highly complex science scenarios are already available globally and regionally (see Section 2). Continually evolving and highly uncertain science.	Climate change scenarios are input to a wide range of technical studies including many of those described below.	Global Circulation Models (GCMs). Regional Climate Models (RCMs).	Global Greenhouse Gas emissions are included in the GCM models to model climate change.
Water resources modelling	Provides an understanding of the total water resources available and the response of water resources to drought events. Can be used to assess the impacts of development and climate change on resources. Does not usually address water quality or flood risk issues.	Requires temperature, rainfall, historical river flow and groundwater level time series and mapping of geology and soil types. A lack of such data limits the accuracy of water resources studies.	Supports water allocation activities such as supply modelling, irrigation modelling and general abstraction licencing, including setting environmental flow limits. Supported by climate change modelling which provides scenarios for water resources modelling.	Hydrological models. Rainfall-runoff models. Hydraulic models.	Scenarios of rainfall and temperature change are used to assess potential changes in resource availability. Sea level rise scenarios for coastal aquifers.
Water supply modelling	Provides an understanding of the demand for water and the performance of supply networks. Can be used to investigate development scenarios and network improvement strategies.	Requires detailed asset location, specification and performance data in order to model the system. Asset data are also essential for general asset management activities.	Supports strategic planning of water supplies as well as operational management of networks and asset management. Supported by water resources assessments which give an overview of the total potential supplies.	Hydraulic water network models.	Climate change may influence water resources which has a knock on effect on supplies. Qualitative assessments of climate change impacts on treatment and distribution.
Crop water modelling	Represents the water requirements of rain fed and irrigated crops. Used for strategic land-use planning including scenarios of climate change to assess land suitability. Also used for short term assessment of field conditions and seasonal irrigation requirements.	Requires rainfall, temperature, soil and water use characteristics of potential crop types.	Supports irrigation systems modelling and strategic and operational agricultural and land-use management activities. Supported by climate change scenarios and seasonal forecasting which can be input to crop water models.	Soil water accounting models.	Climate change scenarios of temperature and rainfall are used to assess crop water requirements in future.
Irrigation system modelling	Used to represent the hydraulic performance of irrigation systems for strategic planning, operational efficiency or equitability purposes.	Requires asset data to support modelling as well as water resources assessment to evaluate source water availability.	Supports irrigation planning and development activities. Supported by crop water modelling which may be integrated into the hydraulic modelling of irrigation systems. May also support water quality modelling of irrigation return flow.	Hydraulic systems models.	Climate change may influence water resources which has a knock on effect on supplies. Qualitative assessments of climate change impacts on distribution.

	Description and purpose	Data requirements	Links to other technical studies	Modelling tools used	Including climate change
Drainage modelling	Used to support strategic investment planning of drainage systems, their management and improvement.	Requires detailed asset location, specification and performance data in order to model the system. Asset data are also essential for general asset management activities. Storm rainfall required to assess performance of drainage systems.	Supports water quality modelling by estimating volumes of wastewater released into the environment treated and untreated. May also support flood inundation modelling.	Hydraulic models of drainage systems.	Climate change scenarios of storm rainfall may be included to assess how drainage systems perform in future.
Water quality modelling	Supports the implementation of environmental regulations and supports assessment of the need for enhanced environmental control (in freshwater and marine contexts).	Requires a range of supporting data including climate and hydrology, records of discharges of pollutants such as wastewater and agrochemicals, supported by water quality sampling.	Supports strategic planning of wastewater systems and pollution control regulation. Supported by drainage modelling and irrigation system modelling if relevant. Climate change scenarios may also be applied.	Water quality systems models (often built into hydraulic river models).	Climate change scenarios of temperature and changing river flows are used to assess decay and dilution of pollutants.
Flood risk modelling	Represents risk of flooding due to river and surface water flooding. Used to underpin land zoning for regulating development away from flood risk. Also provides evidence to support investment in flood management measures.	Requires storm rainfall characteristics and river flow records especially of significant historical flood events. Also required are detailed topographical and river survey data.	Supports strategic planning of investment in flood management. Supported by climate change scenarios for storm rainfall.	Hydrological models for representing storm runoff. Hydraulic models of rivers and floodplains.	Climate change scenarios of storm rainfall can be used to asses future flood risks.
Coastal inundation modelling	Uses projections of storm surge and wave conditions to represent flooding of coastal assets Used to underpin land zoning for regulating development away from flood risk. Also provides evidence to support investment in flood management measures.	Requires marine modelling of surge and wave conditions to derive design water levels. Also required is detail coastal topography and defence asset information.	Supports strategic planning of investment in flood management. Supports assessment of the impacts of sea level rise on coastal inundation.	Hydraulic models for coastal plains. Storm surge modelling.	Climate change scenarios of storm surge and sea level rise can be used to assess future flood risks.

5.2 Section 5: Good-practice Case Studies and lessons learned

5.2.1 Lessons from completing a participatory CRVA in Grenada

Grenada is situated in a humid tropical zone within the Atlantic north east trade wind belt and has a population of approximately 107,317. It has a wet season which occurs from the beginning of June to the end of November and a dry season which occurs from the beginning of December to the end of May.

On Grenada, potable water is drawn from a combination of surface and ground water sources. Twenty-three surface supply sources are the main sources of potable water on the island. The National Water and Sewerage Authority, NAWASA, is responsible for Grenada's drinking water supply. NAWASA manages 28 small water supply systems and produces an average of 32,700 m^3/day, or 7.2 million gallons per day (MGD), of potable water. The table below shows a summary of the water supply system assets for NAWASA.

Table 5-2: Summary of NAWASA's Water Supply System Assets

Service Characteristics	Number
Estimated Service Population	100,262
Water Systems	28
Catchments	Grenada - 71, Carriacou - 17
Daily Production	6.7 MGD
Tanks	19
Ground Water Wells	11
Treatment Plants	23
Treated Water Storage Volume	64 million gallons
Raw Water Storage Volume	59 million gallons

Annual rainfall in Grenada is high, but there is a very marked dry season from January to May. NAWASA produces about 90% of Grenada's drinking water from surface water and approximately 97% of Grenada's inhabitants are connected to the water supply system. NAWASA produces approximately 10% of its drinking water from groundwater wells near the southern coast.

Challenges

Interruptions in the water supply are frequent in Grenada due to the erratic availability of river water and because of technical deficiencies in the water supply system. During heavy rainfall or storms, the water treatment plants have to shut down because of excessive sediment loads in rivers. It is difficult to maintain the water infrastructure on a small island with limited human and technical resources.

Sourcing spare parts and equipment is a challenge. Leaking pipes cause water losses, water quality deterioration and interruptions in supply due to repair works. These problems tend to mostly impact the poor and more vulnerable communities because they have fewer alternatives. Deficiencies in water supply also have a higher impact on women, who are more frequently in charge of water-related tasks in the household.

Lessons learned from the CRVA exercise

On completion of the CRVA exercise, the following results were obtained as it relates to climate resilience and climate change impacts:

Intense rainfall can have an impact on raw water quality, and cause damage to intake structures and pipelines which are a perennial concern for NAWASA. Climate change will more than likely exacerbate these risks and therefore action is required to identify the highest level of risks that require proactive investment. Measures should also be taken to ensure that the exposure of future investment to the impacts of extreme natural hazards is minimised. An improved system to record the impacts of climate hazards which result in water outages and damage to infrastructure is required.

Drought continues to be of concern for Grenada and NAWASA although the last major drought was in 2010. NAWASA needs to consider the level of drought resilient investment required to ensure that the standard level of service can be maintained in the event of the occurrence of future droughts. An assessment should be completed to develop new surface or ground water sources or raw water storage.

Water supply in Grenada is dependent on the sustainable management of watersheds and aquifers. The development of a Water Resources Unit to be housed within NAWASA to oversee the management of the water resources is seen as a necessity. Further information is required on the conditions of the catchments, trends, threats and the effectiveness of the current management instruments for ensuring their further protection.

In recent years NAWASA has been able to make a profit while reducing the proportion of non-revenue water. This is an indication of the utility's financial sustainability and operation efficiency despite the dry conditions which Grenada has experienced in recent years. Present initiatives as well as leakage reductions programmes, tariff restructuring and water conservation measures should continue to be explored and expanded on as necessary.

5.2.2 Lessons from completing a participatory CRVA in St. Kitts and Nevis

St. Kitts and Nevis is situated in a humid tropical zone within the Atlantic north east trade wind belt and has a population of approximately 46,398 (St. Kitts – 34,983; Nevis – 11,415). It has a wet season from the beginning of June to the end of November and a dry season from the beginning of December to the end of May.

St. Kitts has approximately 31 surface water systems as delineated watersheds and a major ground water basin which is the Basseterre Valley aquifer system. Nevis mostly relies on ground water sources with some rainwater harvesting and surface water springs. Ten major drainage basins drain water to the sea during excess rainfall. However, these draining channels do not provide a reliable source of water. Three main springs provide about 9% of the water supply on Nevis. The table below provides a description of the water infrastructure profile for St. Kitts and Nevis.

Table 5-3: Water infrastructure profile: St. Kitts and Nevis

Service Characteristics	St. Kitts (Number)	Nevis (Number)
Estimated Service Population	37,361	12,277
Miles of mains	101	130
Miles of Distribution pipeline	Approx 600	5
Surface Water Treatment Plants	1	0
Surface Water Intakes	6	3
Ground Water Wells	29	16
Service Reservoirs	30	23
Separate Water Systems	5	2

Challenges

St. Kitts and Nevis presently experiences several stresses on the water sector, including: changes in the current rainfall patterns, increase in the demand for water and challenges with the main water resources such as the Basseterre Valley aquifer.

As the economy of St. Kitts and Nevis expands and development increases, the demand for water is expected to increase and could potentially double within the next ten years (National Adaptation Strategy and Action Plan for the Water Sector in St. Kitts and Nevis). Based on the recent studies which were conducted on the Basseterre Valley watershed/aquifer, results show declining trends in the Basseterre well-field, potential for degradation of groundwater quality, evidence of salt water intrusion and improper land usage which can threaten the watersheds.

Lessons learned

On completion of the CRVA exercise, the following results were obtained:

The water security issues differ significantly between St. Kitts and Nevis. In recent years St. Kitts has experienced shortages in water supply which resulted in controlled water outages/water rationing measures for approximately seven (7) hours per day. A project to drill deep water wells in St. Kitts is being developed. In Nevis, a public private partnership was developed in 2007 to ensure the demand/supply balance would be maintained through an investment of 1 MGD of ground water supplies into the system.

Socio-economic growth and development (e.g. hotels and housing developments) in St. Kitts will have an impact on the availability of water as well as the quality of raw water. Urban development which occurs too close to aquifers such as the Basseterre Valley can put the water quality of the aquifer at risk through pollution. However in Nevis potential for pollution of water supplies is less of an issue mainly due to the location of the catchments which are situated in areas which are remote and free from development (potentially due to the topography and the terrain).

Climate change will exacerbate the impacts of climate risks to the water sector as it relates to long term availability of water resources. The results from the CRVA reveal that a 10% reduction in rainfall, coupled with increasing temperatures could result in a 30% reduction in recharge to aquifers. Sea level rise will also have an impact on groundwater yields at coastal wells.

Electricity costs associated with the pumping of water are a significant component of the expenditure for the water departments on both islands. The implementation of energy-efficient and renewable energy programmes will not only lower these costs but also lower the carbon emissions of both water departments.

Catchment protection activities have the potential to provide environmental, tourism and amenity benefits. Improvements in waste water management can protect water quality which can result in wider environmental and health benefits.

It must be noted that the risk priority scale may also be influenced by the participants, recent experiences with weather-related damage to infrastructure or prolonged disruption to services.

5.2.3 Relevant material and other resources

Box 5-4: Relevant material and other resources

World Bank Climate Change Knowledge Portal (CCKP)

The CCKP provides a web-based platform to assist in capacity building and knowledge development. The aim of the portal is to help provide development practitioners with a resource to explore, evaluate, synthesize, and learn about climate related vulnerabilities and risks at multiple levels of details.

Available at: http://sdwebx.worldbank.org/climateportal/

CARIBSAVE Climate Change Risk Atlas (CCCRA)

The CCCRA used evidence-based, inter-sectoral approaches to examine climate change risks, vulnerabilities and adaptive capacities; and develop pragmatic response strategies to reduce vulnerability and enhance resilience in 15 countries across the Caribbean.

The CARIWIG Portal

For the Caribbean Region, this web portal provides information and datasets concerning:

- The observed climate of the present day
- Regional Climate Model (RCM) projections of the future climate
- Future scenarios of weather downscaled from RCM projections
- Scenarios of weather derived from hypothetical tropical cyclone events

Available at: http://www.caribbeanclimate.bz

Available at: http://cariwig.caribbeanclimate.bz/

Climate Risk and Vulnerability Assessment Framework for Caribbean Coastal Transport Infrastructure

This document provides a framework on the importance of conducting a CRVA as a means to understanding and identifying the vulnerabilities and risks to which coastal infrastructure is exposed.

Available at: http://unctad.org/meetings/en/Presentation/CBhat_ICF_SLUWorkshop_p12_en.pdf

Caribbean Regional Climate Sub Hub Assessment of Climate Change Vulnerability and Adaptation and Mitigation Strategies (CCSH)

The CCSH attempts to reduce the risks climate change may bring to the agriculture and forestry sectors. The CCSH serves as a framework to enhance the response in developing and delivering research and information that will increase local productivity, support innovative products and markets, provide regular vulnerability assessments, develop tools for farmers and managers to increase their adaptive capacity, and serve as a clearinghouse for information on climate, agriculture, and forestry in the Caribbean.

Available at: http://caribbeanclimatehub.org

Climate Change Data and Risk Assessment Methodologies for the Caribbean

The aim of this document is to: (1) propose a step-wise process to assess disaster and climate change risks to International Development Bank projects and (2) identify tools and methodologies to support the risk assessment process specific to the Caribbean Region. The pilot risk assessment process focuses on the direct and indirect risks to projects from three climate-induced hazards: sea level rise, hurricanes (including storm surge), and flooding (both coastal and riverine) because these hazards are considered to pose the greatest threat to the Caribbean Region.

Available at: https://publications.iadb.org/bitstream/handle/11319/6453/Climate%20Change%20Data%20and%20Risk%20 Assessment%20Methodologies%20for%20the%20Caribbean.pdf?sequence=1

Rapid Climate Change Vulnerability Assessment: The Eastern and Southern Caribbean Regional Report

This technical assessment report reviews the application of a rapid climate change vulnerability assessment in the Eastern and Southern Caribbean. The report provides an overview of the background of the areas and the assessment, methodology, predicted effects of climate change, institutional and legislative framework, impacts of development projects, and ongoing projects on climate change vulnerability, as well as priority issues for each location.

Available at: https://www.climatelinks.org/sites/default/files/asset/ document/2013CaribbeanClimateChangeVulnerabilityAssessment.pdf

5.3 Section 5: Notes for the trainer / facilitator

5.3.1 Notes for the trainer / facilitator

The following points should be borne in mind in preparing for a participatory CRVA:

- One of the critical first steps is to create a stakeholder map which identifies the relevant government ministries, public and private sector agencies which are involved in research, regulations and policies and provision within the water sector.
- Key personnel from the stakeholders map should be selected to participate in a review group which would be tasked with overseeing the CRVA process and provide guidance/input as necessary.
- Early stakeholder engagement is necessary in order to develop a baseline to establish some of the critical issues that have impacted or are presently impacting the water sector. These meetings should be used as an opportunity to understand:
  - The type of climate and water resources related data which is readily available;
  - Studies and assessments which have been completed;
  - Ongoing infrastructural projects which aim to reduce the impacts of natural hazards and climate change;
  - Climate and non-climate risks which may hinder the operations of the water utility;
  - The most recent hydro-meteorological events which resulted in severe economic, social and environmental impacts;
  - Whether the strategic goals of the water utility and water sector stakeholders align with the national adaptation plans and policies;
  - How do stakeholders in the water sector presently adapt to climate change and extreme weather events
  - Policies specific to the water sector;
  - Policies specific to climate change adaptation in the context of the water sector;
  - Use and management of water sector infrastructure and its associated resources;
  - Institutional arrangements governing the operations of the water sector;
  - Legislation and regulations related to the water sector.

The list above is not finite but provides an example of the type of information that should be attained prior to the actual CRVA workshop if possible. During the CRVA workshop, the facilitators should be attempting to build on this information through receiving input and different points of views from the workshop participants.

- Prior to the CRVA workshop, it is beneficial to identify the majority of the critical assets, resources and infrastructure. This will reduce the amount of time spent on reviewing the assets during the workshop.
- The CRVA workshop should be conducted by at least 2 people. One person would facilitate the workshop while the other person would take notes on comments from the participants to be used for further analysis.
- PowerPoint presentation(s) for use during the CRVA workshop should be prepared which cover the following topics:
  - Definitions of climate change, vulnerability, hazards, resilience and risk;
  - Climate change projections for the country;
  - Climate Change and its potential impacts (present and future) on the water sector in the target country;
  - Introduction to the exercise;
  - CRVA methodology;
  - Prioritising climate risks and identifying potential adaptation investments/solutions.
- Workshop material should be shared with the workshop participants which contains a summary of the methodology/approach for the CRVA.
- The facilitator should use the most recent, readily available climate change projections which are aligned with the projections used to determine strategies and policies at the national level (National Adaptation Plans, National Determined Contributions).

- Workshop participants should be reminded that the focus is on climate risks as some may wish to introduce non-climate risks such as tsunamis, earthquakes and volcanic eruptions. These can be noted if the stakeholders consider them to be more important than the climate-related risks.
- The facilitator should encourage the participants to contribute to the discussions surrounding the CRVA. However guidance should be given to ensure that the discussion does not go off topic (discussion not related to the CRVA or water sector) for an extended period of time.
- The results from the CRVA should be shared with the participants to ensure that the outputs adequately reflect the discussions which occurred during the workshop.

5.3.2 Exercises and discussion topics

The following is an outline of a group session aiming to complete the participatory CRVA.

Group Session 1	
Title Application of the CRVA exercise.	**Type** Working groups.
Objectives Identify climate risks and vulnerable assets of the national water supply sector, as well as potential solutions to reducing vulnerabilities. Identify where quantitative studies are necessary.	
Duration 1 day.	**Materials needed** ■ Training Manual. ■ PowerPoint presentation and projector. ■ Note pads and pencils. ■ Handouts - workshop agenda; CRVA matrix (Section 5.4.3).
Preparation ■ Identification of an appropriate venue for the workshop. ■ Identify and invite relevant stakeholders. ■ Preparation of the necessary PowerPoint presentation(s) and associated materials. ■ Identification of relevant climate change projections.	
Description of tasks and instructions **Step 1: Introduction to the activity (in plenary) (10 mins)** Give some background to the activity based on the information provided in the Training Manual for Section 5. The objectives which are to be achieved during this workshop will be clearly outlined at this time. **Step 2: Climate change projections and potential impacts in the water sector** During this session the participants will be exposed to the most recent (and readily available) climate change projections for their country. Participants will also discuss the vulnerabilities and risks (climate and non-climate) to which the national water sector is exposed and explore how the sector will be further impacted due to a changing climate. **Step 3: Plenary discussion on risks** Participants will discuss the risks to the water sector that have been identified and the investment needs required to enhance resilience. During this time participants will also discuss past and present constraints as they relate to the implementation of identified investments needs.	

Step 4: Completion of a CRVA matrix

- Participants will complete a CRVA exercise where they will discuss the assets and the operations which are vulnerable to climate risks; the type of risks to which they are most vulnerable; the probability/likelihood of these climate risks occurring; and the consequences as a result of the impact of climate change.
- As the more vulnerable assets and infrastructure are highlighted, potential solutions to reducing these vulnerabilities are to be discussed. Also, participants should discuss whether the identified vulnerabilities are recent occurrences or whether they have been impacting the sector for a prolonged period.

Step 5: Plenary discussion

- The facilitator/trainer will wrap up the outcomes of the workshop and present next actions.
- Participants should also develop a framework to share lessons learned during the workshop with other key personnel, stakeholders and decision makers in the water sector through workshops or seminars.

Following the workshop

- Report on the background, results and outcomes of the workshop, recommending next actions.

5.4 Section 5: Annexes

5.4.1 Example data request form

Data requests from Governments, utilities and other stakeholders

How to complete this data request:

- This has been issued to the water utilities as the lead stakeholder for the consultant team. It is anticipated that the water services department may need to liaise with other departments for some data and information;
- Please complete the data request form by filling in the yellow cells in the boxes below to indicate the level of data availability and the responsible stakeholder;
- Please return the completed request to the consultant team members **NAME**, **EMAIL**, **PHONE NUMBER**;
- The consultants would be grateful if you could return this by **DEADLINE**;
- The consultants will then schedule a telephone call during the week **DEADLINE** to discuss the data in detail, how we can utilise it, and how to transfer it so the consultants team can progress work.

Where necessary, the consultants would be pleased to clarify any data requests and if required to discuss further with stakeholders the specific availability and accessibility of these items (see contact details in the covering email).

The main purposes of this data request are:

- To assess how far the water systems are efficient and cost-effective in carrying out their functions;
- The likely sustainability and "fitness for purpose" of current systems in various climate risk scenarios;
- Their current status, and future prospects, regarding financial self-sufficiency;
- Whether the use of water, and demand for water services, is reasonable in the light of water availability and cost of provision;
- What scope exists for water demand-management policies to complement supply-oriented measures.

Table 5-4: Example data request table for CRVA

Documents / data requested	Data not available	Limited data available	Good data available	Please add any additional notes on the data and which organisation holds the data
Water resources				
Details of the current status of the hydrometric data network and data holdings.				
Surface water quality data (daily, weekly or monthly data as available).				
Time series data (daily or monthly) for hydrological or hydrogeological monitoring data (such as flow or water level time series).				
Time series data (daily or monthly) for rainfall, evaporation and other readily accessible variables from reliable stations on the islands, ideally representing a range of climatic conditions.				
GIS data on watershed boundaries, topography, land-use and hydrogeology / geology, as available.				
Storm water/ flooding data (daily, weekly or monthly data, as available).				
Information or reports on impacts of climate hazards on water resources (such as emergency management reports during drought conditions).				
Water supply assets and operations				
Yield assessments for water sources.				
Detailed data on water production, consumption and sales by major consumer (residential, commercial, industrial), ideally by major supply system.				
Water leakage (daily, weekly or monthly data, as available).				
Data and information on the impacts of significant climate hazards such as droughts and storm impacts on infrastructure and operations, such as outage and repair costs of infrastructure, type and location of damages.				
Asset databases including if possible catchment boundaries, sources, tanks, pipework and other assets, with information on their characteristics (as available).				
Schematic information on supply systems to help us understand system sizes and linkages.				
Information on any planned future investments (investment plans / action plans).				
Water supply strategic and financial data				
Annual reports and financial statements of water utilities/ departments for last 10 years.				
Key performance indicators and strategies / strategic objectives which guide the long term planning of the utility.				
Detailed data on costs of water utilities, by major categories, for the last 10 years (including capital and operational expenditures, energy costs are important).				
Key technical and financial performance indicators for water utilities over the last 10 years e.g. working ratio (av. costs/av. revenues, % of Non-Revenue Water to total water production, staffing ratios (workers per 1000 connections), % of wastewater treated to secondary standards).				

Documents / data requested	Data not available	Limited data available	Good data available	Please add any additional notes on the data and which organisation holds the data
Details of financial transfers from Governments to public water utilities for last 10 years, including indirect means of support such as loan guarantees.				
Appraisal reports on water projects from external financing agencies, e.g., CDB, World Bank, EIB, IADB.				
Identification of key departments, agencies, companies and individuals, plus indication of scale of human and financial capacity of these.				
Water demand				
Population estimates (from census data).				
Water demand studies and projections (per capita demand, demand by economic sector).				
Data on irrigation water use and areas covered by irrigation schemes.				
Information on water use by other sectors with private abstractions, such as bottlers, tourism complexes and industrial facilities.				
Information on important environmental water needs (ecosystems services).				
Other items				
Consultants' reports on relevant aspects of topics above.				
Identification of key departments, agencies, companies and individuals, plus indication of scale of human and financial capacity of these.				
Relevant strategy, country policy or sector policy papers prepared by CDB, IADB, CCCCC, World Bank, EIB, EU etc.				
Population growth projections, and any other relevant future socio-demographic projections.				
National scale goals such as economic growth and development, irrigation expansion or major urban developments which may have an impact on water.				
Climate change projections which have been adopted for strategic planning purposes.				
Studies on the assessment on the differential climate change vulnerabilities / adaptive capacities of men and women.				
Any other document or data considered relevant to this consultancy.				

5.4.2 Example climate change projections for Grenada

This note provides further information on the climate modelling projections for Grenada extracted from the CRVA study carried out under the project Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean. It contains a summary of relevant climate change projections and climate variables presented to participants at the risk assessment workshop and subsequently used to assess the degree to which future climate risks may exacerbate current risks. The climate change variables were derived from the CARIBSAVE Risk Atlas for Grenada, and supplemented with more recent information from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2013) where relevant and applicable.

The time horizon of interest has been selected based on a typical strategic planning horizon of 10-15 years (say to 2030) which is also commensurate with the date for achievement of the SDGs.

In terms of climate change, available information on scenarios is typically provided for windows of thirty years (e.g. 2010-2039, 2040-2069 and 2070-2099) and the window 2010-39 is therefore most relevant for an assessment to 2030. However, looking further into the future will also highlight more extreme changes in climate projected over the long term.

Climate change variables which will have an impact on the likelihood and consequences of the risks to water supply systems are given in Table 5-5. This identifies the main climate change variables of interest for each climate hazard. These variables are used subsequently in the CRVA for Grenada.

Table 5-5: Climate hazards identified in the risk assessment and the corresponding climate change variables of interest

Climate hazard (identified in risk assessment)	Climate change variables of relevance
Drought	Seasonal and annual rainfall change. Temperature and evaporation change. Aquifer recharge change.
Heatwave	Seasonal and annual temperature change.
Fire	Seasonal and annual temperature change. Seasonal and annual rainfall change.
Increased temperatures	Seasonal and annual temperature change.
Flooding (river)	Extreme rainfall change. Change in storm and hurricane frequency and severity.
Flooding (coastal)	Change in storm and hurricane frequency and severity. Sea level rise.
High winds	Change in storm and hurricane frequency and severity.
Sea level rise	Sea level rise.

A summary of the climate change scenarios and climate change variables of interest used in the climate risk assessment is given in Box 5-5.

Box 5-5: Summary Climate change variables of interest

Rainfall (annual average and seasonal)

Seasonal and annual rainfall has a primary impact on water availability, aquifer recharge and spring flows. Reductions in rainfall have the potential to reduce source yields and increase the frequency and severity of episodic droughts. The following pragmatic scenarios are suggested:

- 7% reduction in annual average rainfall – central estimate for the 2020s
- 22% reduction in annual average rainfall – upper estimate for 2020s
- 10% reduction in annual average rainfall – central estimate for the 2050s
- 33% reduction in annual average rainfall – upper estimate for 2050s

Temperature

Temperature increases will have an influence on increasing evaporation rates and will therefore reduce aquifer recharge and spring flows, and may have an impact on the demand for water. In addition, the occurrence of heatwaves is of interest from the perspective of infrastructure operations (e.g. overheating of pumps and generators). The following pragmatic scenarios are suggested:

- 0.7°C increase in annual average temperature – central estimate for the 2020s
- 1.5°C increase in annual average temperature – upper estimate for the 2020s
- 1.5°C increase in annual average temperature –central estimate for the 2050s
- 2.2°C increase in annual average temperature – upper estimate for the 2050s

Rainfall extremes

Rainfall extremes refers to the occurrence of heavy rainfall over short periods (typically one to five days) and is of interest in the context of flood-related damage to infrastructure, source water turbidity and potential for contaminated runoff entering water supply systems. The following pragmatic scenarios are suggested:

- 5% increase in design rainfall depths – central estimate for the 2050s
- 15% increase in design rainfall depths – upper estimate for the 2050s

Sea level rise

Sea level rise is a concern both in terms of coastal flooding and saline intrusion into the coastal aquifers. The following pragmatic scenarios are suggested:

- 0.20m increase in sea level – central estimate for the 2020s
- 0.25m increase in sea level – upper estimate for the 2020s
- 0.25m increase in sea level –central estimate for the 2050s
- 0.40m increase in sea level – upper estimate for the 2050s

Storm and hurricane change

Storms and hurricanes bring high wind speeds and heavy rainfall, which typically result in wind damage to infrastructure, river and coastal flooding, and landslides.

- Results for the Caribbean and Central America broadly indicate a 'projected reduction in mean precipitation and increase in extreme precipitation with more extreme precipitation in tropical cyclones making landfall along the eastern and western coasts' (IPCC, 2013a). The IPCC AR5 report concludes that the frequency of smaller storms (Category 1) may decrease and it is more likely than not that the frequency of Category 4 and 5 storms will increase. In addition, the maximum storm intensity and rainfall rate is projected to increase.

Further information: A full analysis of climate change scenarios and the assumptions made in to deriving these suggested variables is given in the following sections.

Rainfall (annual average and seasonal)

Seasonal and annual rainfall has a primary impact on water availability in determining aquifer recharge and spring flows. Reductions in rainfall have the potential to reduce source yields and increase the frequency and severity of episodic droughts. Most climate projections for the Caribbean show a decrease in rainfall under most of the scenarios.

Box 5-6: Summary of annual average and seasonal rainfall projections from the Caribsave Risk Atlas

Gridded observations of rainfall over Grenada do not indicate any statistically significant trend over the period 1960-2006. Long-term trends are difficult to identify due to the large inter-annual variability in rainfall in Grenada.

GCM projections of future rainfall for Grenada span both increases and decreases but tend towards decreases in more models. Projected changes in annual rainfall range from -40 to +7 mm per month (-66% to +12%) by the 2080s across the three emissions scenarios. The overall decreases in annual rainfall projected by GCMs occur largely due to decreased June July August (JJA) and September October November (SON) rainfall, but these changes are less consistent between models.

RCM projections of rainfall for Grenada are strongly influenced by the driving GCM providing boundary conditions. Driven by ECHAM4 [1], RCM projections indicate large proportional decreases in June July August (JJA) (-41%) and decreases in December January February (DJF) (-21%), March April May (MAM) (-15%) resulting in a decrease (-22%) in total annual rainfall. When driven by HadCM3, RCM projections indicate large proportional decreases in DJF (-41%) and MAM (-47%) rainfall resulting in a substantial decrease in annual rainfall (-29%).

Source: (CARIBSAVE, 2012)

Based on these considerable uncertainties, a pragmatic sensitivity test could use the following rainfall scenarios:

- 7% reduction in annual average rainfall – central estimate for the 2020s
- 22% reduction in annual average rainfall – upper estimate for 2020s
- 10% reduction in annual average rainfall – central estimate for the 2050s
- 33% reduction in annual average rainfall – upper estimate for 2050s

Annual average rainfall change (%) relative to 1970-99 baseline period for St Kitts and Nevis	2020s			2050s			2080s		
	Lower	Central	Upper	Lower	Central	Upper	Lower	Central	Upper
GCM ensemble Low emissions (B1)	-22	-6	8	-33	-8	4	-43	-9	12
GCM ensemble Med emissions (A1B)	-19	-9	7	-30	-16	4	-53	-16	1
GCM ensemble High emissions (A2)	-25	-7	12	-36	-15	10	-66	-15	-1
RCM (ECHAM4) High (A2)								-22	
RCM (HadCM3) High (A2)								-29	

Figure 5-3: Annual average percentage rainfall change (1970-1999 baseline) relative to future, based on GCM and RCM scenarios

Source: (CARIBSAVE, 2012)

1 ECHAM4 and HadCM3 are both GCMs

Time period	Mean 1970 -99 rainfall (mm/month)	2020s - GCMs			2050s - GCMs			2080s - GCMs			2080s - RCMs	
		Lower	Central	Upper	Lower	Central	Upper	Lower	Central	Upper	ECHAM4	HadCM3
Annual	126	-19	-9	7	-30	-16	4	-53	-16	1	-22	-29
December - February	77.7	-29	-3	19	-24	-13	30	-38	-16	3	-21	-41
March - May	56.9	-24	0	34	-50	-2	15	-59	-1	17	-15	-47
June - August	179.5	-29	-7	6	-44	-17	4	-75	-18	8	-41	-20
September - November	189.3	-47	-5	18	-39	-22	21	-55	-17	4	-9	-9

Figure 5-4: Annual average and seasonal percentage rainfall change (1970-1999 baseline) relative to future, based on GCM and RCM scenarios, for the medium emissions (A1B) scenario

Source: (CARIBSAVE, 2012)

Temperature

Temperature increases will have an influence on increasing evaporation rates and will therefore reduce aquifer recharge and spring flows. In addition, the occurrence of heatwaves is of interest from the perspective of infrastructure operations which are impacted by high temperatures (for example overheating of pumps and generators). Finally, increasing temperatures may have an impact on the demand for water as consumers increase garden watering through warm periods.

Box 5-7: Summary of temperature projections from the Caribsave Risk Atlas

Observations from the gridded temperature datasets indicate that mean annual temperatures over Grenada has increased at an average rate of 0.14˚C per decade over the period 1960-2006. The observed increases have been more rapid in seasons JJA and SON at the rate of 0.16˚C per decade.

General Circulation Model (GCM) projections from a 15-model ensemble indicate that Grenada can be expected to warm by 0.7˚C to 2.2˚C by the 2050s and 1˚C to 3.7˚C by the 2080s, relative to the 1970-1999 mean. The range of projections across the 15 models for any one emissions scenario spans around 1-2˚C. Projected mean temperature increase is similar throughout the year.

Regional Climate Model (RCM) projections indicate much more rapid increases in temperatures over Grenada compared to the GCM ensemble median projections for the A2 scenario. RCM projections indicate increases of 3.2˚C and 2.4˚C in mean annual temperatures by the 2080s, when driven by the ECHAM4 and HadCM3 respectively. The GCM ensemble projections for the same period range from 2 to 3.7˚C.

The improved spatial resolution in the RCM allows the land mass of the larger Caribbean islands to be represented, whilst the region is represented only by ocean grid boxes at GCM resolution. The land surface warms more rapidly than ocean due to its lower capacity to absorb heat energy, and we therefore see more rapid warming over Grenada in RCM projections than in GCMs.

Source: (CARIBSAVE, 2012)

Based on these considerable uncertainties, a pragmatic sensitivity test could use the following rainfall scenarios:

- 0.7°C increase in annual average temperature – central estimate for the 2020s;
- 1.5°C increase in annual average temperature – upper estimate for the 2020s (or central estimate for the 2050s);
- 2.2°C increase in annual average temperature – upper estimate for the 2050s.

Scenario (Changes in °C)	2020s			2050s			2080s		
	Lower	Central	Upper	Lower	Central	Upper	Lower	Central	Upper
GCM ensemble Low emissions (B1)	0.4	0.7	1.1	0.7	1.1	1.4	1	1.6	2
GCM ensemble Med emissions (A1B)	0.3	0.7	1.2	1.1	1.5	2.2	1.4	2.2	2.9
GCM ensemble High emissions (A2)	0.5	0.7	0.9	1	1.5	2.2	1.9	2.7	3.9
RCM (ECHAM4) High (A2)								3.2	
RCM (HadCM3) High (A2)								2.4	

Figure 5-5: Annual average temperature change (°C) (1970-1999 baseline) relative to future, based on GCM and RCM scenarios (note seasonal changes are not provided as they are similar throughout the year.

Source: (CARIBSAVE, 2012)

Rainfall extremes

Rainfall extremes refer to the occurrence of heavy rainfall over short periods (typically one to five days). This type of rainfall is of interest in the context of flood related damage to infrastructure, source water turbidity and potential for contaminated runoff entering water supply systems.

Box 5-8: Summary of extreme rainfall projections from the Caribsave Risk Atlas

Changes in rainfall extremes, based on 1- and 5-day rainfall totals, as well as exceedance of a relative threshold for 'heavy' rain, were examined. 'Heavy' rain is determined by the daily rainfall totals that are exceeded on 5% of wet days in the 'current' climate or reference period, relative to the particular climate of a specific region or season.

There is insufficient daily observational data to identify trends in rainfall extremes in Grenada.

GCM projections of rainfall extremes are mixed across the ensemble of models, ranging from both decreases and increases of all measures of extreme rainfall. The proportion of total rainfall that falls in heavy events decreases in most model projections, changing by -16% to +8% by the 2080s. Maximum 5-day rainfall events tend to decrease in model projections, but the ensemble range covers both increases and decreases, ranging from -26 to +9 mm annually by the 2080s.

Source: (CARIBSAVE, 2012)

Projections of rainfall extremes in the Caribbean are challenged by the coarse resolution of many of the GCMs which are used as a basis for projections. In addition, a large volume of climate model data is needed in order to be able to extract statistically reliable data on changes in rare events. This requires an intensive modelling programme using RCMs.

Based on the uncertainty around projections of changes in extreme rainfall, there is little more that can be done than simply sensitivity testing the impacts of proportional changes in extreme rainfall. This could include for example increasing the design rainfall depth used in flood studies for new developments or hydraulic infrastructure design. As more reliable climate change projections become available these sensitivity tests could be refined.

Scenario (% change)	2050s Lower	2050s Central	2050s Upper	2080s Lower	2080s Central	2080s Upper
GCM ensemble Low emissions (B1)	-9	0	4	-16	0	8
GCM ensemble Med emissions (A1B)	-11	-3	7	-13	-2	6
GCM ensemble High emissions (A2)	-9	0	5	-14	-5	2

Figure 5-6: Percentage rainfall in heavy events

Source: (CARIBSAVE, 2012)

A pragmatic sensitivity test could use the following extreme rainfall scenarios:

- 5% increase in design rainfall depths – central estimate for the 2050s;
- 15% increase in design rainfall depths – upper estimate for the 2050s;
- Note that these factors are higher than those quoted in the evidence above, however, on the basis of the high level of uncertainty associated with these projections, a precautionary position is recommended until the evidence base is improved.

Storm and hurricane change

Prior to the passage of Hurricane Ivan the location of Grenada was considered to be safe from hurricanes owing to its location in the southern most regions of the hurricane belt. Prior to 2004, Grenada had only been impacted by three hurricanes since the beginning of the 20th century. However, this perception changed after the passage of Hurricanes Ivan and Emily which caused severe damage in 2004 and 2005 respectively.

The most recent IPCC AR5 projections for Caribbean and Central America broadly indicate a ‘projected reduction in mean precipitation and increase in extreme precipitation with more extreme precipitation in tropical cyclones making landfall along the eastern and western coasts’ (IPCC, 2013a). There are two key aspects to consider in terms of future hurricanes and extreme rainfall; the frequency of occurrence and the severity of the events when they do occur. The IPCC AR5 report concludes that the frequency of smaller storms (Category 1) may decrease and it is more likely than not that the frequency of Category 4 and 5 storms will increase. In addition, the maximum storm intensity and rainfall rate is projected to increase.

The table below shows the change in near storm rainfall intensity and wind intensity associated with tropical storm/hurricane activity under global warming scenarios.

Table 5-6: Changes in near-storm rainfall and wind intensity associated with tropical storms under global warming scenarios

Reference	Greenhouse Gas GHG scenario	Type of Model	Domain	Change in near-storm rainfall intensity	Change in peak wind intensity
Knutson et al. (2008)	A1B	RCM	Atlantic	(+37, 23, 10)% when averaged within 50, 100 and 400 km of the storm centre	+2.9%
Knutson and Tuleya (2004)	1% per year CO2 increase	9 GCMs + nested regional model with 4 different moist convection schemes.	Global	+12-33%	+5-7%
Oouchi et al (2006)	A1B	High Resolution GCM	Global	N/A	+14%
			North Atlantic		+20%
			North Atlantic		+20%

Source: (CARIBSAVE, 2012)

Sea level rise

Sea level rise is a concern both in terms of increase in magnitude of coastal flooding events and in terms of saline water intrusion into the coastal aquifers and both these hazards are perceived as very relevant by Grenada's stakeholders.

Box 5-9: Summary of sea level rise projections from the Caribsave Risk Atlas

The increase of sea level in the Caribbean has been shown to be consistent with the global trend of about 1.8 mm/y (from 1961 to 2003). However, regional variations must be superimposed on the mean global sea level rise rate. The estimates of IPCC AR4 report, whose combined range spans from 0.18 to 0.59 m by 2100, have been challenged by a number of studies for being too conservative. Caribbean mean sea level rise by 2100 (relative to 1980 -1999) reported by CARIBSAVE (2012) span from 0.13 m (low emissions, lower estimate) to 0.56 m (high emissions, upper estimate).

Source: (CARIBSAVE, 2012)

Global mean sea level rise	2046-2065			2100		
	Lower	Central	Upper	Lower	Central	Upper
SRES A1B	0.19	0.27	0.34	0.42	0.6	0.8
RCP2.6	0.17	0.24	0.32	0.28	0.44	0.61
RCP4.5	0.19	0.26	0.33	0.36	0.53	0.71
RCP6.0	0.18	0.25	0.32	0.38	0.55	0.73
RCP8.5	0.22	0.3	0.38	0.52	0.74	0.98
SEM	-	-	-	0.32	0.94	1.56

Figure 5-7: Global sea level rise projections (in m) for different time horizons

Source: Data from IPCC (2013)

Based on the uncertainties that characterise these projections and the absence of Caribbean-specific estimates, a pragmatic sensitivity test could use the following SLR scenarios:

- 0.20 m increase in sea level – central estimate for the 2020s;
- 0.25 m increase in sea level – upper estimate for the 2020s (or central estimate for the 2050s);
- 0.40 m increase in sea level – upper estimate for the 2050s.

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5.4.3 Risk Assessment Matrix

The Risk Assessment Matrix provides a structured approach to identifying risks and adaptation actions in the CRVA workshop session. This Annex provides a template of the Risk Assessment Matrix and steps to complete it during the workshop session. It is anticipated to take around 3 hours working in plenary to complete the Matrix. Annex 5.4.4 provides an example completed Risk Assessment Matrix.

- Step 1 - Identification of the assets at risk – A preliminary set of assets have been identified in the Risk Matrix (Table 5-7) which are important for the effective provision of water services and which could be exposed to climate risks. These should be tailored to the water services in each specific country context prior to the workshop, although it can be adjusted during the workshop to add or remove assets.
- Step 2 - Identification of climate hazards for each asset at risk. An initial list is provided in and this should be discussed and refined with participants during the workshop. These are hazards to which water services are presently exposed, not the future climate changes which may affect the severity or prevalence of these hazards.
- Step 3a – For each asset and hazard, an assessment of the consequences (what are the negative impacts of the hazard). A simple qualitative scale has been provided to allow these to be classed. This should be discussed and agreed with stakeholders to ensure a common understanding of the scale to be applied.
- Step 3b - For each consequence, an assessment of the likelihood (what is the chance of it occurring – based on the experience of stakeholders). A simple qualitative scale has been provided to allow these to be classed. This should be discussed and agreed with stakeholders to ensure a common understanding of the scale to be applied.
- Step 3c - The consequence and likelihood scores are then combined in a matrix to give an overall risk level of Extreme, Major, Medium or Minor. This is then discussed with stakeholders to gain broad feedback on whether it is representative of their understanding of the risks facing the water services sector.
- Step 4 - The impact of future climate change projections on risks are then assessed by evaluating how climate change may alter the likelihood and consequence of risks in future. If this step is to be completed in the workshop environment, it will be important to avoid attempting to be too precise in this definition – a simple assessment of whether climate change is likely to increase or decrease risk based on the climate change scenarios is required, together with a comment on the level of confidence in the climate change projections. If the trainer and participants are not comfortable making this assessment, it can be left as a follow up activity to be completed by an expert in climate change adaptation.
- Step 5 - Finally, workshop participants are invited to provide a suggestion on adaptation actions which could reduce these risks. The actions are intended to provide a starting point for developing a focused and balanced programme of investments to increase the resilience of the water sector.

Table 5-7: Risk Assessment Matrix template

System component	Asset	Climate hazard	Consequence	Likelihood	Risk rating	Climate change (risk rating increasing / uncertain / decreasing)	Potential options to reduce climate risks
Step 1		Step 2	Step 3a	Step 3b	Step 3c	Step 4	Step 5
Water sources	Watershed - Surface water source quality						
	Watershed - Surface water source yield						
	Groundwater (coastal) aquifer quality						
	Groundwater (coastal) aquifer yield						
	Groundwater (deep wells) aquifer quality						
	Groundwater (deep wells) aquifer yield						
Collection and raw water storage	Surface water intakes						
	Surface water reservoirs (raw water)						
	Groundwater boreholes and pumps						
	Desalination plant intake structures						
Raw water transmission	Pumping stations						
	Transmission mains						
Treatment	Slow sand filtration plants						
	Pressure filtration plants						
	Desalination plants						
Distribution	Distribution mains (large pipes)						
	Distribution network (small pipes)						
Consumption	Household connections						
	Consumptive activities						
Supporting services	Electrical power						
	Access and transport						
	Logistics and supplies						
	Management and operation staff						
	Communications systems						

Step 1 – Identification of assets at risk

The trainer should identify the assets at risk based on the characterisation of the water sector in liaison with the CRVA focal point prior to the CRVA workshop. The Risk Matrix template (Table 5-7) gives an indicative list of assets which can be refined to reflect the national context. The assets have been broadly classified by functional element from source catchment to consumer. It also includes supporting elements such as electrical power, communication systems, transportation, staffing and equipment. During the workshop stakeholders may identify additional assets in which case the template can be adapted during the workshop if projected electronically.

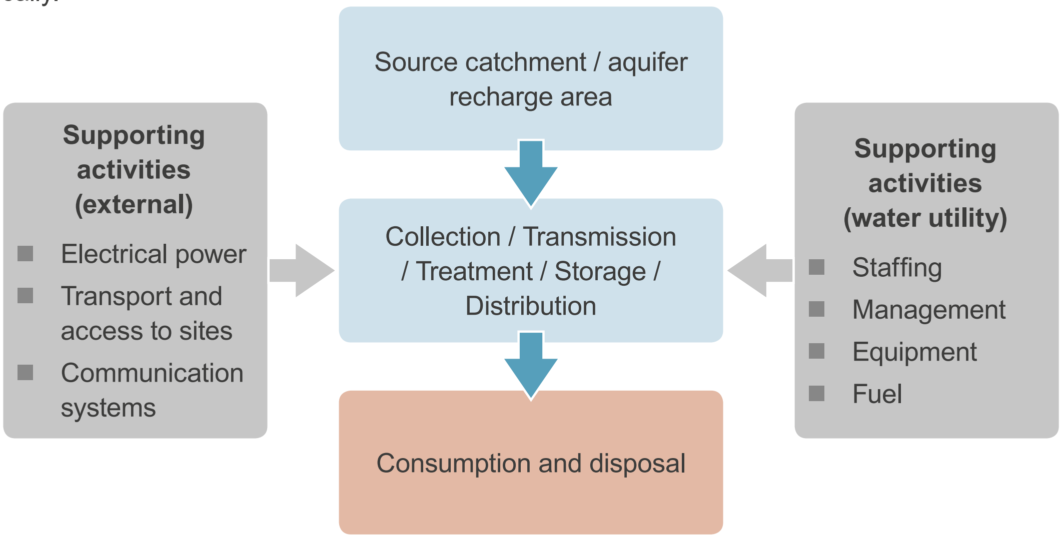

Figure 5-8: Schematic of assets for assessment in the CRVA process

Step 2 – Definition of climate hazards

The trainer should discuss with participants the types of climate related hazards which are typically causing problems in the water sector. This is useful to ensure that participants are on the same page when it comes to the risk assessment matrix.

Stakeholders often cite linked hazards (e.g. hurricane covers high winds, rainfall and storm surge) and stakeholders need to be specific about the causes of the impacts in order to identify actions. Non-climate hazards can also be important in some cases (volcanic eruption, fire, pollution incidents etc.) and these can be noted if the stakeholders feel they are sufficiently important, although the focus should remain on climate hazards.

Climate hazard class	Climate hazard	Indicative impacts
Storm (short duration - may include hurricanes, named storms or smaller systems which result in extreme rainfall or high winds)	Extreme rainfall event	Flooding / erosion / water damage / landslides / high turbidity in source water
	High winds	Physical damage to structures / tree fall
	Lightning strike	Physical damage to structures
	Coastal flooding	Flood inundation / damage to structures / salinisation of coastal aquifers
	Wave attack	Physical damage to structures / erosion
High temperatures (short duration events ~ 1 week to 1 month)	Heatwave	Impact on treatment processes / damage to structures / increased water demand
Seasonal weather conditions (prolonged differences from normal weather patterns over the course of a season, year or multiple years)	Prolonged wet weather	Waterlogging / water damage
	Prolonged dry weather (drought)	Reduced source yields (ground and surface) / ground movement / increased water demand

Step 3 – Consequence, likelihood and risk assessment

The tables below provide a definition for the terms likelihood and potential impacts / consequences; and also defines the ratings "High", "Medium" and "Low" as used during the Risk Assessment exercise.

Step 3a – What are the consequences (loss, damage or impact) if the hazard event occurs?

In many cases consequences of hazards are exacerbated by underlying vulnerabilities, such as degraded watersheds or limited asset maintenance. These should be noted in the Risk Assessment Matrix as contributing factors in the consequence column.

Figure 5-9: Impact / Consequence Scale

Rating	**Potential consequences** In terms of water resources and water services in St. Kitts and Nevis
High	**CATASTROPHIC:** most services cannot be delivered, or several are severely affected
	MAJOR: most services threatened, or one or a few geographical areas severely affected (including critical infrastructure such as hospitals and air and sea ports)
Medium	**MODERATE:** some services affected, and this has moderate impacts but resources and systems are restored
Low	**MINOR:** minor disruption for a short period
	NEGLIGIBLE: very small impact, rectified by normal processes

Step 3b – What is the likelihood of the climate hazard event occurring?

Figure 5-10: Likelihood Scale

Rating	**Likelihood** The potential for climate hazards to occur in the lifetime of the asset
High	**CERTAIN:** Occurs several times per year
	LIKELY: Typically occurs once every 2 years
Medium	**POSSIBLE:** Typically occurs once every 10 years
Low	**RARE:** Typically occurs once every 50 years
	UNLIKELY: Typically has occurred once in the last 100 or more years

Step 3c – Combining consequence and likelihood scores to give a risk level

Not only is it important to identify the risks to assets, it is necessary to identify the level of accepted risk. This involves analysing the likelihood and consequences of each identified risk and deciding which risk factors will potentially have the greatest effect and should, therefore, receive priority with regard to how they will be managed (adapted to). The level of risk is analysed by combining the scores of likelihood and impacts / consequences, to determine the priority level of the risk.

The risk priority scale determines the nature of the risk and helps decision makers to identify an acceptable level of risk to a particular asset or group of assets.

Table 5-8: Risk Priority Scale

		Impacts / Consequences		
		HIGH	MEDIUM	LOW
Likelihood	HIGH	Extreme (1)	Major (2)	Medium (3)
	MEDIUM	Major (2)	Medium (3)	Minor (4)
	LOW	Medium (3)	Medium (3)	Minor (4)

Key:

Extreme	Extreme risks that are likely to occur and have potentially serious consequences requiring urgent attention
Major	Major risks that are likely to occur and have potentially serious consequences requiring urgent attention and/ or investigation
Medium	Medium risks that are likely to occur or have serious consequences requiring attention
Minor	Minor risks and low consequences that may be managed by routine procedures

Step 4 – Climate change impacts on risk

The impacts of future climate change projections on risks are then assessed by evaluating how climate change may alter the likelihood and consequence of risks in future. If this step is to be completed in the workshop environment, it will be important to avoid attempting to be too precise in this definition – a simple assessment of whether climate change is likely to increase or decrease risk based on the climate change scenarios is required, together with a comment on the level of confidence in the climate change projections. If the trainer and participants are not comfortable making this assessment, it can be left as a follow up activity to be completed by an expert in climate change adaptation.

Step 5 – Identification of preliminary adaptation actions

In many instances, stakeholders in the water sector are very aware of the climate risks to which they are exposed based on their experience in coping with past events, although the level of quantified information on these risks may be limited.

Potential actions to address these risks can be identified as each risk is assessed during the workshop (but may only be deemed necessary for medium and above risks, depending on the preferences of stakeholders).

Adaptation actions could involve the following elements:

- Capacity development and knowledge transfer;
- Policy, legislation and regulatory strengthening;
- Strategic investment planning support, including a performance framework for KPIs;
- Asset management system improvement;
- Institutional strengthening and reform;
- Improvements in data collection, management and use;
- Use of innovative technologies and other pilot studies;
- Financial instruments such as subsidies, incentives, sanctions, insurance and instruments for catalysing investment;
- Catchment management interventions to manage source water risks;
- Infrastructure upgrades such as:
  - New water sources (surface, groundwater, desalination);
  - Water storage (raw water for drought resilience, treated water for resilience to outages);
  - Upgraded pipework and strengthening at weak points to reduce the risk of failures;
  - Enhanced treatment works;
  - Improved telemetry systems to monitor system performance;
  - Improving the resilience of assets to natural hazards (improved intakes, raised and protected boreholes);
  - Backup power supplies and communication systems in the event of such failures.

In identifying adaptation actions the following considerations should be made:

- Policies and legislation as it relates to the water sector (whether updated or make reference to the impacts of a changing climate);
- The financial capacity of the stakeholder(s) to implement the proposed solutions;
- The human resource capacity to successfully implement the proposed solutions (and pre-requisites for enhancement).

Lessons learned from past projects (and their challenges) are also useful as they provide context as to the barriers and constraints which the water sector may have experienced in the past; but also provide context as to whether these constraints have been addressed.

5.4.4 Example Completed Risk Assessment Matrix

Example Completed Risk Matrix (for St. Kitts).

Note that this example does not include the identification of adaptation actions.

Asset The infrastructure or natural system on which the water sector depends	**Climate hazard** The event which causes impacts	**Likelihood** How often does this occur?	**Impact/consequences** What happens?	**Risk priority scale** Combination of likelihood and consequence
Basseterre valley aquifer (water resources – quality and quantity)	**Sea level rise**	Almost certain (high) Loss of production wells already occurring, freshwater lens very thin	Major / Catastrophic (high) Depends on timelines, say 2030s	Extreme
	Hurricane	Possible (medium) – it has been a while since the last major hurricane	Medium. Flooding leading to contamination of water supplies Power outage for pumping operations	Medium
	Drought	Almost certain (high) – drought ongoing	Catastrophic (high) – water rationing ongoing	Extreme
	Intense rainfall	Low	Low (impacts on aquifer)	Minor
	Heatwave	Possible (medium)	Medium. Increased electricity demand, may affect power supplies for pumping. Increased demand for water	Medium
Other shallow aquifers (Basseterre is most stressed aquifer, issues similar in other aquifers)	**Sea level rise**	Medium	Medium	Medium
	Hurricane	Medium	Low	Minor
	Drought	High	High – similar impact to Basseterre	Extreme (but less than Basseterre)
	Intense rainfall	Low	Low	Minor
	Heatwave	Medium	Medium. Increased water demand, electricity demand.	Medium
Surface sources watersheds (water quality and quantity)	**Sea level rise**	Almost certain (high)	High. No direct impact on flows, but increased stress on surface water supplies if groundwater impacted.	Extreme
	Intense rainfall	Medium	High Supply interruptions. Siltation. 2 weeks to restore supplies in some cases. Deterioration in water quality (microbes). Surface water sources cannot be used during storm events.	Major
	Drought	Medium	High. Reduced availability (2015 50% reduction in yield). Concentration of contaminants increased. Higher water demand	Major
	Heatwave	Medium	High. Reduced flows. Increased demand.	Major

Asset The infrastructure or natural system on which the water sector depends	**Climate hazard** The event which causes impacts	**Likelihood** How often does this occur?	**Impact/consequences** What happens?	**Risk priority scale** Combination of likelihood and consequence
Wells	**Flooding / intense rainfall**	Medium	High. Well inundation, water quality compromised. Contaminated backflow into well from surface water system.	Major
	Earthquake (not strictly climate hazard)	Medium	Medium. Uncertain. Damage possible. Depends on well construction.	Medium
Well housing (generators, switchgear)	**Hurricane (combination of high wind and rain)**	Low	Medium. Rain entering and damaging electrics. Reinforced construction mitigates risk.	Minor
Surface water intakes	**Intense rainfall**	Medium	High (major) Debris and silt clogging structures. Damage to pipelines.	Major
	Earthquake	Low	High. Physical damage to infrastructure.	Medium
Water treatment plants	**Intense rainfall**	Medium	High. Siltation, problems treating turbid source water. Loss of supply. Increased use of chlorine to treat water. Insufficient treated water entering distribution system.	Major
	Intense rainfall	Medium	Medium. Damage to infrastructure, overflows within plant.	Medium
	Earthquake	Low	High. Damage to infrastructure.	Medium
Storage tanks (utility) (either fibreglass or concrete, one glass fused steel)	**Earthquake**	Low	High. Structural failure. Potential flooding of high end residential properties	Medium
	Hurricane / High winds	Medium	High. Structural failure. Fibreglass tanks at risk (Frigate Bay 2 m.g. storage adjacent to high value properties)	Major
Storage tanks	**Landslides**	Low – has not happened in the past	High. Structural failure. Potential flooding of high end residential properties	Medium
Pipe network (main lines)	**Intense rainfall / Hurricane**	Medium	Medium. Erosion, washing out lines. Bridge damage due to flooding. Pipeline undermined. Surface water main lines on surface, exposed.	Medium
Pipe network (domestic connections)	**Flooding (associated with hurricanes / intense rainfall)**	Medium – almost every hurricane. Recent experience	Medium. Exposed and lightweight materials. Water meters at surface.	Medium

Asset The infrastructure or natural system on which the water sector depends	**Climate hazard** The event which causes impacts	**Likelihood** How often does this occur?	**Impact/consequences** What happens?	**Risk priority scale** Combination of likelihood and consequence
Septic tanks, On Site Treatment and Disposal Systems (OSTDS)	**Earthquakes**	Medium	Medium. Structural damage.	Medium
	Flooding	Medium	Medium. Contaminated flood waters running into sea (environmental health), coming into contact with the public (human health)	Medium
	Sea level rise	Medium	Medium. Potential increase in water levels in coastal or low lying areas	Medium
Pit latrines (2% population)	**Flooding**	Medium	Medium. Contaminated flood waters running into sea (environmental health), coming into contact with the public (human health)	Medium
	Sea level rise	Medium	Medium. Potential increase in water levels in coastal or low lying areas	Medium
Domestic customer demand / behaviour	**Heatwave**	Medium	Medium. Demand rises (showering, drinking)	Medium
	Drought	Medium – compounded by rising demand	High. Demand increases during periods of rainfall – backyard agriculture, car washing, gardening,	Major
Major commercial customers demand / behaviour	**Hurricane**	Medium	Medium. Increase in demand for bottled waterStrain on municipal supplies as customers hoard water before storm.	Medium
	Drought	Medium	Medium. Impacts on businesses if supplies interrupted.	Medium
Agricultural and irrigation water	**Drought**	Medium	High. Difficulty in meeting agricultural demand for WSD water supplies (peaks during drought)Decrease in water availability	Major
	Intense rainfall / flooding	Medium	Medium. Damage to irrigation assets	Medium

Section 6

Prioritising adaptation options for implementation

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Section 6: Prioritising adaptation options for implementation

Summary

This section provides an example of an approach for the completion of a Multi-Criteria Analysis (MCA) exercise. MCA is a tool for assessing and prioritising options/ interventions against series of defined criteria. A longlist of options can be generated following an assessment of the climate risks and vulnerabilities facing the water sector, or particular water systems.

Based on the number of interventions identified, the MCA can be used as a preliminary tool to identify which are of the highest priority and can be feasibly implemented based on criteria such as development goals (internal, national and/or international), human, technical and financial capacity.

Therefore, an MCA is the initial step which provides support for more in-depth analysis to be completed to confirm the feasibility of implementing the interventions as identified during processes such as a Climate Risk and Vulnerability Assessment.

Objectives

At the end of this section, participants will be able to:

- Provide example adaptation options for the Caribbean water sector;
- Identify the steps to agree on the MCA methodology;
- Provide guidance on completing the MCA based on the complete list of adaptation options identified, in order to develop a prioritised list of adaptation options.

Things to know …

- Water practitioners must have a firm understanding of what are the potential barriers to implementation of adaptation actions and how these barriers can be managed or mitigated.
- Climate change adaptation measures should not only fit the mandate of the water utility, but where possible should also be aligned with national objectives as it relates to climate change adaptation.
- The joint use of MCA as a precursor to a Benefit Cost Analysis (BCA) could utilise the strengths of both approaches.
- When resources are limited, a robust and stakeholder-driven MCA process alone can be used: in this case selected criteria need to be relevant, contextual, and developed with the input of multiple stakeholders involved in the decision making process.
- The MCA is not only a systematic, transparent methodology, but also a learning process that stimulates discussion and facilitates a common understanding of the decision problem.

6.1 Section 6: Guidance Materials

6.1.1 Introduction to the Multi-Criteria Analysis

The cross-cutting nature of water implies that decisions relating to the water supply sector usually impact other sectors and that decisions regarding adaptation options need to account not only for a high degree of uncertainty regarding the future, but also for the competing demands for water resources and different stakeholder objectives.

The MCA approach can allow for the use of both qualitative and quantitative data to effectively prioritise adaptation solutions which have been identified for implementation. This approach provides a systematic method for assessing and scoring the options against a range of “decision criteria”, which can be expressed in physical or monetary units.

Box 6-1: Multi Criteria Analysis

Multi Criteria Analysis (MCA) is a framework for ranking or scoring the overall performance of adaptation options against multiple objectives. It consists in ranking or scoring the performance of alternative decision options against multiple criteria.

The “decision criteria” are weighted in order to provide an overall ranking of the identified options. These actions are completed using stakeholder consultation and/or expert input. It is therefore important that stakeholders are mapped and consulted not only from the water sector but also from others such as tourism, health, agriculture, energy etc. The MCA process allows the weights (for each criterion) to reflect the preferences of the decision-makers, since the weighted sum of the different criteria is used to rank the options.

The application of MCA to climate adaptation must be informed by some sort of climate change information. Indications of the future impacts of climate change, e.g. in terms of changes in temperature, weather extremes, runoff and sea level rise, are built up on the basis of climate model data. Similarly, the performance of different adaptation options against these climate risks can be assessed (i.e. scored). MCA is also sometimes used as a complementary tool to support cost-benefit analysis, to consider the performance of options against criteria that may be difficult to value or that involve qualitative aspects.

Since the approach analysis with qualitative information, this is particularly useful given there are often data gaps in climate change adaptation, and/or because there is often a need to consider additional aspects such as the acceptability, equity or environmental or social performance of options which are difficult to quantify.

Given the uncertainty of specific climate change impacts, data gaps and the diversity and multiplicity of factors to be considered in making decisions about adaptation measures, an MCA is generally proposed to initially identify a suite of adaptation which can be considered for implementation.

There are numerous techniques available for solving MCA problems; Figure 6-1 below shows the recommended steps which could be undertaken to complete an MCA exercise. The recommended methodology was followed and tested in two pilot applications in St. Kitts and Nevis and Grenada.

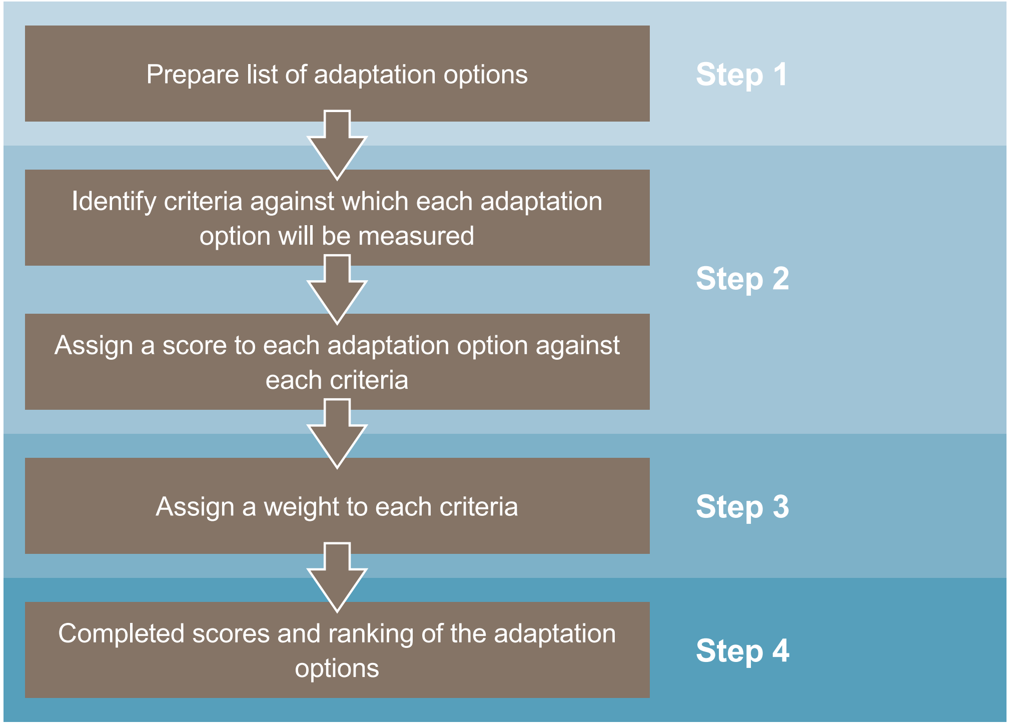


Figure 6-1: Steps of the suggested MCA

6.1.2 Step 1: Agree on potential adaptation options

The first step on the analysis consists in agreeing on a list of adaptation options that need to be considered for implementation. The list of options can, for example, come from the completion of a Climate Risk and Vulnerability Assessment. The list of options should be reviewed with stakeholders in order to identify additional options not captured in the list, or modifications to the existing ones.

Annex 6.4.1 provides a long list of potential adaptation options for the Caribbean water sector, covering enabling activities, water resources and water supply systems. This list is by no means exhaustive but should provide a useful starting point for agreeing on a list of options for the MCA. The case examples section provides a list of adaptation options considered in St. Kitts and Nevis under an MCA.

In agreeing on a list of adaptation actions, stakeholders should have the opportunity to think 'outside the box' of business as usual investment needs. There may be opportunities to identify innovative technologies or approaches for piloting which may attract grant financing from development partners, and which if successful could bring long term benefits to the sector, but may be considered too risky for government investment (see boxes 6-2 to 6-5).

The number of adaptation options proposed can be large and it must be recognised that it would not be feasible to implement all, but rather there is a need to prioritise which of the measures will have the highest benefits and could be feasibly implemented. Scope of the MCA is to assist decision makers in selecting the interventions which are best suited to increase the resilience of the water supply sector to a changing climate.

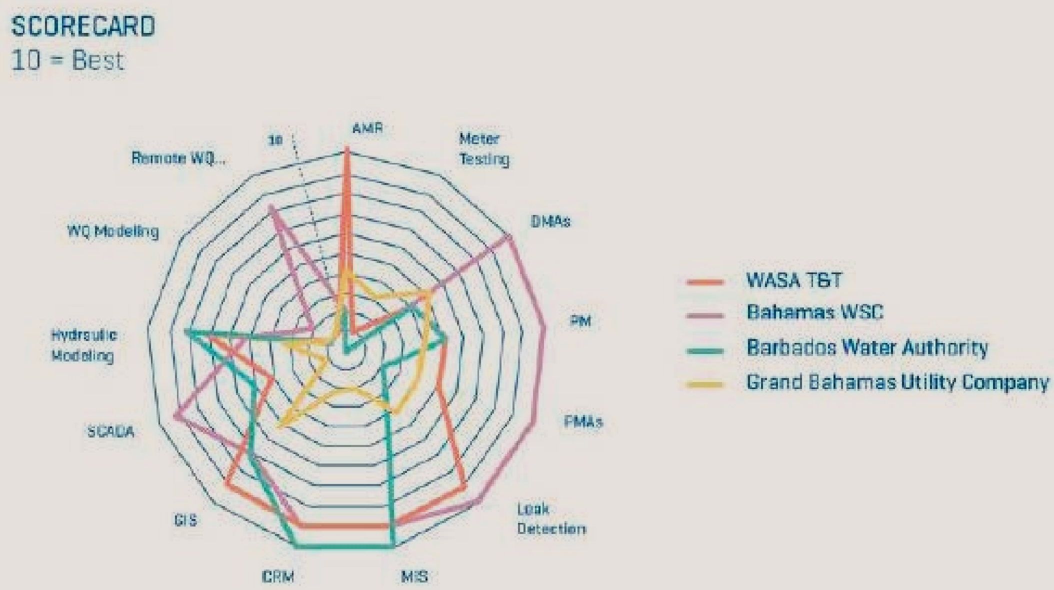
Box 6-2: Smart Water Infrastructure Technologies (SWIT)

The use of SWIT aims at improving the levels of service offered to customers, reducing costs and water losses and increase operational efficiency of water utilities, whilst at the same time offering evidence for informed decision making. In most of the cases, SWIT can be applied to climate resilience related challenges, providing data and tools to estimate and tackle impacts of climate variability on levels of service of the system.

A recent report on the Evaluation of Smart Water Infrastructure Technologies (IDB, 2017) presents an assessment of current applications of SWIT in the Caribbean Region. Of particular relevance to climate resilience the report addresses:

- Smart metering;
- District Metered Areas (DMAs), pressure management (PM) and active leak detection;
- Geographical Information Systems (GIS);
- Supervisory Control and Data Acquisition (SCADA);
- Hydraulic and Water Quality Modelling.

As part of the IDB report, some Caribbean water utilities provided information on the status of implementation of SWITs which is presented in the figure below.



Lessons learned

- Strong professional leadership is key to the success of modernisation programmes in a utility;
- The investment in SWIT needs to be implemented in utilities' long-term action plans;
- SWIT implementation must be progressive;
- Pipe recovery should be implemented only after ascertaining, recurring to DMAs or PMAs, where no other option is viable;
- Capacity development inside the utility is key.

Source: (IDB. (2017). Evaluation of Smart Water Infrastructure Technologies. IDB.)

Box 6-3: Nature Based Solutions for Water

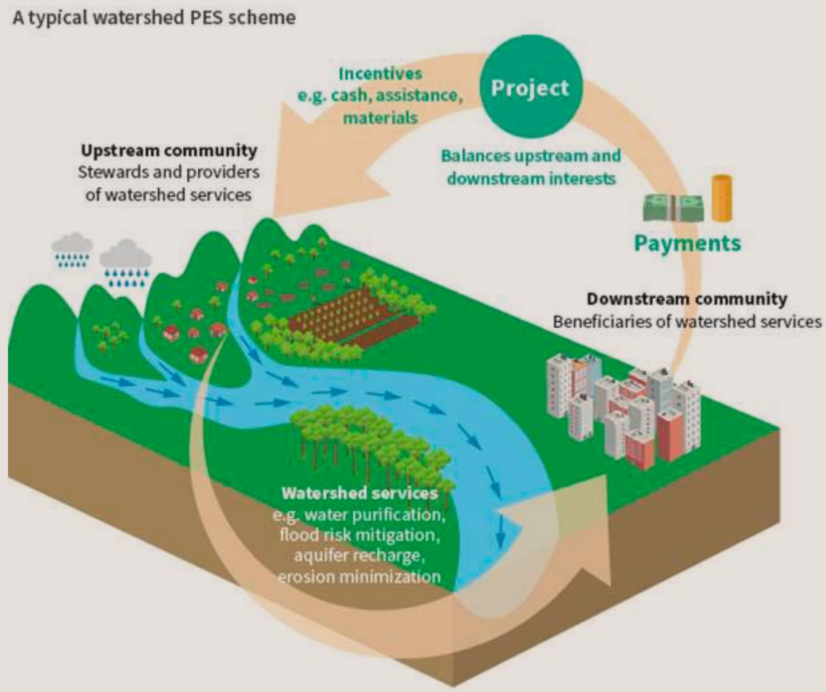
Nature-Based Solutions (NBS) use or mimic natural processes to contribute to the improved management of water. NBS recognise the importance of the ecosystem to achieve water related targets, which is also reflected in Target 6.6 of the SDGs to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

A recent report NBS for water [1] explores the benefits, types and applications of NBS in the water sector.

NBS usually deliver multiple services, helping to address water quality, quantity and water-related risks, improve the performance of existing grey infrastructure or intensify agricultural production.

The application of this type of solutions to date has been limited in the Caribbean. However, the increased attention and business cases supporting NBS have the potential to create opportunities for pilot applications in the region, especially due to the need to improve IWRM and ecosystem protection across the region.

The recognition that improved watershed management is essential to enhance water availability and quality underpins the application of economic incentives such as Payment for Environmental Services (PES) schemes. These schemes are of particular interest in the LAC region, where control, monitoring and enforcement of best practices for Water Resources Management are particularly weak and consist in providing incentives to landowners or farmers in exchange for sustainable land-use practices.



1 WWAP (2018)

Box 6-4: The emerging role of drones in the water sector

The popularity of Unmanned Aerial Vehicles (UAVs) in the water industry is gradually growing, and many water companies around the world have started to explore, with pilot and prototype projects, the potential application of drones for:

- Inspection of assets in remote or less accessible locations – New Jersey American Water;
- Inspection of elevated water towers and tanks - New Jersey American Water;
- Plant modelling - Cherokee County Water and Sewerage Authority's Rose Creek Treatment Facility;
- Monitor river water quality – Australian Government, Darling River;
- Leak detection - Anglian Water (UK) trials thermal imaging drones for leak detections;
- Sewer inspection - Barcelona;
- Assess post-hurricane damages - Texas.

Collaboration and peer-to-peer learning activities could be beneficial in transmitting knowledge between different utilities which can exploit the technology for similar purposes. For example the use of drones for post hurricane damage assessment and elevated infrastructure and equipment inspection can be applied by energy companies as well (Grand Bahamas Power Company, 2018).

Source: Williams, A. (2018). Flying High: How Water Is Adopting Drones. Retrieved 2018, from Water and Wastewater International : http://www.waterworld.com/articles/wwi/print/volume-33/issue-1/technology-case-studies/flying-high-how-water-is-adopting-drones.html

Box 6-5: The potential of water reuse in the Caribbean

Reuse of wastewater addresses both water supply and pollution issues and is influenced by the availability, type and cost of existing water supplies, as well as by the existing wastewater systems.

While at present the implementation of centralised wastewater reuse projects in the Caribbean is not attractive due to the high initial capital costs required, the potential for use in the hotels and resorts industry is significant and could meet up to 38% of the needs of major hotels and resorts of Eastern Caribbean if employed for irrigation and toilet flushing.

Some touristic facilities have already implemented wastewater reuse as a way to sustain the incredibly high water usage in hotels (estimated as 825 litres/day on average). In St. Kitts, the St. Kitts Marriot Hotel treats 272,800 m^3/y of wastewater and utilises 87% of it for golf course irrigation; other examples can be found in Antigua and Barbuda, the Grenadines and Trinidad and Tobago (where wastewater is reused also for industrial applications).

The table below identifies a set of conditions that would inform a preliminary assessment of an island's potential for wastewater reuse (Peters, 2015).

Feature	Answer
1 – Absence of surface water	Yes/No
2 – Absence of groundwater	Yes/No
3 – Annual rainfall less than 1000 mm	Yes/No
4 – High dependence on desalination	Yes/No
5 – Wastewater collection system in place	Yes/No
6 – Water supply from desalination greater than 10% of total supply	Yes/No
7 – Significant number of hotels treating own wastewater	Yes/No
8 – Price of water to domestic customers is more than US$ 2/m^3	Yes/No
9 – Average price of water to hotels twofold higher or more than to domestic customers	Yes/No
10 – Water use by the tourism sector greater than 10% of domestic demand	Yes/No
11 – Adequate legislation in place	Yes/No

Source: Peters, E. J. 2015, wastewater reuse in the Eastern Caribbean: a case study. Water Management - Proceedings of the Institution of Civil Engineers.

6.1.3 Step 2: Agree on the decision criteria and score options against them

In order to identify the adaptation objectives which will inform the prioritization, it may be helpful to refer to documents such as:

- The most recent National communication to the UNFCCC;
- The National Determined Contribution Report; and
- Other nationally endorsed documents.

The decision criteria need to be agreed and each criterion must be described, including the unit and span of possible scores, so as to provide a shared understanding to those involved in the assessment process.

Section 6.4.1 provides an example of decision criteria and of the description associated with their score scale.

The criteria for the MCA prioritisation may be gleaned from the project's Terms of Reference and/or from the country's most recent National Communication. During the workshop, stakeholders should comment and achieve consensus on the criteria.

In the interest of time, it would be best for the trainer/facilitator to prepare an example of criteria which would guide the participants as to the type of indicators to be used in this process. The participants will also be allowed to amend the list of criteria as necessary to ensure that it fits within the context of the issues experienced in the country.

Some examples of decision criteria can be:

- Effectiveness in achieving climate resilience;
- Economic benefits;
- Direct impact on public finances over the next five years;
- Social and gender impact;
- Environmental impact;
- Political feasibility;
- Legal, administrative and institutional feasibility.

Once the list of criteria has been identified and agreed upon, each adaptation option will be scored against each of the assessment criteria; scores will be assigned in a range from 5 = very high to 1 = very low. Table 6.1 provides an example table.

Table 6-1: Example of a populated table which shows the scores per criterion

Criterion	Green Energy Investment	Improve Water Quality Testing	Undertake Drilling Programme	Relocation of well heads	Installing Automated Telemetry	Install Additional Storage	Strengthening and Protection of pipes	Catchment Protection Measures
Effectiveness in achieving climate resilience	3	4	3	2	4	5	1	1
Economic benefits	4	4	3	2	4	5	2	3
Direct impact on public finances over next 5 years	5	2	4	3	2	4	3	4
Social and gender impact	3	2	2	3	4	5	2	1
Environmental impact	2	4	3	2	1	1	2	3

Box 6-6: Additional criteria to score options

The United Kingdom's Climate Impacts Programme (UKCIP) identifies a useful set of criteria that may be used to evaluate investment options to determine their attractiveness to development partners.

- Effectiveness – will the actions meet your objectives?
- Efficiency – do the benefits exceed the costs?
- Equity – the action should not adversely affect other areas or vulnerable groups.
- Flexibility – is it flexible and will it allow for adjustments and incremental implementation?
- Sustainability – does it contribute to sustainability objectives, and are they themselves sustainable?
- Practical – can the action be implemented on relevant timescales?
- Legitimacy – is it politically and socially acceptable?
- Urgency – how soon could it be implemented?
- Costs – consider social and environmental costs, not just economic.
- Robust – is the option able to cope with a range of future climate projections?
- Synergies / coherence with other strategic objectives – does it help to achieve other objectives?
- Any other factors which your organisation regards as important.

Source: UKCIP 2010, https://www.ukcip.org.uk/wizard/adaptation-options/

6.1.4 Step 3: Assign a weight to criteria to reflect priorities

The weight attached to each of the criteria will be formulated, with equal weights assigned to each criterion at the start. For example, if there are 5 criteria, then a weight of 0.20 can be assigned to each. An example weighting of criteria from an MCA workshop run in St. Kitts is shown in Box 6-7.

Box 6-7: Example criteria weighting for St. Kitts MCA exercise

Effectiveness in achieving climate resilience	0.25
Economic benefits	0.15
Direct impact on public finances over next 5 years	0.20
Social and gender impact	0.05
Environmental impact	0.05
Political feasibility	0.25
Legal, Administrative and institutional feasibility	0.05
Total	**1.00**

Once that the weight of each criterion has been decided, the weighted score of each option is calculated simply multiplying the score assigned in Step 2 by the weight of the relevant criterion. Table 6-2 provides an example completed table with the weighted score for each option.

Table 6-2: Example of a completed table which shows the weights per criterion; the weighted scores per criterion per alternative; and the total.

Criterion	Green Energy Investment	Improve Water Quality Testing	Undertake Drilling Programme	Relocation of well heads	Installing Automated Telemetry	Install Additional Storage	Strengthening and Protection of pipes	Catchment Protection Measures	Weight
Effectiveness in achieving climate resilience	0.20*3 = 0.6	0.2*4 = 0.8	0.6	0.4	0.8	1.0	0.2	0.2	0.20
Economic benefits	0.20*4 = 0.8	0.2*4 = 0.8	0.6	0.4	0.8	1.0	0.4	0.6	0.20
Direct impact on public finances over next 5 years	0.20*5 = 1.0	0.2*2 = 0.4	0.8	0.6	0.4	0.8	0.6	0.8	0.20
Social and gender impact	0.2*3 = 0.6	0.2*2 = 0.4	0.4	0.6	0.8	1.0	0.4	0.2	0.20
Environmental impact	0.2*2 = 0.4	0.2*4 = 0.8	0.6	0.4	0.2	0.2	0.4	0.6	0.20
Total weighted score	3.4	3.2	3.0	2.4	3.0	4	2.0	2.4	

6.1.5 Step 4: Rank the options

Finally, the weight-adjusted scores are aggregated and compared. The main result of an MCA is a rank order of adaptation options and an appreciation of the weaknesses and strengths of the attributes of each of the options. These results provide a more solid foundation for the full Cost Benefit Analysis (CBA) to be completed on the highest ranked options.

The option with the highest total weighted score is the most preferred. Three to five of the options with the top scores can be seriously considered for implementation. For the feasible options selected, it will be necessary to discuss mechanisms for implementation, which should include investment strategies, capacity needs, whether/how they align with national priorities and whether a more in depth cost benefit analysis [2] should be completed. Table 6-3 below provides an example of how the adaption options could be ranked based on the scores and weighted criteria.

It should be noted that the single weighted score combines a broad range of criteria, and has been scored subjectively by stakeholders. Therefore, it is critical to treat it as a guide, and to validate the prioritization with stakeholders, especially those who would be involved with implementing, operating and maintaining any options which are taken forward, as these stakeholders may be aware of more detailed issues requiring attention during planning.

Table 6-3: Example ranking of adaptation options on the basis of weighted score

Adaptation Option	Weighted Score
Install Additional Storage	4
Green Energy Investment	3.4
Improve Water Quality Testing	3.2
Undertake Drilling Programme	3.0
Installing Automated Telemetry	3.0
Relocation of Well heads	2.4
Catchment Protection Measures	2.4
Strengthening and Protection of Pipes	2.0

6.1.6 Other prioritisation techniques

A wide range of prioritisation techniques are available to help prioritise options for implementation and each of these has its own strengths and weaknesses and should be selected on a fit for purpose basis (see Figure 6-2). Cost Benefit Analysis and Cost-Effectiveness Analysis (CEA) are single criteria methods aimed at assessing whether the return on investment is worthwhile using a single monetary value. Given the uncertainty that can be associated with the calculation of the monetary benefits of certain options (e.g. legislative reforms, watershed protection etc.), it is important that when BCA or CEA are chosen, the assumptions made for monetisation of costs and benefits are clearly presented.

2 A Benefit Cost Analysis (BCA) is a process by which business decisions are analysed. The benefits as it may pertain to a certain programme or project are identified and listed with the associated costs as it relates to implementation being highly considered.

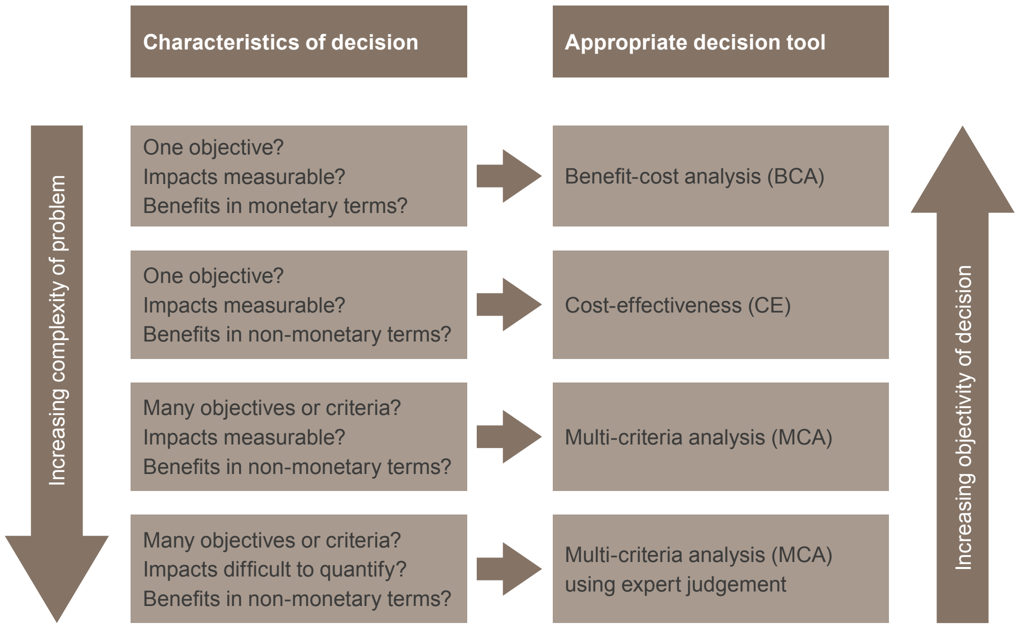


Figure 6-2: Key considerations on the use of MCA, BCA and CEA for prioritisation

Source: UNFCCC, 2011. Assessing the Costs and Benefits of Adaptation Options: An Overview of Approaches. The Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change.

BCA is a well-established method for project-appraisal and consists in selecting options on the basis of a threshold value of the result (e.g. size of net present values, benefit-cost ratio, economic rate of return). However, BCA does not address the relative distribution of benefits and costs among different stakeholders and the choice of discount rate to deal with future costs and benefits is a problematic area. Ensuring that social and economic costs and returns are included in the BCA and agreeing on their monetisation can be difficult but should be attempted. This is especially true in the area of natural resources management where externalities of development are far-reaching.

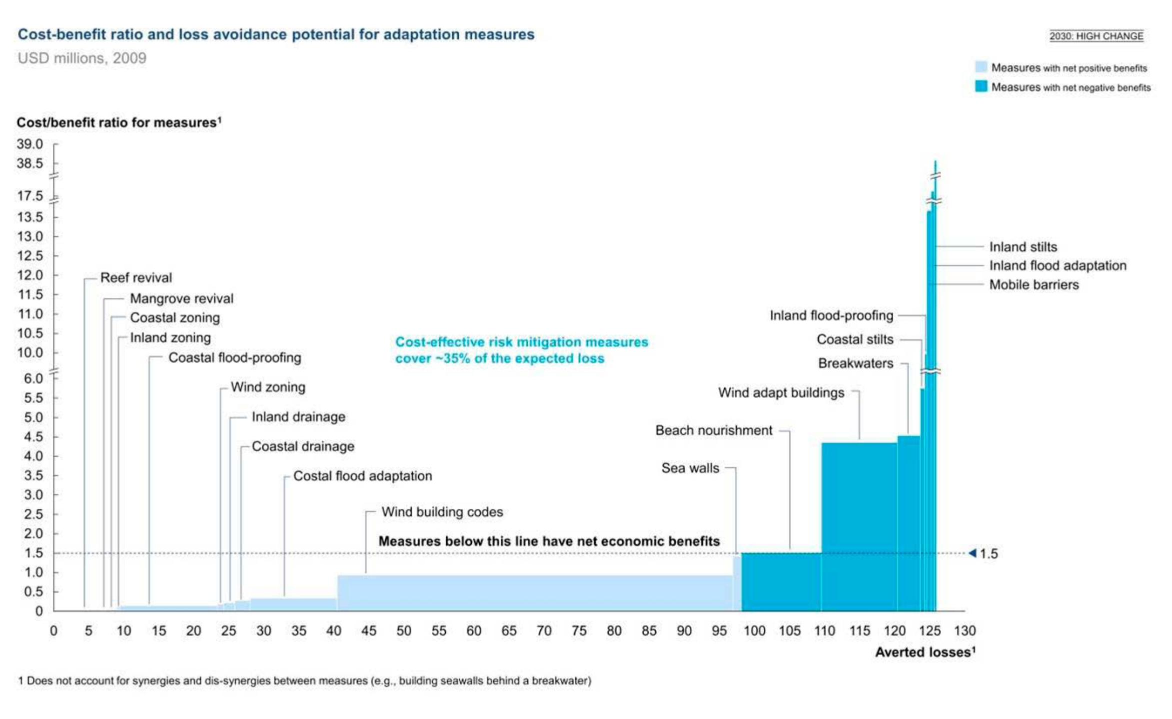
CEA is more suitable for conditions where the number of risks faced by a country is limited and where it is difficult to quantify benefits. Options which provide benefits are ranked according to their cost per unit of benefit. This is the basis of the adaptation cost curve by the Economics of Climate Adaptation (ECA) working group and this method has been applied in the Caribbean context by the Caribbean Catastrophe Risk Insurance Facility (see Box 6-8),

Box 6-8: The Caribbean Catastrophe Risk Insurance Facility (CCRIF) results of the Economics of Climate Adaptation (ECA) Study

A component of the ECA study carried out by CCRIF provided a high level estimate of the cost effectiveness of adaptation options for eight pilot countries Anguilla, Cayman Islands, Antigua and Barbuda, Dominica, Barbados, Jamaica, Bermuda and St. Lucia.

This is a methodology for the identification, assessment and ranking of projects for the reduction of climate risks. It can apply to situations where there is a specific overriding climate-related risk that can be addressed by a number of different policy responses. These responses may be alternative or cumulative in nature. The cost curve plots the quantitative impact of the various options on the problem (x axis) against their cost-effectiveness or cost per unit of benefit (y axis).

In the figure below, risk reduction options are presented for Barbados to reduce the negative impacts of climate change in 2030 under a high climate change scenario. The approach to assess the climate risks uses projections of future climate hazards (such as hurricanes) into the future as well as an assessment of the value of assets exposed to these hazards and their vulnerability (a measure of how much damage a hazard could inflict on an asset). Different adaptation options are then applied and their benefit-cost ratio together with the reduction in impact are assessed. The options are then ranked on a curve to indicate their cost-effectiveness. In the case of Barbados, the analysis indicates that reef revival, mangrove revival and coastal zoning can together avert ~US$ 10 million in losses for a much lower cost, making them attractive options. On the other hand mobile barriers, coastal stilts and breakwaters are more costly than the losses they would avert, making them less attractive.



Although this assessment provides adaptation options for 2030, it would also be interesting to see a cost curve for the current climate risks. This would help identify those measures which are currently attractive and compare them with future adaptation options to identify changes in the cost benefit ratio in the future. This could be used to make the case for actions to be undertaken regardless of climate change projections.

Source: CCRIF, 2010, Enhancing the Climate Risk and Adaptation Fact Base for the Caribbean: An informational brochure highlighting the preliminary results of the Economics of Climate Adaptation (ECA) Study available from www.ccrif.org The study was implemented by CCRIF and regional partners including Caribbean Community Climate Change Centre and UN Economic Commission for Latin America and the Caribbean, with analytical support provided by McKinsey and Company and by Swiss Re, who developed the loss assessment model. It is based on the ECA framework developed by the ECA working group.

6.2 Section 6: Case examples and other relevant material

6.2.1 Lessons learned from the MCA in St. Kitts and Nevis and Grenada

As a result of the completion of the MCA exercises in both Grenada and St. Kitts and Nevis, the following strengths were identified:

- Learning process that stimulates discussion and facilitates a common understanding of the decision problem;
- Openness to divergent values and opinions;
- Capability to tackle qualitative and intangible factors;
- Accountability (systematic, transparent);
- Support a broad stakeholder participation;
- Preferences are revealed in a more explicit and more direct way.

However, there are some weaknesses which were observed during the course of the exercise which were identified as follows:

- Potentially time consuming and technically complex;
- Perceived as a technocratic approach;
- Choice of stakeholders and timing of their participation;
- Experts/stakeholders are reluctant to share their knowledge and values.

On completion of the MCA exercise, follow up consultations were held with key stakeholders to ensure that the outputs from the exercise accurately reflect what was discussed during the workshop.

6.2.2 Case example: Options identified to increase climate resilience in St. Kitts

Box 6-9: Long-list of options identified to increase climate resilience in St. Kitts

Water scarcity and drought:

- Development of new and more resilient water sources (e.g. Additional 1 MGD of water production from new deep wells);
- Desalination as a short term option to provide additional supplies through ongoing drought (back-up source);
- Increase investment in measures set out in the Water Conservation Plan, including further investment in leak detection and repair and bulk metering with SCADA telemetry in order to reduce NRW and leakage;
- Identify green energy investments such as solar/wind and retrofit with more efficient pumps to reduce carbon emissions and bring down costs;
- Investment in alternative water supplies for agriculture (potentially converting surface water sources) to reduce consumption of potable water, especially during periods of low water availability.

Hurricane and flood:

- Raising and protecting or relocating exposed well heads and assets to reduce flood risk;
- Renovating and replacing back-up generators to ensure continuity of services during power outages;
- Installing automated telemetry to close treatment works when turbidity threshold is exceeded to avoid damage to treatment works or turbidity entering the distribution system;
- Conservation works to improve and maintain the watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds;
- Installing small scale water storage systems, with appropriate treatment systems to provide emergency water supplies to key facilities (including government) and community emergency shelters;
- Improvement in drainage infrastructure to reduce flood risks to water infrastructure and other property infrastructure.

Water quality and pollution:

- Invest in catchment protection measures as appropriate, including reforestation, slope stabilisation, incentives and community initiatives;
- Improve water quality testing facilities and sampling programmes including capacity development for staff.

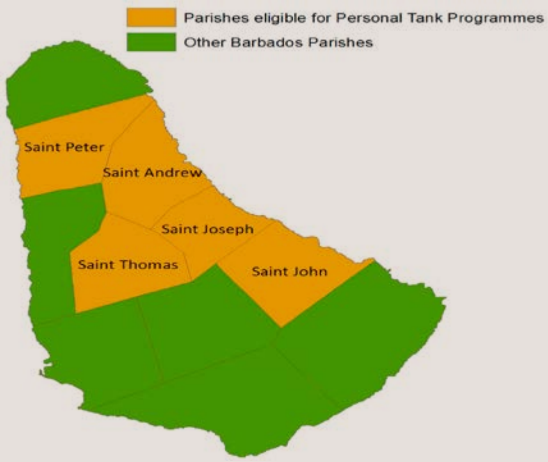
Source: St. Kitts and Nevis - Task 1 - Climate Risk and Vulnerability Assessment (CRVA) - Part D, Chapter 9

Table 6-4 provides the list of adaptation options and weighted score from the St. Kitts analysis:

Table 6-4: St. Kitts – Results of the MCA analysis

Investment options to alleviate risks	Total Weighted Score	Effectiveness in achieving climate resilience	Economic benefits	Direct impact on public finances over next 5 years	Social and gender impact	Environmental impact	Political feasibility	Legal, administrative & institutional feasibility
	Weighting factors	0.25	0.20	0.20	0.10	0.15	0.05	0.05
Development of new and more resilient water sources (e.g. Additional 1 MGD production from new deep wells)	3.25	1.00	0.80	0.20	0.30	0.45	0.25	0.25
Desalination as a short term option to provide additional supplies through ongoing drought (Backup source)	1.65	0.25	0.20	0.20	0.10	0.75	0.10	0.05
Increase investment in measures set out in Water Conservation Plan (including further investment in leak detection and repair and bulk metering with SCADA telemetry in order to reduce NRW and leakage)	3.45	1.00	0.80	0.20	0.30	0.75	0.20	0.20
Identify green energy investments such as solar/wind and retrofitting with more efficient pumps to reduce carbon emissions and bring down costs	3.65	1.25	0.80	0.20	0.30	0.60	0.25	0.25
Investment in alternative water supplies for agriculture (potentially converting surface water sources) to reduce consumption of potable water, especially during periods of low water availability	3.20	1.00	0.80	0.20	0.30	0.60	0.20	0.10
Raising and Protecting or relocating well heads and auxillary infrastructure assets to reduce flood risk, where exposed	2.50	0.75	0.40	0.40	0.10	0.45	0.20	0.20
Renovating and Replacing backup generators to ensure continuity of services during power outages	3.60	1.00	0.80	0.80	0.30	0.30	0.20	0.20
Installing automated telemetry to close treatment works when turbidity threshold is exceeded to avoid damage to treatment works or turbidity entering the distribution system	3.25	1.00	0.60	0.80	0.20	0.30	0.15	0.20
Conservation works to improve and maintain the watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds	3.25	1.00	0.60	0.80	0.10	0.45	0.10	0.20
Installing small scale water storage systems, with appropriate treatment systems to provide emergency water supplies to key facilities (including government) and community emergency shelters	3.90	1.25	0.60	0.80	0.40	0.60	0.15	0.10
Improvement in drainage infrastructure to reduce flood risks to water infrastructure and other property infrastructure	2.70	0.75	0.60	0.40	0.30	0.45	0.10	0.10
Invest in catchment protection measures as appropriate, including reforestation, slope stabilisation, incentives and community initiatives	4.00	1.25	1.00	0.60	0.10	0.75	0.15	0.15
Improve water quality testing facilities and sampling programmes including capacity development for staff	3.60	0.75	0.80	0.80	0.40	0.60	0.15	0.10
Hydrogeological mapping and baseline studies	3.30	1.00	0.80	0.40	0.20	0.60	0.15	0.15

6.2.3 Inspirational case examples from the Caribbean Region



Source: (CAWASA Newsletter Jan-March 2018.)

Box 6-10: Case example: Personal Water Tank Programme in Barbados

The Personal Water Tank Programme (PTP), which is a public/private partnership (PPP) between Barbados Water Authority (BWA) and the City of Bridgetown Credit Union, was launched by BWA in 2017 with the aim of ease impacts of drought amongst the most vulnerable communities.

The programme offers residents in eligible parishes (see figure) to install a 400-gallon tank (comprehensive of pump and fittings) under a 5 year interest-free hire purchase agreement from the BWA. Installation is free and the tank is filled by BWA tankers during outages.

Box 6-11: Case example: Meter replacement programme in Barbados

BWA has recently completed an ambitious water meter replacement programme, which resulted in the installation of 82,000 smart ultrasonic domestic meters and other related activities such as:

- Update of customers database;
- Implementation of a recycling workshop for material of deposited meters;
- Training of staff on tools and reading methods.

Project overview

Total budget: approximately US$ 26 million (financed through the Canadian Commercial Corporation)

Duration: 3 years (2014-2017)

Key results:

- 15% increase in BWA's income;
- 40% increase of metered volumes;
- Secure meter readings and reduced time of meter reading rounds.

Source: Ms Andrea Gill, Project Manager at BWA, personal communication (2018)

Box 6-12: Case example: Peer learning to enhance capacity in Belize

Promoting knowledge sharing and best practices among water utilities operators allows to circulate know-how and competencies across the region, and to enhance technical capacity inside the utility and increasing involvement, awareness and stewardship of the operators. Experience exchanges allow for the development of synergies and improvements in the sector, building regional collaboration and support mechanisms.

In the Caribbean Region, GWOPA/UN Habitat funded (together with IDB and PPIAF) a Water Operators' Partnership (WOP) project between Belize Water Services (BWS) and Contra Costa Water District (CCWD), a California-based water utility.

WOP project overview

Total budget: US$ 100,000

Duration: 5 years (2010-2015)

Key results:

- 119 employees (+50% of staff) completed 215 water operators certificates
- Safety Committee created
- US$ 350,000 investment in safety equipment
- SCADA system introduced
- Tariff system modernized

In Europe, an innovative exchange programme was launched in 2017 by Aqua Publica Europea: the APE Water Erasmus. The programme, through voluntary short-term exchanges, aims at sharing knowledge and enhancing capacity across European water utilities.

Source: APE Website and GWOPA. (2015, December 02). WOP: BWS and CCWD . Retrieved February 27, 2018, from GWOPA, UN HABITAT: http://gwopa.org/en/wop-profiles/wop-belize-water-services-limited-and-contra-costa-water-district

Box 6-13: Case example: Ground water supply enhancement in Nevis

Nevis mostly relies on groundwater, which is mainly abstracted from three coastal aquifers in the west, southeast and northwest of the volcanic island. Three new wells have been recently drilled (2008) into deep volcanic aquifers by Bedrock Exploration and Development Ltd (BEAD) under a public private partnership; two of these (Maddens Height and Fothergills) are currently operational and produce 1 MGD of supply.

Deep groundwater was considered as a preferred option over other supply side interventions because:

- It is less subject to saltwater intrusion than shallow wells (thanks to higher water tables and larger freshwater interfaces) and less subject to contamination than surface water resources;
- This intervention has cheaper installation, operational and maintenance costs, as well as lower environmental impacts than desalination;
- Larger freshwater interfaces coupled with heavy permeability and porosity means large abstraction and recharge rates.

The use of deep water wells is expected to be more resilient to climate risks and drought events since:

- The water chemistry in deep water wells tends to be constant;
- They are fully protected from surface water contaminants: the use of raised well heads avoids water turbidity issues;
- They are protected from surface flow restrictions which can occur during hurricanes and tropical storms, such as fallen trees and debris;
- The use of back-up generators avoids any type of other down-time.

The deep wells have helped to mitigate the effects of drought over the past decade as they provide more reliable supplies than the coastal wells, which are vulnerable to saline intrusion. However, despite recent investments by the Water Department which improved water infrastructure and took NRW down to 25%, growing demand associated with tourism development, coupled with ageing and deteriorating wells, requires additional deep wells to increase supplies.

Lessons learned and opportunities:

- Planning of adaptation options to increase water supply needs to factor in projected demand;
- Lack of data and specific island geology can be barriers to implementation in other islands;
- Land ownership and land-use policies need to allow this type of intervention;
- There are opportunities for water source and use diversification (e.g. shallow aquifer could be used to supply water for irrigation purposes);
- These type of interventions (and associated feasibility studies) can provide opportunities to increase education on groundwater resources and to gather data on the islands' hydrogeological system.

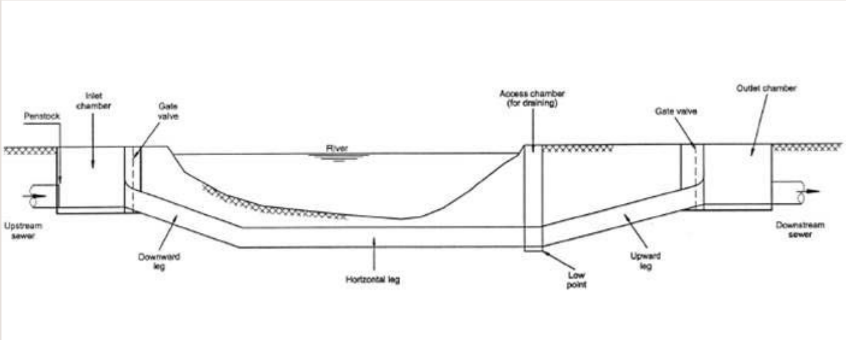
Source: HR Wallingford. (2017a). Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean - St. Kitts and Nevis - Task 1 - Climate Risk and Vulnerability Assessment Report. Wallingford, UK: HR Wallingford.

Box 6-14: Case example: Improved infrastructure design to improve resilience

Some Caribbean countries face technical challenges to protect their infrastructure from climate hazards, due to their steep and complex topography. Access to intakes can be difficult when these are located at high elevations; also, landslides and debris can impact and damage intake structures, pipes and water treatment plants. In this complex context, innovative solutions need to be investigated and learning from countries with similar challenges can be an advantage.

The Central Water and Sewerage Authority in St. Vincent and the Grenadines, for example, is currently working on infrastructural improvements to increase resilience of their water supply system to natural hazards. Actions taken to:

- Improve river crossing design – Traditional simple supports which are built along the cross section of rivers proved to be highly vulnerable to flooding and earth movements. Therefore, new, more resilient designs are being investigated. These include the possibility of laying pipes directly in the river bed via inverted siphon formation (see '1' below), as well as the use of suspension cables to span the entire cross-section of the river (see '2' below) above the maximum possible flows and across gorges.
  Most interventions recently put in place have not been tested under an extreme weather event to date. However, the 200 ft inverted siphon river crossing at Perseverance has remained intact since April 2011, following severe flooding on Christmas Eve 2013 and successive flood events in November 2016.(Bernard Maloney, Engineer at CWSA).



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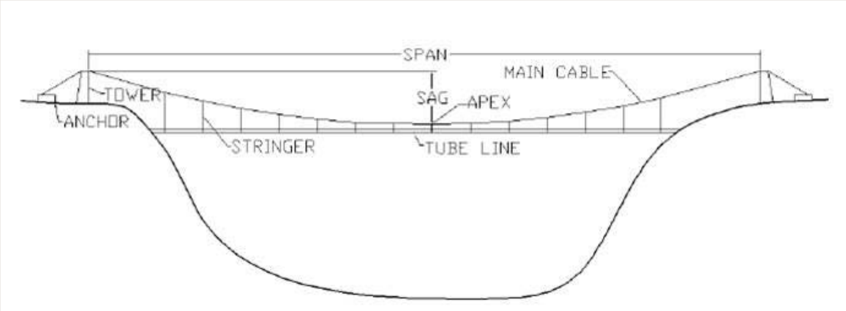


2

- Upgrade treatment to cope with higher turbidity – The application of Multimedia Filtration technologies to reduce the silt load of raw water is being trialled.
- Produce digital maps of the network – The digitisation of network infrastructure is under development with a view to improve asset management and leak detection and control, as well as measure network vulnerability to natural hazards.

Source: Mr Bernard Maloney (CWSA Engineer) 2018, personal communication

Box 6-15: Knowledge Brief – Community engagement

Informed and educated communities can play an important role in building resilience of the water supply sector, address potential conflicts between competing needs, and ensure effective governance. Aware water users have more confidence in tap water, are more prone to implement conservation measures and water-efficient behaviours, but also more inclined to accept reviews of water tariffs. Especially in the Caribbean region, where independent regulators are often absent and water tariff updates not frequent, it is important to communicate to the community the true value of water and make a strong case for water conservation and tariff reforms.

Communication tools can be websites, bills and bill inserts, as well as social media, blogs and online tools such as bill calculators.

Who is the community?

Consumers, citizens, general public, communities of place (groups of individuals linked by a shared location), communities of interest (groups of individuals linked by a shared interest), stakeholders (individuals that have an interest in the issue).

What is engagement?

A process of establishing effective and productive relationships to enable a shared understanding of goals or a shared commitment to change. Public participation can be developed on different levels, as shown in the figure below.

Increasing impact on the decision →

Inform	Consult	Involve	Collaborate	Empower
To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.

Source: IAP2 Federation and Dean et al. 2016

Characteristics of successful engagement

A successful community engagement strategy will:

- Use consistent and constant communication practices: these must be conducted throughout the year and not only during droughts or some months before appealing for an increase in water tariffs;
- Promote transparency and accuracy: share up to date, publicly available reports on water utility missions, targets and performance;
- Allow community engagement: through workshops, consultations, education programmes;
- Convey convincing messages and effective framing: fact-based messages which provide details on safety, cost savings, environmental sustainability, adoption of innovative technologies and commitment to high standards of service and customer satisfaction;
- Evaluate outcomes of the engagement activity: performance indicators must be set at the development stage of the strategy and measured through the whole life of the project.

Evaluation of outcomes

The evaluation of outcomes should be based on a mix of different indicators:

- Process indicators: number of community members engaged with, representativeness of the individuals of the broader community, participant satisfaction, number of complaints about the engagement;
- Outcome indicators: change in knowledge, attitude and behaviours, community preference and values incorporated into a policy or decision;
- Impact indicators: reduced water demand, improved water quality, greater community trust in the organisation, ongoing stewardship activities.

In particular, due to its sensitiveness, the rate-setting process may require an ad-hoc communication strategy, separate from the general communication strategy used by the utility.

Case examples

A survey sent by HR Wallingford to Caribbean Countries in 2018 highlighted that improving awareness and public education is a key priority for most of the utilities in the region and, where education measures have been implemented, these have proved to be successful and effective in changing users' behaviour and enhancing resilience.

Montserrat - Educational outreach in the primary schools to inform students on the need to conserve water and the impacts of climate change. Children were receptive and are known to transfer the information to their parents which makes the measure effective in information transmission.

Antigua and Barbuda - Since drought conditions are recurrent in Antigua and Barbuda, the Water Business Unit has maintained a water conservation program since 1992, whose intensity varies depending on the severity of the impact on water resources. The programme includes a school program, which also consists in nominating "Water Police Officers" among students with the role of encouraging good water conservation behaviour, as well as adverts and presentations on mass-media channels.

St. Vincent and the Grenadines - An awareness campaign will be undertaken in 2018 by CWSA to create national awareness among population and customer base regarding the importance of water, leaks reporting and the need for conserving water and enhance domestic water capability of customers.

Lessons learned

- Audio-visual formats and children education have proven to be an effective way of raising awareness among communities;
- It is unclear whether the effectiveness of community engagement programmes can be supported by quantitative indicators;
- Social-media (Facebook, Twitter, You-Tube, Instagram) should have a main role in water conservation and awareness campaigns not only to reach out to a higher number of users but also as a way of translating conservation messages into familiar and popular means of communication.

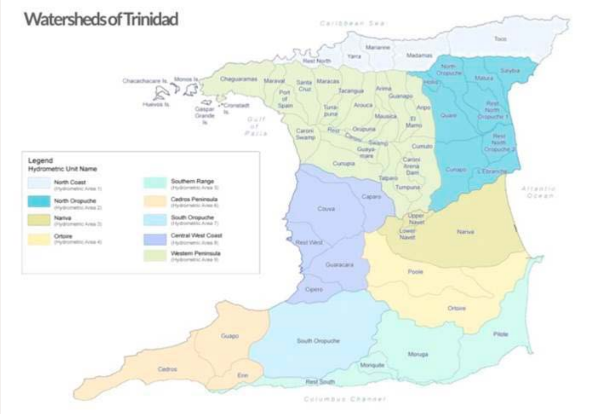
Source: Dean, Fielding, Newton, and Ross, 2016, (Mulki, 2016), (APE, 2018)

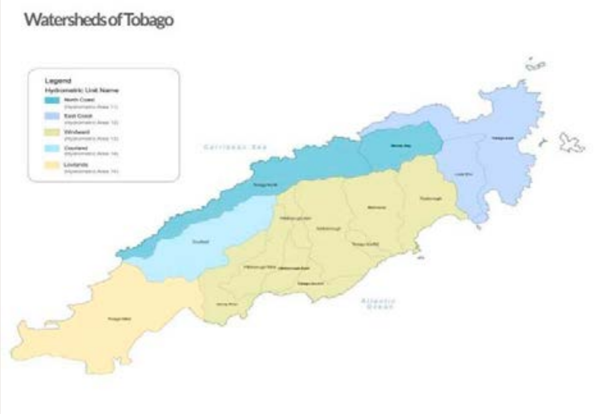
Box 6-16: Case Example – Increasing awareness in Trinidad and Tobago

In 2012 the Water and Sewerage Authority of Trinidad and Tobago (T&T) launched the Adopt a River Programme aimed, among others, at:

- Increasing awareness towards water issues in T&T in the community (see Box 6-16);
- Improving the status of water resources and watersheds in T&T.

The programme includes an evaluation tool to assess progresses in community participation, awareness, water quality and cost/benefits and included community training programmes. The dedicated website (http://www.adoptarivertt.com/) includes information regarding watersheds, water quality testing and other linked activities and initiatives.





6.2.4 Relevant material and other resources

Box 6-17: Relevant material and other resources

Multi Criteria Analysis : A manual (2009)

This manual provides guidance for Government officials and other practitioners on how to undertake and make the best use of multi-criteria analysis (MCA) for the appraisal of options for policy and other decisions including, but not limited to, those having implications for the environment. It covers a range of techniques which can be of practical value to public decision makers and are increasingly being used in the UK and in other countries. They are described in this manual as MCA techniques.

Available at: http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf

A Comparison of Multi Criteria Analysis Techniques for Water Resources Management (2006)

This paper applies MCA to six water management decision problems. The MCA methods tested include weighted summation and range of value. The results suggest that whilst selection of the MCA technique is important, more emphasis is needed on the initial structuring of the decision problem, which involves choosing criteria and decision options

Available at: https://www.napawatersheds.org/img/managed/Document/3483/Hajkowicz2008%20 AComparisonOfMultipleCriteriaAnalysisTechniqu.pdf

Climate change adaptation technologies for water (UN Environment, 2017)

This guide focuses on adaptation technologies for ensuring sustainable supplies of clean water and mitigation of water-related disasters. This guide takes six current climate-related water challenges as an entry point to identifying relevant adaptation responses, followed by identification of the specific water adaptation technologies relevant for each response.

Available at: https://www.ctc-n.org/sites/www.ctc-n.org/files/resources/water_adaptation_technologies_0.pdf

6.3 Section 6: Notes for the trainer / facilitator

6.3.1 Preparatory activities

Prior to the workshop, the trainer will need to organise the collection of the following information:

- Reports on capital investment budget spending for all Government departments for the last 10 years, and projections for capital spending budgets for future years;
- Relevant country macroeconomic assessments and projections from key external financing agencies (CDB, IADB, World Bank, EIB);
- Details of future investment plans and intentions by water and energy utilities, and by other institutions and companies with a major potential impact on water resources management or usage;
- Portfolio of projects for financing, prepared by governments and utilities for potential funding by climate finance and other international financing agencies;
- Sector and project assessment and appraisals by the above mentioned agencies, specifically relevant to water, power and energy, agriculture and other climate-sensitive sectors;
- Technical, economic and financial reports on projects in relevant sectoral areas by consultants, or other agencies.

As the outputs from the MCA exercise can be used to contribute to the development of future investment plans, collecting this information will allow for an easier transition towards this next phase. However, should the trainer not be able to secure this data/information prior to the workshop, the workshop itself serves as a good opportunity to follow up on the request and to confirm what data is readily available.

Section 6.4.4 provides an example of a data request form which can be used as a starting point to discuss data availability and access with stakeholders.

6.3.2 Useful resources and information

- Any existing climate risk and vulnerability assessment reports;
- Investment plans or recommendations for investment (past / current);
- Most recent UNFCCC National Communication Report;
- UNFCCC Nationally Determined Contribution (NDC) Report;
- Any other nationally endorsed documents;
- Information that supports the proposed adaptation options in terms of providing an Enabling Environment (policy and legislation);
- National Sustainable Development Policy;
- Climate Change (Adaptation) Policy;
- National Economic Development Growth Strategy / Policy;
- National (Renewable) Energy Policy.

6.3.3 Key stakeholders

Key personnel from the water sector that should be considered should include:

- Water utility staff (managers, engineers, field staff, operators);
- Representatives from Government Ministries such as energy, education, tourism, health, agriculture, finance and disaster management;
- Meteorological Office;
- Private sector groups, Civil Society Organisations, Non-Governmental Organisations;
- Electric utility staff.

6.3.4 Guiding the assessment

- The MCA process is not always easily understood until the participants start the exercise. It should be clearly explained that although the exercise may seem a bit complicated during initial discussions, the process becomes easier to understand once the exercise begins.
- As mentioned in a previous section, it would be best for the trainer/facilitator to prepare an example of criterion which would guide the participants to the type of indicators to be used in this process. Participants must be advised that the criterion initially presented is just an example and that they should feel free to amend (add or remove) the criterion as necessary.
- Once the criterion has been agreed upon, a score (from high to low) will be assigned per criterion for each adaptation option. Participants should be given enough time to express the reason for selecting a score and arrive at a general consensus before moving on to assigning a weight.
- The activity of assigning a weight to the selected criteria can be a lengthy process. As the sum of the weight of each criteria must equal to one, facilitators should present the example by assigning an equal weight across all criteria. It must also be explained to the participants that the weighting assigned can be a number with more than one decimal (e.g. 0.26 instead of 0.2).
- Participants should be allowed to thoughtfully express their reasons for assigning the weight to the different criteria.
- An automated table to calculate the scores should be prepared prior to the workshop and populated throughout the exercise. This will allow the participants to see how the adaptation solutions were scored and ranked immediately on completion of the exercise. Prior to closing the workshop, the scores can be amended if the participants are not in agreement with the adaptation options been identified as high priority ones.
- The facilitator should encourage the participants to contribute to the discussions surrounding the MCA. However, guidance should be given to ensure that the discussion does not go off topic (discussion not related to the MCA or water sector) for an extended period of time.
- The results from the MCA should be shared with the participants to ensure that the outputs adequately reflect the discussions which occurred during the workshop. The selected adaptation solutions from this exercise will be used during the development of strategic and or investment plans (long term planning).

6.3.5 Exercises and discussion topics

<table>
<tr><th colspan="2">Group Session 1</th></tr>
<tr><td>Title
Development of MCA.</td><td>Type
Working groups.</td></tr>
<tr><td colspan="2">Objectives
Complete the MCA for adaptation options identified on a national level. Also, to discuss how the results from an MCA can be used to in developing short, medium and long term strategies and plans for the water sector.</td></tr>
<tr><td colspan="2">Link with other materials
Section 5.</td></tr>
<tr><td>Duration
1 day.</td><td>Materials needed
■ Copies of templates/tables to be populated with criteria, assigned scores and assigned weights.
■ Post-it notes, paper and pens/pencils.
■ Flipchart and pen to record discussion.</td></tr>
<tr><td colspan="2">Preparation
■ Identify an appropriate venue for the workshop.
■ Identify and invite relevant stakeholders.
■ Prepare the necessary PowerPoint presentation(s) and associated materials.</td></tr>
<tr><td colspan="2">Description of tasks and instructions
Step 1: Introduction to the activity
■ Give some background to the activity, based on the information provided in the Training Manual for Section 6.
Step 2: Identify criteria to be used and assign scores to adaptation options
■ Review the list of adaptation options provided (by the trainer) as a result of the CRVA exercise or of other national processes.
■ Identify the criteria to be used during this activity.
■ Discuss the reasons for choosing the criteria and how each criterion can be scored against the adaptation options.
Task 3: Assign the weighting to the criteria
■ Discuss the weighting assigned to the criteria.
Task 4: Wrap-up
■ Rank the adaptation options and summarise outcomes of the analysis.</td></tr>
<tr><td colspan="2">Following the workshop
■ Report on the outcomes of the workshop.
■ Provide recommendations on how best to apply the results of the MCA to allow decision makers to develop and implement short, medium and long term plans for the water sector.</td></tr>
</table>

6.4 Section 6: Annexes

6.4.1 List of potential adaptation options

Legend

1	Positive benefits
2	No benefits
3	Potential for negative impacts unless managed

Pillar	Cluster	Adaptation action	Drought	Heavy rainfall	High wind speeds	Storm surge	Sea level rise	Climate change mitigation co-benefits	Environmental co-benefits	Operational cost saving co-benefits
Enabling Environment	Institutional roles and responsibilities	Establishment of multi-stakeholder forums to support decision-making in relation to climate-risks	1	1	1	1	1	2	2	2
		Establishment of national goals and targets in relation to climate resilience	1	1	1	1	1	2	2	2
		Inclusion of climate resilience and adaptation in relevant institutions mandates	1	1	1	1	1	2	2	2
	National policies and strategies	Policy and legislative reform to provide a platform for investment for resilience	1	1	1	1	1	2	2	2
		Inclusion of gender-sensitive considerations in national water and climate policies and strategies	1	1	1	1	1	2	2	2
		Consultation with climate experts for the development of water policies and plans	1	1	1	1	1	2	2	2
		Alignment of national policies with regional and international agreements on climate change and adaptation	1	1	1	1	1	2	2	2
	Institutional capacity and knowledge base	Raising political support for enhanced resilience in the water sector	1	1	1	1	1	2	2	2
		Institutional strengthening and capacity development to support investment plan preparation	1	1	1	1	1	2	2	2
		Establishment of climate-relevant knowledge exchange platforms among decision-makers	1	1	1	1	1	2	2	2
		Mainstreaming results of CRVAs into the formulation of strategies and plans	1	1	1	1	1	2	2	2
		Mainstream climate risk into planning processes for water supply services	1	1	1	1	1	2	2	2

Pillar	Cluster	Adaptation action	Drought	Heavy rainfall	High wind speeds	Storm surge	Sea level rise	Climate change mitigation co-benefits	Environmental co-benefits	Operational cost saving co-benefits
Water resources and watershed management	Water resources data and information	Improve collection, management and use of hydro-meteorological data	1	1	1	1	1	2	2	2
		Improve collection, management and use of water use data	1	1	1	1	1	2	2	2
		Implement and maintain short and long-term water resources monitoring systems	1	1	1	1	1	2	2	2
	Water resources management	Develop Water resources drought management plans	1	2	2	2	2	2	1	1
		Improve estimates of source yields under normal and drought conditions, and future climate change scenarios	1	2	2	2	2	2	2	2
		Hydrological and hydrogeological models of sources to improve yield estimates	1	2	2	2	2	2	2	2
		Apply IWRM principles and practice as part of the overall water resources framework	1	1	1	1	2	1	1	1
		Licensing arrangements	1	2	2	2	2	2	1	2
		Conjunctive use policies	1	2	2	2	2	2	1	2
		Groundwater	1	3	3	3	3	2	2	2
		Desalination	1	3	3	3	3	3	3	3
		New / relocated surface water intakes	1	1	1	2	2	2	2	2
		Inter-basin transfers	1	2	2	2	2	2	3	3
		Domestic level rainwater harvesting	1	1	1	1	2	2	2	2
		Water recycling and reuse	1	2	2	2	2	1	1	2
		Incorporate seasonal forecasting into short term planning	1	1	1	1	2	2	2	2
	Catchment and aquifer management	Forest management activities to improve soil cover	1	1	1	1	2	1	1	1
		Reforestation and slope stabilisation works	1	1	1	1	2	1	1	1
		Agricultural practices which promote soil conservation	1	1	1	1	2	1	1	1
		Catchment risk assessments and action plans	1	1	1	1	2	1	1	1
		Community engagement in catchment management issues	1	1	1	1	2	1	1	1
		Inter-agency collaboration mechanism for cross cutting land management issues	1	1	1	1	1	1	1	1
		Land use zoning in aquifer recharge areas and water catchments, and supporting legal instruments	1	1	1	1	2	1	1	1
		Assess potential benefits of nature-based solutions to reduce catchment vulnerability	1	1	1	1	2	1	1	1

Pillar	Cluster	Adaptation action	Drought	Heavy rainfall	High wind speeds	Storm surge	Sea level rise	Climate change mitigation co-benefits	Environmental co-benefits	Operational cost saving co-benefits
Water supply systems	Water supply strategy and action plans	Scenarios of future supply and demand under climate change and socio-economic change	1	2	2	2	2	2	2	2
		Define levels of service and carry out supply / demand balance for present day and future scenarios	1	2	2	2	2	2	2	2
		Climate change projections to support long term planning and a mechanism for periodic review	1	1	1	1	1	2	2	2
		Adopt a long-term planning perspective into strategies and plans for water service provision	1	1	1	1	1	1	1	2
	Flexibility and redundancy in supply systems	Agree water system performance criteria and measurement system	1	1	1	1	1	2	2	2
		Asset database and asset management system	2	1	1	1	1	2	2	1
		Hydraulic model of supply systems to facilitate identification of improvements	1	1	1	1	1	2	2	2
		Managed Aquifer Recharge	1	1	2	2	2	2	2	2
		Water efficiency of large water users	1	2	2	2	2	1	1	2
		Irrigation efficiency and management systems	1	2	2	2	2	1	1	2
		Customer metering	1	2	2	2	2	2	1	1
		Demand management areas with district metering	1	2	2	2	2	2	2	1
		SCADA systems to optimise management of supply systems	1	1	1	1	1	1	1	1
		Active leak detection and repair	1	2	2	2	2	1	1	1
		Tariff reform to incentivise efficient water use	1	2	2	2	2	1	1	1
		Legal instruments to promote water efficiency in new-builds	1	2	2	2	2	1	1	1
		Financial / legal incentives for water saving devices	1	2	2	2	2	1	1	2
	Critical infrastructure and assets	Review design standards for infrastructure and natural hazards	2	1	1	1	1	2	2	2
		Online raw water reservoirs	1	3	2	2	2	2	2	2
		Offline raw water reservoirs	1	2	2	2	2	2	2	2
		Treated water storage	2	1	1	1	2	2	2	1
		Domestic level storage	2	1	1	1	2	2	2	1
		Raising and improving well heads	2	1	1	1	1	2	2	1
		Real time monitoring of salinity at well heads	1	2	2	1	1	2	2	2
		Pumping regimes which minimise the risk of saline intrusion	1	2	2	1	1	2	2	2

Pillar	Cluster	Adaptation action	Drought	Heavy rainfall	High wind speeds	Storm surge	Sea level rise	Climate change mitigation co-benefits	Environmental co-benefits	Operational cost saving co-benefits
Water supply systems	Critical infrastructure and assets	Strengthening and improving intakes	2	1	1	2	2	2	2	1
		Improved removal of sediment in raw water	2	1	1	2	2	2	2	1
		Monitor and automatic shutoff when raw water turbidity exceeds threshold	2	1	1	2	2	2	2	1
		Strengthening treatment plant buildings to withstand storms	2	1	1	1	2	2	2	2
		Strengthening pump house buildings to withstand storms	2	1	1	1	2	2	2	2
		Assessing pipeline vulnerability to climate risks to prioritise and proactively manage risks	2	1	1	1	2	2	2	2
		Re-route or strengthen pipework at risk from natural hazards	2	1	1	1	2	2	2	1
		Strengthen pipe crossings at rivers by burying or improving ducting on bridges	2	1	1	1	2	2	2	1
		Improve inter and intra-connections and flexibility of distribution systems	1	1	1	1	2	2	2	2
		Enhancing maintenance of access routes to intakes and other assets	2	1	1	1	2	2	2	2
		Automatic start-up alternative energy sources for pumps and other plant requiring power	2	1	1	1	2	3	2	2
		Use of small scale solar power for UV disinfection and telemetry systems	2	1	1	1	2	2	2	1
		Promotion of slow sand filtration systems (which do not require power supply)	2	1	1	2	2	2	2	1
		Burying vulnerable sections of power lines to key plant	2	1	1	1	2	2	2	2
	User awareness and engagement	Public awareness campaigns for water efficiency	1	2	2	2	2	1	1	2
		Public awareness campaigns for climate change	1	2	2	2	2	1	1	2
		Establish users consultation processes regarding the identification of options to manage climate risks	1	2	2	2	2	1	1	2
	Disaster Risk Management	Decentralised stockpiling of spare parts to effect repairs quickly following severe weather	2	1	1	1	2	2	2	2
		Communication systems which are resilient to natural hazards (not reliant on mobile phone coverage)	2	1	1	2	2	2	2	1
		Develop drought and floods Early Warning Systems	1	1	2	1	1	2	2	1

6.4.2 Template tables for MCA

Example description of potential criteria and their rating scale

Table 6-5: Example decision criteria for MCA with a description of the rating scale. Indicator is expressed on a scale of 1-5, explained in the relevant box (5 = excellent, 1= negative or poor).

Criterion	Measure/Indicator
Effectiveness in achieving climate resilience	5 = likely to have a major, direct and early impact on relevant aspects of climate resilience 1 = likely impact weak, uncertain, or distant in time
Economic benefits	Note: result of benefit-cost analysis, Cost-Effectiveness and/or Value-for-Money (VFM) Criteria 5 = scores highly on any or all criteria; including “win-win” or “no regret” projects 4 = “climate-risky” projects that are good VFM 3 = marginally positive scores 2 = projects with marginal returns and/or high degree of uncertainty and risk 1 = unacceptably low scores on economic criteria; high risk
Direct impact on public finances over next 5 years	5 = sizeable net benefit likely due to savings or extra revenues; 4 = minor benefit 3 = zero or neutral net impact 2 = modest expenditure or subsidy required, or minor sacrifice of tax revenue 1 = major cost to public finances on recurrent and/or capital budgets off-balance sheet financing
Social and gender impact	5 = major tangible benefits likely to socially-deserving groups 4 = net benefit to social and gender equity 3 = neutral or unclear social and gender impact 2 = radical changes in current practices and behaviours needed on part of civil population; 1 = negative impacts on social and gender criteria; widely unpopular measures
Environmental impact	5 = clear and significant benefits to natural and built environment and public amenities 4 = minor but positive impacts on the above 3 = uncertain or neutral impacts 2 = minor dis-amenities and negative impacts 1 = serious costs to natural environment and public amenities

Criterion	Measure/Indicator
Political feasibility	5 = positive political benefits, no serious costs; widely popular measures 4 = political pros offset costs 3 = not a political issue; public indifference 2 = political costs involved, but probably manageable; grudging acceptance by electorate 1 = serious political capital would need to be spent introducing and enforcing new policies; widely unpopular measures
Legal, administrative and institutional feasibility	5 = feasible within existing legal and institutional framework and administrative capacity 4 = minor changes and adaptations required in current policies, laws, planning procedures, regulations and/or institutional structures 3 = significantly increased burden of administration, monitoring and enforcement falling on public services 2 = new policy statement required 1 = requiring major legal and/or institutional reforms
Feasibility of obtaining finance for new investment projects	5 = good likelihood of attracting commercial finance 4 = good prospects of securing external public finance from donors, international financing Institutions or other global funds and facilities 3 = good prospects/strong case for including in national capital budgets for next 5 years 2 = could be included in national budget, but with low priority 1 = little prospect of obtaining funds from any source

Source: HR Wallingford MCA workshop in pilot countries

Step 1 and 2: agree upon and score decision criteria

Scores per criterion for each Option (5=very high 4=high 3=average 2= low 1=very low)

Criterion No	Criterion	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
1	Effectiveness in achieving climate resilience								
2	Economic benefits								
3	Direct impact on public finances over next 5 years								
4	Social and gender impact								
5	Environmental impact								
6	Others								

Step 3: Assign weight to each criteria and compute total weighted score of each option against that criterion

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Weight
Effectiveness in achieving climate resilience									
Economic benefits									
Direct impact on public finances over next 5 years									
Social and gender impact									
Environmental impact									
Political feasibility									
Legal, administrative and institutional feasibility									
Others									
Total weighted score									

6.4.3 MCA Excel tool

See E-Annex.

6.4.4 Example data request form

Data requests from Governments, utilities and other stakeholders

How to complete this data request:

- This has been issued to the water services department as the lead stakeholder for the consultant team. It is anticipated that the water services department may need to liaise with other departments for some data and information;
- Please complete the data request form by filling in the yellow cells in the boxes below to indicate the level of data availability and the responsible stakeholder;
- Please return the completed request to the consultant team members NAME, EMAIL, PHONE NUMBER;
- The consultants would be grateful if you could return this by DEADLINE;
- The consultants will then schedule a telephone call during the week DEADLINE to discuss the data in detail, how we can utilise it, and how to transfer it so the consultants team can progress work on Tasks 1, 2 and 3 of the consultancy;

Where necessary, the consultants would be pleased to clarify any data requests and if required to discuss further with stakeholders the specific availability and accessibility of these items (see contact details in the covering email).

This information request is necessary to:

- Assess the content of current and prospective capital spending programmes of government departments, agencies and other key national stakeholders (including private sector water users) relevant to the climate resilience of water infrastructure;
- Formulate a prospective investment programme to address climate resilience in water infrastructure, containing priorities determined following a multi-criteria selection approach, , "climate-risky" and "no regret" options, identification of potential funding sources, recurrent cost and budgetary implications and other relevant aspects.

Table 6-6: Example data request table form

Documents / data requested	Data not available	Limited data available	Good data available	Please add any additional notes on the data and which organisation holds the data
Reports on capital investment budget spending for all Government departments for last 10 years, and projections for capital spending budgets for future years.				
Relevant country macroeconomic assessments and projections from key external financing agencies (CDB, IADB, World Bank, EIB)				
Details of future investment plans and intentions by water and energy utilities, and by other institutions and companies with a major potential impact on water resources management or usage.				
Portfolio of projects for financing prepared by governments and utilities for potential funding by climate finance and other international financing agencies				

Documents / data requested	Data not available	Limited data available	Good data available	Please add any additional notes on the data and which organisation holds the data
Sector and project assessment and appraisals by abovementioned agencies, specifically relevant to water, power and energy, agriculture and other climate-sensitive sectors.				
Technical, economic and financial reports on projects in relevant sectoral areas by consultants, or other agencies				
Other documents and data relevant to this consultancy.				

Section 7

Taking options forward for implementation

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Section 7: Taking options forward for implementation

Summary

Building climate resilience in the water supply sector will require balanced portfolio of investments and complementary measures across policy and strategy development, water resources and watershed management and water supply systems and services. These investments will bring about tangible benefits in reducing the negative impacts of climate variability and change on water services. This section provides insights into how to take adaptation actions forward to implementation through the preparation of an Investment Plan and the integration of investments into development planning processes.

Objectives

At the end of this section, participants will be able to:

- Understand the main components of an Investment Plan for a climate resilient water supply sector;
- Identify entry points and opportunities for integrating investments into planning and financing processes.

Things to know …

- An Investment Plan for improving climate resilience in the water services sector cuts across multiple sectors, it does not only involve the water utilities sector (although this may receive substantial investment). Investment is likely to be required in catchment management, data collection, disaster risk management, energy services and the enabling legislative and regulatory regime.
- Investment is required in institutional strengthening, information collection and management and infrastructure.
- An Investment Plan that works across sectors requires careful coordination to ensure that the responsibilities for planning and implementing each action are clearly understood by stakeholders.
- Implementing the Investment Plan should ideally happen through existing processes. Therefore it will be necessary to ensure that actions in the Investment Plan make their way into the strategic plans and budgets of the various implementing agencies (for example water utility project management units).
- Investment actions may range from fully designed infrastructure schemes right down to initial concept ideas. In the former case this may be as a result of a stalled work programme due to lack of funding, in which case the project may be ready to seek finance. In the latter case substantial project preparation will be required to conduct pre-feasibility, feasibility and design studies, before it can be considered ‘bankable’.
- Many countries are already working on cross sectoral strategic and investment plans, such as the National Adaptation Plan (NAP) process under the UNFCCC, which covers all sectors with a climate change angle. It is important to build on these initiatives, looking at synergies and learning and incorporating lessons on effective coordination mechanisms where appropriate.

7.1 Section 7: Guidance Material

This section provides insights into the preparation of an Investment Plan, the integration of investments into development planning processes and project preparation.

Integrating investments into existing development planning mechanisms and processes essential to ensure effective implementation and support the long term sustainability of the investment benefits. Good project preparation practices help ensure good project ideas and concepts are translated into bankable investment projects and programmes. Ultimately, the aim is mainstreaming water security and climate resilience into development planning processes.

7.1.1 Preparation of an Investment Plan

An Investment Plan for a prioritised programme of climate-resilient investments will typically include:

- Identification of activities and investment options
- Prioritisation of needs
- Development of technical profiles and preliminary cost estimates
- Implementation plan
- Potential sources of finance and funding
- Monitoring and evaluation

Investment Plans are primarily for use by central government and other key stakeholders but are also a very effective tool to communicate needs to development partners, including where applicable the private sector.

The following sections provide an overview for the typical content of an investment plan

The sub-sections that follow relate provide additional details of the typical content of an Investment Plan.

Box 7-1: Example structure and content of an Investment Plan

In the Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean project, Investment Plans for climate resilient water supply services were prepared for Grenada, St. Kitts and Nevis using the following broad structure:

Section 1 – Water and Development Context

Section 2 – Overview of the current and future climate risks to water supplies;

Section 3 – Process for development of the Investment Plan and its structure;

Section 4 – Investment Plan;

4.1 Vision and objectives

4.2 Investment programmes (note these will vary depending on the country context, vision and objectives)

- Programme 1 – Policy, legislation and capacity development
- Programme 2 – Catchment management and water resources
- Programme 3 – Climate resilient water supply infrastructure
- Programme 4 – Water demand management
- Programme 5 – Energy efficiency and renewable energy
- Programme 6 – Disaster risk management

Section 5 – Summary of benefits of resilient water supply services;

Section 6 – Financing plan - Potential sources of funding and financing strategies for implementation;

Section 7 – Implementation plan - including schedule, coordination and monitoring and evaluation;

Section 8 – Considerations to ensure the sustainability of the Investment Plan.

Water and development context

It is important to provide a high level overview of the water development context, in order to demonstrate alignment of the Investment Plan with broad development objectives, and the role which a resilient water sector plays. Typical content will:

- Articulate the essential role of water in sustaining social and economic growth (health, tourism, agriculture, manufacturing, etc.);
- Identify climate vulnerabilities and impacts, and adaptation needs that the Investment Plan is envisaged to address, and detail exposure to climate hazards - including hurricanes, storms, droughts, floods, etc.;
- Evidence loss and damage from historical events, and overall impact on GDP;
- Indicate how the Investment Plan fits in with the country's national priorities, its contribution to the country's Nationally Determined Contributions (NDCs), national climate strategies or other plans such as NAPs (or equivalent);
- Describe measures to unlock barriers (social, gender, fiscal, regulatory, technological, financial, ecological, institutional, etc.) that need to be addressed.

Box 7-2: Grenada: Water and Development Context

The following is an excerpt from the Water and development Context section of an Investment Plan for climate resilience in the water sector. It provides a high level overview of the development, economic and water issues which the Investment Plan is responding to.

Grenada is highly exposed to climate hazards, including hurricanes and the impacts of drought. Hurricane Ivan in 2004 resulted in damages equivalent to 200% of GDP and the 2009/10 drought resulted in widespread water rationing and impacts on economic sectors. Key contributing sectors to the Grenadian economy include tourism and agriculture which depend on reliable and sustainable water services. Improving the resilience of the water sector to climate variability and change will support sustainable and inclusive growth.

Grenada is part of the Organisation of Eastern Caribbean States (OECS) and a member of the Eastern Caribbean Currency Union (ECCU). The 2011 census population was 105,539, up by 2.2% from 103,137 in 2001 with 6% of the population located on Carriacou (Government of Grenada, 2009) (Kairi Consultants Ltd, 2008).

The Grenadian economy averaged 4.8% growth in the ten years before Hurricane Ivan in 2004, which is higher than the ECCU average. The cost of damages from Ivan was estimated at US$ 800 million, more than 200% of GDP, and resulted in a decline in economic activity of 5.7%. Post-Ivan growth has partly been a result of the reconstruction and rebuilding programmes, but also from debt restructuring and entry into the International Monetary Fund's (IMF) Poverty Reduction and Growth Facility (PRGF). By the end of 2017 Grenada's ratio of public debt to GDP is expected to have declined to 68.9% (from 108% in 2014) due to comprehensive debt restructuring, fiscal adjustment and economic growth driven by strong growth in export markets, a rebound in tourism in the Caribbean and the recovery of agriculture (IMF News, May 23, 2017; Budget Statement for 2018). Despite this progress, the level of public debt is still a constraint on public investment and social spending.

Tourism is Grenada's main foreign exchange earner after a number of new hotel operations were opened in the 1990s. These developments were encouraged through government initiatives on marketing and human resources development (Foreign and Commonwealth Office, 2010; Government of Grenada, 2009). The sector is mainly concentrated in the southwest where the beaches, such as Grand Anse Beach, are located. A large cruise ship pier and esplanade were built in 2004 in the capital to accommodate the rapid growth in cruise tourism and there has been some diversification of the product with eco-tourism being promoted and the development of small eco-friendly guesthouses in the more remote parishes (Kairi Consultants Ltd, 2008); (Government of Grenada, 2011); (Government of Grenada, 2009)).

Key contributing sectors to the Grenadian economy including tourism, light industry and agriculture depend on reliable and sustainable water services. As such, maintaining water resources in the face of a changing climate will be important in achieving economic growth and development.

Grenada is currently developing national plans and policies, not only for climate change adaptation and mitigation, but integrating climate change considerations into its overall national development planning. These plans include the Nationally Determined Contributions (NDC), the National Adaptation Plan process, the Technology Needs Assessment process and the development of the first Nationally Appropriate Mitigation Action for the country.

Overview of current and future risks to water supplies

This section should provide more specific evidence on the need for investment in the water sector, as it pertains to the impacts of climate variability and change on the levels of service and long term sustainability of the sector. It should draw on information generated from the Climate Risk and Vulnerability Assessment and may include the following elements:

- An overview of the water sector institutional landscape, recent and planned developments in the sector
- Climate risks in the water sector evidenced through recently experienced disruption to services as a result of climate hazards
- An overview of the priority risks and their impacts on society, the economy and environment
- A discussion of future climate projections and how these will exacerbate risks
- A discussion of the vulnerabilities which compound the risks, for example poor land management, inappropriate development, limited financial space for investment

Process for development of the Investment Plan and its structure;

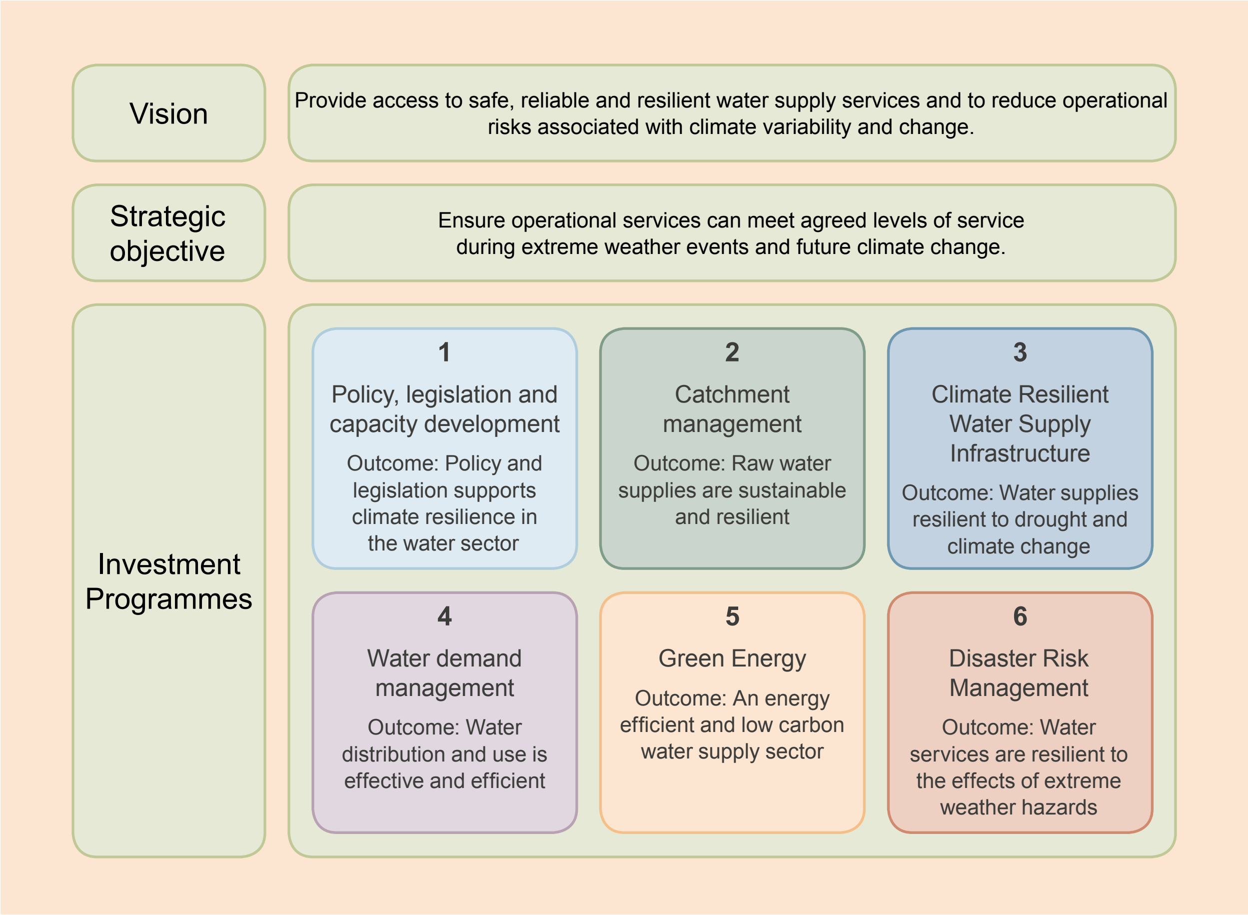
It is important to describe the process used to develop the Investment Plan in order to demonstrate the consultation process used, and the sources of evidence which have underpinned the selection and prioritisation of the investments. It is also important to set out and justify the structure used in the plan for clarity, as a number of agencies may have been involved in its development.

Box 7-3: Example structure for an Investment Plan

The Investment Plans developed in Grenada, St. Kitts and Nevis were structured into six programmes which reflect the strategic priorities for water supply resilience. These respond to the challenges identified by stakeholders and the analysis carried out in the Climate Risk and Vulnerability Assessment and screening of policies, plans, strategies and legislation.

The rationale for this structure was to minimise dependencies across the programmes in order for multiple programmes to proceed at their own pace, recognising the limited resources available to finance and implement all the investments together. The thematic areas were also designed to align with development partners' objectives in terms of attracting concessional financing for implementation.

The Investment Plans took a cross cutting approach to building resilience, acknowledging the broad range of stakeholders involved in the water sector, from governance through to water resources management, catchment management, service delivery and disaster risk. They also took a strategic approach, including both immediate short-term priorities as well as medium-term activities for the long-term sustainability of water supply services.



Investment Plan Vision, Strategic Objectives and Investment Projects / Programmes

This section of the Investment Plan describes in detail:

- Vision – The long term outcome which the Investment Plan is working towards, or contributing to. This should be couched in broad national development objectives, in terms of the social, economic and environmental benefit.
- Strategic Objectives – The near term outputs which are anticipated. These should be the measureable benefits of the investments, couched in terms of the levels of service, cost savings or other relevant metrics which can be aligned with a Monitoring and Evaluation (M&E) system.
- Investment projects or programmes. This section should describe the investments in as much detail as is available. Investment projects are distinct activities, whereas programmes are longer term suites of projects or actions which aim towards a common objective, and cannot necessarily realise the benefit in isolation. The following information should be provided for each project or programme:
  - Summary
  - Justification (in economic, social and environmental terms)
  - Alignment with relevant strategies and policies
  - Implementing entity
  - Partner stakeholders
  - Implementation arrangements
  - Expected outcome
  - Specific results to be achieved
  - Activities with a description, costs and timeline
  - References to pre-existing studies (such as feasibility studies, designs or masterplans)

Summary of benefits of resilient water supply services;

A clear statement on the overall benefits of the investment programme should be provided in terms of the economic and social development and environmental / ecosystem services. The benefits should provide some narrative context to the strategic objectives and logical framework for the Investment Plan which will be developed as part of the M&E system.

Financing plan - Potential sources of funding and financing strategies for implementation;

A financing plan should set out the potentially appropriate sources of finance to implement the various types of projects / programmes within the Investment Plan. This is addressed in more detail in the financing section of this Training Manual. In addition to financing investments, funding may be required for feasibility studies and other preparatory activities for major infrastructure projects. Less costly initiatives such as policy reform or capacity development may be eligible for technical assistance grant funding.

Implementation plan - including schedule, coordination and monitoring and evaluation;

The implementation plan should set out the timeline, role and responsibilities for ensuring that the projects and programmes are successfully implemented, and the M&E process to verify this and adjust the process if circumstances change. Since the investment plan is broad (multiple implementing agencies and funding sources), it requires overall coordination. Each project or programme within the plan will have its own detailed implementation systems based on the processes used by the implementing agency and any requirements imposed as a condition by the financing agency (if different). The implementation plan should cover the following aspects:

- Timeline for implementation;
- Roles and responsibilities for coordinating the investment plan (the lead agency, or a secretariat developed for the purpose);
- Roles and responsibilities for implementing agencies each project / programme;
- An M&E Framework (both for monitoring the progress of the Plan's implementation (see Table 7-2), and for evaluating the outcomes resulting from the implementation of the projects and programmes within the plan). M&E is covered in more detail in Section 9 of this Training Manual.

Table 7-1: Example of implementation monitoring activities

M&E level	M&E actions (and anticipated stakeholder responsible)
Overall Investment Plan	■ Annual review of Implementation Progress and updating implementation schedule (Investment Plan coordinating agency, input from partners). ■ Triennial revision of Investment Plan - review of implementation progress, addition of emerging priorities and removal of completed or low priority actions (Investment Plan coordinating agency, input from partners).
Programme (group of projects)	■ Set up detailed outcome targets for each programme, conduct baseline analysis and set up data collection processes to monitor progress on each outcome target. Where data is not already being collected, this will require new data collection systems to be developed (Programme lead implementing Agency – with support from partners on an activity basis). ■ Annual reporting on progress and updating implementation schedule to be passed onto overall Coordinating agency; the Ministry of Communications (Programme lead implementing Agency – with support from partners on an activity basis).
Individual project	■ Utilise standard M&E processes of implementing agency, with any additional M&E required by financing or development partners as required (Implementing Agency – with support from Ministry of Finance).

The implementation plan should be cognisant of other national processes. For example the National Adaptation Planning (NAP) process under the UNFCCC is likely to be developing multi-sectoral investment plans, and the water sector is often a priority in NAPs. Therefore it may be appropriate to align the Investment Plan, or integrate its implementation within the NAP process.

Considerations to ensure the sustainability of the Investment Plan.

The long term sustainability of interventions is a key consideration. All too often projects are not sustained once the implementation phase has been completed, due to a lack of sustainable funding or lack of institutional arrangements for adopting infrastructure. Lessons should be drawn from previous initiatives and actions identified for inclusion in the M&E system to maximise sustainability.

7.1.2 Integrating adaptation options into development planning processes

Once adaptation options have been identified and included with the Investment Plan they will require integrating into existing plans and work programmes to provide a modality for implementation. Options which are clearly part of a coherent sector strategy or expenditure framework will be more likely to gain support from development partners as well as leveraging domestic sources of finance.

Adaptation options will often be additional components bolted onto planned development activities to ensure that climate variability and change is considered during development. For example, a programme of water supply improvements may have an adaptation option bolted on to carry out capacity development in drought management planning including the development of climate change scenarios. In such a case the adaptation option should be integrated into the implementation programme for the main project to ensure that objectives are aligned between the two.

Integration of adaptation options into an organisation's development planning processes will require a consideration of the following principal actions:

- Ensure high level political support for integrating options into relevant planning bodies and detailed planning processes. This provides a driver for planning authorities to carry through investments to the implementation phase;
- Understand the planning process and find entry points to influence it at whichever planning level the adaptation option is most relevant. A summary of potential entry points is provided in Table 7-2;
- Identify ‘windows of opportunity’ for detailed planning and implementation of options within existing plans and strategies (e.g. alongside the planned upgrading of existing infrastructure) or integrating longer-term adaptation options in strategies under review (e.g. strategic water resources planning);
- Maintain support to planners through partnerships and capacity building to catalyse integration and capitalise on new skills and partnerships.

Table 7-2: Potential entry points to integrate adaptation options into planning processes

Planning level	Potential entry points
Regional	Regional work programmes and projects
National	National Adaptation Plans (NAPs) National development plans and annual / medium term budgetary processes Donor and Multilateral Development Bank country investment strategies Sector strategies, policies and plans Sector budgets and expenditure frameworks
Sub-national	Municipal development plans and budgets District and community plans and programmes of action Watershed management plans

Source: Global Water Partnership Caribbean (GWP-C) and Caribbean Community Climate Change Centre (CCCCC). 2014. Achieving Development Resilient to Climate Change: A Sourcebook for the Caribbean Water Sector. Global Water Partnership-Caribbean

National and sector-level strategies and action plans are key tools for aligning resources with policy implementation. Strategy formation has its own 3-5 year cycle and each strategy will be at a different stage in different countries. The inclusion of already identified adaptation options to influence those strategies that are due for revision in the near future and focusing on priority sectors (which vary from country to country) will help to ensure resources are targeted towards water security and climate resilience.

Central ministries (e.g. Economic Planning and Finance and/or the Office of the Prime Minister) play a key role in allocations and arbitration among sectors. This includes the budget process which determines how much funding is received by sectors affected by water security and climate change. Presenting a well-argued and economically justified case for sector investments in adaptation options which support national development goals is essential.

The national budget process is an important tool for promoting water security and climate resilience. While the national development strategy provides broad guidance, the national budget process is where the hard decisions over resource allocation – both recurrent and development spending – take place. Claiming climate resilience benefits in promoting sector or cross-sector strategies should provide opportunities to influence budgeting if the ministry of finance is fully engaged in the process.

7.1.3 Aligning with the National Adaptation Plan process

The NAP process was established under the UNFCCC in 2010 as part of the Cancun Adaptation Framework. The process enables Parties to the UNFCCC to formulate and implement NAPs as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs. It is a continuous, progressive and iterative process that follows a country-driven, gender–sensitive, participatory and fully transparent approach. NAP processes are supported by funding sources such as the Green Climate Fund (GCF) Readiness and Preparatory Support Programme[1], domestic government revenues, bilateral providers, multilateral providers and the private sector.

The objectives of NAPs were defined by COP-17 as:

- to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience;
- to facilitate the integration of climate change adaptation into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate.

1 Through its Readiness Programme, the GCF provides up to US$ 3 million per country for the formulation of adaptation plans. In addition, the GCF provides up to US$ 1 million per country per year for readiness and preparatory support, of which the National Designated Authority (NDA) or GCF focal point of a country may request up to US$ 300,000 per year to help establish or strengthen a NDA or focal point. All developing countries can access the GCF Readiness Programme, and the Fund aims for a floor of 50 percent of the readiness support allocation to particularly vulnerable countries, including least developed countries (LDCs), small island development states (SIDS) and African States.

Parties to the UNFCCC reached a landmark agreement, in December 2015, in Paris, to combat climate change. The Paris Agreement aims to limit global temperature rise this century to well below 2˚C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5˚C. The Paris Agreement also aims to increase the ability of countries to deal with the impacts of climate change through adaptation. Countries have set out their commitments to mitigation in their Nationally Determined Contributions (NDCs). A majority of developing countries have also chosen to include an adaptation component in their NDC.

The 2030 Agenda for Sustainable Development was adopted by Parties at the UN General Assembly in September 2015. The Agenda sets out 17 SDGs covering a wide range of development issues and includes a specific SDG on clean water and sanitation (SDG 6). Developing countries are, therefore, aligning their long–term national development priorities with the framework of the SDGs.

The formulation and implementation of NAPs therefore needs to take into account the commitments in the NDCs, and the 2030 Development Agenda and its SDGs, which present opportunities for mutual reinforcement.

The process to formulate and implement NAPs benefits from the experiences of National Adaptation Programmes of Action (NAPAs), a process initiated in 2001, which focused on urgent and immediate adaptation needs, i.e. those for which further delay could increase vulnerability or lead to increased costs at a later stage in the Least Developed Countries (LDCs). The implementation of projects in NAPA priority areas is ongoing, with financing from different sources, including the Global Environment Facility's (GEF's) Least Developed Countries fund, the Special Climate Change Fund and the Adaptation Fund.

At country level, the national adaptation planning should evolve out of existing adaptation and resilience building processes, often within a wider climate change response that may include disaster risk reduction (DRR), disaster risk management (DRM), climate change mitigation planning and climate finance.

Many developing countries consider adaptation as their main priority because of the significant impacts climate change is expected to have on national development, sustainability and security.

Box 7-4: NAP Water Supplement

The Water Supplement (Edition 2) accompanies the United Nations Framework Convention on Climate Change (UNFCCC) National Adaptation Plan (NAP) Technical Guidelines prepared by the Least Developed Countries Expert Group (LEG) of the UNFCCC. Drawing on recent experiences and lessons learned of integrating water in adaptation planning, the Water Supplement provides guidance for the integration of water in the NAP process that reinforces implementation of the Paris Agreement and achievement of the SDGs.

The Water Supplement aims to support developing countries in:

- reducing water-related climate vulnerabilities by building adaptive capacities and resilience;
- addressing water in the formulation and implementation of NAPs; and
- enhancing the integration of water-related adaptation in development policies, programmes and plans.

The purpose of the Water Supplement is to:

- establish a framework for planning, implementing and monitoring adaptation actions that promote water security and climate resilience;
- help non-water specialists to understand the issues related to water security in the context of climate change empower stakeholders involved in using or managing water to participate effectively and efficiently in the process to formulate and implement NAPs;
- facilitate the integration of concerns and perspectives related to water security into national climate change adaptation planning and implementation;

- enable stakeholders involved in using or managing water to incorporate climate change adaptation in medium– to long–term policy and planning processes;
- strengthen gender considerations in water-related adaptation planning and implementation in the least developed countries; and
- highlight water-related climate vulnerabilities to enable the identification, prioritization and implementation of adaptation options.

The Water Supplement is intended for use by those leading the NAP process at a national level, by water planners and managers responsible for addressing adaptation in water resources management and water-dependent economic sectors, and by those who provide support to countries to achieve a coherent and strategic response to adaptation planning.

Preparing bankable investment projects and programmes

Implementation requires working adaptation options up into bankable investment projects and programmes. Adaptation options may vary considerably in their scale and the nature of the interventions required and this will determine how best to develop bankable investment options. They may include ‘soft’ options such as capacity development, technical studies, revising legislation and regulations or ‘hard’ options such as climate proofing infrastructure, restoring watersheds or other physical measures.

Options such as small scale technical studies to inform a regulatory review process will require less effort to prepare than a large scale programme of infrastructure development or renovation. The former may only require the development of a terms of reference and a logical framework setting out how the results will be utilised for positive benefits. The latter may require a much more involved process of pre-feasibility, feasibility and detailed design. Support is available for these types of studies through multilateral channels such as the IDB. Box 7-5 gives an example of the project preparation process which the IDB follows. This is intended as an illustration of the type of project preparation activities which are required by a lending organisation. Each development partner and national government will have its own project preparation requirements.

Project preparation is closely linked to financing which is covered in this Training Manual. A supportive development partner or multilateral agency may offer project preparation resources as part of a wider package of grant or loan financing which will assist national planners in translating ideas and concepts into bankable projects and programmes.

Box 7-5: Inter-American Development Bank (IDB) technical cooperation

The IDB provides support through its technical cooperation activities either as grants or loans to assist in project preparation, institutional strengthening, project implementation, planning and resources mobilisation. These are closely aligned with many of the tools and methods in the Sourcebook and are discussed in more detail below.

Pre-investment. The Bank provides technical assistance for the countries in the field of pre-investment helping them at various stages in the preparation of specific investment projects.

- Basic Studies. Economic and social studies to identify priority areas and studies of sectors, sub-sectors, and geographic areas to identify potential projects.
- Pre-feasibility Studies. Studies designed to examine viable project alternatives from the technical and economic standpoints.
- Feasibility Studies. In-depth studies of the viable alternative that emerged from the prefeasibility study. If the alternative is found to be acceptable steps are taken to prepare the final design of the project.

- Final Design. The orderly presentation of data relating to the project, duly adjusted. The design should also contain all the details relating to the feasibility, design, organization, and execution of a project in its technical, financial and legal aspects.

Institution Strengthening. The Bank provides technical assistance for the creation, organization, and strengthening of institutions involved in the economic and social development process particularly those with responsibility for executing development plans and projects and those with responsibility for pre-investment activities. Technical assistance for institution building mainly bears on matters related to the creation or modification of institutions, organization, the design of systems and procedures, staff training and the adoption of new technology.

Investing Execution. The Bank provides technical assistance for institutions in charge of carrying out projects financed through Bank loans to ensure that:

- the techniques best suited to the management of financial and human resources are adopted;
- the technical and economic objectives of projects are attained.

Development Planning. Technical cooperation in this field comprises activities that contribute to the improvement of:

- Institutional capacity to prepare general, sector, subsector and regional development plans.
- Coordination of institutions that work in the field of planning.
- Formulation of development policies and criteria for identifying high priority projects.
- Formulation of national pre-investment programs and preparation of specific technical cooperation requests.

Mobilization of Resources. The Bank provides technical assistance for studies and measures related to the mobilization and management of domestic resources in general, fiscal policy and management and programming the use of external financial resources.

Source: IDB Basic guidelines General Operational Policies (policy 401). Available at http://www.iadb.org/en/about-us/basic-guidelines,6247.html

Project preparation will involve the development of a project or programme concept note by the proponent. This is a simple tool which communicates the main elements of the project including its scope and objectives as well as the intended impact and justification (in social, economic and/or environmental terms). This initial step results in a document which can be circulated to potential funding agencies or integrated into upcoming work plans or strategies within the proponent's organisation. Ideally the objectives of the project should be aligned with the proponent organisations strategic objectives and with the objectives of the potential financing agencies being targeted. Project concept notes form a first step in getting the process of preparation off the ground. Subsequent steps vary depending on the institutional processes of proponents and financing agencies.

7.2 Section 7: Case examples and other relevant material

7.2.1 Case example

Box 7-6: Case example: The National Adaptation Planning process and the water sector in St. Lucia

NAP VISION: St. Lucia and its people, their livelihoods and the country's social systems and environment are resilient to the risks and impacts of climate change through continuous, coordinated and effective adaptation efforts.

The NAP goals aim to enhance the broad national Enabling Environment for climate-related adaptation and risk-reduction action within and across development sectors. NAP also provides sectoral goals aiming to safeguard water resources and services under a changing climate, the resilience of critical infrastructure and the built environment; and to protect ecosystems.

The process for the development of St. Lucia's NAP has been underway from May 2017 and has resulted in the development of several Sectoral Adaptation Strategies and Action Plans (SASAPs). Different sectors were ranked and the top priority sector was identified to be the water sector, followed by agriculture and food security.

A water SASAP 2018-2028 was also developed. The adaptation measures included in the SASAP were prioritised by stakeholders based on their urgency and are planned to be implemented in three different time frames: short-term (2018-2021), medium term (2021-2024) and long term (2024-2028).

Water SASAP goal: To drive the implementation of effective adaptation actions across all sectors and at all levels of society to safeguard St. Lucia's water resources and services under a changing climate.

The NAP process can help to maximize the opportunities for funding and financing in the water sector. In particular, where there is a cross-cutting theme, individual smaller projects across different sectors which would not meet the cost threshold can be collated to qualify for donor funding.

Source: Presentation given by St. Lucia representatives at the Training of Trainers workshop, 2018

7.2.2 Relevant material and other resources

Box 7-7: Relevant material and other resources

Achieving Development Resilient to Climate Change: A Sourcebook for the Caribbean Water Sector (GWP-C and CCCCC, 2014)

The main aim of the Sourcebook is to guide planners, project developers and water sector practitioners on the main elements to be considered in the planning and execution of actions aimed at improving water resources management practices, to build the resilience of the water sector to the impacts of climate change and variability. Chapter 9 deals specifically with taking options forward for implementation, preparing bankable investment projects/programmes and integrating adaptation options into development planning processes.

Available at: https://www.gwp.org/globalassets/global/gwp-c-files/sourcebook---wv.pdf

National Adaptation Plan (NAP) Water Supplement, 2015

This Water Supplement (Edition 2) accompanies the United Nations Framework Convention on Climate Change (UNFCCC) National Adaptation Plan (NAP) Technical Guidelines. The Water Supplement aims to support countries address water issues in the formulation and implementation of NAPs and enhance the integration of water-related adaptation in development policies, programmes and plans.

Mainstreaming adaptation to climate change within government systems: An analytical framework and examples from practice (ACT, 2018)

The paper introduces a general analytical framework for mainstreaming adaptation to climate change within governance systems. It covers both the process of mainstreaming and the context, and is based on three dimensions that are relevant at multiple levels: 1) entry points for mainstreaming climate change into the planning and policy process; 2) the Enabling Environment or ‘system’ that supports mainstreaming; and 3) political economy drivers within the system.

7.3 Section 7: Notes for the trainer / facilitator

7.3.1 Notes and considerations

- Integration of adaptation options into government development planning processes will require high level political support, finding entry points and windows of opportunity to integrate investments and measures within existing plans and strategies.
- Increasingly, NDC and NAP processes provide a country-wide framework into which investments and measures can integrated, providing a coherent country-wide process by which to move toward implementation. Engaging with these processes can avoid duplicating work programmes.
- The NAP process was established under the UNFCCC in 2010 to formulate and implement NAPs as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs. It is a continuous, progressive and iterative process that follows a country-driven, gender–sensitive, participatory and fully transparent approach.
- Specialist climate funds are increasingly used to access funds for climate resilient interventions, including the Green Climate Fund. However, each fund comes with its own eligibility criteria so it is important to fully understand these.
- Seek out opportunities for peer-to-peer exchanges between different groups to explore which funds have been accessed to-date, and why. It would also be good to learn from applications that have been successful (what were there strengths) as well as those that have been unsuccessful (what could have been done better).

7.3.2 Exercises and discussion topics

<table>
<tr><th colspan="2">Group Session 1</th></tr>
<tr><td>Title
Producing initial draft concept notes for high priority adaptation actions.</td><td>Type
Plenary and 3 to 4 breakout groups (depending on numbers), reporting back to plenary.</td></tr>
<tr><td colspan="2">Objectives
■ Agree a structure for concept note template.
■ Develop initial drafts of concept notes for high priority adaptation actions. This session assumes that around 10 concept notes will be developed.
■ Agree the process for finalising concept notes.</td></tr>
<tr><td>Duration
4 hours</td><td>Materials needed
■ Training Manual.
■ Template for concept notes.
■ Draft concept note template completed for each high priority adaptation action (assume around 10). Printed as handouts with space for annotation.</td></tr>
</table>

Preparation

- This session assumes a list of prioritised adaptation actions have been developed. Sections 5 and 6 provide additional guidance on this.
- The facilitator should prepare a concept note template (an example is provided in the E-annex to this session). This should be adapted to the national context in advance of the session. Note also that the Green Climate Fund concept note template may provide a useful frame of reference.
- The facilitator should complete the draft template as far as possible for each high priority adaptation action in advance of the session. These should be printed as handouts. The more detail which is available for the prioritised actions in advance of this session will allow greater progress to be made in developing the concept notes.
- The facilitator should ensure that the session participants are appropriately experienced in the topic areas of the adaptation actions to be able to meaningfully contribute to the development of the concept notes.

Description of tasks and instructions

Step 1: Introduction to the activity (in plenary)

- Outline the main steps and objectives in this session and provide an overview of the adaptation actions identified as highest priority, and the current state of information on these.

Step 2: Food for thought (in groups)

- Present the concept note template to participants in plenary, explaining the logic behind each of the concept note headings.
- Facilitate a discussion around these headings and make any changes recommended by participants to ensure the template reflects national priorities.

Task 3: Assess potential of financing options (in groups)

- Participants are divided into groups, with each group working on one concept note. The facilitator should ensure that participants are divided to align their individual expertise with the subject of the adaptation action.
- Each group works for around an hour on developing the concept note using the handouts provided. A scribe in each group should record all the changes / additions suggested by the group so these can be integrated into a revised draft of the concept note following the workshop.
- Participants present their concept note back to the group for feedback.
- The two steps above are repeated until all the concept notes have been addressed. For example if 12 concept notes were being developed by four groups, this would require three repetitions.

Task 4: Round-up of results (in plenary)

- The facilitator summarises the work completed in the session and leads a discussion on the process for finalising the concept notes. This is likely to involve re-drafting of the concept notes by the facilitator and submission for finalisation to their respective lead implementing organisations.

Following the workshop

Report on the main findings of this section, and feedback on the relevance of the section proceedings for future training purposes.

Section 8

Identifying sources of finance to implement priority adaptation measures

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Section 8: Identifying sources of finance to implement priority adaptation measures

Summary

An ever changing range of financing options exist for the water sector in the Caribbean, both from conventional sources and more recently specialist climate change funds. This section provides an introduction to the main types and sources of finance relevant to water infrastructure and water resources management as well as a description of the main sources of climate finance. It also considers the factors involved in choosing between different financing options.

Objectives

At the end of this section, participants will be able to:

- Understand the fundamentals for funding and financing in the water sector for recurrent and capital spending requirements;
- Be more familiar with the main sources of financing for the above from both “conventional” sources and from specialist climate funds and facilities;
- Appreciate the considerations involved in choosing financing sources and matching these to the investment priorities identified;
- Share and benefit from knowledge of experiences, policies and practices in other countries;
- Gain an appreciation of project and programme proposal preparation, in particular for the Green Climate Fund.

Things to know …

- Investing in climate resilience will involve a balance of measures, some of which involve spending on infrastructure, and others require changing policies, institutions and citizens’ behaviour. Although the latter are often referred to as “soft” measures, in political terms they may be the hardest.
- Specialist climate funds are increasingly funding investments impacting climate resilience. The most important are the Green Climate Fund (GCF), the Adaptation Fund, the Global Environment Facility (GEF) and the Climate Investment Funds.
- Conventional International Financial Institutions, principally the World Bank, the Caribbean Development Bank, the European Investment Bank and, for some larger countries, the Inter-American Development Bank, will remain major lenders for infrastructural investment.
- Caribbean countries have the option of national accreditation to climate funds or can access such funds through other agencies that already have accreditation (e.g. CDB, CCCCC, GIZ, World Bank, IDB).
- The Caribbean Region is gaining experience in accessing the Green Climate Fund. At its Board Meeting in Korea Feb/Mar 2018, the Green Climate Fund approved three major Caribbean projects:
  - For Grenada, a US$ 35.29 million project for a Climate Resilient Water Sector, in partnership with GIZ;
  - For Barbados, US$ 27 million for a Water Sector Resilience Nexus, through CCCCC;
  - For the Environment Department of Antigua and Barbuda a US$ 20 million project for Integrated Physical Adaptation and Community Resilience.

8.1 Section 8: Guidance Materials

8.1.1 Introduction to sources of finance for the water sector

Investment proposals for climate resilience in water will typically contain a variety of activities: policy and institutional reforms, investments in new or modified infrastructure, spending on efficiency savings, precautionary measures against future events, watershed conservation measures. Each of these categories will need its own kind of financing.

At the most general level, the two basic categories of funding requirements for water infrastructure are for recurrent annual spending, and for capital spending on investment projects (see Table 8-1).

Recurrent annual spending

Depending on whether this is by Government Departments or the water service provider, recurrent annual spending will be presented in the Government's Annual Budget Statements or the Annual Reports and Financial Statements of the water utility.

A "cost recovery" business model for water utilities, is one in which all recurrent costs (overheads, operations and maintenance outlays, plus debt servicing and repayment) are more than covered by tariff revenues, leaving a surplus to contribute to new capital expenditure. This "ideal" state is rarely achieved, except for the few cases where utilities are in private ownership.

A more common situation is where recurrent spending – on rent, salaries, wages, energy, raw materials and other consumables – is normally funded from tariff revenues, supplemented by central Government subsidies in the form of grants (deficit finance) plus grants from external development agencies and other international facilities (including climate funds)[1].

All new capital expenditure (see relevant section below) will have implications for future annual recurrent spending budgets. Some of these may produce efficiencies which reduce recurrent spending, but most projects will entail additional spending commitments in the first instance, on operation and maintenance, administration, etc. In planning new capital projects, their implications on future recurrent budgets should be fully factored in – and take a realistic assumption about the availability of the latter.

Capital spending on investment projects

Capital expenditure on investment projects appears in a Government's "Estimates of Expenditure" (typically approved at the same time as the Annual Budget, and appearing in a rolling medium term – 3-4 year – Public Investment Programme).

Capital spending of a one-off or periodic nature (for development and rehabilitation of water sources, pipelines, treatment, pumping, distribution. including enhancing the resilience of these assets) is normally funded from a combination of grants and long term loans. Items of a manageable size[2] can be funded from tax revenues or included in the utilities' annual financial budgets, but larger items will normally require borrowing or access to other external finance.

Borrowing can either be domestic (through the issue of bonds or medium/long term loans from commercial banks), or by recourse to grants and long term concessional loans from external agencies. In the Caribbean Region these are mainly the IDB, CDB, World Bank and EIB. Such loans are normally contracted through the Central Government which guarantees repayment and takes the foreign exchange risk[3], and makes the money available to the water utility either as a grant or local currency loan.

Certain types of project lend themselves to Public-Private Partnerships in which initial finance is raised by the private partner.

1 Year-to-year deficits caused by irregular cash flows can be funded from short-term bank overdrafts, but this is not a sustainable solution except for very short term purposes.
2 Manageable here refers to projects that cost less than the threshold for inclusion in the PSIP (Public Sector Investment Programme).
3 In the usual case where the loan is denominated and repayable in US dollars, devaluation of the local currency will cause a higher debt service and repayment burden in local currency terms.

Specialised climate finance agencies are increasingly an option (e.g. the Green Climate Fund). More detail on climate finance is given in the following section.

Table 8-1: Categories and sources of funding for water infrastructure

Recurrent annual spending	Capital spending on investment projects
■ tariff revenue ■ government subsidies (deficit finance) ■ donor agencies and external networks ■ climate funds and facilities	■ tax revenues ■ local borrowing (bonds and loans) ■ external grants and concessional loans ■ private partners in PPPs ■ climate funds and facilities

Opportunities from the growing importance of climate finance

In the context of water infrastructure, most investment proposals are likely to concern adaptation of infrastructure to changing climate, but there is also scope for tapping climate mitigation finance for activities aimed at reducing or offsetting Greenhouse Gas Emissions.

The water sector is eligible for funding from a number of international funds and facilities dedicated to financing climate mitigation and adaptation. Currently most climate funds prioritise mitigation over adaptation, although this bias is changing, and the GCF, which is likely to become the largest fund of this type, is pledged to treat adaptation and mitigation on an equal 50:50 footing. In 2014 climate adaptation finance from seven of the largest multilateral development banks (World Bank, IDB, EIB, etc.) totalled US$ 25 billion, of which US$ 14 billion was directed to water and wastewater management – by far the largest share by sector. In contrast water and wastewater took a very minor share of such finance to climate mitigation activities [4].

A range of funds and facilities are available:

> "The global climate finance architecture is complex and always evolving. Funds flow through multilateral channels – both within and outside of the UNFCCC Financial Mechanism – and increasingly through bilateral, as well as through regional and national climate change channels and funds."
>
> *Bird, Watson and Schalatek (2017): The global climate finance architecture. Climate Funds Update. Overseas Development Institute and Heinrich Boll Stiftung. November.*

The following funds are of particular relevance.

- **Green Climate Fund**, The GCF's current project portfolio totals US$ 13.0 billion. It has a target to fund adaptation and mitigation projects on an equal 50:50 basis. Currently adaptation takes 29% of funding, compared with mitigation (43%) and cross-cutting projects (28%). GCF funding is available both as grants and loans (43% each), with the balance coming from equity and guarantees www.greenclimate.fund.org.
- **Global Environment Facility (GEF)**, increasingly focusing on climate change and its relationship with land-use and forestry www.thegef.org.
- **Least Developed Countries Fund and Special Climate Change Fund**. Also administered by GEF, support the development and implementation of national adaptation plans (NAPs).
- **Adaptation Fund**, financed through a levy on the sale of emissions credits through the Clean Development Mechanism. Offers direct access to countries through accredited National Implementing Entities. www.adaptation-fund.org

The GCF and the Adaptation Fund are the major funds relevant to the Caribbean Region (Box 8-1).

4 Winpenny, Tremolet and Cardone (2016): Aid flows to the water sector: Overview and recommendations. World Bank, Water Global Practice Working Paper November.

Box 8-1: The Green Climate Fund and the Adaptation Fund

Green Climate Fund (GCF)

GCF is the financial mechanism of the UNFCCC set up to help Small Island Developing States (SIDs), Least Developed and African Countries meet their mitigation and adaptation goals. So far, total funding of US$ 10.3 billion has been pledged, and projects totalling US$ 424.6 million approved.

Project bids are considered in the following size categories: micro (less than US$ 10 million), small scale (US$ 10-50 million), medium (US$ 50-250 million) and large (over US$ 250 million).

Financial support can be in grants, concessional loans, guarantees or equity.

Access can be either through a National Designated Authority (NDA) or through accredited multilateral, regional and national entities. The CDB and CCCCC are accredited to GCF, subject to an upper limit on individual projects (US$ 50 million for CDB).

The process for project approval involves the NDA, the Implementing Entities (IEs), and the GCF Secretariat, Board and Advisory Panel. The elapsed time between submission of a concept note and final project approval can be 13 months, according to GCF guidance.

Adaptation Fund (AF)

The AF is a financial instrument under the UNFCCC and the Kyoto Protocol, created to finance adaptation projects and programmes in countries party to the Protocol.

CDB is accredited to the AF for projects up to US$ 10 million.

Approval criteria include: consistency with national sustainable development strategies and plans; economic, social and environmental benefits, cost-effectiveness; arrangements for managing the project and dealing with risk; monitoring, evaluation and impact assessment; avoidance of duplication with other funding sources for adaptation.

Sources: Websites of GCF and AF; Presentation by Derek Gibbs, CDB, "Financing the Water Sector" Barbados, 20 Feb 2018.

All the above mentioned entities operate under the aegis of the UNFCCC [5], but many others, such as the following, do not.

- **Climate Investment Funds**, administered by the World Bank in partnership with regional development banks (including IDB but not CDB). The CIFs include a range of specialized funds: Clean Technology Fund, Strategic Climate Fund, Pilot Program for Climate Resilience, Forest Investment Program, Scaling-Up Renewable Energy Program for Low Income Countries, etc.
- **Global Energy Efficiency and renewable Energy Fund**, administered by EIB on behalf of the EU.

In addition to these specialised funds, all the major mainstream international development banks have reoriented their lending programmes to reflect climate resilience aims. This applies to the World Bank, IDB, CDB, EIB and others.

There are also important bilateral climate finance programmes, such as the UK's International Climate Fund, Germany's International Climate Initiative, and others.

5 United Nations Framework Convention on Climate Change.

Countries seeking access to these climate funds should take the following points into account:

- While some funds are focused on adaptation measures (e.g. Adaptation Fund, GCF), the majority have mitigation as their primary aim. Access to the latter would depend on giving priority to activities aimed at the reduction or offsetting of Greenhouse Gas Emissions, such as energy efficiency in water distribution, water loss reduction, use of renewable energy sources, creation of new carbon sinks through afforestation.
- Applications to climate funds can typically be made either directly through accredited national agencies, or indirectly through membership of accredited international or regional development banks or UN agencies.
- Access to the Green Climate Fund's resources must either be from, or through, an accredited agency. By May 2018, GCF had 59 accredited entities – within the Caribbean Region these included CDB, IDB, CCCCC and the Antigua and Barbuda Department of the Environment. Accredited non-regional bodies with active interests in the Caribbean included EIB, agencies of the World Bank Group, KFW, GIZ, FMO, PROPARCO, UNDP, UNEP and IUCN.
- Different funds have their own criteria and processes, coping with which can absorb precious staff time and resources. External consultants could help with this. The GCF deals with relatively large projects compared to others (e.g. the AF) and its applications process is correspondingly more rigorous and time-consuming. The CDB can offer advice on project proposals to both the GCF and the AF, as well as training workshops for applicants to these funds, and access to Project Preparation support. The GCF has its own Project Preparation facility.
- No regret and low regret options are terms used to describe projects which are justified whatever the future climate scenario – in other words, justified even if there is no climate change because of their benefits to present climate-related events and their contribution to future water security. Many investment proposals will be of the no regret kind, in view of the current deficit in services, backlog of investment in repair and rehabilitation, and the urgent need for new investment to meet growing demand and future challenges.
- However, and with the above points in mind, some climate funds (including GCF) are reluctant to fund "mainstream" water investments, even where these have an incidental climate-resilience impact. Such projects may be more suitable for funding by one of the major IFIs.(CDB, World Bank, EIB etc.).

Pragmatic considerations in the choice of funding

There is no "one size fits all" solution

Different types of investment proposal call for distinct funding options, as illustrated below.

- **Policy, legislation and capacity building**

This entails funding for the upfront costs of studying, planning, public consultation and legislative enactment of the proposed changes, followed by the bureaucratic costs of creating new or reformed institutions and enhancing their functionality.

These costs typically fall on a combination of the public budget with certain standalone activities supported from consultancy and training programmes funded by external agencies and networks (e.g. GCF, CDB, USAID, CIDA, EU, EIB, GIZ, DFID, and the World Bank's Regional Disaster Vulnerability Reduction Project [6]).

The creation of new institutions would, unless offsetting savings were made elsewhere, cause a permanent rise in annual public spending, which would have to be funded largely from taxation and other sources of public revenue such as charges to beneficiaries and penalties from transgressors.

6 World Bank and Global Facility for Disaster Reduction and Recovery (2013): Building resilience: integrating climate and disaster risk into development. Especially Box 14, p. 31, "Tools, capacity and investment support to Eastern Caribbean countries".

Box 8-2: Selected regional funding programmes for climate resilience

The following initiatives illustrate the growing interest of development agencies in financing Caribbean climate resilience projects.

The EU's Caribbean Regional Indicative Programme (CRIP) of the European Development Fund (EDF) for 2014-20 has a budget of €346 million. This represents a substantial increase relative to the 10th EDF (€165 million). The CRIP will address three focal areas, namely a) regional economic cooperation and integration, b) climate change, environment, disaster management and sustainable energy and c) crime and security. This makes it highly relevant for building climate resilience in the water sector.

UK's DFID, via the UK-Caribbean Infrastructure Partnership Fund is now open for proposals for projects in renewable energy, water and sea defences, amongst other infrastructure items.

The European Investment Bank now has a US$ 65 million line of credit with CDB for financing climate resilience projects. Part of which is available for technical assistance for the preparation of projects.

Source: GWP-C and CCCCC (2016); Caribbean Water Security and Climate Resilient Development: a Regional Framework for Investment. EC Website accessed 31 May 2018 https://ec.europa.eu/europeaid/regions/caribbean-0_en

- **Catchment management**

The recurrent expenses of catchment management and other kinds of water resources management commonly fall on the budgets of public agencies. Some of these expenses can be recovered from charges on water users through abstraction charges or fees for specific services. Certain kinds of catchment management are carried out by private farmers and other landowners, and these costs could be shared with public agencies with a close interest, e.g. Payments for Environmental Services (PES) schemes (see Box 8-3 below). Major investment in catchment rehabilitation and reforestation may be eligible for specialist development finance such as through the Global Environmental Facility (GEF) and climate change mitigation and adaptation financing mechanisms such as the GCF.

Globally, it is estimated that in 2013 US$ 9.6 billion was invested in watersheds and other water-critical ecosystems, of which 90% came from public subsidies. The remaining 10% came from utilities, businesses, collective action funds and bilateral deals such as water funds.

There are many examples of local schemes (typically PES) involving the transfer of money from beneficiaries (e.g. downstream users, water supply companies or hydropower companies) to land-users as compensation for changing their practices (in Latin America there are a number of water funds set up for this purpose).

Box 8-3: Payment for Ecological Services (PES) schemes

While there is not a global definition for PES schemes, these are schemes in which downstream beneficiaries of watershed conservation compensate upstream farmers and landowners.

Studies show that there is potential for application of PES schemes in several Eastern Caribbean countries (e.g. Antigua and Barbuda, Dominica and St. Lucia). The Department of Sustainable Development of the Organisation of American States has been compiling an inventory of Payment for Environmental Services schemes in the OAS Member States [7] and the report "Payments for ecosystem services: getting started: a Primer" [8] which provides a global developing country perspective on the subject.

7 It is unclear if the inventory is still accessible (http://www.oas.org/dsd/PES/Database.htm#)

8 By Katoomba Group, sponsored by UNEP andForest Trends 2008. Accessible at: https://wedocs.unep.org/bitstream/handle/20.500.11822/9150/payment_ecosystem.pdf?sequence=1&isAllowed=y

In this context there is also a possibility of "debt-for-nature" swaps, in which creditors agree to forego financial claims in return for assurance that the local fiscal savings are devoted to worthy causes such as nature conservation [9], This option may be considered by countries targeting a reduction of external debt, with under-funded domestic programmes of watershed conservation.

- **Making water supplies climate-resilient**

Major items of capital investment are typically borne by Governments and appear in Capital Expenditure Budgets. External development and lending agencies such as CDB, EU, EIB and the World Bank are potential lenders for such projects with funds channelled through Central Government and made available to the water utility or service provider as grants or loans, with central Government acting as guarantor in the case of loans. Some countries have been able to attract grant funding from the GCF for infrastructure components of GCF projects, although the GCF is only likely to fund infrastructure assets which are demonstrably required to adapt to a changing climate, or the protection of assets against more extreme weather events.

In this context, some external agencies routinely apply climate risk assessments and other screening tools to their lending propositions. CDB, for instance, has applied this approach to recent projects in the Eastern Caribbean, including dam rehabilitation and installation of solar photovoltaic pumps [10].

There is potential scope for engaging private operators through PPPs for groundwater drilling for new abstraction sources, and likewise for providing desalination units in outlying areas and outer islands.

- **Water demand management**

Demand management aims to reduce waste, losses and excessive consumption in the water system, and improve the efficiency and thereby the financial viability of the utility, ensuring that in future it could contribute more to climate-resilient investment in all sectors of its operations.

Some components, e.g. water audit and revenue enhancement, loss reduction programmes and public awareness campaigns – could be funded from loan finance, since they should yield tangible benefits to the utility's cash flow in the medium/long term (Box 8-4). CDB, IDB, EIB and/or the World Bank may be potential funding sources, amongst others. Initial studies, capacity building, consultancy and training costs might be funded from external grant sources including CDB, EIB, World Bank, EU and other development agencies.

Box 8-4: The Performance-Based Contract for Non-Revenue Water Reduction and Control- New Providence, Bahamas

This project, funded by IDB, is to finance a 10-year contract with a private company, Miya, to carry out a comprehensive programme of non-revenue water reduction in this water-stressed island in the Bahamas. Signed in Feb 2012, the contract ties payments to the actual performance of the company in fulfilling specified objectives, and provides strong incentives for the company to over-achieve these. A recent evaluation of the project states that "The NRW reduction in the period from mid-2013 to mid-2015 was so large as to be "off the charts"" with major impacts likely on the financial status of the utility, the Water and Sewerage Corporation.

Source: (IDB Case Study: Performance-Based Contract for NRW Reduction and Control- New Providence, Bahamas. Technical Note No. IDB-TN-813, January 2018)

The cost of retrofitting water-efficient devices in households and commercial premises could be shared between the water users themselves and public agencies through a subsidy programme. Initial costs should quickly be offset by lower recurrent costs in future, hence these schemes should be self-financing on a medium-term perspective. The creation of a Revolving Fund for this is one possibility, exemplified in the recent Grenada project proposal submission to the GCF.

9 Government of Grenada, National Climate Change Adaptation Plan (NAP) for Grenada, Carriacou and Petite Martinique (2017-2021), 2017
10 CDB Annual Report 2015, p. 25

- **Energy efficiency and renewable energy**

There is a close correlation between efficiency in the distribution and use of water, on the one hand, and energy efficiency, on the other, since water is a major consumer of energy in pumping and treatment. Increasing the energy efficiency through operational improvements, or upgrading plants could be argued to provide emissions reductions. Energy use within water systems could also become "greener" by adapting installations for the use of renewable sources of energy such as solar, to make them more cost-efficient and disaster-resilient. Depending on the size of these investments, they could be funded within utilities' business plans, with further support from the CDB, GCF and other climate funds with an interest in both adaptation and mitigation.

- **Disaster risk management (DRM)**

Some items with DRM benefits overlap those in other programmes (e.g. afforestation to reduce flood risk, extra storage to retain floodwater or store water strategically against drought, addition of collection chambers to hold silt that would otherwise clog pipes and interrupt water supply, and hurricane proofing water tanks).

Other DRM Items might include Asset Condition Assessment and Vulnerability Analysis, construction of silt traps and river intake retrofits, and remote monitoring and control (SCADA) systems. These components could potentially be funded through the GCF. Other DRM components could be funded by a combination of internal national budgets, and external funds and facilities, including bilateral development agencies, the World Bank's RDVRP, etc.

Insurance is another potential source of finance for disaster risk and remediation. This option can be considered both at the national level, and in respect of individual parties (households, farmers, companies, etc) at risk. Nationally, Caribbean countries can avail themselves of the CCRIF a regional risk insurance pool. There is also CERC, a disaster compensation facility administered through the World Bank's IDA (Box 8.4). At a different level, individual parties at risk can be encouraged, or obliged, to take out insurance, though in most Caribbean countries this is not a widespread practice.

Box 8-5: CCRIF and CERC- Disaster risk insurance and compensation schemes for the Caribbean

The Caribbean Catastrophic Risk Insurance Facility (CCRIF) is the world's first regional risk pooling financial institution offering insurance to governments for the most prevalent natural disasters in the region. Formed in 2007, it currently has 17 member states.

CCRIF insures against tropical cyclones, excessive rainfall and earthquakes. Each participating country can buy up to US$ 100 million of cover for each risk category. The programme is designed to finance emergency response after disasters. Insurance is parametric, meaning that payouts are based on parametrised models for each category of insured event: this means that payouts are triggered by a pre-determined threshold being exceeded rather than actual losses on the ground (e.g. thresholds being a certain amount of rainfall, wind speeds of a certain scale or earthquake of a certain intensity). These parameters are publicly observable. Payouts are quick – typically in less than two weeks after the event. This method avoids time-consuming damage assessments, and members have complete freedom in their use of funds received.

From 2007 to 2015 CCRIF made 13 payouts to 8 members totalling US$ 38 million.

The Contingency Emergency Response Component (CERC) is part of the Regional Disaster Vulnerability Reduction Project of the World Bank and GFDRR, providing rapid disbursements either to meet immediate post-disaster liquidity needs to finance critical emergency goods, or to finance emergency recovery and reconstruction works and services.

Following Tropical Storm Erika in 2015 the CERC was triggered for Dominica, providing US$ 1 million of IDA funds for procurement of emergency items, small works and clean-up activities, all provided under streamlined procurement and disbursement procedures.

Source: International Monetary Fund: World Economic Outlook, October 2017. P. 150, World Bank and Global Fund for Disaster Risk Reduction: Building Resilience: integrating Climate and Disaster Risk into Development. 2013. P. 31and DVRP Website and ppcrdvrp@dominica.gov.dm

Political factors in the choice of finance

Choice between physical infrastructure and "soft" reforms to laws, institutions and consumer behaviour.

Governments will often prioritise spending on physical infrastructure, especially when it is funded by external grants or loans on favourable terms, rather than generating funds from raising water tariffs, general taxes, or introducing new charges on abstraction, pollution, etc. In the latter case, the "cost" is borne – and funded - by water users. This is never popular with the electorate.

In reality, investing in climate resilience will involve a balance of measures, some of which involve spending on infrastructure, and others require changing policies, institutions and citizens' behaviour. Although the latter are often referred to as "soft" measures, in political terms they may be the hardest.

For the purpose of demand management, water users may be induced to change their practices through a combination of tariff increases and the introduction of abstraction and pollution charges, on the one hand, and subsidies and tax breaks (e.g. for installing household rainwater butts, water-efficient toilets and domestic appliances, and industrial processes) on the other. A judicious balance of the carrot and the stick is called for – some measures will be positive in fiscal terms, some will be negative.

- **Recurrent expenditure and capital budgets**

Some activities require funding on annual budgets, others will be included in Capital Expenditure budgets, depending on their nature and size. Capital spending is typically of a "one-off" nature and it is normally easier to attract external funding for this (although some donor agencies will support recurrent spending too). Capital spending projects, once under implementation, will normally have implications for recurrent annual spending – reducing it where a more efficient asset is created, or increasing it where new assets need higher levels of labour, energy or materials. Costs of servicing and repaying debt will also fall on the annual budget.

Capital spending items are typically funded from a combination of domestic resources (tax revenues, local bond issues, bank loans) and external funding. The latter, if obtained from donor agencies or IFIs, may have attractive terms (long repayment periods, low interest rates, initial waivers and grace periods) but are usually denominated in foreign exchange (dollars) hence pose serious exchange risks in the long term. Concessional funding also usually comes with conditions involving policy and institutional changes, tariff increases, etc which may be domestically difficult to comply with.

- **"Off-balance sheet" finance**

Certain types of project finance do not enter the Annual Budgets voted in parliaments, and avoid routine political scrutiny. These items may be presented as being "additional" to normal investments. One example is a form of Public-Private Partnership [11] in which the private partner supplies the finance, builds the assets, and operates it for a number of years in return for a fee for the services and products rendered. In this case the cost falling on the Government or citizens is deferred into the future. Another example would be finance provided by a foreign government or its agency as part of a barter deal, with repayment taken in the form of oil, minerals or other raw materials.

While such deals may offer short-term political attractions, their long term cost can weigh heavily on future budgets.

Mapping the financing options

Planning a financing strategy for the Investment Plan involves matching its different components with mechanisms that finance mechanisms that are suitable and – crucially – available. Constructing and populating a matrix such as the following may be a useful start.

11 Aka Private Sector Participation, or (in the UK) Private Finance Initiative.

Table 8-1: Summary of potential sources of finance for investments to increase the resilience of the water sector [12]

	Programme	Domestic government budget	Water utility balance sheet	Private sector finance	External grants	Concessional loans	Specialist climate finance	Water users
1	Policy, legislation and capacity development	High potential	Low potential	Low potential	High potential	Medium potential	High potential	Medium potential
2	Catchment management	High potential	Medium potential	Low potential	Medium potential	Low potential	Medium potential	Medium potential
3	Climate resilient water supplies	High potential	Medium potential	Medium potential	High potential	High potential	High potential	High potential
4	Water demand management	Medium potential	Medium potential	Medium potential	High potential	High potential	Medium potential	High potential
5	Energy efficiency and renewable energy	Medium potential	Medium potential	High potential	Medium potential	High potential	High potential	Medium potential
6	Disaster Risk Management	High potential	Low potential	Low potential	High potential	Medium potential	High potential	Medium potential

12 please note – the boxes in this table are for illustration only. The actual ratings will have to be decided country-by-country

8.2 Section 8: Case examples and other relevant material

Case example – Grenada choices within overall fiscal constraints

The overarching theme of Grenada's economic policies over the last decade has been its effort to reduce the size of its public debt, incurred during reconstruction from Hurricanes Ivan and Maria. Public debt in 2017 has fallen to 69% of GDP, though debt repayment and interest will still take up 36% of all public spending in 2018.	**Lesson: control of public debt can override other pressing considerations.**
Although the fall in the size of the public debt, due to restructuring, releases funds for other purposes, expenditure restraint is still the keynote of the Government's 2018 Budget Statement. Capital expenditure in 2017 (XCD $117 million) was at a similar level to the previous year, and only around half its size in 2014.	**Lesson: don't assume it is easy to increase public capital investment.**
The NAP states, "As a small island developing state, Grenada has limited human resources and capacity." (p. 74). Furthermore, as a condition of the IMF's Structural Adjustment Programme, Grenada has had to impose strict hiring conditions in the public service, such that only three people may be hired for every ten persons leaving the public service. As a way of alleviating this constraint the Government of Grenada is considering more "embedding" of international experts within the administration, and requiring the inclusion of funded staff positions in all new bilateral funding arrangements.	**Lesson: try to ensure institutional change and capacity building occur within existing budgets.**
In 2016 roughly one quarter of Grenada's overall capital budget, and the same proportion of its capital budget for climate change mitigation and adaptation, was funded from domestic resources. In other words, three-quarters of finance for Grenada's capital spending both in general and for climate resilience, was funded externally.	**Lesson: most public investment will be financed externally.**
The Government of Grenada's policy is to borrow on concessional terms only. In this connection, its 2015 Memorandum of Understanding with the IMF imposes restrictions on its access to debt finance from third parties. In 2017 Grenada received XCD$ 280 million in external grants and concessional loans, of which XCD$123 million was related to climate resilience.	**Lesson: importance of giving priority to finance on concessional terms.**
Grenada has legislative provision for Public-Private Partnerships (2014) for which certain kinds of contract might be appropriate in groundwater drilling and water loss-reduction programmes, as well as desalination units. However, as the NAP stated in 2017, "Grenada is rated as high-risk by the rating agencies, and therefore continues to experience difficulties in attracting private sector investors and securing competitive debt finance".	**Lesson: Private Sector Participation is an option, but opportunities are limited.**
Grenada has successfully tapped various sources of climate adaptation funding, totalling US$ 16.47 million over the last decade. An application has also been made and accepted to the Green Climate Fund for funding a programme of investment in the water sector. For more details please see Section 7 of this manual. Grenada is expecting to sign up to a World Bank Policy Loan of US$ 25 million in 2018 for climate adaptation and mitigation, protection of natural resources, and physical planning. Grenada would also be eligible to draw on a facility funded by the EIB and CDB for emergency post-disaster reconstruction, as well as a US$ 120 million Climate Action Loan for the Caribbean. Likewise, Grenada could access the UK-CIF funding for climate resilience and roads, expected to total US$ 79 million in 2018.	**Lesson: take up whatever climate finance is available, including GCF.**

8.2.1 Green Climate Fund (GCF) Concept Notes

The GCF project cycle includes as a voluntary first step the preparation and submission of a GCF Concept Note. While it is a voluntary step, developing a concept note is highly recommended as experience has shown that it leads to better proposals and provides the opportunity to start a dialogue with the GCF Secretariat and receive valuable feedback and guidance.

The Concept Note is self-funded but once submitted further technical assistance support is available to turn a project Concept Note into a fully-fledged funding proposal. For example, the GCF Board can approve requests for support under their Project Preparation Facility (PPF) based on a review and assessment against GCF's investment criteria and a justification of needs for project preparation funding.

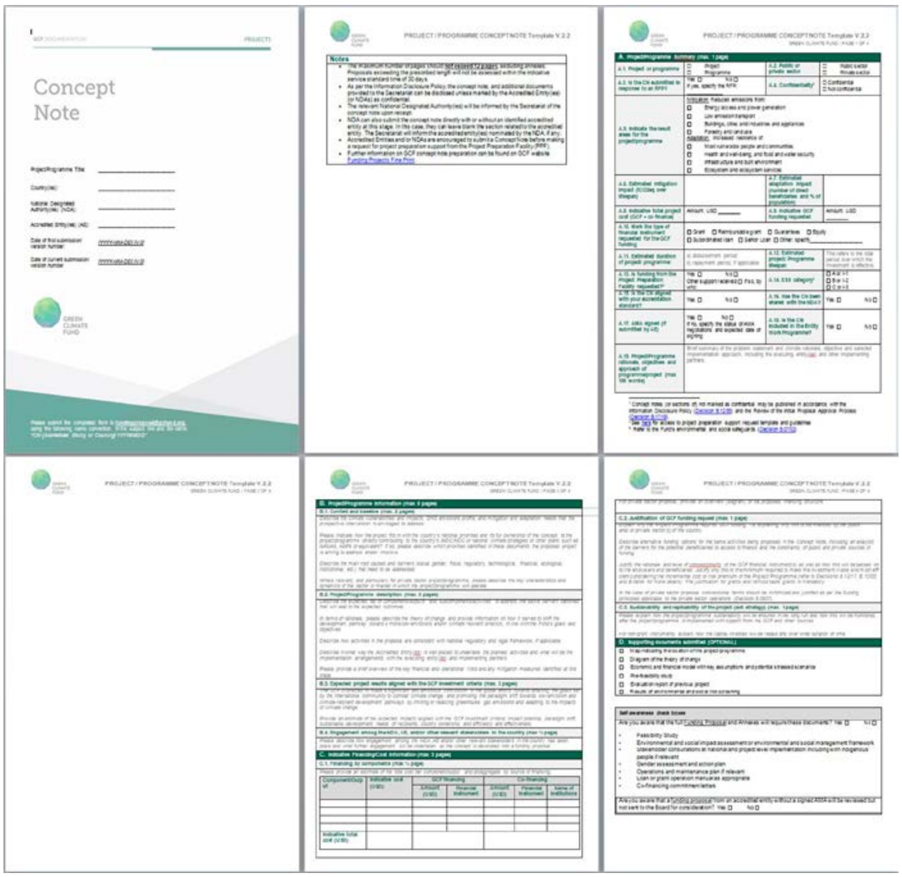
Concept Note

Figure 8-3: GCF Project Concept Note

Source: GCF Website

A project or programme GCF Concept Note document provides basic information about a project or programme to seek feedback on whether the concept is broadly aligned with objectives and policies of the Fund. They provide Accredited Entities with a chance to seek initial feedback on whether their proposal matches GCF's objectives and mandate, and may offer a useful way to share funding ideas with the GCF secretariat. However, initial GCF feedback does not represent a commitment to provide financial resources to support the proposed climate finance initiative. Although only at the concept stage, preparing a GCF Concept Note template still requires considerable research, consultation and thinking regarding a project's design and costing. The maximum number of pages should not exceed 12 pages, excluding annexes.

The template is available (version 2.2) at https://www.greenclimate.fund/library/-/docs/list/574044 .

Learning lessons from other submissions are worthwhile particularly where these relate to water sector projects in the Caribbean, see the Good Practice case study in the following section.

8.3 Section 8: Case examples and other relevant material

8.3.1 Example GCF proposal

Box 8-6: Climate-resilient water sector in Grenada (G-CREWS) project

Background

Climate change poses a severe threat to Grenada's water supply because the small island developing State relies on surface water sources and rainwater catchment. Water is a scarce resource in Grenada and climate change is already aggravating the problem with an increasing average temperature and more erratic rainfall. More frequent heavy rainfall events make water supply outages more common due to high turbidity in the raw water supply. Saltwater intrusion in coastal groundwater aquifers due to sea-level rise will further reduce the availability of freshwater in the future.

In 2018, Grenada successfully submitted a proposal to the GCF for a EUR 42.3 million Climate-resilient water sector in Grenada (G-CREWS) project. The GCF financing amounted to EUR 35.5 million alongside a domestic contribution of EUR 4.3 million. The project's approach addresses two main vulnerabilities of Grenada: freshwater availability and disaster preparedness. Other Caribbean communities share these vulnerabilities, rendering this project a model for regional application.

Climate-resilient water sector in Grenada (G-CREWS) project

The project included five components as follows:

Component 1: Climate-resilient water governance (total cost: EUR 2.9 million; GCF cost: EUR 2.5 million)

This component supports the integration of climate resilience into Grenada's water sector governance by establishing a dedicated water resources management unit (WRMU), mainstreaming climate resilience into water sector-related policies, plans and regulations as well as introducing a climate-responsive water tariff. It leads eventually to a strengthened institutional and regulatory system for climate-responsive planning and development. Strengthening the collection and management of water resources and climate change data leads to increased use of climate information in decision-making.

The creation of the WRMU will facilitate sound and climate-responsive regulation of water resources management. Through ongoing technical assistance for this new entity, the project will achieve the following benefits: (1) development of climate-responsive regulations to protect water resources and optimize efficiency in water use; (2) reduction of water abstraction from different resources, depending on the impacts of climate variability and climate change on the hydrological regimes, as well as on ecosystems; (3) priority setting for water uses (domestic, ecosystems, agriculture, commercial); and (4) upgrade and improvement of the existing climate and water information system; with management of the system transferred from the National Water and Sewerage Authority, Grenada (NAWASA) to WRMU.

The establishment of WRMU is considered an effective means of concentrating climate change research and water management policy in a single government body, addressing the stated problem of incoherent policy setting of the past.

A climate-responsive water tariff will be established, targeted at specific groups of water users. This dynamic tariff is considered to have the potential to inspire a transformative change in attitudes towards water use in the face of reducing availability of fresh water due to climate change.

Component 2: Climate-resilient water users (total cost: EUR 6.1 million; GCF cost: EUR 5.4 million)

There is considerable potential for water efficiency gains in Grenada, particularly in households on the Grenada mainland, the tourism industry and agriculture. This component focuses on the following initiatives:

- Establishing a challenge fund for climate-resilient commercial water users in the agricultural and tourism sectors (the two major water-using sectors). The challenge fund will provide post-investment grant subsidies for implementation of water efficiency measures and rainwater harvesting; and
- Strengthening the understanding and awareness of the public, the private sector and political decision makers about the challenges the water sector faces due to climate change.

This component focuses on making the users of potable water more aware of the national fresh water context and the impact of climate change on water availability. These attitude changes are further strengthened with the dynamic water tariff from component 1 and, jointly, they may be expected to constitute a paradigm shift in how fresh water is being perceived by the population of Grenada.

Component 3: Climate-resilient water supply systems (total cost: EUR 27.1 million; GCF cost: EUR 24.0 million)

The project will strengthen the climate resilience of the water supply system by focusing on the following three areas:

- The capability of the NAWASA water supply (raw and freshwater storage, and groundwater resources) to provide the required potable water resources. Increased storage and more in-built flexibility through the interconnection of pipelines and sustainable groundwater systems will enhance the capacity of NAWASA to react to dry spells when less surface water is available, as well as to the increased frequency of heavy rainfall events with local impacts;
- Installation of larger on-site storage capacities at critical infrastructure like medical centres to reduce exposure to climate-induced scarcity of piped water; and
- Improvements in the ability to respond to heavy rainfall and other disaster events through disaster-proof infrastructure and comprehensive emergency response plans, which will help to ensure that water supply interruptions are minimized.

The proposed activities address both the supply side, which is impacted by slow-onset climate change, such as changes in rainfall patterns and amounts; and increasing resilience to the projected force and frequency of extreme weather events. Taken together, these activities show a comprehensive perspective on the long-term viability of potable water supply to the population of Grenada.

Activities on the resilience of the water sector focus on the service continuity of public services, such as medical centres and schools, used as community shelters during hurricanes; therefore, making sure that the more vulnerable groups of the population benefit the most from the investments.

Component 4: Additional contribution of the water sector to Grenada's nationally determined contribution (total cost: EUR 1.7 million; GCF cost: 0)

The project will improve the water and energy efficiency of NAWASA systems and unlock additional contributions to the project's objective and Grenada's nationally determined contribution. The component is designed to complement the project and stimulate climate action in other sectors. This will be achieved by:

- exploring and implementing solutions for powering NAWASA operations with renewable energy (e.g. solar-powered water pumping, solar-powered water treatment, hydropower micro turbines within the piped network); and
- implementing measures to support the NAWASA water loss reduction strategy.

Component 5: Regional learning and replication (total cost: EUR 0.8 million; GCF cost: 0)

The project will increase learning and replication on climate-resilient water sector approaches in the Caribbean. The component is designed to stimulate climate action as well as engagement with GCF in other Caribbean countries. It will contribute to strengthened institutional and regulatory systems for climate-responsive planning and development and strengthened awareness of climate threats and risk-reduction processes of government institutions in the Caribbean.

Source: Adapted from 'Consideration of funding proposals – Addendum XXVIII, Secretariat's review. GCF Board meeting notes GCF/B.19/22/Add.28/Rev.02'

8.3.2 Example of GCF proposal review

Box 8-7: Example of GCF Secretariat review of assessment of performance

The reviewers remarks at the submission of the Climate-resilient water sector in Grenada (G-CREWS) project proposal highlight key strengths and points of caution that were noted if the intended results were to be realised. Performance assessment against specific criteria is given below.

Strengths	Points of caution
■ Public infrastructure investment in a small island developing State highly vulnerable to increased hurricane activity ■ Building resilience into a public utility to minimize the impact of service disruptions after hurricanes ■ Public utility management will be made climate aware to guide future investments ■ Government and water authority providing co-financing	■ Water consumption patterns need to change to ensure adequate long-term supply of fresh water ■ Elements not related to climate change to be funded from co-financing ■ Project focuses on network resilience, other elements of proper management not included

Impact potential (Scale: medium):

- The policy interventions, including the dynamic water tariff, benefit the entire population of 107,000 and all economic sectors. The activities are focused on achieving an attitude change among all water users. Awareness-raising, dynamic water tariffs tailored to specific user groups and policies are aimed at reducing consumption; while retrofitting existing infrastructure is increasing the efficiency of capturing the reducing supplies of fresh water.
- A significant part of the project focuses on making the public water supply more resilient to the impacts of severe weather, both at the dimensions of the actual event (e.g. reducing erosion to reduce turbidity of run-off) and in the aftermath (e.g. retention in the network that can buffer against service interruptions from hurricanes).
- Overall, the impact of the project is medium as its potential is limited by the lack of influence at the political level, especially in the tourism and industrial sectors.

Paradigm shift potential (Scale: Medium/high)

- The project approach of combining interventions towards climate-resilient water governance, resilient water users and resilient water supply systems will help to achieve the necessary reduction in water demand and sustained water supply. By tackling these issues on multiple levels (policy, financial, infrastructure), the chances of achieving the impacts is considered high.
- From the government side, there is recognition that policies on water production and utilization need to be integrated, with climate change forecasts being integrated into long-term policies.
- The project reaches out to major water users in agriculture, hotels and industries through a challenge fund. This fund aims to leverage private-sector financing. Overall, the impact of the fund on the private sector is expected to be limited, due to the relatively small size. In combination with the other components of the proposal, however, the fund may catalyse interest and investment from the private sector in water-use reduction and increased resilience to severe weather.

Sustainable development potential (Scale: Medium)

- Tourism and agriculture are two of the biggest contributors to Grenada's gross domestic product (GDP) and employment. Both economic sectors depend heavily on a reliable water supply and water resources management. Shortages in water supply will have major negative impacts on tourism, a sector highly reliant on water. Providing water supply and water resources management will support economic growth, create jobs, raise the average income and thus increase purchasing power. The project addresses substantial future economic losses due to climate-induced and natural hazards, which have been estimated to be up to 61 times higher than the costs of adaptation measures.
- The project reduces the population's vulnerability to water scarcity generally, and particularly among low-income groups without access to piped drinking water and storage facilities. Low-income households not connected to the supply network, or with no or very small storage capacity, are highly vulnerable to droughts and interruptions in supply. The project therefore contributes to social development by expanding access to drinking water for vulnerable groups. The project also contributes to public health by reducing water-related diseases because the protection and safeguarding of water sources, covering of water storage facilities, and faster leak repair in the distribution network prevent contamination. The project focuses on increasing the water-related resilience of medical centres, as these were assessed as highly vulnerable.

Needs of the recipient (Scale: Medium)

- Grenada's economy is vulnerable because it relies heavily on tourism and agriculture. Both sectors depend on water availability, favourable weather, infrastructure and coastal ecosystems. In addition, Grenada's public finances are constrained by a severe debt burden and are unable to provide the necessary fiscal space for investments in enhancing the islands' resilience.
- Among Grenada's population, low-income households, women-led households, the elderly, as well as women and girls in general, are particularly vulnerable. One underlying reason is the segregation of roles for women, men and children resulting in, for example, unequal access to financial resources and decision-making about natural resources. It also increases the burden on women managing households, especially in times of drought or disaster.
- If Grenada is not able to increase its resilience soon, negative climate change impacts will increasingly affect the entire population. The main impacts will include reduced availability of water, increasing heat stress and environmental hazards caused primarily by droughts, heavy rainfall events and tropical storms. These impacts are already a reality in Grenada today. In 2009 and 2010, a prolonged drought caused widespread disruption in the water sector resulting in substantial losses in crops and livestock. Some communities on the island saw their water supply decline by over 40 per cent. Two hurricanes hit Grenada directly: Ivan in 2004 and Emily in 2005. The storms brought catastrophic destruction to Grenada's population, economy and public sector. Over 40 lives were lost, 90 per cent of the islands' homes destroyed and the damages exceeded 200 per cent of Grenada's GDP.

Country ownership (Scale: High)

- The project is properly aligned to national priorities concerning climate change adaptation. The Government of Grenada and all relevant stakeholders fully agree that climate resilient water supply is a priority for the country's survival. This can be seen in the role the water sector plays in the following key national documents when it comes to climate change: (a) Grenada's Initial National Communication (INC) included a comprehensive vulnerability assessment of "what is currently known about Grenada's vulnerability". The INC clearly identified Grenada's water sector as an adaptation priority based on a plausible vulnerability assessment taking a then-limited data situation and scientific uncertainty into account; (b) The National Climate Change Policy and Action Plan 2007–2011 refers to the assumptions and assessments in the INC, including global climatic trends obtained from the contemporary Intergovernmental Panel on Climate Change reports, very limited national data, stakeholder consultations, and regional studies for the Caribbean. It also identified the water sector as one of Grenada's most vulnerable sectors, confirming the water sector as a policy priority; (c) In 2015, Grenada submitted its intended nationally determined contribution, an essential cornerstone of Grenada's climate change policy.
- The nationally determined contribution identified water resources management as one of four priorities for adaptation action. The rationale is that a resilient water sector is "crucial to the long term development of Grenada as a nation" and that "improved capture, storage, distribution and conservation of water increases the adaptive capacity of individuals and communities"; and (d) The 2017 National Adaptation Plan is about to be forwarded to the cabinet for approval. Its function is to provide a strategic, coordinating framework for building climate resilience in Grenada, recognizing the need to develop the Enabling Environment for climate change adaptation as well as programmatic priorities. It is a five-year plan (2017–2021) with 12 multi-sectoral programmes of action. The plan dedicates the entire Program of Activities 3 to water availability, including a detailed and budgeted list of recommended activities and a budget estimate of approximately US$ 50.2 million. All activities foreseen within the climate-resilient water sector in Grenada (G-CREWS) project are included in the Program of Activities.

Efficiency and effectiveness (Scale: Medium)

- The investment costs for the climate-resilient water sector are approximately 350 EUR per capita. These costs cover the broad range of interventions (technical assistance, awareness building, private sector involvement, capacity-building, infrastructure and institutional development) and the generally high per-capita costs of project implementation in a small island developing State due to a small population.
- The Government of Grenada is seeking grant-funding to alleviate severe climate-induced risks related to drinking water availability for the entire population of Grenada, including particularly poor and vulnerable groups, and the two largest and highly vulnerable economic sectors: tourism and agriculture.
- The International Monetary Fund noted a number of outstanding challenges for Grenada after recovering from the hurricanes in 2004 and 2005: public debt is still considerably high and Grenada remains vulnerable to shocks. Therefore, Grenada must stay on the current path of fiscal prudence until various reforms yield expected results. This means Grenada must continue avoiding any burden on public debt. The Government of Grenada has formulated a clear commitment to continue reducing its debt to 60 per cent of GDP in the coming years. The limited public financing available and the constraints regarding Grenada's ability to take on additional debt are hindering the country's implementation of long-term adaptation measures in its water sector.

Source: Adapted from 'Consideration of funding proposals – Addendum XXVIII, Secretariat's review. GCF Board meeting notes GCF/B.19/22/Add.28/Rev.02'

8.3.3 Relevant material and other resources

Box 8-8: Relevant material and other resources

Green Climate Fund Proposal Toolkit 2017: Toolkit to develop a project proposal for the GCF (CDKN, 2017)

The GCF, the world's largest dedicated climate fund, is designed to help developing countries achieve their ambition for low-carbon resilient development. This toolkit aims to guide project proponents' understanding of the key considerations to take into account to fulfil the GCF's requirements when developing funding proposals.

Available at: https://cdkn.org/wp-content/uploads/2017/06/GCF-project-development-manual.pdf

Concept Note Users Guide (GCF)

The GCF Concept Note presents a summary of a proposed project/programme to the GCF in order to receive feedback from the Secretariat on whether the concept is aligned with the GCF's objectives, policies and investment criteria. The objective of this user's guide is to assist Accredited Entities (AEs) and interested National Designated Authorities (NDAs) to develop and strengthen a Concept Note to be submitted to the Green Climate Fund.

Available in E-Annex

Consideration of funding proposals – Addendum XXVIII, Secretariat's review. GCF Board meeting notes GCF/B.19/22/Add.28/Rev.02

This addendum contains the Secretariat's review of the public sector funding proposals (FP059-FP077) submitted for the Board's consideration at its nineteenth meeting. It includes review and recommendations in relation to the Climate-resilient water sector in Grenada (G-CREWS) project. This includes (i) assessment of performance against investment criteria, (ii) assessment of consistency with GCF safeguards and policies and (iii) identified risks.

Available in E-Annex

Accreditation to the Green Climate Fund (GCF, Feb 2017)

A useful guide to the GCF with instructions on how to become accredited.

Available in E-Annex

Climate Funds Update

This is a leading source of information and advice on climate finance hosted jointly by the Overseas Development Institute, London, and the Heinrich Boll Stiftung (North America). CFU produces regular Briefs and periodic larger reports on this topic, all downloadable from its website.

Available at: www.climatefundsupdate.org

Caribbean Water Security and Climate Resilient Development: A Regional Framework for Investment -Chapter 5, Financing the Regional Framework for Investment, 2016, Global Water Partnership-Caribbean and CCCCC

This provides useful material and guidance.

Available at: www.gwp-caribbean.org

8.4 Section 8: Notes for the trainer / facilitator

8.4.1 Notes and considerations

- Be aware that governance and institutions for water supply, including water resources management, differs between all the islands. For instance, in water service provision there is a spectrum ranging from entities that are run as government departments (e.g. St. Kitts and Nevis) through to those with greater autonomy and a stronger commercial orientation (e.g. Grenada, St. Lucia) [13].
- Recall that the different islands have different funding options. Some of the larger ones are members of the IDB [14] as well as CDB, and may have local options (bonds, loans) for project finance.
- Exercise caution in presenting any particular governance or funding model as an "ideal paradigm". Water is everywhere a sensitive issue. Be aware of specific political, social, economic and geographical constraints in the different countries. OK to recommend "good practice" within those constraints.
- Draw out country experiences and attitudes. How far has climate resilience been a "game changer" in the water sector? How to raise the profile of water in national agenda?
- Seek out opportunities for peer-to-peer exchanges between countries. Do other countries in the region serve as beacons for water reform and climate resilience? Which ones?
- Anticipate any possible confusion over the terms no regret and low regret investment options. These terms are commonly used in discussions over climate change adaptation. Many investment proposals will be of the no regret kind, in view of the backlog and urgent need for new investment to meet growing current and expected future challenges. Use of term win-win might resonate more in these circumstances.

8.4.2 Exercises and discussion topics

<table>
<tr><th colspan="2">Group Session 1</th></tr>
<tr><td>Title

Identifying sources of finance to implement priority climate resilience measures.</td><td>Type

2-3 breakout groups (depending on numbers), reporting back to plenary.</td></tr>
<tr><td colspan="2">Objectives

■ Become familiar with the main sources of funding for priority climate resilient investments in water, both "conventional" sources and from specialist climate funds and facilities.
■ Appreciate the considerations involved in choosing financing sources and matching these to the investment priorities identified.
■ Share and benefit from knowledge of experiences, policies and practices in other countries.</td></tr>
<tr><td>Duration

1 hour 30 mins.</td><td>Materials needed

■ Training Manual.
■ Flip Chart (template Table in Section 8.5.1).
■ Cards and Post-It Note pads for participants.
■ Marker pens.
■ Hand-outs (agenda, case material).</td></tr>
</table>

13 There has so far been very limited experience with private ownership of "customer-facing" water utilities in the Caribbean (an attempt to privatise St Lucia's WASCO in 2008 proved abortive). There have, however, been cases of Public-Private Partnerships involving the private supply of bulk water.to utilities for onward sale, e.g. a Build-Operate-Transfer desalination unit for Trinidad contracted to Seven Seas Water Co.

14 Bahamas, Barbados, Guyana, Jamaica, Trinidad and Tobago, Suriname

Preparation

- Familiarise with the PowerPoint presentation provided for this session and adjust it on the basis of the national context.
- Familiarise with recent and ongoing financing from development partners, and the potential range of development finance which the country is eligible to access.
- Convey key logistical information to participants.
- Study list of participants and compose Groups reflecting diversity and potential synergies amongst them.

Description of tasks and instructions

Step 1: Introduction to the activity (in plenary)

- Outline the main issues in this topic, drawing on the Training Manual material for Section 8. Divide participants into 2-3 breakout groups, with convenors and rapporteurs agreed.

Step 2: Food for thought (in groups)

- Participants should answer, in groups, to the following questions, and write their answers on the flip-chart.
  - Do you agree there is plenty of funding potentially available for climate resilience in the region?
  - How would you match the required investments with the different kinds of funding available in your country?
  - What are the main constraints in getting access to these funds?
  - Propose three practical measures for improving access to funding.

Task 3: Assess potential of financing options (in groups)

- Participants will complete the template Table in Section 8.5.1 using a representative sample of investment projects suggested by participants, and provide justification for the result.

Task 4: Round-up of results (in plenary)

- Carry forward resulting chart and outcomes of group discussion to plenary, to be presented by convenor/rapporteur for each group.

Following the workshop

Report on the main findings of this section, and feedback on the relevance of the section proceedings for future training purposes.

Group Session 2	
Title Review of Green Climate Fund (GCF) concept note template.	**Type** Exercise, working in three groups.
Objectives To gain an appreciation of project and programme proposal preparation for the GCF. This will be supported by the availability of pre-identified investment options. The task will rationalise this in to an outline GCF concept note that responds to GCF assessment criteria.	
Link with other materials Pre-identified list of investment options. GCF Concept Note Template (provided in E-Annex).	

Duration	Materials needed
1 hour 40 mins: ■ 10 minutes on Step 1. ■ 1 hour on Step 2. ■ 30 minutes on Task 3.	■ Two sets of print-outs for each of the four steps. ■ Six copies of the GCF concept note template (x2 per Group). ■ Post-it notes, paper and pens/pencils to record ideas. ■ Flipchart and pen to record discussion.

Preparation

Prepare a list of investment options to present to the participants.

Description of tasks and instructions

Step 1: Introduction to the activity (in plenary)

- Give some background to the activity based on the information provided in the Training Manual for Section 8.
- Ask the workshop participants to split into three groups: A, B and C.
- Each Group will follow the same process.

Step 2: Complete Section B.1 to B.3 of the GCF Concept Note template in bullet form

- Based on the Group's own knowledge/expertise and the pre-identified investment needs formulate a high-level outline for Section B.1 to B.3 (e.g. in bullet form).
- Move from group to group throughout the task to see how participants are progressing and answer any questions they may have on the process.

Task 3: Feedback and whole group discussion

- Once the Section B.1 to B.3 assessments have been completed, ask a volunteer from each group to report back their findings to the plenary, including their list of expected components, outputs and activities.
- Highlight any interesting points to the group, and encourage feedback from other groups to any potential gaps and/or other actions to strengthen the outline.

Task 4: Justification and sustainability

- Invite participants to explain the justification for the eligibility for GCF funding, and why this is not financed by public and/or private sectors of the country.
- Invite participants to explain how the project/programme sustainability could be ensured in the long-run and how this could be monitored.

Task 5: Plenary session

- Share (on screen) texts from the Grenada case example for Justification and Sustainability.
- Highlight any interesting points to the group, and encourage feedback from participants.
- Invite any questions for further discussion, noting any key points.

Following the workshop

- This session is a demonstration only. The intention is to gain an appreciation of GCF Concept Note proposal preparation.
- Following the workshop, the intention is to develop a full GCF Concept Note based on the evidence generated from the policy Screening, CRVA and Investment Plan.

8.5 Section 8: Annexes

8.5.1 Group Session 1 - Template table

Table 8-2: Potential sources of finance for climate resilience investments - Template

Climate resilience action/investment	Domestic government budget	Water utility balance sheet	Private sector finance	External grants	Concessional loans	Specialist climate finance	Water users

Fill the table with potential of each type of funding for each option based on the likely eligibility, availability and practicality of accessing financing.

High potential

Medium Potential

Low Potential

Section 9

Monitoring and evaluation

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Section 9: Monitoring and evaluation

Summary

This section introduces concepts of monitoring and evaluation (M&E) for climate resilience building measures. It covers the main aspects of effective M&E systems in the context of a results framework and a vision for a climate resilient water supply services sector. It provides insights regarding the type and characteristics of indicators for a climate resilient water sector that could be developed as part of a national process. It also discusses the role of the ***WaterRiSK*** self-assessment methodology to support countries in this process.

Objectives

At the end of this section, participants will be able to:

- Agree on monitoring actions and methods to evaluate outcomes and progress of the implemented adaptation (resilience-building) measures;
- Define indicators to monitor progress towards resilience and outcomes of adaptation measures;
- Understand how to reflect on lessons learned from each "planning cycle" and how to apply them to the next investment cycle.

Things to know …

- Monitoring frameworks should be established as part of the process design, and not left until after completion of a process cycle.
- You can't monitor what you're not measuring. Resilience in the water supply sector is complex and is influenced by many different factors. Taking stock of 'resilience indicators' from time to time, helps decision makers to understand what could be done better and helps to shape development in a climate resilient manner.
- Ad-hoc quantitative indicators are not always available: when this is the case it can be necessary to resort to proxy or qualitative indicators, as well as identify actions to enhance the capacity to access and produce quantitative indicators, for example strengthening water data management practices.
- Results-based management provides information to decision makers (and other stakeholders) on progress (or lack thereof) toward achieving intended adaptation objectives, outputs and outcomes.
- There is no need to develop a completely new set of indicators if suitable ones already exist. However, there is need to mainstream adaptation to climate change into existing M&E processes.

9.1 Section 9: Guidance Materials

9.1.1. Effective M&E systems

Monitoring and evaluation (M&E) is vital to ensure that we can learn about which interventions for water sector resilience work and why, and what needs to be adjusted. When done well, it can demonstrate the effectiveness of projects and programmes, as well as generate new learning [1].

Monitoring helps to track progress and demonstrate the impacts that different efforts have on improving conditions and services [2], as well as being used to inform future policy, planning and investments. As more is learned about the effectiveness of different projects and programmes, this information is then fed back to inform decisions about whether any adjustments are necessary to improve performance.

It is then vital to provide evidence that interventions to improve the climate resilience of the water sector are effective in achieving their scope and that interventions and investments involve planning, implementation, learning and adjustment that is continuous and forward looking [3].

Box 9-1: Monitoring and evaluation [4]

Monitoring is the 'ongoing process of tracking and reviewing resilience enhancing activities, their results, and the surrounding context'. Resilience enhancing interventions, projects or programmes can be evaluated using the information generated from monitoring. Monitoring and evaluation are often considered as a single M&E system.

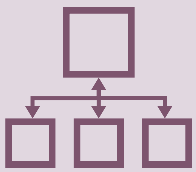
M&E systems used to track adaptation in the water supply sector must account for factors that affect long-term changes, even if they cannot be definitively measured in a given implementation period.

For monitoring and evaluation systems to be effective in a context of enormous uncertainty about the impacts of climate change, they need to be consistent with Results-Based Management (RBM) approaches, and in doing so maintain flexibility and encourage learning. RBM captures the quality of implementation efforts and the results of those efforts, supports efforts to meet periodic targets and captures evidence for reflecting on what leads to intended and unintended changes.

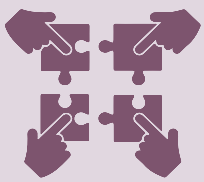
1 Bours, D., McGinn, C. and Pringle, P. (2013) Monitoring and Evaluation for Climate Change Adaptation: A Synthesis of Tools, Frameworks and Approaches. SEA Change CoP, Phnom Penh and UKCIP, Oxford.)
2 Schwemlein, S., Cronk, R. and Bartram, J. (2016) Indicators for Monitoring Water, Sanitation and Hygiene: A Systematic Review of Indicator Selection Methods. International Journal of Environmental Research and Public Health, 13, 333.
3 Willows, R.I. and Connell, R.K. (Eds.) (2003) Climate adaptation: Risk, uncertainty and decision-making. UKCIP Technical Report. UKCIP, Oxford.
4 Adapted from Spearman, M. and McGray, H. (2011) Making adaptation count: Concepts and options for monitoring and evaluation of climate change adaptation, manual. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ), and World Resources Institute (WRI). Available from: www.seachangecop.org/node/107.

Box 9-2: Main principles of M&E for climate change adaptation

- Results from the M&E should be reported and disseminated so as to ensure that they are fed back into the respective adaptation process, but also to allow for lessons learned and good practices identified to be shared with the wider community of water resources users and planners.



- The M&E framework must link individual (sub-national) assessments (of vulnerability or resilience) with national level assessments to broaden the focus from the means of achieving outcomes (individual interventions) to the desired end result which is, the country's water supply services becoming less vulnerable / more resilient.



- Definition of successful adaptation and the ways of measuring successful adaptation should align with water resources managers / funding agencies/ the country's/communities shared objectives.

9.1.2. Types of indicators

Indicators are used to help measure progress towards specific targets and objectives. By tracking key indicators through monitoring, options and plans can be adjusted if necessary through a cycle of evaluation and learning. M&E is crucial to guide the implementation process and ensure that the benefits of the Investment Plan are realised on the ground. The two main elements to consider are (i) M&E of outcomes and (ii) M&E of the implementation process itself. Monitoring of outcomes aims to ensure that implementation activities lead to the desired programme outcomes and impacts (e.g. reduced operational risks associated with climate variability and change and improved levels of service to customers). Monitoring of implementation is a management process to ensure that activities are delivered effectively and efficiently.

Box 9-3: Types of indicators

Indicators are useful for decision-making because they can quantify information so its significance is more readily apparent, and simplify information about complex phenomena to improve communication. Indicators can also help structure the process for data collection and can be quantitative or qualitative. Unlike quantitative indicators which give a numeric measure of something, qualitative indicators depict the status of something that is less easily quantifiable in more qualitative terms, for example, the perceived change in the reliability of different springs during a drought event.

Indicators may be used at different points in the results chain. These indicators include:

- Activity or process indicators – actions taken or processes through which inputs are mobilised to produce specific outputs;
- Output indicators – the immediate effects of interventions or measures, or the direct products or deliverables of interventions or measures;
- Outcome indicators – the intermediate effects of an intervention or measure's outputs.

There are also proxy indicators, which can be used to represent something that is difficult to measure, and aggregate indicators (e.g. Aqueduct Water Risk Atlas), which summarise and simplify complex information from multiple individual indicators.

9.1.3. Monitoring a results framework

A vision for a climate resilient water supply services sector can be articulated as a generic results framework, as shown in Table 9-1.

The results framework provides a tool that can be used to monitor and review progress and to report on delivery toward a climate resilient water supply services sector. It helps to set out a structured approach to catalysing change and can be made country-specific by incorporating targets and indicators that respond to an individual country's vision for 2030.

The overall objective is to provide access to safe, reliable and resilient water supply services and to reduce operational risks associated with climate variability and change. The results framework sets out the key indicators of success, outputs and outcomes recommended for climate resilient water supply sector. At the national, catchment, and water supply system levels, there are a number of indicators, different outputs and an intermediate outcome.

- At the national level, the focus is on an Enabling Environment which guides and promotes a proactive approach to the integration of climate resilience.
- At the catchment level, the focus is on water resources and watershed management practices which secure water quantity and quality and are robust to cope with climate variability and climate-induced emergencies.
- At the water supply system level, the focus is on water supply systems that can quickly respond and recover from climate caused disruption and users are engaged in the drive for greater resilience.

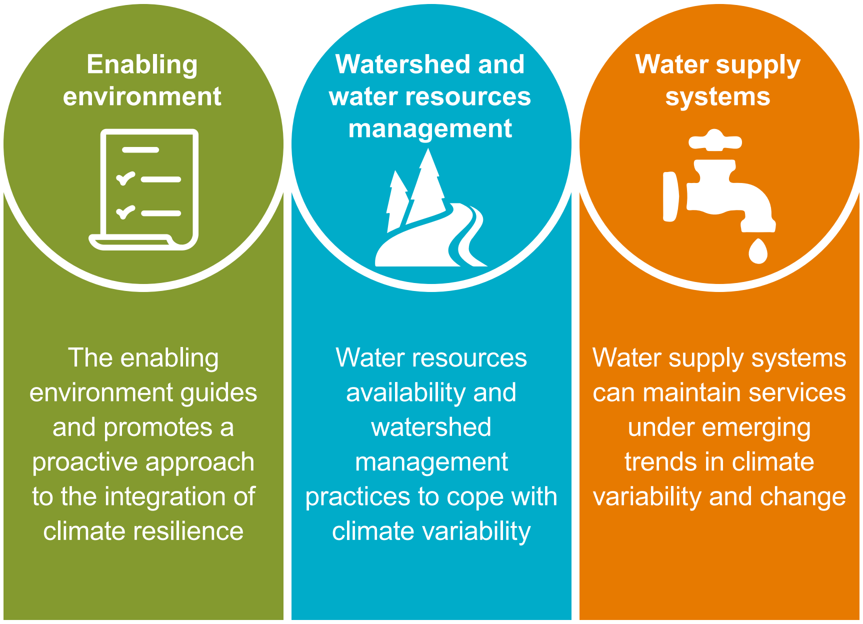


Figure 9-1: Three pillars of climate resilience for the water supply sector

The individual characteristics of a resilient water supply services sector will be country and context specific but are underpinned by a number of common characteristics at national, catchment and water supply system level that contribute to successful outcomes.

Table 9-1: A generic results framework to achieve a vision for a climate resilient water supply services sector

<table>
<tr><th colspan="3">Main outcome</th></tr>
<tr><td colspan="3">Provide access to safe, reliable and resilient water supply services and to reduce operational risks associated with climate variability and change</td></tr>
<tr><th>Intermediate outcomes</th><th>Intermediate Outputs</th><th>Potential outcome indicators</th></tr>
<tr><td rowspan="3">An Enabling Environment which guides and promotes a proactive approach to the integration of climate resilience</td><td>Clear, harmonised and inclusive institutional roles and responsibilities for water and climate resilience (CR)</td><td>■ Institutional mechanisms for coordinating different official agencies for CR
■ Platforms and processes for multi-stakeholder engagement and consultation
■ Water Policy adopted by Government
■ Compliance with checklist on Water Governance and policies (see Section 4)
■ Legislation for IWRM enacted and implemented
■ Water Resources Management Unit created and functioning effectively and sustainably</td></tr>
<tr><td>Climate resilience mainstreamed into national policies and strategies</td><td>■ Incorporation of CR centrally into strategies and policy statements (level of priority given to CR relative to other national objectives, climate resilience targets)
■ Fit for purpose legislation and regulations (see NASAPS)
■ Routine mainstreaming of CR into Environmental Impact Assessments (EIAs) and project feasibility studies and due diligence
■ Availability of guidance and tools to identify, plan and implement climate resilience measures
■ % of recommendations from Water Policy Committee meetings being implemented</td></tr>
<tr><td>Capacity and knowledge base built to integrate climate resilient considerations into strategy and planning</td><td>■ Use of data to inform policy making and to improve understanding of climate change impacts among key sector managers and stakeholders
■ Enhanced coordination for implementing IWRM, including climate change action
■ Engagement with international sources of expertise and finance for CR
■ Political buy-in and support for investment in the sector
■ Degree of shared, coordinated action to address climate risks and vulnerabilities
■ Strength of inter-sectoral coordination and cooperation
■ Number of CR investment actions supported by IFIs, climate funds or domestic sources</td></tr>
</table>

Water resources and watershed management practices secure water quantity and quality and are robust to cope with climate variability and climate-induced emergencies	Strengthened evidence base on water resources status and pressure	■ Adequate routine data collection and analysis of state of water resources and trends ■ % of present monitoring stations that are operational, data collected at given intervals and providing reliable data for the Water Resources Management Information System ■ Allocated budget for maintenance of data collection systems ■ National Water Information Systems up and running ■ Monitoring of global and regional projections of climate trends and their specific implications for islands concerned ■ Number of basin water audits and catchment water balances available ■ Platforms and processes for multi-stakeholder data collection and collation systems ■ Long-term monitoring systems implemented and maintained
	Climate resilience and IWRM principles integrated into water resources management	■ Progress with implementation of IWRM ■ Adequacy of water supply and potential for increase, in relation to changing demand ■ Water resources scarcity/availability ■ Gap in water supply/demand balance ■ Availability of Drought Management Plans ■ Feasibility and readiness of drought-management tools ■ Adequacy of rules for resource allocation and adaptive management to manage extreme events ■ Diversity of sources (surface, groundwater, desalination, catchments) ■ Management of groundwater aquifers ■ Abstraction licensing and charging ■ % of water abstraction and discharge permit holders complying with permit conditions ■ Number of catchments plans following guidelines for environmental flow requirements, economic efficiency and social goals ■ Water demand management practices applied ■ % Reuse of wastewater and greywater
	Protected and managed catchments and aquifers	■ Catchment management measures in place (afforestation, erosion control, etc) ■ Building regulations and land-use control ■ Other “green” options (e.g. set asides along rivers) ■ Urban drainage (length, effectiveness) ■ Physical barriers to flooding (length, % of reduced flood extent) ■ Flood management ■ % of retrofitted buildings and public installations ■ Available financial tools – insurance and compensation schemes ■ Levels of wastewater treatment and disposal (% of sewage treated to secondary/tertiary levels) ■ % of households covered by centralised sewerage ■ Regulation and penalties (including charging) for water pollution ■ Effective solid waste management and prohibition on dumping in watercourses ■ Control of non-point source pollution from agriculture ■ Water quality (turbidity, chemical and biological) improved in priority catchments ■ Increase in effectively protected catchment areas ■ Increase in appropriate forest cover in catchment areas ■ Decrease in inappropriate land-use activities in catchments ■ Decrease in pollution loads into priority watercourses.

Water supply systems can quickly respond and recover from climate caused disruption and users are engaged in the drive for greater resilience	Climate resilience mainstreamed into sectoral policies and strategies	■ Influence of national water supply strategy and action plan in guiding investments and priorities ■ Time horizon of water service provision strategies and plans ■ Agreed Levels of Service account for impact of climate change ■ Utilities' use of Asset Management Plans incorporating CR ■ Capacity development and training in climate resilient water supply services
	Enhanced robustness of water supply systems	■ Technically efficient and climate resilient systems and utilities for water sourcing, transport, treatment and distribution ■ Water storage facilities enhanced where needed ■ Water sources diversified and augmented where necessary ■ Climate smart technologies for water supply investigated and implemented ■ Distribution losses and non-revenue water (NRW) reduced, no. of service interruptions, and improved energy efficiency ■ Improved financially viable utilities (cost-recovering tariffs, working ratios and other performance measures ■ Access to finance for O&M and investment ■ Reduction in drought related water restrictions (through increasing total source yields) ■ Increased water availability for communities. ■ Reduction in Water Departments' energy consumption ■ Development of renewable energy proposals for the water sector. ■ Increased volume of water storage in Water Departments' systems ■ Emergency storage available to cope with emergencies and droughts
	Protected and robust critical assets	■ Infrastructure design and implementation standards strengthened ■ Protection of essential water infrastructure against flooding, hurricanes and other extreme climatic events ■ Physical condition of infrastructure and assets ■ Public education and information programmes ■ Systems for stakeholder consultation ■ Incentives and penalties (sticks and carrots – demand management) ■ Evidence of response of user behaviour to climate resilience (e.g. take up of water saving devices)
	Aware and engaged users	■ Increased use of water efficient devices ■ Reduced per household water consumption ■ Level of involvement of communities and users ■ % length of network that needs maintenance ■ Evidence of public awareness of climate resilience
	Dynamic and effective disaster risk management procedures and emergency response plans	■ Integrating CR with Disaster Management ■ Early-warning systems for disasters (hurricane, volcanic and seismic activity, flooding and drought) ■ Early warning and community disaster risk reduction committees strengthened ■ Increase in functioning water storage at critical facilities ■ Reduction in service interruptions occurring as a result of severe weather.

9.1.4. Using *WaterRiSK* as an M&E tool

WaterRiSK uses an analytical method that stimulates a questioning mode of analysis. The assessment can be used as an organising principle for a climate resilience 'lens' through which assessments of climate risk and vulnerability, screening of policies, plans and strategies, and identification of investment needs takes place.

> **Box 9-4: Applying a climate lens**
>
> This is an analytical method that stimulates a questioning mode of analysis. A climate lens should be applied during the formulation of strategies and plans for the water sector, but its retrospective application is also beneficial in order to identify areas in the existing governance landscape where climate resilience focus can be strengthened during policy review and reformulation.
>
> *Source: Adapted from 'GWP and UNICEF (2015)'*

The assessment is structured on the basis of the results framework and as such it can be used to identify performance indicators and plan activities towards the delivery of each intermediate outcome of the framework. The assessment can also be used to report the progress towards the main and intermediate outcomes during different planning and assessment cycles, as shown in Figure 9-2.

The questions in the assessment are intended to guide each country in the identification of indicators and evidence to support a certain score; this allows to take into consideration the diversity of the Caribbean region and each country-specific context providing a set of "soft" indicators which lend themselves to be adapted to national needs.

In order to know how effective any intervention is, there needs to be a baseline condition to measure against. This is typically the situation before an intervention is made; but can also be the status of resilience in the water supply sector at a time, if it is agreed that M&E is to be conducted. As such, the ***WaterRiSK*** assessment would be completed to establish a baseline, at specific times according to the schedule for M&E.

Section 9.4.1, provides a summary of the ***WaterRiSK*** assessment pillars and sub-clusters. We suggest to see Section 3 of this Manual for a complete overview of the ***WaterRiSK*** approach.

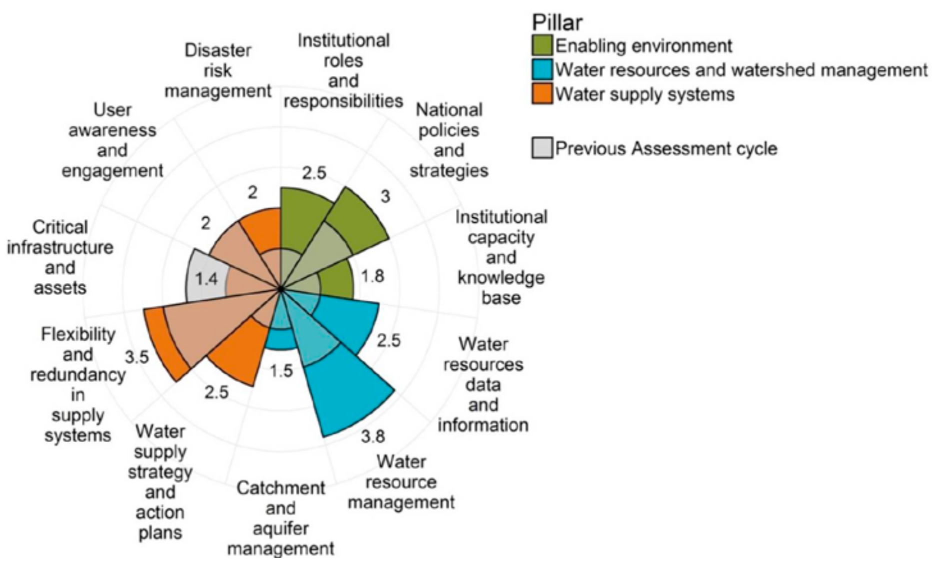


Figure 9-2: Mock-up example of the use of *WaterRiSK* to map progress across successive planning cycles.

Note that scoring an area with 5 does not mean that the maximum level of resilience possible has been achieved and no action needs to be undertaken in that area. It rather means that that area has fulfilled the objectives of a specific planning cycle.

Box 9-5: How to develop a set of national indicators

Caribbean countries can utilise existing processes, arrangements or systems, including domestically available information, methodologies, entities, experts and other aspects, for M&E.

To develop a set of national indicators that is broadly applicable at the sub-national level:

1. Take stock of current water resources monitoring schemes and analyse which aspects of these schemes could be adapted to monitor adaptation indicators.
2. Assess whether adaptation benefits can be measured and streamlined into the existing schemes. This analysis will attempt to examine both the suitability of existing national indicators and the capacity of stakeholders to provide the corresponding data on a regular basis. It also provides decision makers with the opportunity to incorporate the available data into planning-budgeting documents.

   a) Define “ideal” ‘adaptation’ and ‘resilience’ conditions, propose a set of ‘adaptation indicators’, then scrutinize the existing national indicators.

   b) Map out available data to measure adaptation / resilience goals / targets in the context of the proposed list of indicators.

   c) Taking sub-national actions into account; what would be the national level climate change adaptation indicators and how would they be monitored? Compared to policy targets:

      - Trends in community resilience
      - Trends in infrastructure resilience
      - Trends in ecosystem and natural resources resilience
      - Trends in socio-economic sector resilience

   d) Identify data gaps and update the M&E Plan.

   e) For current and approved water sector resilience projects, how would project level indicators be integrated into the national level indicators?

      - Trends in community resilience by # of communities benefitting from the adaptation measure
      - Trends in infrastructure resilience by # of critical infrastructure networks benefitting from the adaptation measure
      - Trends in ecosystem and natural resources resilience by # of ecosystem services improved as a result of the adaptation measure
      - Trends in socio-economic sector resilience for whole sector and sub-sector entities benefitting from the adaptation measure

3. Check their functionality and cohesion with stakeholders (indicator validation).

While it is not a necessary step, given the role of M&E in financing climate change, countries are advised to evaluate whether agreed indicators support the basis for demonstrating the need for adaptation funds in this sector, from either domestic or external sources.

Once the suite of indicators is agreed and developed (see Section 9.3), the next step is to collect and examine the corresponding data. Data collection has to be done on a larger scale and provide narratives to quantitative data in order to clarify the vulnerability context and root causes. NGOs and academia could contribute significantly to this process.

Selecting indicators

You may find it easier to use some indicators over others. This will depend on the data and information that is available. You need to make sure that you select indicators that are appropriate to what you want to achieve from using the M&E system. Selecting poor or inappropriate indicators may lead to a misunderstanding over what works well, and what does not. The most appropriate indicators to use will depend on which of the intermediate outcomes, outputs and activities are you looking at. Are you interested in the Enabling Environment, monitoring and managing water resources or resilient water supply systems and communities? Is there a specific output that you'd like to focus on, such as strengthening inter-sectoral coordination at the national level, or increase robustness of storage facilities that feed the supply network?

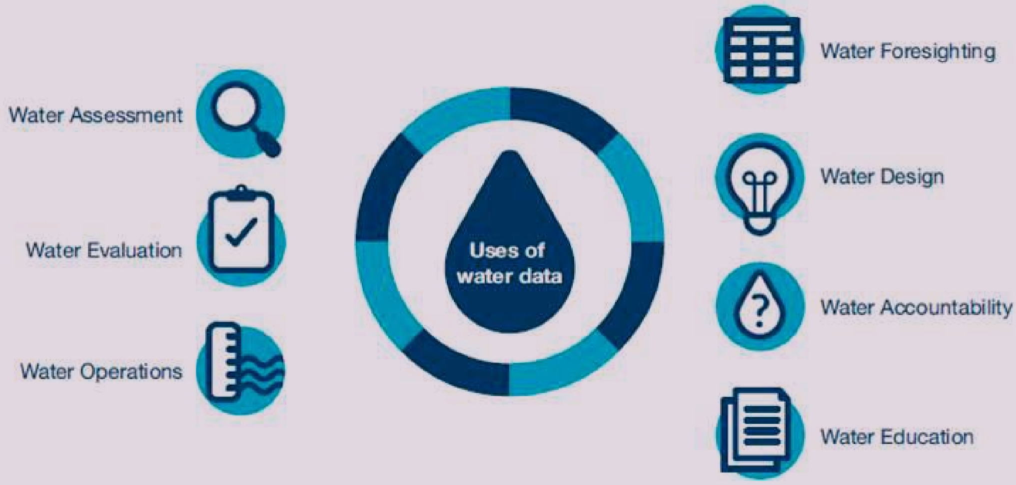
Some further criteria to consider when selecting which indicators to use, depending on the context, include [5]:

- Are data sources and collection methods available to inform the chosen indicators? Are they easy to use with limited resources, time, or expertise?
- Is there an appropriate mix between the qualitative and quantitative indicators that you have selected? Qualitative indicators and information can be used to complement quantitative indicators.
- Specifically with respect to indicators for measuring capacity, can the results be used to help make decisions about water supply sector development in the context of climate resilience?
- Will data be available and information provided in a timely manner to fit in with important decision-making processes in the sector, particularly those which 'lock in' investments for long periods of time?
- Who will be responsible for collecting data to provide information to ensure the sustainability of water supply services, e.g. implementing agencies, local/governmental authorities, communities, etc. Is there agreement amongst all those involved that this is the best indicator or set of indicators to use?
- Where relevant, are indicators pro-poor and gender disaggregated?

5 Based on Spearman and McGray (2011) and Pringle (2011)

Box 9-6: Water data management

Accessible and reliable water data are a key enabling requirement for delivering informed decision making and strategic planning, as well as for the development of strong M&E systems. Getting water information right is, however, a major challenge and requires careful planning as well as sensible investment and diligent execution of strategy. While country specific technical and financial capacity, as well as existing gaps, proprieties and challenges can compromise the ability of implementing good practices, the reform process to improve water data management arrangements must be initiated and set achievable and strategic objectives.

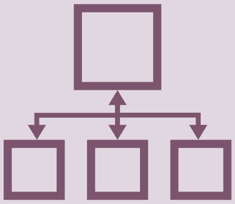


The Good Practice Guidelines for Water Data Management Policy report, prepared under the World Water Data Initiative on behalf of the United Nations and World Bank High Level Panel on Water, recognises this challenge and aims to support the formulation and implementation of government strategies to improve water information. The guidelines describe the high value uses of water data and identify the building elements of good water data management, providing useful recommendations, literature and examples to support the improvement of water data management.

Source: *Bureau of Meteorology, 2017, Good practice guidelines for water data management policy: World Water Data Initiative, Melbourne*

Whichever indicators you decide to use in the M&E system, it is important to remember that they can have limitations and you will need to interpret the resulting data accordingly. You'll also need to make sure that any efforts are proportionate to the investment, because you don't want to spend a lot on an M&E system to evaluate an option that did not cost much to implement. You may find it beneficial to use a mix of indicators, and M&E systems may use data from a number of different sources. By using a variety of indicators, each can be used to focus on different results at the various levels.

Box 9-7: Water Information Systems



In the Caribbean region it is common that responsibilities for water management lie in more than one institution or jurisdiction. Usually, the collection of hydro-met data is undertaken by meteorological services agencies, Ministries of Agriculture, water and sewerage authorities as well as Ministry of Health and environmental agencies. This often implies a high degree of scattering of the data, which are stored in different formats which compromise accessibility to water-relevant information.

The Caribbean Institute for Meteorology and Hydrology (CIMH) collects, analyses and publishes meteorological and hydrological data for the region, as well as maintaining a service for the upkeep, repair and calibration of meteorological instruments. However, the establishment of National Water Information Systems (NWIS) can facilitate the process of transforming data into information products by CIMH.

The use of National Water Resources Information Systems can tackle the problem of data fragmentation, improving not only data accessibility but also setting standards for data quality and reliability, supporting, at the same time, the application of IWRM.

Best practices

- Use of centralised database for easy storage and retrieval of data;
- Use of Geographic Information Systems to provide spatial dimension to the dataset;
- Continuous training of staff and monitoring and upgrading of measuring equipment;
- Establishment of clear protocols for data exchange;
- Maintenance of the WIF must be clearly part of the mandate of the designated agency and a database Administrator within this must be appointed in order to coordinate inputs from other agencies;
- The use of charging fees to access the information helps contributing to the financial sustainability of the system.

Case studies

- Jamaica (2007): the system includes stream flow, rain gauges and groundwater data and is hosted by the Water Resources Authority and can be accessed via http://www.wra.gov.jm
- Grenada (2008): the system was developed as part of a multi-stakeholder collaboration under the CAIRIWN initiatives and can be accessed at www.cariwin.gd. The platform is maintained by the Ministry of Agriculture (Land Use Division) and represents a good source of historical data, which undergo a thorough validation process.

Source: *Fletcher-Paul, L., Madramootoo, C., and Thomas, H. (2008). A Review of Water Information Systems in the English-Speaking Caribbean – challenges and lessons learnt.*

Thompson, T. (2010, June 21-25). National Water Information Systems A Tool to Support Integrated Water Resources Management in the Caribbean. Montego Bay, Jamaica.

9.1.5. Factors to consider in monitoring climate resilience

There are a number of challenges associated with adapting to and improving climate resilience that may make it difficult to implement M&E systems. The following table identifies these challenges and shows how to address them, to ensure that M&E is effective.

Figure 9-3: Factors to consider in monitoring climate resilience

Factor	Challenges	How to ensure that M&E is effective
Long and short timeframes	M&E systems for climate resilient water supply services will need to track success over short to long timescales. This leads to challenges as the impacts of implementing different options may only become clear with changes in the climate in the long term.	Ensure an appropriate mix of activity, output, and outcome indicators. Ensure that M&E is carried out regularly so that progress can be tracked. M&E should be a continuous, learning process that informs decisions to enable options to be adjusted as necessary.
Uncertainty	Uncertainty about how and when changes in climate will occur and what effects there will be, particularly at a local level, makes it more challenging to come up with appropriate objectives for M&E and determine the success of a particular option.	To address this, use an approach which focuses on strengthening options in the future, and establish baselines to track what has changed from when you first implemented the option.
Monitoring non-events	If a hazard, such as a storm, flood or drought, does not occur during a monitoring cycle, then you may not be able to measure the success of a particular option as you originally intended.	Success may still be measured, but in a different way, for example if these events are periodic, then the indicator would measure the number of cycles without this event occurring. If the option improves preparedness towards the hazard, then the indicator would seek to measure how well prepared a community or type of infrastructure is to that hazard.
Availability of baseline data	Good baseline data[8] are required to track progress and evaluate options. M&E should monitor and evaluate not only the option, but also the situation it is trying to address, or the changing environment in which the option has been implemented. Baselines for vulnerability and capacity might not be readily available.	It may be necessary to ensure that a data gathering element is built in to the initial phase of an option. This will have resource implications and should be considered when appraising and prioritising options[9]. Once a baseline has been established, data should be gathered periodically. The availability of baseline data also varies as an issue depending on the type of indicator that is used; it will be more problematic for numeric indicators. For qualitative indicators, it will be less of an issue, because these are based largely on expert assessment. This initial assessment can therefore be used as the baseline.
Shifting baselines	High variability in baselines makes it difficult to compare data before and following the implementation of climate resilient options. This is because the contexts change which means that any comparisons lose their validity. For example, for annual rainfall variability or probabilistic extreme events such as floods and droughts, there is high variability in the baseline.	As well as gathering data on the results of specific options, you will also need to collect data on climate and environmental trends (as well as other influential factors) and the occurrence of extremes and disasters so that you can interpret the monitoring results in the context of climate risks. Quantitative indicators should be complemented by qualitative assessments, to help those involved understand how the impacts of interventions are influenced by these factors.

6 Changes in indicators can be compared against baseline data to track progress

7 See Technical Brief on appraising and prioritising options for climate resilient WASH for details

Factor	Challenges	How to ensure that M&E is effective
Generic indicators	There is a lack of generic indicators that can be widely used in monitoring because resilience has to be grounded in the context, scale, sector and nature of the option, all of which vary. It is also much more challenging to monitor and evaluate options that are non-technical or offer qualitative benefits, e.g. capacity building activities. There may be difficulties in aggregating indicators at higher scales or in using national-level indicators to understand the effectiveness of options at local levels.	This Section has suggested a number of indicators to use which can be modified as necessary to suit the requirements of different M&E systems. Process indicators are used frequently in the context of adaptation because they measure the progress made towards implementing an option; useful when the outcome of the option cannot yet be evaluated to ensure that progress is on track. This often involves non-technical benefits such as capacity building.
Contribution and attribution	M&E normally looks to demonstrate the attribution of changes to a specific measure. However, climate change and climate resilience is complex, involving multiple sectors and scales, often with long timescales. This means that traditional approaches to M&E need to be adjusted.	You'll need to be able to show how an option or programme of options can contribute to enhanced climate resilience. The use of appropriate indicators is one way of doing this, with quantitative indicators complemented by qualitative indicators and assessments, such as structured interviews and participatory vulnerability assessments. This can help those involved to understand the ways in which an intervention is translated into an impact.
Varying use of definitions	Definitions of basic concepts may vary between agencies, while more specialised terms may only be well understood by one particular agency. Specifically with respect to M&E systems for climate resilience, it may be difficult to reach agreement on what is considered to be a 'success' and therefore on what processes can be used to assess 'effectiveness' adequately.	To avoid any confusion, make sure you define the terms used in your M&E system and indicators.

9.2 Section 9: Case examples and other relevant material

9.2.1. Case example: M&E for Grenada Investment Plan. Overview of programme outcomes and potential outcome indicators for Grenada

Programme	Expected outcome	Potential outcome indicators
Overall Investment Plan	Strategic Objective - Ensure operational services can meet agreed levels of service during extreme weather events and future climate change	■ Reduced incidence of water interruptions and disruptions (associated with severe weather) ■ Reduced incidence of drought related water rationing (and other emergency restrictions) ■ Increased coverage of reliable supply to remote and vulnerable communities ■ Reduced incidence of water quality contraventions.
Programme 1: Water policy, legislation and capacity building	"Fit for purpose" national policies, legislation and institutions for a climate-resilient water sector	■ Water Policy adopted by Government ■ Legislation for IWRM enacted and implemented ■ Water Resources Management Unit created and functioning effectively and sustainably ■ Improved capacity for water quality analysis.
Programme 2: Watershed Management	Catchments protected from the negative impacts of climate hazards and human activities, ensuring the long term sustainability of water resources	■ Water quality (turbidity, chemical and biological) improved in priority catchments ■ Increase in effectively protected catchment areas ■ Increase in appropriate forest cover in catchment areas ■ Decrease in inappropriate land use activities in catchments ■ Decrease in pollution loads into priority watercourses.
Programme 3: Climate Resilient Water Supplies	Water services are more resilient to the impacts of drought and climate change	■ Increased volume of water storage in NAWASA systems ■ Reduction in drought related water restrictions (through increasing total source yields) ■ Increased water availability for communities.
Programme 4: Water Demand Management	More efficient and effective production and use of water	■ Reduction in leakage ■ Reduction in Non-Revenue Water.
Programme 5: Energy Efficiency and Renewable Energy	Reduction in the utility cost of energy and carbon emissions from water services, and increase in energy reliability for water services	■ Reduction in NAWASA energy consumption ■ Development of renewable energy proposals for the water sector.
Programme 6: Disaster Risk Management	Water services are more resilient to the impacts of extreme weather events and climate change	■ Increase in functioning water storage at critical facilities ■ Reduction in service interruptions occurring as a result of severe weather.

Monitoring implementation

Monitoring of implementation is a management process to ensure that activities are delivered effectively and efficiently. M&E is required at three levels, Investment Plan, programme and activity. Monitoring of the overall Investment Plan is intended to provide a high level view of progress and allow adjustment of the plan to emerging priorities. Monitoring of the programmes will feed up into the overall Plan level. Monitoring of the implementation of the activities themselves is an operational activity which is expected to be carried out within the standard management processes of the implementing agency. In addition, external finance may come with its own set of M&E requirements to satisfy the financing source, in which case this must be included within M&E.

Table 9-1: Summary of implementation monitoring activities

M&E level	M&E actions (and anticipated stakeholder responsible)
Overall Investment Plan	■ Annual review of Implementation Progress and updating implementation schedule (Ministry of Communications with input from Ministry of Finance, NAWASA and other relevant stakeholders). ■ Triennial revision of Investment Plan - review of implementation progress, addition of emerging priorities and removal of completed or low priority actions (Ministry of Communications with input from Ministry of Finance, NAWASA and other relevant stakeholders).
Programme	■ Set up detailed outcome targets for each programme, conduct baseline analysis and set up data collection processes to monitor progress on each outcome target. Where data is not already being collected, this will require new data collection systems to be developed (Programme lead implementing Agency – with support from partners on an activity basis). ■ Annual reporting on progress and updating implementation schedule to be passed onto overall Coordinating agency; the Ministry of Communications (Programme lead implementing Agency – with support from partners on an activity basis).
Activity	■ Utilise standard M&E processes of implementing agency, with any additional M&E required by financing or development partners as required (Implementing Agency – with support from Ministry of Finance).

9.2.2. Case example: Strategic objectives and indicators for water supply in St. Kitts

Box 9-8: Strategic objectives for water supply in St. Kitts

Strategic planning is the key to addressing challenges and setting actions for enhancing resilience. It is important that water providers and practitioners adopt a strategic planning approach to tackle climate risks and implement adaptation actions not only in the short but also in the medium and long term. Strategic planning objectives can also serve to inform performance indicators that can be used for M&E.

Water Sector Department (WSD) overall goal

To ensure that all reasonable needs of our customers are met in a timely and efficient manner through the effective management of our water resources.

Water Sector Department strategic planning

St. Kitts water sector department's overall goal focuses on meeting customer needs in a timely and efficient manner, and speaks directly to the management of water resources. In achieving this goal the WSD has identified three key strategic objectives (as shown below) and a balanced portfolio of ongoing and planned investments to achieve these, addressing water policy and planning, as well as supply and demand side management actions.

Objectives for 2017	Performance Indicators	Goals for 2017
To ensure continuous service of water to consumers	Average annual duration of disruption of service to customers	Less than 48 hours
To produce a new water policy	Date the new water policy is completed	December 2017
To produce sufficient water to meet the customer demand	Average daily volume of water produced	5 MGD

Lessons learned

- 2017 drought conditions impacted on the ability to achieve Objective 1;
- Strategic objectives are focused on supply side water provision and neglect demand side planning and management;
- Lack of medium and long-term perspective;
- Lack of explicit reference to climate resilience.

Source: Adapted from 'HR Wallingford, 2017, Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean: St. Kitts and Nevis - Task 1 - Climate Risk and Vulnerability Assessment'

9.2.3. Relevant material and other resources

Box 9-9: Relevant material and other resources

Monitoring and Evaluation for Climate Change Adaptation: A Synthesis of Tools, Frameworks and Approaches (Bours, D., McGinn, C. and Pringle, P. , 2013)

The report represents a synthesis and summary of frameworks for the monitoring and evaluation (M&E) of climate change adaptation (CCA) interventions, with a specific focus on international development projects and programs.

Available at: http://www.pactworld.org/sites/default/files/SEA%20Change%20Synthesis%20Report_October%202013.pdf

An operational framework for Tracking Adaptation and Measuring Development (TAMD) (Brooks, N., Anderson, S., Burton, I. Fisher, S., Rai, N. and Tellam, I., 2013)

This paper outlines the steps needed to apply the Tracking Adaptation and Measuring Development (TAMD) framework, providing practical guidance on how to put the concepts outlined in IIED Climate Change Working Paper no. 1 (Brooks et al., 2011) into operation.

Available at: http://pubs.iied.org/10038IIED/

Achieving Development Resilient to Climate Change: a sourcebook for the Caribbean water sector (GWP-C, 2014)

The Sourcebook offers users a framework for enhancing climate resilience throughout the decision making cycle. Ultimately, the Sourcebook is intended to stimulate the identification and implementation of investments to enhance climate resilience, thereby underpinning sustainable development and growth in the region.

Available at: https://www.gwp.org/en/gwp-caribbean/

GEF-IWCAM Integrating Watershed and Coastal Area Management in the Small Island Developing States of the Caribbean (IWCAM). Experience Notes and Lessons Learned.

These experience notes provide a summary of the lessons learned in various aspects of the GEF-IWCAM project and are a useful reference for project proponents engaged in preparing regional programmes or projects.

Available at: http://iwlearn.net/iw-projects/1254/experience-notes-lessons-learned

Case Studies, Lessons Learnt, and Recommendations in the Development, Implementation and Management of GEF Projects in the Wider Caribbean Region (WCR)

The purpose of this technical report is to summarise the results of case studies, lessons learnt, and recommendations from the implementation of selected GEF Projects in the Wider Caribbean Region (WCR). It provides a useful resource to understand the success factors behind regional programmes

Available at: http://www.cep.unep.org/publications-and-resources/technical-reports/cep_technical_report_59-revised-final.pdf/download.

GWP. Undated. Monitoring and evaluation indicators for IWRM strategies and plans. Technical Brief 3.

The following brief focuses on defining indicators as a part of a coherent M&E system. It builds directly on the discussion of M&E in Catalysing Change: A Handbook for Developing IWRM and Water Efficiency Strategies, and on the basic information about indicators provided in GWP Technical Brief 2: Tools for keeping IWRM strategic planning on track. The information and recommendations presented are based on experiences in monitoring sustainable development initiatives as well as IWRM plans and strategies.

Available at: http://www.gwp.org/Global/ToolBox/Publications/Technical%20Briefs/03%20Monitoring%20and%20evaluation%20indicators%20for%20IWRM%20strategies%20and%20plans%20(2006)%20English.pdf

9.3 Section 9: Notes for the Trainer and Facilitator

9.3.1. Notes and considerations

- Monitoring frameworks should be established as part of the process design, and not left until after completion of a process cycle.
- The results framework provides a tool that can be used to monitor and review progress and to report on delivery toward a climate resilient water supply services sector. It helps to set out structured approach to catalysing change and can be made country-specific by incorporating targets and indicators that respond to individual a country's visions for 2030.
- Ad-hoc quantitative indicators are not always available: when this is the case it can be necessary to resort to proxy or qualitative indicators, as well as identify actions to enhance the capacity to access and produce quantitative indicators, for example strengthening water data management practices.
- Using existing M&E systems is recommended and is more efficient than setting up parallel processes. M&E is best integrated within lead agencies standard M&E processes, although external finance may come with its own set of M&E requirements (i.e. donor or IFI specific) in which case these requirements will also need to be considered.
- Outcome indicators may need to be further elaborated to give quantitative targets to measure the high level resilience benefits of the adaptation programmes. Note that a baseline measurement of the current situation is required before a future target can be fully quantified, and in cases where this information is not already available, a data collection and analysis exercise will be required. Regular monitoring of the outcome indicators would provide a valuable metric on progress towards resilience and should be adopted as part of the overall implementation plan for adaptation investments.

9.3.2. Exercises and discussion topics

Defining indicators

Group Session 1	
Title M&E activities and indicators.	**Type** Exercise, divided in groups.
Objectives Define indicators to monitor activities of the results framework and agree an M&E plan.	
Duration 5 hours.	**Materials needed** ■ Flipchart. ■ Results framework canvas.
Preparation ■ The trainer, with the support of other stakeholders, should review current water resources monitoring schemes in order to define which aspects of these could be adapted to the climate resilience framework. ■ Activities/investments should have been identified as part of the previous workshop: these, must be inserted in the results framework canvas before this group session takes place.	
Description of tasks and instructions **Step 1: Introduction to the activity (in plenary)** ■ As part of the introduction, the facilitator will list previously identified indicators which can be used as part of this M&E framework. **Step 2: Identify indicators** ■ Participants will be divided in groups according to their main area of expertise: Enabling Environment, water and catchment management and water supply systems. Each group will be therefore working on one relevant pillar. ■ Each group will be tasked to identify a set (at least 1/2) of indicators for each of the activities identified under the intermediate outputs for their assigned pillar. The indicators will need to be consistent with the criteria shown in the technical notes. **Step 3: Monitoring activities** ■ Each group should then answer, for the identified indicators, the following questions: - How will you monitor the indicators? - How frequently will you monitor these indicators? - How will the results be documented? - Whose responsibility will it be to monitor and document? **Step 4: Plenary session** ■ Each group will report on their results to the others. ■ Material will be collated and given to the trainer.	
Following the workshop ■ Report on the Session and its results, in particular specifying the indicator identified for each outcome and on the monitoring activities.	

9.4 Section 9: Annexes

9.4.1. *WaterRiSK* assessment pillars, clusters and question descriptions

Pillars	Sub-clusters	Descriptions
Enabling Environment	Institutional roles and responsibilities	■ Institutional framework ■ Roles and responsibilities ■ Multi-stakeholder forums ■ Goals and targets
	National policies and strategies	■ Climate challenges ■ Principles and practice ■ Gender-sensitive approaches ■ Wider engagement ■ Regional/international agreements and commitments
	Institutional capacity and knowledge base	■ Institutional capacity ■ Generation and dissemination of policy-relevant information ■ Knowledge base ■ Climate risk and vulnerability assessments ■ Consensus on priorities ■ Risk management processes
Water resources and watershed management	Water resources data and information	■ Water resources data collection ■ Water use trends ■ Climate scenarios and variables ■ Monitoring and review
	Water resources management	■ Integrated water resources management ■ Water resources planning and allocation ■ Water resources status and pressures ■ Surface water vulnerability ■ Groundwater vulnerability
	Catchment and aquifer management	■ Integrated watershed management ■ Water source quality ■ Impacts of extreme events ■ Green infrastructure solutions

Pillars	Sub-clusters	Descriptions
Water supply systems	Water supply strategy and action plans	■ National water supply strategy ■ Long-term planning ■ Climate trends ■ Supply/demand balance
	Flexibility and redundancy in supply systems	■ Maintaining service standards ■ Adaptability of supply systems ■ Non-revenue water ■ Water storage provision
	Critical infrastructure and assets	■ Water intakes and sources ■ Pipelines networks and distribution systems ■ Water treatment plants and facilities ■ Storage facilities and tanks ■ Pumping stations
	User awareness and engagement	■ Communication, education and awareness ■ Behavioural change ■ Consultation processes
	Disaster risk management	■ Early warning systems ■ Emergency procedures and plans ■ Contingency plans

9.4.2. Template Result Framework for group session

Main outcome: Provide access to safe, reliable and resilient water supply services and to reduce operational risks associated with climate variability and change.

Intermediate outcomes	Intermediate outputs	Activities	Potential outcome indicators
An Enabling Environment which guides and promotes a proactive approach to the integration of climate resilience	1.1 Clear, harmonised and inclusive institutional roles and responsibilities for water and climate resilience		
	1.2 Climate resilience mainstreamed into national policies and strategies		
	1.3 Capacity and knowledge base built to integrate climate resilient considerations in strategy and planning		

Intermediate outcomes	Intermediate outputs	Activities	Potential outcome indicators
Water resources and watershed management practices secure water quantity and quality and are robust to cope with climate variability and climate-induced emergencies	2.1 Strengthened evidence base on water resources status and pressure		
	2.2 Climate resilience and IWRM principles integrated into water resources management		
	2.3 Protected and managed catchments and aquifers		

Intermediate outcomes	Intermediate outputs	Activities	Potential outcome indicators
Water supply systems can quickly respond and recover from climate caused disruption and users are engaged in the drive for greater resilience	3.1 Climate resilience mainstreamed into sectoral policies and strategies		
	3.2 Enhanced robustness of water supply systems		
	3.3 Protected and robust critical assets		
	3.4 Aware and engaged users		
	3.5 Dynamic and effective disaster risk management procedures and emergency response plans		

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