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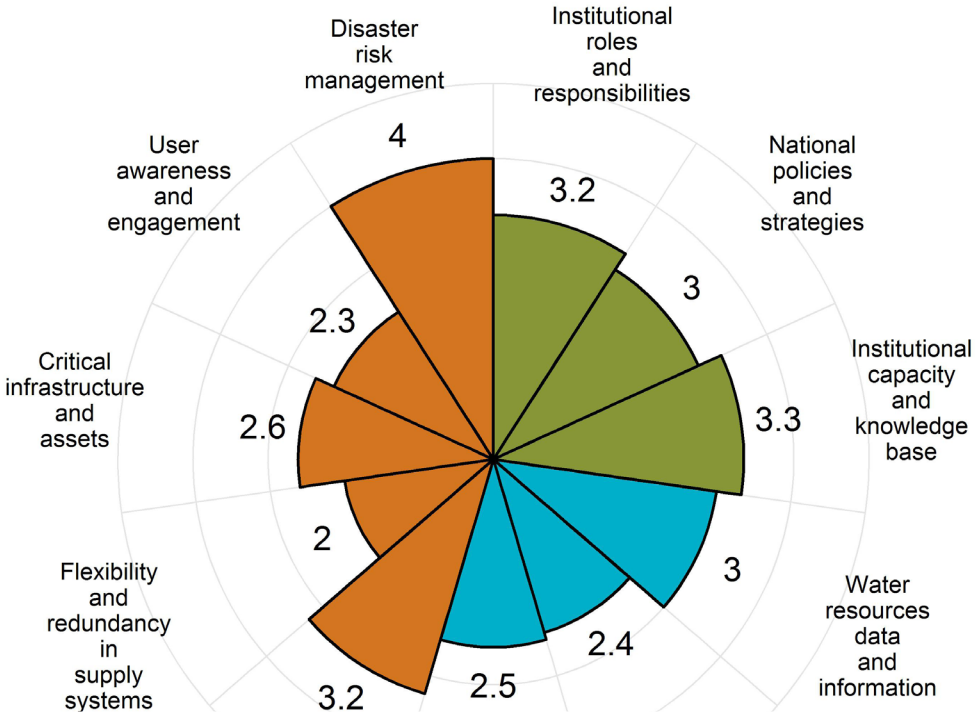
Planning for the Integration of Climate Resilience in the Water Sector in the Caribbean

WaterRiSK: self-assessment tool to support the integration of climate resilience



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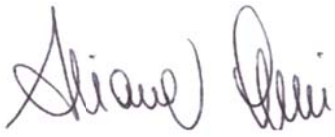		

Executive summary

This documents presents the WaterRiSK tool, 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. It 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 stakeholder such as 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. It highlights the diverse characteristics of a climate resilient water supply services sector and encourages a questioning mode of analysis when identifying actions and priorities to strengthen climate resilience.

Data availability is often a limiting factor to the application and development of quantitative indices of climate resilience; also, data availability also strongly depends on country specific contexts whereby metrics may be available in one country may not be available in another. The ***WaterRiSK*** tool recognises these aspects and has been designed in order to be not overly constrained by the absence of data. It provides a structured framework and systematic approach of semi-quantifiable indicators that collectively assess the level of integration of climate resilience in national water supply services.

The approach is based on completing a ***WaterRiSK*** questionnaire with performance and relevance scorings, as well as providing supporting evidence and potential actions to improve performance. It is structured around three pillars of assessment, namely:

- Enabling environment;
- Water resource and watershed management; and,
- Water supply systems and services.

Based on consultation findings, the development of the ***WaterRiSK*** approach took account of needs identified and articulated by national and regional practitioners and is designed to be applicable to the whole region. At the same time it recognises country-specific needs and its application and use can be tailored to country specific contexts as required. Suggested applications of the tool as part of a national process for the integration of resilience are, however, outlined under separate cover in the *Training Manual - Supporting the Integration of Climate Resilience in the Water Supply Sector in the Caribbean* developed by HR Wallingford (2018).

Suggested citation

HR Wallingford (2018). *WaterRiSK: 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 Caribbean Development Bank.

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1. About ***WaterRiSK***

1.1. Purpose and objectives

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 stakeholder interests 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.

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.

1.2. Structure and content

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 of such as policy and strategy development, water resource 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 pro-active 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 resource 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 and climate related damage, and the degree to which water users are actively engaged in the drive for greater resilience.*

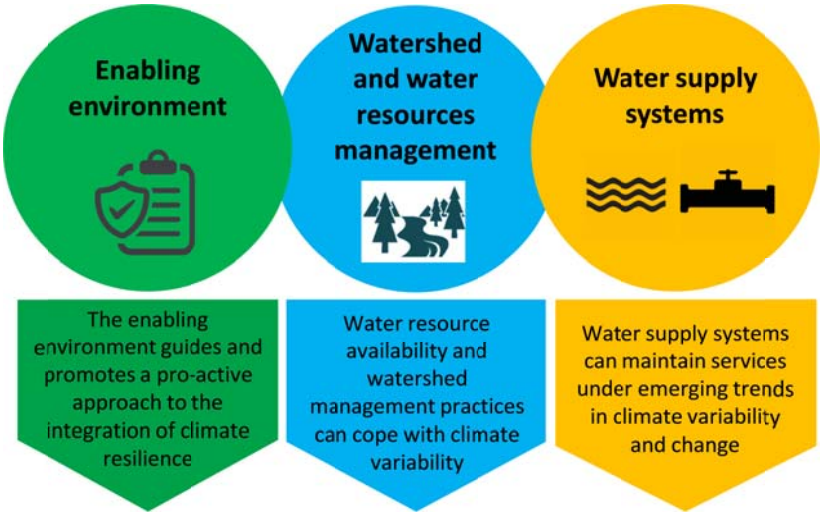

Figure 1.1: The three pillars of ***WaterRiSK*** assessment

The approach is based on completing and scoring a ***WaterRiSK*** questionnaire. The questionnaire is articulated in accordance with the three pillars and each pillar includes a set of sub-clusters under which a series of questions are posed to capture more in-depth information on current baseline conditions and recommendations on actions and measures to strengthen the integration of climate resilience. For each question, a list of possible responses is provided to help users choose those answers, and associated scores, that best describe the existing conditions, these are intended as a guide only.

A schematic representation of the ***WaterRiSK*** questionnaire structure is shown in Figure 1.2.

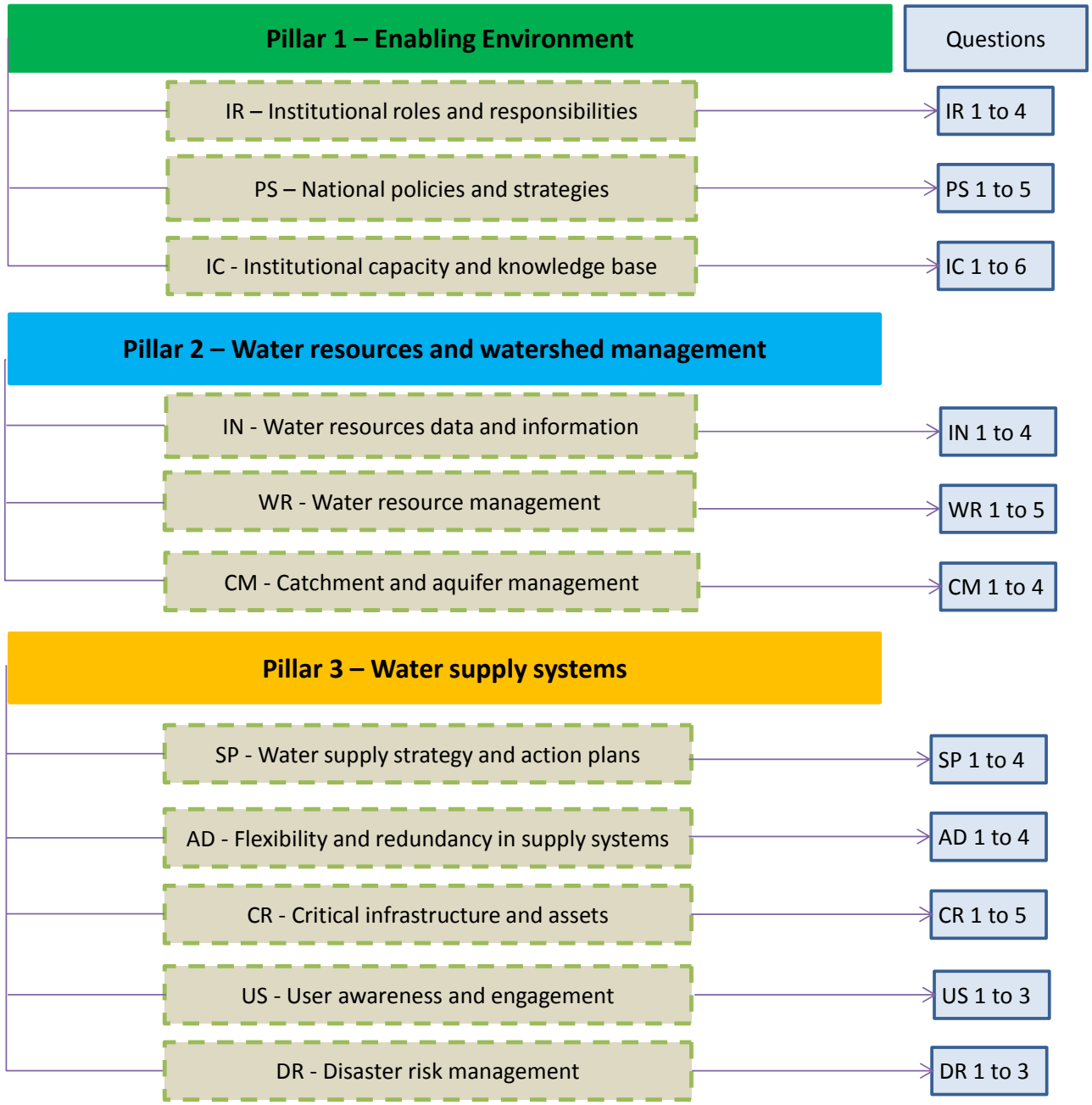

Figure 1.2: Structure of ***WaterRiSK***

Details of the application of the ***WaterRiSK*** approach are given in Section 2 and the entire ***WaterRiSK*** questionnaire is given in Section 3.

Further details and an example application can also be found in Annexes C and D.

1.3. Scoring the questionnaire

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).

Performance score

- 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.).
- 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 they accord to taking action to address the challenges identified, ranging from a low to a high priority as follows:
    i. **'1 - low'** – not relevant and not urgent;
    ii. **'2 - low/medium'** – some relevance, but not urgent;
    iii. **'3 - medium'** – relevant, and some urgency;
    iv. **'4 - medium / high'** – relevant, and urgent;
    v. **'5 - high'** – highly relevant, and urgent.

1.4. 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. 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 be 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 an endpoint in themselves.
- However, they do serve 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 the 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 shows an example filled assessment table from the Grenada case study assessment for the "institutional roles and responsibilities" sub-cluster and its questions. Annex F provides a blank table to be used for the assessment.

Table 1.1: Example of a completed assessment table

IR - Institutional roles and responsibilities				
Evidence, gaps and needs	**Recommended actions/M&E indicators**	**Question ID**	**Perf.**	**Rel.**
• Policies and legislation is outdated. • Further work needs to be done to ensure the mainstreaming of CC and DRR in a coordinated manner. • Key personnel/decision makers are not always available to participate in these forums. • Human and financial resources to maintain climate resilience solutions may not be available.	• Review and update the existing legislation and policies. • Build on existing committees such as the National Climate Change Committee to ensure that frequent meetings are held with stakeholders providing updates on any new DRR or CC projects/initiatives. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these forums. • Ensure that proper M&E plans are developed prior to the implementation.	IR1	3	5
		IR2	4	5
		IR3	3	4
		IR4	3	5

1.5. Presenting the results

Performance diagrams

Spider and rose diagrams can be used to communicate performance under each pillar and sub-cluster. shows an example of this, where the average performance of each cluster is shown (for a mock-up case).

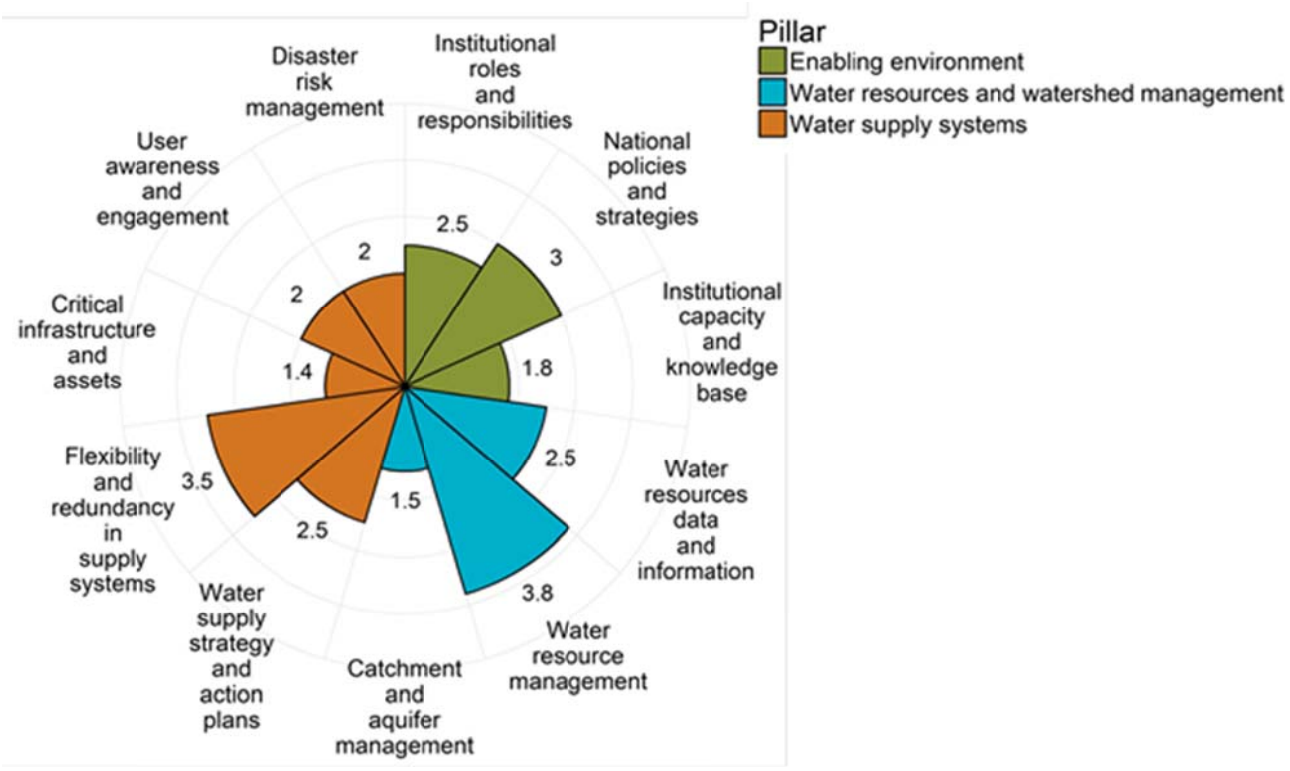

Figure 1.3: Example visualisation of results: performance under each sub-cluster of the WaterRiSK assessment

Prioritisation plots

Prioritisation plots can be produced to highlight high priority actions and sectors. A mock-up example is shown in Figure 1.4: 4. In this example, the performance and relevance scoring for Pillar 1 are indicated as these help to communicate priority areas and actions. High relevance and low performance scores suggest these are high priority actions whereas low relevance and high performance scores suggest these actions are less urgent although they should still be captured as longer term planning and investments needs.

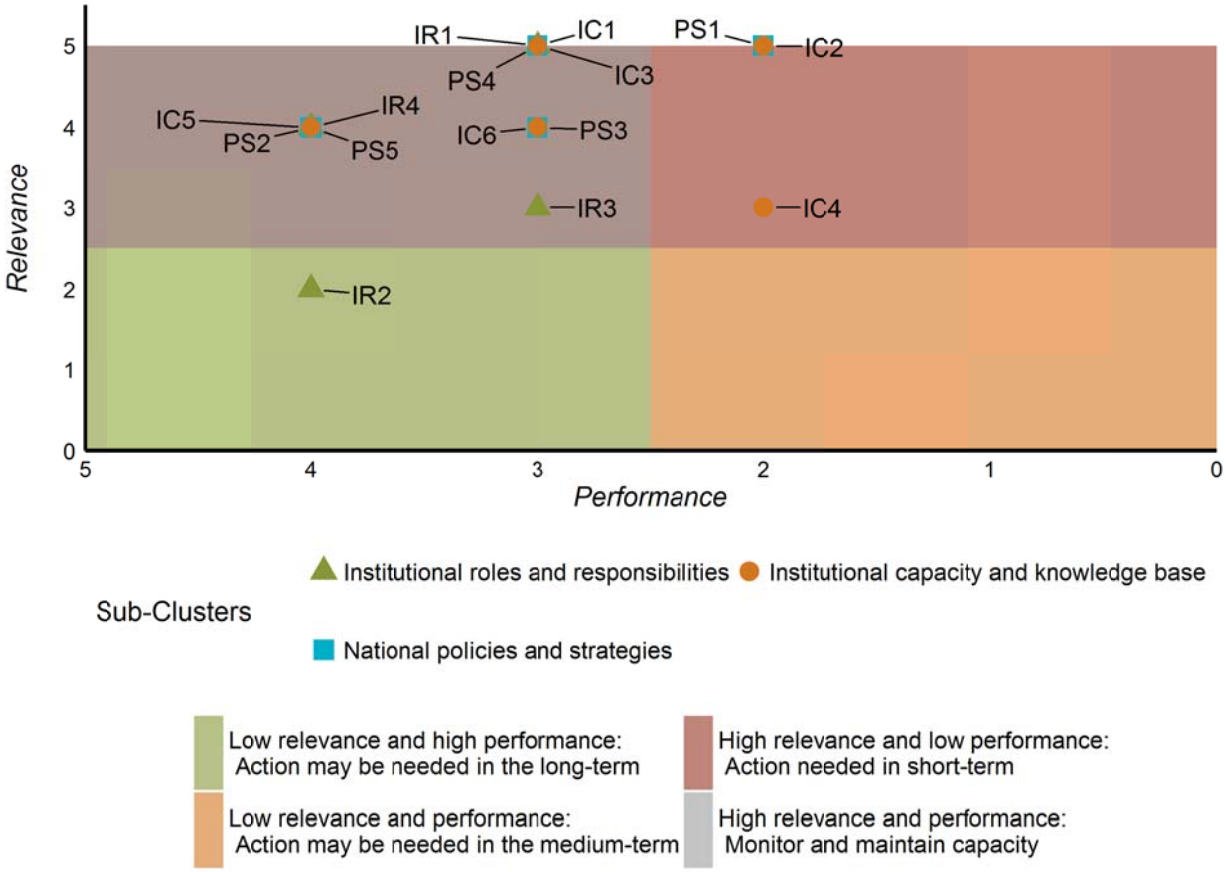

Figure 1.4: Example outcome of ***WaterRISK*** assessment tool: identification of priority

Monitoring and review

The application of ***WaterRiSK*** as part of a regular cyclic process allows it to be used to monitor and review progress with the integration of climate resilience. For example, application of WaterRiSK on a 3-year cycle would enable progress towards a vision, or the improvements from the previous planning cycle, to be shown and communicated, as shown in Figure 2.3. This will highlight where improvements and progress have been made (with respect to the previous planning cycle) and where gaps still need to be addressed. Indeed, it could also show where progress has been retarded or declined, for example due lack of maintenance or similar.

Spider and rose diagrams can be used to communicate progress made under each cluster and can similarly indicate where gaps and needs still need to addressed; Figure 2.2 shows an example of this.

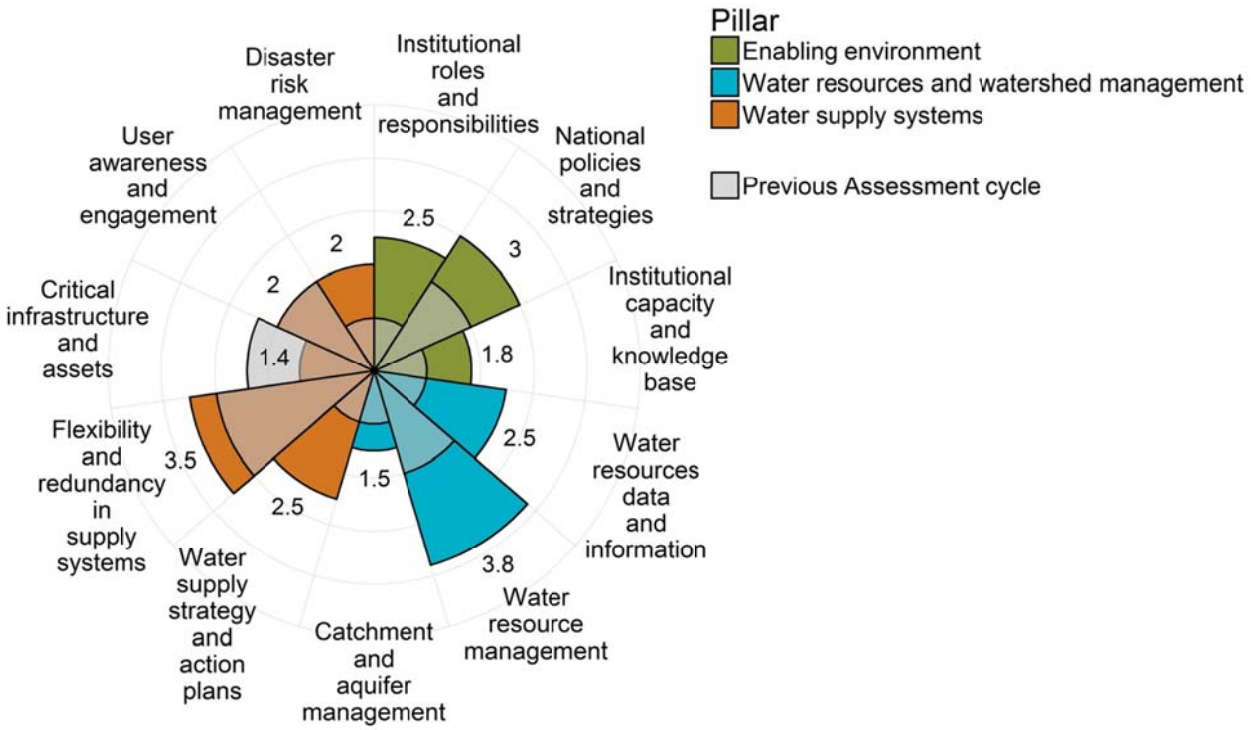

Figure 1.5: Example visualisation of results: review and monitoring of progress under each sub-cluster of the WaterRiSK assessment

2. Typical ***WaterRiSK*** process

2.1. Workshopping approach

Completing a ***WaterRiSK*** assessment is anticipated to be a collaborative effort. A workshop setting is suggested that brings together different stakeholder interests and perspectives. Typically, the individual steps would be as below, and further details on selected steps and activities are given in the Section 2.2 onwards.

Prior to the workshop:

a. Identification of a country champion as lead facilitator;
b. Identification of participants;
c. Grouping of participants on the basis of the three pillars;
d. In preparation to the workshop, the facilitator will:
   - Share a briefing note on ***WaterRiSK*** (cf. Annex C for a template briefing note);
   - Share the full assessment questionnaire (cf. Section 2);
   - Communicate to each participant which pillar/group he was assigned to and ask him to fill one/ more part/s of the assessment table.

During the workshop:

a. Introduction to the workshop purpose and assessment process;
b. Participants are divided in groups;
c. Each participant presents his/her 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;
d. The facilitator will need to verify the quality of the supporting evidence and suggest an alternative score if needed to better represent reality;
e. The group will reach a consensus on the scores, whereby the score is not an average of the score of each participant but an agreed score.

After the workshop:

a. The facilitator will produce a report highlighting the outcomes of the overall assessment via:
   - Spider and priority diagrams;
   - Main gaps and needs for each pillar;
   - Specific outcomes relevant to the intended scope of the assessment (e.g. next steps resulting from the assessment, recommended actions or indicators to monitor progress).

The above approach is a suggestion only and the final approach should be tailored by the facilitator to ensure it is appropriate for the country context. For example, the assessment could be applied in plenary with the full group rather than having different groups assessing each different pillars. This could favour a broader engagement and knowledge sharing among all participants but would likely require more time to complete the assessment.

2.2. Facilitating the process

It is recommended that the process is facilitated by a recognised country champion and supported by two facilitators, or by a third party team (e.g. a consultant).

Prior to the workshop the facilitator should share with the participants the full assessment template, as well as brief participants on the scope and structure of the assessment, and ask them to familiarise in particular with the questions from their assigned pillar.

The workshop setting brings together different stakeholder interests and perspectives through a combination of plenary and group session working. During a plenary session at the beginning of the workshop, the facilitator would introduce the assessment and its purpose to the participants. Participants can then be divided into the three “Pillar” groups, each of which will ideally be followed by one facilitator, and asked to complete the assessment questions for their pillar, as well as nominate a scribe and a speaker which will have the role of reporting back to the plenary at the end of the session.

The group session is anticipated to last approximately 4 hours. At the end of the group session, the team can be brought back to a plenary setting with the group representatives presenting findings of their respective groups. This plenary session not only serves to maximise knowledge exchange but also allows for further feedback and comment on the findings from a full group.

2.3. 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 (see Box 1.1).

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 water user 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.

Box 1.1 - Stakeholder mapping and engagement

Stakeholder mapping 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. One of the first steps is 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. The map should also identify the role of each stakeholder and how they can influence or impact on climate resilient outcomes. A tentative list of potential stakeholders is shown below.

Stakeholder	Typical role in the water sector
Water services provider	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 Dept 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)

2.4. Grouping of participants

Between 20 to 30 participants can be envisaged as part of the workshopping process. Each participant will be assigned to one of three working groups based on the three Pillars on the basis of his/her expertise and institutional mandates. For example, it is recommended that representatives from the Ministry responsible for regulation of water sector be assigned to Pillar 1, representatives from Water Resources Management Agencies to Pillar 2 and representatives from Water Utilities to Pillar 3. Ideally, the three groups would be of comparable size but it is suggested that no group should have less than 5 members to ensure sufficient representativeness.

A degree of flexibility can be adopted in the creation of the groups since each country context will be different and will require different considerations; the key rationale behind the creation of the groups is that people should be assigned to a topic that they are, to a large extent, familiar with.

3. *WaterRiSK* questionnaire

3.1. Pillar 1 - Enabling environment

3.1.1. 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 resource management, infrastructure, environment and different economic sectors, as well climate change adaptation and disaster risk reduction. Representation and engagement of a wide range 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 share 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 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 or similar).
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.

3.1.2. 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. 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 Sustainable Development Goals.

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/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

Score	Description
	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 and consult with climate experts (e.g. climate focal points, NAP leads/coordinators, etc.)?*

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 etc.)?*

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 learnt 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 learnt 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.

3.1.3. 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 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.

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 its relation to the water sector; training activities also focus on Climate Risk and Vulnerabilities assessments. 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 is trained on climate impacts and its relation to the water sector but training activities also focus on Climate Risk and Vulnerabilities assessments. 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 as it relates 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 Climate Risk and Vulnerabilities assessments. A comprehensive framework exists that allows to exploit this capacity for the identification and prioritisation of actions.
2	Limited - Training on climate impacts as it relates 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 Climate Risk and Vulnerabilities assessments. 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 climate change and vulnerability assessments 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. These are aware of the existence of the electronic platform and are adequately supported in accessing it (e.g. tutorials, user guide, helpdesk support etc.).
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 this 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.

Score	Description
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 etc.) 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 have 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 well clear to water

Score	Description
	governance institutions and stakeholders and addressed in a national adaptation strategies and action plans.
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 neither 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.

3.2. Pillar 2 - Water resources and watershed management

3.2.1. 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 check or used for further analysis.
1	None - A hydrological monitoring system is not in place or operational.

- **IN2 – Water use trends**
  - *Q. To what extent is data and information collected and analysed on water use, including how this is being 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 is not considered in the analyses.
3	Moderate - Information on disaggregated water use is collected but the time-spatial scale is not adequate to developed informed analyses – climate is not considered.
2	Limited - Some information is collected/analysed but it is either of low quality or outdated – climate 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 resource monitoring systems implemented and maintained, and used to periodically review the long-term status of water resources?*

Score	Description
5	Comprehensively - Water resource monitoring systems in place and data actively used to review the status of water resources.
4	Available but under-used - Water resource monitoring systems in place but data is not used to review the status of water resources
3	Moderate - Water resource 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 resource monitoring systems and data cannot be used to review the status of water resources
1	None - No monitoring systems in place

3.2.2. WR - Water resource 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 and 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 resource 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 etc.)?*

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

Score	Description
5	Comprehensively - Water resource 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 resource 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 resource management and allocation incorporates some climate change considerations.
2	Limited - Water resource management and allocation 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-

Score	Description
	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 is 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 is 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.

3.2.3. 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 sources 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 for this. 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, un-controlled 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 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 etc.) 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 etc.) 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 etc.) 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[9] solutions

- *Q. To what extent are nature-based solutions (e.g. wetland restoration, reforestation, water harvesting, flood bypasses, mangroves protection etc.) 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 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.

[9] For an overview of green infrastructure measures cf. Appendix A

3.3. Pillar 3 - Water supply systems level

3.3.1. 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 this 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.

Score	Description
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 undertaken.

3.3.2. 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 is there flexibility and adaptability 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**
  - *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 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 the 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.

3.3.3. 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, etc.)?*

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, etc.)?*

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, etc.)?*

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.

Score	Description
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 (e.g. storm and wind damage, flooding, etc.)?*

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, etc.)?*

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.

3.3.4. 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 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 has 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 etc.)?*

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.

3.3.5. 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 response to extreme weather events are lacking and financial and/or capacity barriers hinder their effective implementation.
2	Limited - Some EWS information are available but are 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 in effective.
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.

Score	Description
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 etc.)
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 for are not in place.

Appendices

A. Glossary

Words marked with ***** in the text are explained below.

Early Warning Systems: means by which people receive relevant and timely information in a systematic way prior to a disaster in order to make informed decisions and take action. The word system is used to refer to the interplay between an array of elements aimed at facilitating communication and prompt response to protect and aid those in need.

Flexibility and adaptability: ability of the water supply network to reduce specific risk by exercising operating options in order to adapt to changes in the state variables (e.g. interconnected water supply systems, back-up sources etc.)

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 eco-systems.

Integrated Watershed Management: it builds upon the foundational principles of watershed management to integrate various social, technical, and institutional dimensions, as well as conservation, and economic objectives. This integration generates an integrated multi-resource management planning process that seeks to balance healthy ecological, economic, and cultural/social conditions within a watershed (Wang. et al. 2016).

Levels of Service: standard of supply. The three principal level of service which relate to the performance of aqueduct systems are hydraulic performance (minimum pressure and flow), continuity of supply (number, duration and circumstances relating interruptions of deficiencies of supply) and water quality standards.

Monitoring and evaluation: 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.

Non Revenue Water: NRW is the difference between water supplied and water sold (i.e. the volume of water “lost”), expressed as a percentage of net water supplied. NRW is generally estimated to be due to a lack of universal metering and of economic valuations of water usage. However, the use of NRW has been adopted by utilities to represent the level of loss between production and consumption.

Water audits: systematic study of the current status and future trends in both water supply and demand, with a particular focus on issues relating to governance, institutions, finance, accessibility and uncertainty in a given spatial domain.

Water budgets: relationship between input (precipitation) and output (evapotranspiration) of water through a region or a watershed.

B. Green Infrastructure solutions

Water management issue (Primary service to be provided)		Green Infrastructure solution	Location				Corresponding Grey Infrastructure solution (at the primary service level)
			Watershed	Floodplain	Urban	Coastal	
Water supply regulation (incl. drought mitigation)		Re/afforestation and forest conservation	■				Dams and groundwater pumping Water distribution systems
		Reconnecting rivers to floodplains		■			
		Wetlands restoration/conservation	■	■	■		
		Constructing wetlands	■	■	■		
		Water harvesting*	■	■	■		
		Green spaces (bioretention and infiltration)			■		
		Permeable pavements*			■		
Water quality regulation	Water purification	Re/afforestation and forest conservation	■				Water treatment plant
		Riparian buffers		■			
		Reconnecting rivers to floodplains		■			
		Wetlands restoration/conservation	■	■	■		
		Constructing wetlands	■	■	■		
		Green spaces (bioretention and infiltration)			■		
		Permeable pavements*			■		
	Erosion control	Re/afforestation and forest conservation	■				Reinforcement of slopes
		Riparian buffers		■			
		Reconnecting rivers to floodplains		■			
	Biological control	Re/afforestation and forest conservation	■				Water treatment plant
		Riparian buffers		■			
		Reconnecting rivers to floodplains		■			
		Wetlands restoration/conservation	■	■	■		
		Constructing wetlands	■	■	■		
	Water temperature control	Re/afforestation and forest conservation	■				Dams
		Riparian buffers		■			
		Reconnecting rivers to floodplains		■			
		Wetlands restoration/conservation	■	■	■		
		Constructing wetlands	■	■	■		
		Green spaces (shading of water ways)			■		
Moderation of extreme events (floods)	Riverine flood control	Re/afforestation and forest conservation	■				Dams and levees
		Riparian buffers		■			
		Reconnecting rivers to floodplains		■			
		Wetlands restoration/conservation	■	■	■		
		Constructing wetlands	■	■	■		
		Establishing flood bypasses		■			
	Urban stormwater runoff	Green roofs			■		Urban stormwater infrastructure
		Green spaces (bioretention and infiltration)			■		
		Water harvesting*	■	■	■		
		Permeable pavements*			■		
	Coastal flood (storm) control	Protecting/restoring mangroves, coastal marshes and dunes				■	Sea walls
		Protecting/restoring reefs (coral/oyster)				■	

Figure B.1: Overview of Green Infrastructure solutions for water resources management

Source: Green Infrastructure – Guide for Water Management, UNEP, 2014

C. *WaterRiSK* – Briefing note template

WaterRiSK – A resilience self-assessment tool

Stakeholder briefing note

The *WaterRiSK* approach

The objective of WaterRiSK is to identify the strengths and weaknesses of current practices and to ascertain opportunities and priorities to enhance the integration of climate resilience in the water supply sector. In doing so, WaterRiSK supports continual improvement of water supply services in the Caribbean by and the development of a Roadmap to reduce operational risks associated with climate variability and change.

Objectives of the assessment

- Introduce a common language and common concepts to discuss and communicate about climate resilience;
- Provide an organising principle for applying a climate resilience "lens";
- Identify priorities to enhance the integration of climate resilience in the water supply sector;
- Encourage discussion and knowledge sharing among stakeholders, bringing together different interests and perspectives;
- Support stakeholders in the choice of performance indicators to track progress towards the vision of a climate resilient water sector.

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 policy and strategy development, water resource and watershed management and water supply systems and services.

WaterRiSK structure

The WaterRiSK questionnaire is articulated in three pillars; each pillar encloses a set of sub-clusters which, in turn, gather together a set of questions. The sub-cluster and their questions are intended to capture more in-depth information on each pillar.

Completing the assessment

Text detailing the approach chosen, the structure and aim of the workshop and the role of each respondent.

Tasks to be completed

Text detailing the task to be completed by the respondent before the workshop.

D. *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 resource management	WR1	Integrated water resource management
		WR2	Water resource 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 source quality
		CM3	Impacts of extreme events
		CM4	Green Infrastructure solutions
Water supply systems	Water supply strategy and action plans	SP1	National water supply services 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
	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

Figure D.1: Summary table of pillars, sub-clusters and questions

E. ***WaterRiSK*** – Example applications for the pilot countries: Grenada, St Kitts and Nevis

In order to provide an example of ***WaterRiSK*** application and develop a pilot test of the assessment, ***WaterRiSK*** has been applied by the Consultants Team to the Grenada and St Kitts & Nevis case studies. This has been possible due to the detailed assessments of the countries' water supply services sector undertaken as part of this project and which included:

- A characterisation of the water sector context (Inception phase and Task 1);
- The identification of the main climate risks and vulnerabilities in the sector (Climate Risk and Vulnerability Assessment, Task 1); and,
- A screening of existing policies, strategies plans and legislation (Task 2).

Note: The assessments are illustrative only and were scored by members of the Consultants team based on the above studies. They do not necessarily represent the views and opinions of the countries themselves.

E.1.1. Overview and comparison of results

The application of ***WaterRiSK*** to the case studies highlighted that most of the problems as well as strengths are common to the countries analysed, which suggests, as expected, 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. This is shown in Figure E.1 which illustrates a rose diagram of the sub-clusters performance scoring for the three countries.

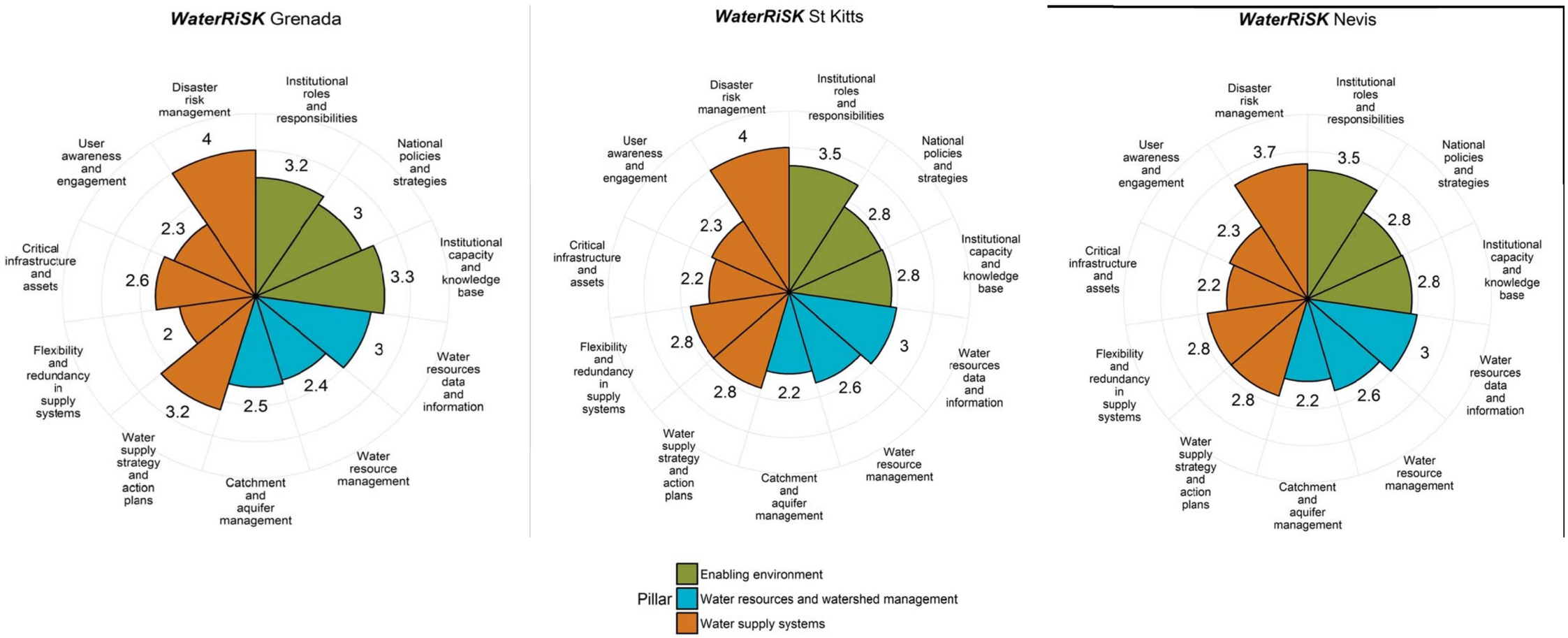

Figure E.1 (a, b, and c): WaterRiSK sub-cluster scoring for Grenada, St Kitts and Nevis: the sub-clusters belonging to the water supply system level usually have the lowest performance, with the exception of Disaster Risk Management. Major gaps are also present in terms of catchment and aquifer management

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 (Figure E.2)

- 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 talks to the presence of **high-level goals and targets related to climate risks**) and IC2 (which talks to the level of **dissemination of climate risks 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 Climate Risks and Vulnerability Assessments in the formulation of strategies and plans (IC4) also come across as high priority.

Catchment level/ Watershed and water resources management (Figure E.3)

- 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 (the **vulnerability of surface water quality and quantity to future climate trends**), CM2 (the effects of **poor watershed management** on water quality and quantity) and CM3 (the **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 (Figure E.4)

- 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.

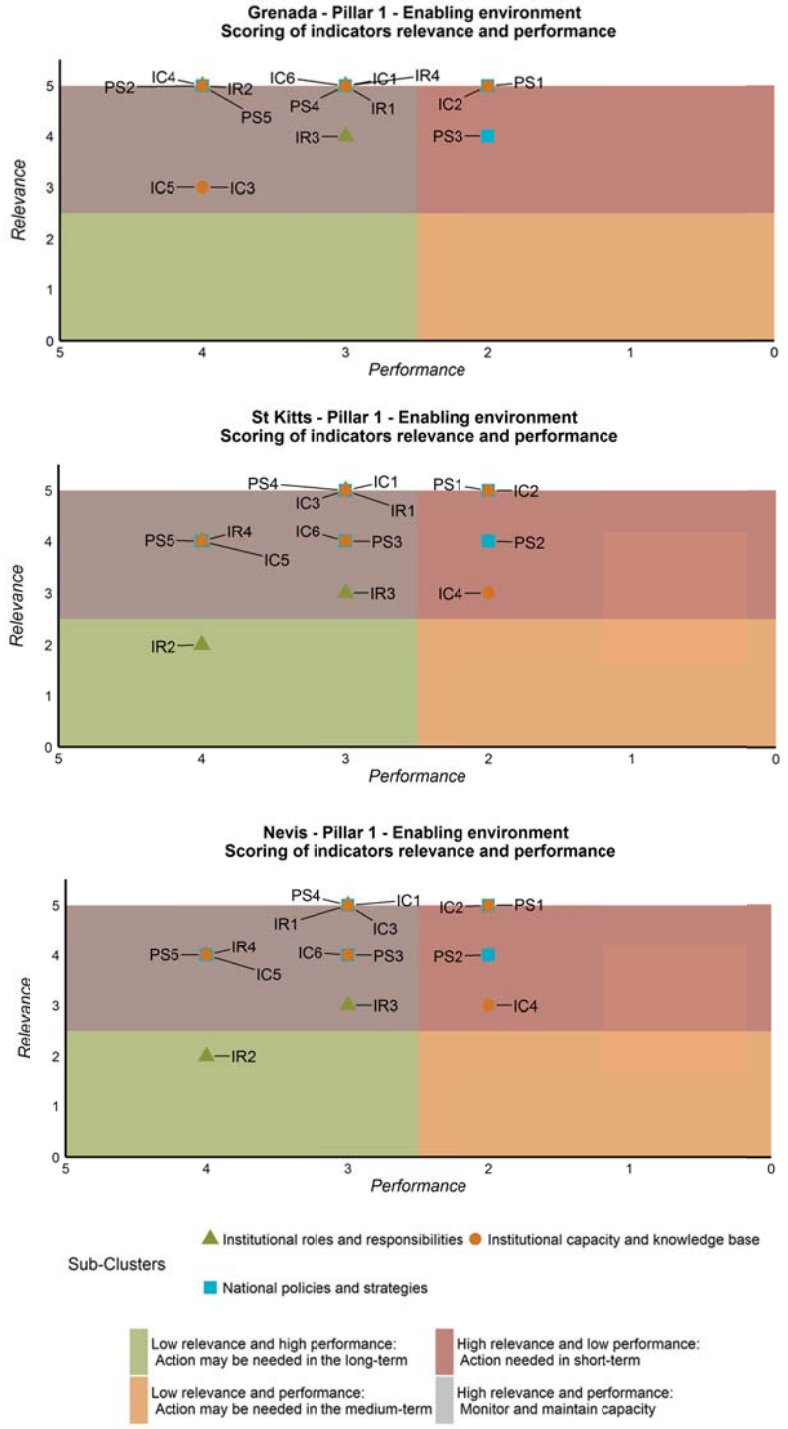

Figure E.2: Scoring of indicators relevance and performance of Pillar 1 for Grenada and Saint Kitts and Nevis. IC2 (*Generation and Dissemination of policy relevant information*) and PS1 (*Climate Challenges*) have a high relevance and low performance in all the case studies and should therefore suggest where high priority actions are needed in the short term to improve the Enabling Environment for climate resilience

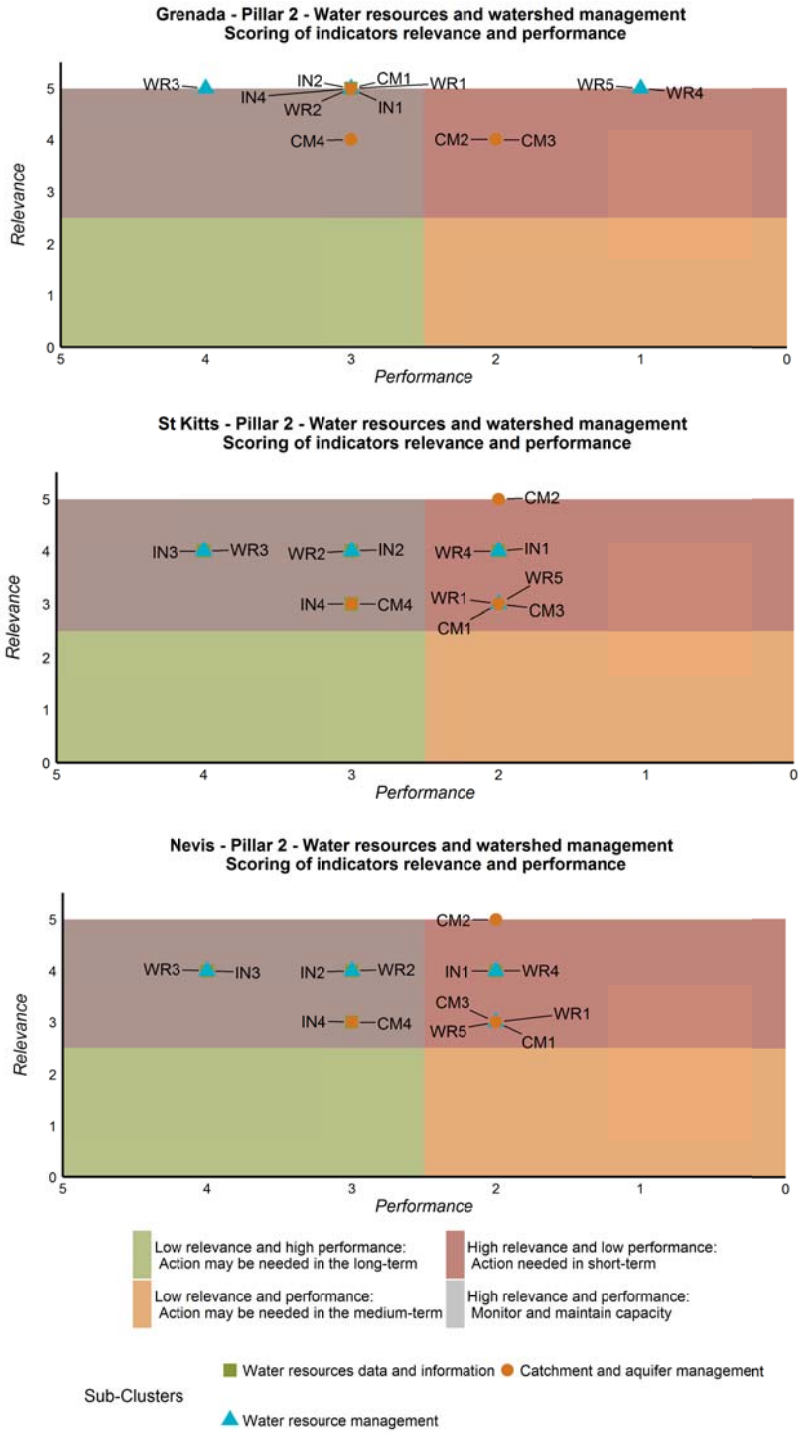

Figure E.3: Scoring of indicators relevance and performance of Pillar 2 for Grenada and Saint Kitts and Nevis. WR4 (*Surface Water availability*), CM2 (*Water source quality*) and CM3 (I*mpacts of extreme events*) have a high relevance and low performance in all the case studies and should therefore suggest where high priority actions are needed in the short term to improve the Enabling Environment for climate resilience

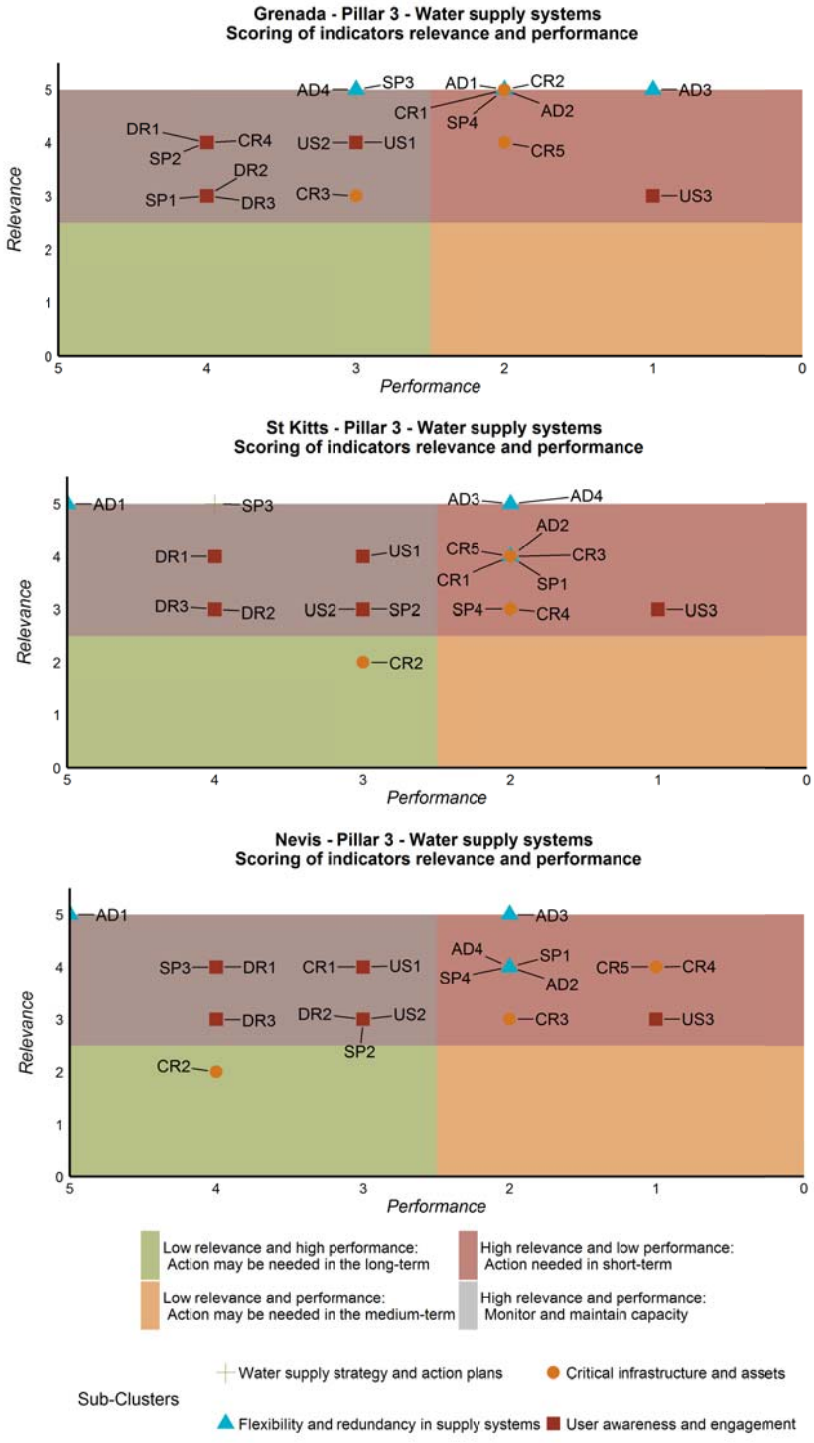

Figure E.4: Scoring of indicators relevance and performance of Pillar 3 for Grenada, St Kitts and Nevis. The higher number of priority actions is identified for this pillar and most of these are common to all the case studies: SP4 (*Supply/demand balance*), AD2 (*Adaptability of supply systems*), AD3 (*Non-revenue water*), and US3 (*Consultation processes*) and many indicators belonging to the CR sub-cluster (*Critical infrastructure and assets*)

E.1.2. *WaterRiSK* assessment for Grenada

Figure E.1(a) shows the performance score of the ***WaterRiSK*** sub-clusters. It can be observed a low performance (<= 2.5) in most of Pillar 2 (Water resources and watershed management) and Pillar 3 (Water supply systems) sub-clusters.

The enabling environment (Pillar 1) has the best performance among the three. This reflects the existence of detailed proposals for legislative, institutional and policy reforms, as well as the presence of a National Water Policy, still not formally adopted, which proposes a set of aims and actions for governance and institutional reforms. This shows that Grenada has made some progress in improving the enabling environment for climate resilience but that full implementation of policy updates and recommendations needs to happen to actually mainstream climate resilience in the enabling environment. The priority plot shown in Figure E.2 suggests in which areas priority actions should be implemented in order to improve the enabling environment. These primarily concern the amendment of policies to include climate risks and gender issues (PS1 and PS2), and the appropriate collection and dissemination of data for informed policy and decision making (IC2).

Pillar 2 “Water resources and watershed management” obtained the lowest performance score (2.6). This is generally due to a lack of sufficient monitoring and understanding of water resource and catchment status and yields during drought conditions, which, in turn, should inform long-term planning. High priority actions, as shown in Figure E.3, should be aimed at improving the estimation of surface and groundwater sources yields (WR4 and WR5) and at the implementation of catchment protection measures such as reforestation, slope stabilisation, and ownership among communities (CM2 and CM3).

The higher number of priority actions is identified for Pillar 3 “Water supply systems”, whose average score is slightly less than 3 (Figure E.4). Improving the ability to maintain levels of service during the dry season is key (AD1, AD2 and AD3), as well as increasing robustness of critical infrastructure to withstand extreme weather events (CR1, CR 2 and CR5). Long-term planning should be informed by the development of water supply/demand balance (SP4) and strengthened by the consultation and involvement of users in the decision making process (US3).

Table E.1 shows the detailed assessment table for Grenada.

Table E.1: ***WaterRiSK*** assessment table for Grenada

Evidence, gaps and needs	Recommended actions	Question ID	Perf.	Relev.
IR - Institutional roles and responsibilities				
• Policies and legislation is outdated. • Further work needs to be done to ensure the mainstreaming of CC and DRR in a coordinated manner. • Key personnel/decision makers are not always available to participate in these forums. • Human and financial resources to maintain climate resilience solutions may not be available.	• Review and update the existing legislation and policies. • Build on existing committees such as the National Climate Change Committee to ensure that frequent meetings are held with stakeholders providing updates on any new DRR or CC projects/initiatives. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these	IR1	3	5
		IR2	4	5
		IR3	3	4
		IR4	2	5

	forums. • Ensure that proper M&E plans are developed prior to the implementation.			
PS	**National policies and strategies**			
• Policies and legislation may be outdated and may not speak specifically to addressing climate risks. • Policies and strategies identified but implementation is an issue. • Limited progression in mainstreaming gender into programmes, policies, plans and strategies. • Key personnel/decision makers are not always available to participate in these forums. • Key personnel/decision makers are not always available to participate in these forums.	• Update and amend the policies as necessary to include the need to address climate risks. • Formation of a Water Management Unit or an independent Regulator may assist with progressing these activities. • Adopt documents such as the Gender Equality Policy and Action Plan as the overarching guidance to mainstreaming gender. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these forums. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these forums.	PS1	2	5
		PS2	2	5
		PS3	2	4
		PS4	3	5
		PS5	2	5
IC	**Institutional capacity and knowledge base**			
• Inadequate human resources to undertake the necessary tasks to ensure proper watershed management • Inadequate technical resources in terms of rain gauges and automated meteorological stations for capturing weather data within watersheds • Limited human resources to adequately capture, store and analyse the data • The National Water Information System (NWIS) is currently not accessible • Lack of knowledge and understanding of the available water resources therefore hindering the country's ability to plan long term for water usage for both domestic and non-domestic services • Lack of planning for mitigating the impacts of natural disasters and climate change • Absence of a systematic approach to allocating water resources and mediation mechanisms to resolve conflicts over the	• Capacity building for staff or hiring additional staff with the necessary skill sets. • Capacity building for staff or hiring additional staff with the necessary skill sets. • Invest additional technical equipment that would allow for the classification and quantification of the island's water resources. • Development of a framework which allows for the sharing the quantification and classification with policymakers. • Restore accessibility to NWIS. • Capacity building for staff or hiring additional staff with the necessary skill sets. • Invest in software (GIS) and technical equipment that would allow for the classification and quantification of the island's water resources.	IC1	3	5
		IC2	2	5
		IC3	4	3
		IC4	4	5
		IC5	4	3

use of water resources. • Lack of planning for mitigating the impacts of natural disasters and climate change.	• Improve coordinated approach to water resources management and long term planning in the face of the potential effects of climate change. • Improve coordinated approach to water resources management and long term planning in the face of the potential effects of climate change. • Improve coordinated approach to water resources management and long term planning in the face of the potential effects of climate change.	IC6	3	5
IN	**Water resources data and information**			
• Inadequate technical resources in terms of rain gauges and automated meteorological stations for capturing weather data within watersheds. • Limited human resources to adequately capture, store and analyse the data. • Inadequate infrastructure to ensure water quality and quantity to meet demand especially during dry seasons. • Lack of awareness of reports which identify the climate change projections for Grenada and limited understanding of the models used. • Lack of environmental monitoring of water courses. • Poor enforcement of regulations and the need to revise and update current legislation and policies pertaining to water services and water resources.	• Capacity building for staff or hiring additional staff with the necessary skill sets. • Invest additional technical equipment that would allow for the classification and quantification of the island's water resources. • Continued investment in infrastructure to capture data which will be used to make informed decisions in the face of a changing climate. • Capacity building for staff or hiring additional staff with the necessary skill sets. • Update and enforce current legislation and policies.	IN1	3	5
		IN2	3	5
		IN3	2	5
		IN4	2	5
WR	**Water resource management**			
• Need to develop and/or update policies which potentially speak to IWRM principles. • Need to improve on planning and allocation. • Need to understand the current status of water resources. • Need to understand the current status of water resources. • Need to understand the current status of water resources.	• Strengthening/reform of the Water Resources Management Unit to take on the role of water resources quality and quantity management. • Complete a water resources and supplies master plan which includes strategic supply and demand balances for the next 30 years. • Improved estimation of source yields during drought conditions to inform long term investment planning for securing additional water supplies.	WR1	3	5
		WR2	2	5
		WR3	4	5

	• Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new surface water sources. • Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new groundwater sources.	WR4	1	5
		WR5	1	5
CM	**Catchment and aquifer management**			
• Need to update policies, strategies and plans as it relates to protecting the watershed. • Need to invest in catchment protection measures in priority catchments which are suffering degradation. • Need to improve the national laboratories for water quality testing. • Encroachment of farming and other human developments in watersheds.	• Review legal protection status of watersheds and identifying opportunities to strengthen protection through incentives and enforcement. • Implement measures such as reforestation, slope stabilisation, incentives and community initiatives amongst others. • Conservation works to maintain and improve watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds. • Enhance monitoring and modelling of saline intrusion into coastal aquifers. • Develop a programme of improved water quality monitoring. • Conservation works to maintain and improve watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds. • Review legal protection status of watersheds and identifying opportunities to strengthen protection through incentives and enforcement.	CM1	3	5
		CM2	2	4
		CM3	2	4
		CM4	3	4
SP	**Water supply strategy and action plans**			
• Need to develop the strategic plan. • Need to continue building on long term strategic goals it relates to climate change. • Issues with regards to data collection and understanding how to use accessible climate information in decision making processes. • Need to start using water budgets and water supply/demand balances.	• Confirm the status of the strategic plan. • Define the level of drought resilience NAWASA should plan and design water supply systems to withstand. • Assessment on the frequency and severity of droughts. • Update strategic plan to include climate related resilience targets over longer periods. • Expanding and improving hydro-met data	SP1	4	3
		SP2	4	4

	collection and use to inform investment planning. • Capacity building for staff which have to use data to make informed decisions as it relates to the impacts of climate change. • Improved estimation of source yields during drought conditions to inform long term investment planning and feasibility study for securing additional water supplies through the identification of new surface water sources and potential for new groundwater sources.	SP3	3	5
		SP4	2	5
AD	**Flexibility and redundancy in supply systems**			
• Need to continue to ensure that demand can continue to be met especially during the dry season. • Need to continue to ensure that demand can continue to be met especially during the dry season and drought like conditions. • Significant reduction of NRW from 30% to 25% in the last 5 years: need to sustain the positive trend and maintain good results. • Need to control pumping costs and treatment costs. • Present storage is not sufficient.	• Development of new and more resilient water sources • Investment in raw water storage infrastructure to buffer the effects of seasonal drought. • Investment in strategic pipeline replacement, expansion and upsizing, and system telemetry to increase the connectivity and flexibility of the supply systems. • Investment in leakage detection and repair programme to reduce leakage to an economically feasible level. • Investment in meter replacement and district metering to allow more accurate assessment of leakage and unauthorised water consumption. • Water storage expansion project in being implemented.	AD1	2	5
		AD2	2	5
		AD3	4	5
		AD4	3	5
CR	**Critical infrastructure and assets**			
• Need to address potential impacts due to heavy rainfall which could result in raw water quality issues, damage to intake structures and landslides on pipelines. • Need to address potential impacts due to heavy rainfall which could result in damage to intake structures and landslides on pipelines. • Need to address potential impacts due to decreased rainfall and intense rainfall	• Need to continue building on capturing information on the impacts of climate hazards on service outage and infrastructural damage. • A proposed asset management system to integrate climate hazard assessments and management. • Need to continue building on capturing information on the impacts of climate hazards on service outage and	CR1	2	5
		CR2	2	5

events. • Vulnerable to the impacts of very dry and drought like conditions. • Need to address potential impacts due to heavy rainfall which could result in loss of power to pumping stations.	infrastructural damage. • A proposed asset management system to integrate climate hazard assessments and management. • Need to continue building on capturing information on the impacts of climate hazards on service outage and infrastructural damage. • There is a need to complete an assessment of the target design drought conditions and develop new surface or groundwater sources of raw water storage. • Consideration should be given to the installation of stand-alone solar PV systems at strategic stations	CR3	3	3
		CR4	4	4
		CR5	2	4
US	**User awareness and engagement**			
• Need to continue building on present public awareness initiatives on campaigns. • Need to continue building on present public awareness initiatives on campaigns.	• Production of short videos for television and social media purposes which identify the challenges experienced by the water utility. • Continued development of water conservation campaigns all year round. • Production of short videos for television and social media purposes which identify the challenges experienced by the water utility.	US1	3	4
		US2	3	4
		US3	1	3
DR	**Disaster risk management**			
• Lack of Early Warning Systems in place as it relates to drought events. • There is a need to review the emergency response plan. • Drought Management Plan is still in drat format. • Need for improvement on the planning for mitigating the impacts of natural disasters and climate change.	• Launch of the Drought Early Warning and Information Systems Committee. • Share the emergency response plan with stakeholders and submit to Cabinet for approval. • Finalise the Drought Management Plan. • Update disaster/emergency management plans to ensure they take into account the impacts of a changing climate.	DR1	4	4
		DR2	4	3
		DR3	4	3

E.1.3. *WaterRiSK assessment for Saint Kitts and Nevis*

Figure E.1(b and c) shows the performance score of the ***WaterRiSK*** sub-clusters for St Kitts and Nevis respectively. It can be observed that the lowest performance (< 2.5) is in sub-clusters belonging to Pillar 2 (Water resources and watershed management) and Pillar 3 (Water supply systems).

The enabling environment (Pillar 1) scores an average performance of 3: main actions needed to improve this relate to the creation of a more comprehensive and coordinated institutional framework, to the update and enactment of water related policies and improved consultation with stakeholders.

The priority plot shown in Figure E.2 suggests in which areas priority actions should be implemented in order to improve the enabling environment. These primarily concern the amendment of policies to include climate related risks and challenges (PS1), the collection and dissemination of data for informed policy and decision making (IC2) and the use of CRVAs to inform high-level policies, goals and targets (IC4).

Pillar 2 “Water resources and watershed management” obtained an average score of 2.8 for both St Kitts and Nevis. Adaptation actions would need to address the lack of appropriate environmental monitoring of water courses, and the existing gaps in water data collection and management. High priority should be placed in the creation of a Water Resources Agency to improve resources management, and in the thorough assessment of resource yields and vulnerabilities.

The higher number of priority actions is identified for Pillar 3 “Water supply systems”. This pillar is particularly weak due to the high vulnerability of water supply to drought events, which does not allow to guarantee the continuity of service, quality standards and fulfil strategic objectives not even in the short term. It is necessary that feasibility studies to investigate availability of new resources continue to be undertaken and that users are more engaged, not only during drought events.

Table E.2 and

Table E.3 show the detailed assessment table for St Kitts and Nevis respectively.

Table E.2: ***WaterRiSK*** assessment table for St Kitts

Evidence, gaps and needs	Recommended actions	Question ID	Perf.	Relev.
IR - Institutional roles and responsibilities				
• Need to ensure there are policies in place which speak to proper land use, watershed and waste management etc. Need to be more coherence across stakeholders as it relates to the development of policies regarding flood management. • Key personnel/decision makers are not always available to participate in these forums. • Human and financial resources to maintain climate resilience solutions may not be available.	• Enact new Water Resources Legislation. • New Public Health Act. • Regulations to establish water quality standards. • Early enactment of the National Conservation and Environmental Management Act. • Continued engagement between the relevant stakeholders to achieve this goal. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these forums. • Ensure that proper M&E plans are developed prior to the implementation	IR1	3	5
		IR2	4	2
		IR3	3	3
		IR4	2	4
PS National policies and strategies				
• Need to ensure that there are policies in place which speak to addressing climate risks. • Need to identify laws which have a bearing on IWRM. • Gender could be a bit more prominent in some of the policies and legislation for the water sector. • There is little national coherence in policies and structures governing water resource management, flood management and prevention, catchment protection and land use, groundwater abstraction, and pollution control.	• Relevant policies should speak to climate resilience once updated. • Laws have been previously identified. • Update policies and acts to ensure that gender is adequately reflected in these documents. • Enforcement of policies and structures should specifically need to mention the inclusion of climate change focal points in all climate related projects and discussions. • Continue to be well integrated with regional and international agreements and institutions offering support in the various aspects of CR.	PS1	2	5
		PS2	2	4
		PS3	3	4
		PS4	3	5
		PS5	4	4
IC Institutional capacity and knowledge base				
• Lack of expertise to identify and address climate risks to their operations. • Progress has been made but there are still significant gaps in data for the water	• Build capacity or hire additional staff with the expertise to recommend solutions to address climate risks. • Build capacity or hire additional staff to	IC1	3	5

sector. • Need to continue improving on the knowledge base to identify and address climate risks. • Risk assessments have been completed in the past but solutions to address climate risks may not be implemented in a timely manner. • Need to be a more structured form of coordination among the stakeholders. • National responses to climate-related disasters and extreme events have tended to be reactive and ad hoc.	record and manage data. • Purchase additional equipment/technology to capture the data. • Build capacity or hire additional staff with the necessary skills and expertise. • Need to identify champions to implement identified adaptation solutions. • Creation of a dedicated Water Resources Agency to govern the management of watersheds. • Identification of key gaps in policies and legislation and address them.	IC2	2	5
		IC3	3	5
		IC4	2	3
		IC5	4	4
		IC6	3	4
IN	**Water resources data and information**			
• Identify the most serious gaps in water sector data and make proposals for how these can be overcome. • Robust data management system to record data. • Need to formulate Strategy and Business Plans with a central focus on identifying and addressing climate risks to their operations and proposing options for dealing with these. • Lack of environmental monitoring of water courses. • Poor enforcement of regulations and the need to revise and update current legislation and policies pertaining to water services and water resources.	• Multi stakeholder approach to decide how data could best be stored and accessed across the different stakeholder groups. • Encourage more personnel to be involved in the data collection process (SK). • Continue to use and build on assessments such as the NASAP. • Update and enforce current legislation and policies.	IN1	2	4
		IN2	3	4
		IN3	4	4
		IN4	3	3
WR	**Water resource management**			
• No legal standing for the implementation of the IWRM concept. • Need to improve on the availability of	• Need to modify laws which would have a bearing on IWRM. • Purchase more equipment and tools to	WR1	2	3

reliable data. • Further work still needs to be done to understand the status of water resources. • Need to understand the current status of water resources.	better capture data. • National vulnerability and risk assessments should be reviewed and updated. • Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new surface water sources. • Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new ground water sources.	WR2	3	4
		WR3	4	4
		WR4	2	4
		WR5	2	3
CM	**Catchment and aquifer management**			
• Need for continued work on integrated watershed management. • Need to develop initiatives which enforce the management of national water resources and preservation of the quality. • Need to improve the national laboratories for water quality testing. • Encroachment of farming and other human developments in watersheds.	• Creation of a dedicated Water Resources Agency to govern the management of watersheds and wetlands, as proposed by the NASAP. • Create the conditions (including legislative, institutional and policy reforms) for managing national water resources in support of climate resilient water services, including catchment and source protection, forest management, control of soil erosion, and associated land use measures. • Enhance monitoring and modelling of saline intrusion into coastal aquifers. • Develop a programme of improved water quality monitoring. • Conservation works to maintain and improve watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds. • Review legal protection status of watersheds and identifying opportunities to strengthen protection through incentives and enforcement.	CM1	2	3
		CM2	2	5
		CM3	2	3
		CM4	3	3
SP	**Water supply strategy and action plans**			

• Need to develop the strategic plan. • Need to develop an agency that assists with identifying investment priorities for the water sector. • Some efforts are made to account for climate trends in long-term strategies but more still needs to be done to ensure that resilience of the water sector is coupled with sustainable development. • Lack of equipment to record data and certain expertise to make some decisions as it relates to climate resilience. • Given the difficulty with accessing and capturing relevant data, this exercise would pose some challenges.	• The need for a Water Resources Agency for St. Kitts and Nevis to govern the management of watershed and to ensure that a baseline study of all watersheds and wetlands to inform preservation planning in St. Kitts and Nevis. • The Development of a Water Master Plan will also assist with addressing these issues. • Formulate Strategy and Business Plans with a central focus on identifying and addressing climate risks to their operations and proposing options for dealing with these. • Capacity building for key personnel and hiring of personnel with the requisite skills and expertise.	SP1	2	4
		SP2	3	3
		SP3	4	5
		SP4	2	3
AD Flexibility and redundancy in supply systems				
• Highly exposed to very dry/drought like conditions which result in water rationing. • Need to continue to ensure that demand can continue to be met especially during the dry season and drought like conditions. • Continued need to ensure service standards are maintained during extreme weather events. • There is a need to upgrade storage to ensure that it is sufficient to buffer the effects of extreme weather events.	• Complete the Water Services Drought Management Plan. • Water Resource Management Project (Aquifer Protection) — aimed at the protection of the primary water resource - the Basseterre Valley Aquifer. • Well Drilling and Extension of Water Lines — Bedrock Exploration and Development (BEAD) Technologies and Ocean Earth Technologies (OET) contracted to increase water production. • Implement the Water Loss Programme — reduce non-revenue water (increase collections, mitigate water leaks, metering of public buildings etc.) • Continue to work towards increasing water storage across the island.	AD1	1	5
		AD2	2	4
		AD3	2	5
		AD4	2	5

CR	**Critical infrastructure and assets**			
• Lack of legislation and policies in place to ensure that the quality of the water resources on island is preserved. • Pipelines at ghaut crossings are potentially exposed to damage as a result of extreme weather such as high winds. • Issues treating turbid source water. • Loss of water supply. • Increased use of chlorine to treat the water. • Insufficient treated water entering distribution system. • Although the likelihood for climate impacts is low, assessments should be completed as it relates to the vulnerability of the storage tanks.	• Create the conditions (including legislative, institutional and policy reforms) for managing national water resources in support of climate resilient water services, including catchment and source protection, forest management, control of soil erosion, and associated land use measures. • Continue to ensure that damage to pipelines at ghaut crossings as a result of extreme weather is kept to a minimum. • Create a robust policy, legislative and institutional framework for the protection of water quality against pollution from untreated domestic wastewater, untreated commercial and industrial effluent, unregulated solid waste disposal, non-point source pollution from agriculture, and over-abstraction of surface and groundwater sources leading to salinization and other quality problems. • The need for upgraded water storage catchment and distribution systems.	CR1	2	4
		CR2	3	2
		CR3	2	4
		CR4	2	3
		CR5	2	4
US	**User awareness and engagement**			
• During drought like and dry conditions there is engagement with the public on water conservation measures. • Need to continue building on present public awareness initiatives on campaigns.	• Continued engagement with the public both during and outside of the dry season, or dry/drought like conditions. • Production of short videos for television and social media purposes which identify the challenges experienced by the water utility.	US1	3	4
		US2	3	3
		US3	1	3
DR	**Disaster risk management**			

• Lack of Early Warning Systems in place as it relates to drought events. • There is a need to review the emergency response plan. • Need for improvement on the planning for mitigating the impacts of natural disasters and climate change.	• Review any existing practices or procedures with relevant stakeholders and experts and prepare a modern and dynamic plan which includes early warning systems. • Share the emergency response plan with stakeholders and submit to Cabinet for approval. • Finalisation and adoption of Drought Management Plan. • Update disaster/emergency management plans to ensure they take into account the impacts of a changing climate.	DR1	4	4
		DR2	4	3
		DR3	4	3

Table E.3: WaterRiSK assessment table for Nevis

Evidence, gaps and needs	Recommended actions	Question ID	Perf.	Relev.
IR - Institutional roles and responsibilities				
• Need to ensure there are policies in place which speak to proper land use, waste management etc. • Need to be more coherence in ensuring that policies regarding flood management. • Key personnel/decision makers are not always available to participate in these forum. • Human and financial resources to maintain climate resilience solutions may not be available.	• Enact new Water Resources Legislation. • New Public Health Act. • Regulations to establish water quality standards. • Early enactment of the National Conservation and Environmental Management Act. • Continued engagement between the relevant stakeholders to achieve this goal. • Capacity building for staff or hiring additional staff with key skill sets that can make meaningful contributions in these forums. • Ensure that proper M&E plans are developed prior to the implementation.	IR1	3	5
		IR2	4	2
		IR3	3	3
		IR4	4	4
PS National policies and strategies				
• Need to ensure that there are policies in place which speak to addressing climate risks. • Need to identify laws which have a bearing on IWRM. • Gender could be a bit more prominent in some of the policies and legislation for the water sector. • There is little national coherence in policies and structures governing water resource management, flood management and prevention, catchment protection and land use, groundwater abstraction, and pollution control. • Not much issues or gaps.	• Relevant policies should speak to climate resilience once updated. • Laws have been previously identified. • Update policies and acts to ensure that gender is adequately reflected in these documents. • Enforcement of policies and structures should specifically ned to mention the inclusion of climate change focal points in all climate related projects and discussions. • Continue to be well integrated with regional and international agreements and institutions offering support in the various aspects of CR.	PS1	2	5
		PS2	4	4
		PS3	3	4
		PS4	3	5
		PS5	4	4
IC Institutional capacity and knowledge base				
• Lack of expertise to identify and address climate risks to their operations. • Progress has been made but there are still significant gaps in data for the water	• Build capacity or hire additional staff with the expertise to recommend solutions to address climate risks. • Build capacity or hire additional staff to	IC1	3	5

sector. • Need to continue improving on the knowledge base to identify and address climate risks. • Risk assessments have been completed in the past but solutions to address climate risks may not be implemented in a timely manner. • Need to be a more structured form of coordination among the stakeholders. • National responses to climate-related disasters and extreme events have tended to be reactive and ad hoc.	record and manage data. • Purchase additional equipment/technology to capture the data. • Build capacity or hire additional staff with the necessary skills and expertise. • Need to identify champions to implement identified adaptation solutions. • Creation of a dedicated Water Resources Agency to govern the management of watersheds. • Identification of key gaps in policies and legislation and address them.	IC2	2	5
		IC3	3	5
		IC4	2	3
		IC5	4	4
		IC6	3	4
IN	**Water resources data and information**			
• Identify the most serious gaps in water sector data and make proposals for how these can be overcome. • Robust data management system to record data. • Need to formulate Strategy and Business Plans with a central focus on identifying and addressing climate risks to their operations and proposing options for dealing with these. • Lack of environmental monitoring of water courses. • Poor enforcement of regulations and the need to revise and update current legislation and policies pertaining to water services and water resources.	• Multi stakeholder approach to decide how data could best be stored and accessed across the different stakeholder groups. • Encourage more personnel to be involved in this process (SK). • Continue to use and build on assessments such as the NASAP. • Update and enforce current legislation and policies.	IN1	2	4
		IN2	3	4
		IN3	4	4
		IN4	3	3
WR	**Water resource management**			
• No legal standing for the implementation of the IWRM concept. • Need to improve on the availability of reliable data.	• Need to modify laws which would have a bearing on IWRM. • Purchase more equipment and tools to better capture data.	WR1	4	3

• Further work still needs to be done to understand the status of water resources. • Need to understand the current status of water resources. • Need to understand the current status of water resources.	• National vulnerability and risk assessments should be reviewed and updated. • Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new surface water sources. • Improved estimation of source yields during drought conditions to inform long term investment planning for the evaluation of new ground water sources.	WR2	3	4
		WR3	4	4
		WR4	2	4
		WR5	4	1
CM	**Catchment and aquifer management**			
• Need for continued work on integrated watershed management. • Need to develop initiatives which enforce the management of national water resources and preservation of the quality. • Need to improve the national laboratories for water quality testing. • Encroachment of farming and other human developments in watersheds.	• Creation of a dedicated Water Resources Agency to govern the management of watersheds and wetlands, as proposed by the NASAP. • Review legal protection of watersheds and identifying opportunities to strengthen protection through incentives and enforcement. • Enhance monitoring and modelling of saline intrusion into coastal aquifers. • Develop a programme of improved water quality monitoring. • Conservation works to maintain and improve watershed land cover to improve slope stability and reduce the impacts of heavy rainfall and high winds . • Review legal protection status of watersheds and identifying opportunities to strengthen protection through incentives and enforcement.	CM1	2	3
		CM2	2	5
		CM3	2	3
		CM4	3	3
SP	**Water supply strategy and action plans**			
• Need to develop the strategic plan. • Need to develop an agency that assists with identifying investment priorities for the water sector. • Some efforts are made in this regard but	• The need for a Water Resources Agency for St. Kitts and Nevis to govern the management of watershed and to ensure that a baseline study of all watersheds and wetlands to inform preservation	SP1	2	4

more still needs to be done to ensure sustainable development while securing the water sector. • Lack of equipment to record data and certain expertise to make some decisions as it relates to climate resilience. • Given the difficulty with accessing and capturing relevant data, this exercise would pose some challenges.	planning in St. Kitts and Nevis. • The Development of a Water Master Plan will also assist with addressing these issues. • Formulate Strategy and Business Plans with a central focus on identifying and addressing climate risks to their operations and proposing options for dealing with these. • Capacity building for key personnel and hiring of personnel with the requisite skills and expertise.	SP2	3	3
		SP3	4	4
		SP4	2	4
AD Flexibility and redundancy in supply systems				
• Highly exposed to very dry/drought like conditions which result in water rationing. • Need to continue to ensure that demand can continue to be met especially during the dry season and drought like conditions. • Continued need to ensure service standards are maintained during extreme weather events. • There is a need to upgrade storage to ensure that it is sufficient to buffer the effects of extreme weather events.	• Complete the Water Services Drought Management Plan. • Improve the distribution network and collect adequate data on water production and distribution on a daily basis. • Implement the Water Loss Programme — reduce non-revenue water (increase collections, mitigate water leaks, metering of public buildings etc.) • Continue to work towards increasing water storage across the island.	AD1	5	5
		AD2	2	4
		AD3	2	5
		AD4	2	4
CR Critical infrastructure and assets				
• Lack of legislation and policies in place to ensure that the quality of the water resources on island is preserved. • Pipelines at ghaut crossings are potentially exposed to damage as a result of extreme	• Create the conditions (including legislative, institutional and policy reforms) for managing national water resources in support of climate resilient water services, including catchment and	CR1	3	4

weather such as high winds. • Issues treating turbid source water. • Loss of water supply. • Increased use of chlorine to treat the water. • Insufficient treated water entering distribution system. • Assessments should be completed as it relates to the vulnerability of the storage tanks. • Pumps cannot operate during power outages.	source protection, forest management, control of soil erosion, and associated land use measures. • Continue to ensure that damage to pipelines at ghaut crossings as a result of extreme weather is kept to a minimum. • Create a robust policy, legislative and institutional framework for the protection of water quality against pollution from untreated domestic wastewater, untreated commercial and industrial effluent, unregulated solid waste disposal, non-point source pollution from agriculture, and over-abstraction of surface and groundwater sources leading to salinization and other quality problems. • The need for upgraded water storage catchment and distribution systems. • Need to consider installing renewable energy technologies to allow the pumps to be operational during an outage.	CR2	4	2
		CR3	2	3
		CR4	1	4
		CR5	1	4
US	**User awareness and engagement**			
• During drought like and dry conditions there is engagement with the public on water conservation measures. • Need to continue building on present public awareness initiatives on campaigns.	• Continued engagement with the public both during and outside of the dry season, or dry/drought like conditions. • Production of short videos for television and social media purposes which identify the challenges experienced by the water utility.	US1	3	4
		US2	3	3
		US3	1	3
DR	**Disaster risk management**			
• Lack of Early Warning Systems in place as it relates to drought events. • There is a need to review the emergency response plan. • Need for improvement on the planning for mitigating the impacts of natural disasters and climate change.	• Review any existing practices or procedures with relevant stakeholders and experts and prepare a modern and dynamic plan which includes early warning systems. • Share the emergency response plan with stakeholders and submit to Cabinet for approval. • Finalisation and adoption of Drought Management Plan.	DR1	4	4
		DR2	3	3

	• Update disaster/emergency management plans to ensure they take into account the impacts of a changing climate.	DR3	4	3

F. *WaterRiSK* – Assessment table template

Evidence, gaps and needs	Recommended actions	Question ID	Perf.	Relev.
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		
IN	**Water resources data and information**			
		IN1		
		IN2		
		IN3		
		IN4		
WR	**Water resource management**			
		WR1		
		WR2		

		WR3		
		WR4		
		WR5		
CM	**Catchment and aquifer management**			
		CM1		
		CM2		
		CM3		
		CM4		
SP	**Water supply strategy and action plans**			
		SP1		
		SP2		

		SP3		
		SP4		
AD	**Flexibility and redundancy in supply systems**			
		AD1		
		AD2		
		AD3		
		AD4		
CR	**Critical infrastructure and assets**			
		CR1		
		CR2		

		CR3		
		CR4		
		CR5		
US	**User awareness and engagement**			
		US1		
		US2		
		US3		
DR	**Disaster risk management**			
		DR1		
		DR2		

		DR3		

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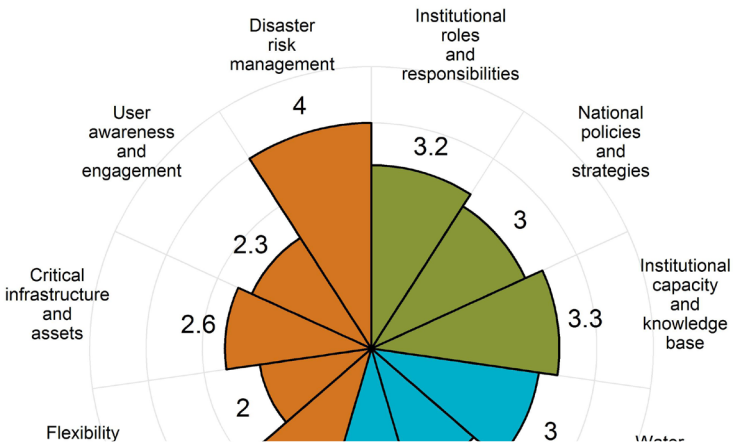

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