

Government of Bangladesh

Local Government Division, Policy Support Unit

Sector Development Plan (FY 2011-25)

Water Supply and Sanitation Sector in Bangladesh

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Climate Change and Adaptation Measures for the
Water and Sanitation Sector in Bangladesh

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CLIMATE CHANGE:

Climate Change and Adaptation Measures for the Water and Sanitation Sector in Bangladesh

1 Introduction to Climate Change

Bangladesh is already vulnerable to many climate change related extreme events and natural disasters. It is expected that climate change will bring changes in the characteristics of natural hazards and may gradually change the attributes of the physical system. The 4th IPCC report has described climate change impacts for different region of the globe with very high and high confidence. The report identifies Bangladesh as one of the worst victims of climate change, although one of the lowest per-capita emitters historically and currently. IPCC and the rest of the world agreed that reduction of emissions is the only way to overcome the challenge. The UNFCCC process and negotiations are working to that end. It is also well known that the greenhouse gases (GHGs) already emitted or 'locked in' will continue to exert pressure in the form of adverse impacts. To tackle these changes, adaptation is a short-term but essential action. However, the higher the levels of GHGs emitted, the more adverse impacts shall be there - investing now in mitigation will considerably reduce the cost of adaptation. Bangladesh is therefore proactive in contributing to global emission reduction initiatives and processes.

Studies and assessments of impacts, vulnerabilities and adaptation to climate change and sea level rise for Bangladesh clearly demonstrate that Bangladesh is one of the most climate vulnerable countries in the world.

The overall impacts of climate change on Bangladesh are expected to be significant. It is estimated that climate change could affect more than 70 million people due to the countries geographic location, low elevation, high population density, poor infrastructure, high levels of poverty and high dependency on natural resources¹. Ultimately adverse impacts have the potential to undermine poverty reduction efforts and could compromise the achievement of the Millennium Development goals (MDGs), such as the eradication of poverty and hunger by 2015. Furthermore, the OECD and World Bank estimated that 40% of the Overseas Development Assistance (ODA) to Bangladesh may be climate sensitive or at risk.

In order to develop future climate change scenarios both General Circulation Model (GCM) and Providing Regional Climates for Impacts Studies (PRECIS) have been run for Bangladesh. The GCM is a global scale model whereas PRECIS is a regional scale model. Both models outputs indicate a steady increase in temperatures along with increased trend of summer monsoon precipitation with higher level of inter-seasonal variability.

The PREICs model result shows that temperature (maximum and minimum) and rainfall vary over space and time. Values for some months are much higher than the season or annual average. Annual average of maximum temperature shows an increasing trend but shows that increase over time will

¹ UN Human Development Report 2007/'08

decline while minimum temperature shows a gradual increase over time. Projections show that rainfall in monsoon and post-monsoon seasons will increase while rainfall in the dry season will remain closer to historical amounts. Rainfall in pre-monsoon shows erratic nature.

2 Political Commitments

The Government of Bangladesh recognizes the vulnerability of our Country, its people and overall development, to the adverse effects of global warming and climate change. Since 1992 from the days of the Earth Summit at Rio in Brazil, our political leadership has expressed our concerns time and again in many formal and informal fora, at national, regional and global levels.

Also, as one of the least developed countries (LDC), our political leadership are actively engaged and participated in international response to climate change processes, with a view to ensure that the most vulnerable country concerns are addressed in any global framework to respond to climate change.

As a part of demonstrating our spirit and will to participate collectively to address global warming, Bangladesh ratified the Climate Convention in 1994 and the Kyoto Protocol in 2001.

In 2007 following the publication of the Fourth Assessment Report of the Inter-Governmental Panel on Climate Change (IPCC) confirming that global warming is accelerating, and its impacts will continue for many decades, the global community has engaged itself in exploring how to collectively address the concern.

Some of the significant interventions expressing our political will

In April 2007, at the UN Security Council, Bangladesh supported the UK position which claimed that climate change is an emerging concern to security.

At the UN High Level Event of in September 2007, the Hon'ble Chief Adviser of the Caretaker Government made a statement urging the global community to ensure the right of the vulnerable.

At Bali in December 2007 during the Climate Change Negotiations, Bangladesh was instrumental on the final day in creating the necessary pressure to build momentum among countries trying to block the negotiations.

Regionally Bangladesh has championed climate change concerns in development which has led to SAARC declaration on climate change in December 2007. Plan to implement prioritized action collectively and cooperatively in the agenda for an expert ministerial meeting in Dhaka at the end of April 2008.

Bangladesh has already invested in reducing risks and adaptation (built 2100 cyclone shelters, 200 flood shelters, over 6000 km coastal embankments, over 4770 km drainage channels) over time. The country's ability to manage disaster risks, in particular floods and cyclones, has evolved and improved over time.

The GoB has initiated a number of agricultural programs to help manage climate related impacts. For example, the crop diversification has helped developed drought and salinity resistant rice varieties. Other programs, such as the agro forestry and the production and use of biogas and organic fertilizer programs, are more related to climate change mitigation

SAARC Declaration on Climate Change

We, the Foreign Ministers of member states of SAARC are deeply concerned that the adverse impacts of climate change threaten human lives and livelihoods, sustainable development, and the very existence of many developing countries, particularly in South Asia. We believe that climate change is a phenomenon that impacts on the right to development and human security.

The low-lying region and long coastlines of SAARC face serious threats from sea level rise. Our peoples are being adversely impacted, including massive displacements as a consequence of sea level rise, riverbank erosion, droughts, severe storms and cyclones, and permanent inundation. The Himalayan regions also face the catastrophic consequences of accelerated glacial melt, including Glacial Lake Outburst Floods (GLOF).

We believe climate change is a global challenge. There is still an opportunity for mankind to address this challenge. The SAARC member states are determined to contribute to this global effort, in line with the principle of common but differentiated responsibilities. Given our vulnerabilities, inadequate means and limited capacities, we need to ensure rapid social and economic development in our region to make SAARC climate change resilient. Development provides the best form of adaptation. We also believe that developed countries must assume greater commitments in line with their responsibility.

SAARC believes that the way forward must include:

- Adequate resources to tackle climate change without detracting from development funds.
- Effective access to and funding assistance for the transfer of environment-friendly technologies and for adaptation.
- Binding GHG emission reduction commitments by developed countries with effective timeframes.
- Equitable burden sharing.

As we meet in New Delhi, the Conference of Parties of the United Nations Framework Convention on Climate Change (UNFCCC) is taking place in Bali, Indonesia. We believe that the best and most appropriate way to address the threats of climate change is to adopt an integrated approach to sustainable development. We emphasize that the UNFCCC and Kyoto Protocol provide a multilateral framework to address the challenge of climate change. We call upon the international community to honor its commitments.

Adopted by the 29th Session of the Council of Ministers,
7th December 2007

3 Existing Institutional, Legal & Policy Instruments

Institutional set up

From the point of view of environment, disaster management and climate change, the key ministries are (EC, 2008)²:

- the Ministry of Environment and Forest (MoEF) which includes:
 - the Department of Environment which houses
 - the Climate Change Cell
- the Ministry of Food and Disaster Management (MoFDM) which includes
 - the Disaster Management Bureau (DMB) which houses:
 - the Comprehensive Disaster Management Programme (CDMP)

The *Climate Change Cell* was established in 2004 and has been doing its chartered work within the Comprehensive Disaster Management Programme (CDMP). The Cell provides the central focus of the Government's climate change related work, operating as a unit attached to the Department of Environment. Its objective is to enable the management of long term climate risks and uncertainties as an integral part of national development planning³.

The *Disaster Management Bureau* is the apex institution responsible for coordinating national disaster management interventions across all agencies. It is the technical arm of MoFDM. It oversees and co-ordinates all activities related to disaster management from national down to the grass-root level.

The *National Disaster Management Council* (NDMC), headed by the Hon'ble Prime Minister, is the highest-level forum for the formulation and review of disaster management policies. The Inter-Ministerial Disaster Management Coordination Committee is in charge of implementing disaster management policies and decisions of the NDMC, assisted by the National Disaster Management Advisory Committee.

Ministry of Food and Disaster Management (MoFDM) will be overall responsible to provide the guidance for disaster risk reduction and emergency management planning.

The Ministry of Finance and Planning is basically responsible for macro planning process and providing funds to the Annual Development Program (ADP). There are more than 35 line ministries responsible for implementing development activities for different sectors which are vulnerable to the effects of climate change— such as agriculture and water management, physical infrastructure, health and water supply & sanitation, etc. To address cross cutting issues like climate change into the sectoral policies and plans, the Planning Commission plays a key role to ensure the incorporation of CC issues through the process of national development planning.

² EC (2008) Identification Mission for EC support in the area of Environment and Disaster Management in Bangladesh Draft Final Report, March 2008.

³ Bangladesh Reducing Development Risks in a Changing Climate, Vision, Challenge, Response Future. Report prepared by UNDP, DFID, EC, CDMP and the Department of Environment

Legal instruments, Policies, Plans and Programmes

Draft Disaster Management Act The Bangladesh Disaster Management Act, XXXX forms the legislative basis for the protection of life and property and to manage long term risks from the effect of hazards both natural, technological and human induced, and to respond to and recover from a disaster event. The Disaster Management Act is being revised by the concerned authority to shift the paradigm of existing relief and rehabilitation mode into a proactive disaster risk reduction management, taking into account the "holistic approach".

Standing Orders on Disaster The standing Orders on Disaster provide a detailed institutional framework for disaster risk reduction and emergency management. It outlines detailed roles and responsibilities of Ministries, divisions, departments, various committees at different levels, and other organizations involved in disaster risk reduction and emergency management.

Coastal Zone Policy (CZP) The Coastal Zone Policy approved by the government in 2005 provides a general guidance so that the coastal people can pursue their livelihoods under secured conditions in a sustainable manner without impairing the integrity of the natural environment.

Draft National Disaster Management Policy (NDMP) The government has initiated the process of formulating National Disaster Management Policy. The draft NDMP defines the national policy on disaster risk reduction and emergency response management, and describes the strategic policy framework, and national principles of disaster management in Bangladesh.

Poverty Reduction Strategy Paper (PRSP) The PRSP (2005) of Bangladesh outlines a comprehensive medium-term strategy in a sound macroeconomic environment for implementing pro-poor growth, effective safety-net programmes and human develop. The PRSP -II formulation process has just began where Climate Risk Management and Adaptation is being considered as a development agenda.

Clean Development Mechanism Government has set up a two tier Designated National Authority (DNA) in 2003 for CDM projects approval which then eventually be registered by the CDM Executive Board of the UNFCCC. Apart from establishment of DNA, the government has also established national procedures for evaluation and approval of CDM projects and developed interim sustainable development criteria for the evaluation of CDM projects.

Coastal Development Strategy (CDS) The CDS was approved in 2006 and serves as the basis for transforming the CZP into concrete interventions. It was prepared for coordinated priority actions and arrangements for their implementation through selecting strategic priorities and setting targets.

Draft Disaster Management Plans The government is formulating Bangladesh National Plan for Disaster Management which shall provide the overall guideline for the relevant sectors and the disaster management committees at all levels to prepare and implement their specific tasks. The draft plan identifies key sectoral policy agenda, hazard specific management plan, area based disaster management plan and the mechanism for horizontal and vertical coordination through different committees and institutions of different levels.

Comprehensive Disaster Management Programme (CDMP) The Comprehensive Disaster Management Programme (CDMP) was approved by the Bangladesh Government in 2003 as a key strategy to advance whole-of-government and agency risk reduction efforts in the country.

This improved disaster management capability was tested during the November 2007 Cyclone Sidr event, which affected some 18.7 million people, of which 6 million in the four worst affected districts in coastal areas.

National Adaptation Programme of Action (NAPA) The National Adaptation Programme of Action (NAPA) is prepared and approved by the government of Bangladesh in 2005 as a response to the decision of the seventh session of the conference of the parties (COP7) of the UNFCCC. Government decided to revise NAPA to be more effective accommodating contemporary knowledge

Current Setup, Process, Tools, Frames And Practice

Climate Change Cell: To address current impacts and manage future risks of climate change and variability at all levels in all stages toward a climate resilient Bangladesh, the government has established the Climate Change Cell in 2004. Its objective is to enable the management of long term climate risks and uncertainties as an integral part of national development planning.

Bangladesh is preparing for climate change facilitating mainstreaming climate concerns into national development planning through establishing a partnership with the relevant agencies initiated through focal points and aims to elaborate into a core team within respective sector, facilitating knowledge generation through research and adaptability studies, facilitates to establish climate modeling and downscaled scenarios generation capacity, and supporting government to functionally participate in negotiation

Understanding climate risks: To facilitate stakeholders understand climate impacts and risks the country setting has been characterized adopting Sustainable livelihood framework (details in CCC, 2008a).

Adaptation research: Government has conducted adaptation research on tolerant crops, crop insurance, health issues and vulnerability of women and disadvantaged groups as being demanded by the stakeholders. Results are available in CCC website (www.climatechnagecell-bd.org). Demand driven key research areas to support emerging needs is a continuous process.

Cost of impacts and investment needs for adaptation: A framework and model has been developed to estimate cost of climate change and compensation for the infrastructure in the water sector, roads and highways. Similarly, framework and model has been developed for estimating environmental cost of Climate Change (CCC, 2008b).

Climate impact prediction: To downscale climate change impact prediction modeling Government has developed an institutional road map (CCC, 2006). BUET, IWM and CEGIS are three main institutions working on climate modeling, water modeling and application modeling respectively in collaboration with BMD, BARC and SPARSSO. Government facilitated establishment of a 'climate change study cell' at BUET, is equipped to provide capacity building training for modeling in the country.

Meteorological and hydrological information: BMD, FFWC, DMIC provides these services. Efforts are continuing to streamline and improve the service to provide real time warning to the community in time.

Capacity building and promoting partnerships: Government promotes partnership with non-government agencies to service long term and immediate needs. The government officers including the focal points have been provided orientation on climate change concerns and responses. The

government is inclusive and develops concepts, ideas, needs and frames with the partners by improving access to relevant knowledge timely and systematically. Research needs, good practices, impacts of climate change, damage, risks and climate risk management and adaptation for the sector and priority investment for the sector can be identified and addressed through meaningful and effective partnerships.

Network sharing knowledge services: The government collects, generates, archives and manages data, information and knowledge and provide support and services in making knowledge based decision to all stakeholders. A climate change database and a library archives not only includes data but also reports and study findings in the arena of the climate change. The website offers a pool of resources, including news on events at home and abroad, progress and achievements

Mainstreaming climate change into development plans and processes: Mainstreaming is a long term process and has just been initiated. A total of 61 Focal Points (FPs) have been established in different ministries, technical agencies, academic institutions and research institutions. Awareness, orientation, capacity building and advocacy at different levels and spheres of operation are going on as prerequisite for mainstreaming. Next step is to elaborate the FPs among the planning professionals and build their capacity. The FPs collectively could form a platform to facilitate coordination and harmonization function.

A Country Framework for Climate Resilient Development to facilitate addressing climate risk management and adaptation holistically, practically and systematically in a country setting, thereby enabling development to take into account climate related risks and their management (CCC, 2006).

Proactive civil Society The civil society including NGOs, researchers, academicians and scientists were and are very proactive in championing climate change issues at home and abroad. They raise voice of Bangladesh in various international forums. There are a large number of studies conducted in Bangladesh by the scientists, environmentalist, researchers and others. An annotated bibliography (CCC, 2006) recorded over 100 such studies. Civil societies in Bangladesh works in close partnership with GoB for adaptation research, piloting and ensuring effective community participation.

Proposed Institutional Arrangements

To mainstream climate risk management and adaptation in to the national development planning process requires creating an enabling institutional environment so that stakeholders by large relevant to the development planning (community, Local Government Institutes, local level officials of the line (development) agencies, NGOs, CBOs, civil societies) are aware and understand the risks of the climate change, appreciate their functional engagement, oriented and skilled to identify/select options and incorporate options to manage risks into their respective working domains. Stakeholders shall require capacity building, development of respective screening tools, sector policy adjustment for CRM&A. Developing specific institutional guidelines were recommended that could provide for mechanisms on the followings (Ahmed, 2005a):

- *how the inter-ministerial coordination should take place;*
- *how the inter-ministerial (sectoral) policy conflicts would be resolved; and,*
- *who is supposed to mainstream CC concerns into the development initiatives.*

In Bangladesh, mainstreaming climate risks and adaptation has been limited until now, with development workers beginning to consider climate change risk factors as an integral part of their project planning. Successful mainstreaming depends very much on addressing key aspects of organizational and institutional learning, as evidenced from practice. A common barrier cited is that housing climate change in environmental or meteorology departments of government lead to

limited leverage on the issue/concern (IDS, 2007). A systematic analysis is, therefore, desirable to scope where housing climate risk and adaptation is appropriate, in line with the level of urgency and priority. Effective identification of roles and responsibilities of different Ministries, Agencies, Departments need to discharge toward climate resilience through mainstreaming will be an important starting point.

The services necessary to support capacity strengthening may be tailored according to the gaps and needs identified in respective scope of work. Multi-stakeholder national coordination committees may be required, chaired by a 'national level authority' with sufficient ability and mandate for macro policy formulation, planning and implementation. This may facilitate managing the national adaptation strategy more effectively.

In this connection, considering the existing set up of more than 35 development Ministries along with their technical Agencies and Departments would be of much importance. Revisiting their roles and functions to have necessary adjustment/revision towards 'response implementation' shall be the key strategy for mainstreaming purpose. This must be coordinated in a harmonized way through the proposed multi-sectoral national level coordination mechanism.

The basic framework should centre around the existing government structures (institutions) through providing necessary TA in order to build sufficient capacity to deal with CC matters, and to reflect the later in all spheres development activities. The role and functions of central planning unit of the government (i.e. PC) including the NEC/ECNEC process need to be considered in this connection to have necessary adjustment and required policy directives.

Supra-Ministerial Institutional Platform

The proposed institutional framework for mainstreaming may be housed and implemented under a **supra-ministerial platform**, in order to facilitate its smooth functioning and to avoid unnecessary confusion. The proposed '*institution*' must be adequately empowered so that it can operate in cooperation with other relevant sectoral ministries with sufficient influence in regard to implementation (**Annex:2** shows a Framework for CRM with scope of mainstreaming; while **Annex:3** presents the envisaged role of different Institutions)

Following Institutional arrangements may accelerate pace of successful implementation of the strategy keeping directions towards a climate resilient Bangladesh

Cluster I: MoEF/DoE, MoFA (central govt)

- to address global/regional issues/ Mitigation/ negotiation processes, CDM- Intl. protocols-IPCC/UNFCCC processes, etc.

Cluster II: PC (NEC/ECNEC), MoF/ERD (central govt), Research/Academic Inst.

- to address Adaptation (sectoral approach) through development interventions (involves
- ADP process- to address sectoral policies/strategies and projects/programmes)
- Capacity Building (training, screening tools, CRM)
- Knowledge Management (prediction models, vulnerability- CRA)

Cluster III: MoFDM/Agencies, MoLGRD&C/LGIs (central-local govt)/ NGOs/CBOs

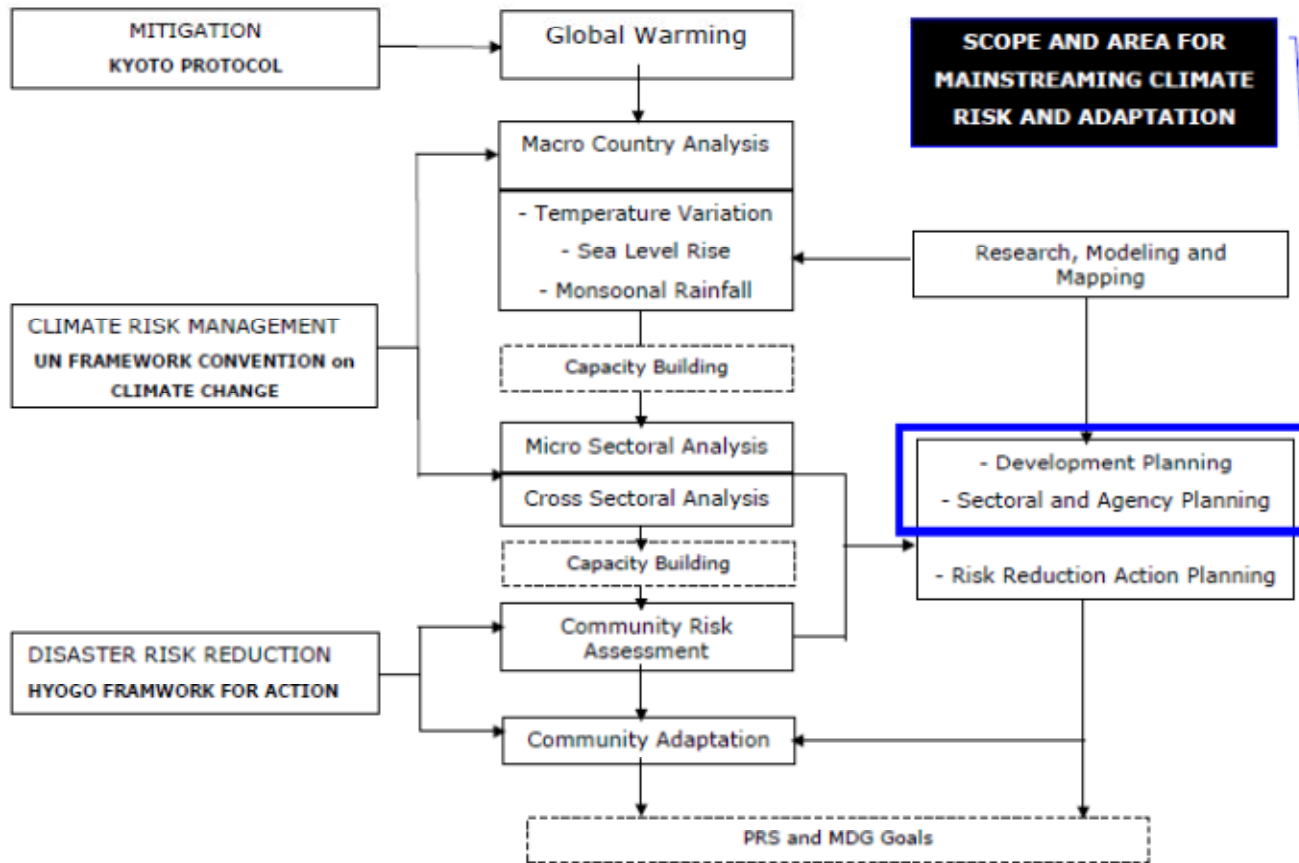
- to address disaster management (climate induced) along with cross-cutting issues (involvement of LGIs/DMCs)
- CRA/RRAP processes integrating CC concerns- Analysis

Cluster IV: Energy/Power Divisions/Private Sector (producer-consumer)

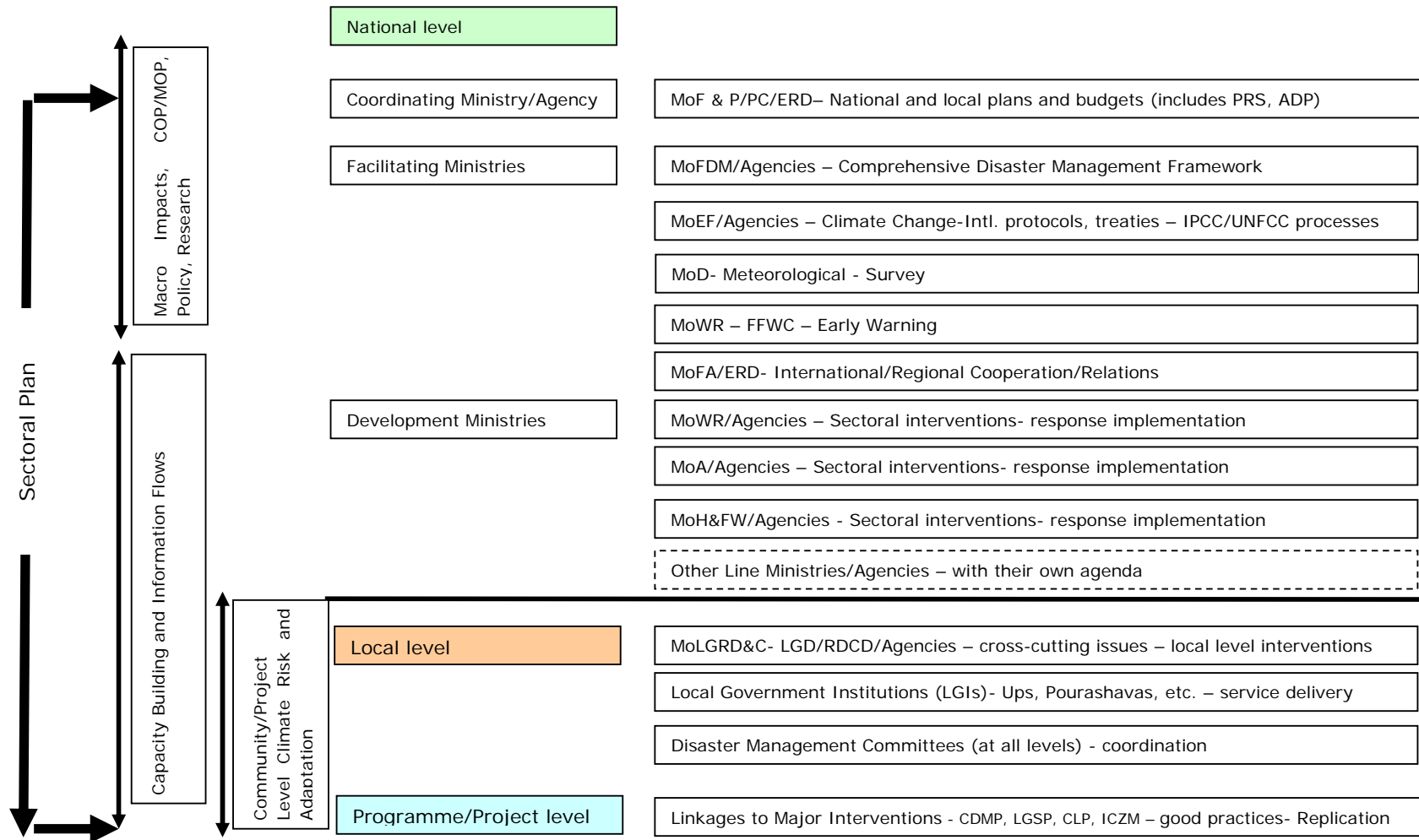
- to produce adequate cleaner energy
- to follow CDM path (of IPCC-UNFCC, Intl. protocols, negotiation)
- emission reduction (following standards)

Annex II: Framework to Manage Climate Risks and scope of current mainstreaming process

Annex II: Framework to Manage Climate Risks and scope of current mainstreaming process



Annex 3: Mainstreaming Climate Risk and Adaptation into Development Planning Process – Institutional Roles and Levels



4 Context of Vulnerability of WSS Sector

The types and contexts of vulnerability to climate change and sea level rise for Bangladesh vary across the country. The contexts may be characterised by geographical region with predominant ecosystems. A summary of the characteristics of the climate related vulnerability context by major geographical region and ecosystems are provided in Table 1 below.

Table 1 Summary of Vulnerability Context

Types of Geographical Areas with Dominant Ecosystems	Climate Change Vulnerability Context and Characteristics
Floodplain (freshwater aquatic ecosystem, fisheries, Transplanted Aman)	Changes in Flooding Characteristics
	Coverage of inundated area in monsoon season will increase (more flood vulnerable area)
	Changes in depth and duration of inundation (depth of water will be higher and period of flooding will be longer)
	Changes in recession period of flood water (water logging)
	Changes in flood frequency (more frequent and intense flooding)
Drought Prone (dryness, moisture stressed condition)	Changes in Drought Characteristics
	Changes in drought intensity (greater area under severe drought)
	Changes of extent of drought prone area (expansion of area)
	Changes in timing of drought (erratic behaviour of rainfall and temperature)
Coastal Zone	Changes in Coastal Characteristics
	Expansion of salinized areas
	Increase in salinity intensity
	Increase drainage congestion and coastal flooding
	Cyclone and storm surges
Haor Basin (tectonically depressed area)	Changes in Haor Basin Characteristics
	Changes in timing of flash flood
	Changes in recession period
Hilly Region	Changes in distribution of rainfall and intensity
	Changes in erosion of top soil
	Increase possibility of landslide

Source: National Adaptation Programme of Action (NAPA), 2005

The above mentioned vulnerability contexts of climate change are likely to affect agriculture sectors including crops, livestock and fisheries; freshwater for drinking and agricultural purpose; and rural infrastructure including water supply and sanitation, and rural roads. Table 2 below illustrates level of impacts of climate change on different sectors.

Table 2 Level of Impacts of Climate Change on Different Sectors

Physical Vulnerability Context						Sectoral Vulnerability Context	
Extreme Temperature	Sea Level Rise	Drought	Flood		Cyclone and Storm		Erosion and Accretion
			River Flood	Flash Flood			

	Coastal Inundation	Salinity Intrusion				Surges		
+++	++	+++	+++	+	++	+++	-	Crop Agriculture
++	+	+	++	++	+	+	-	Fisheries
++	++	+++	-	-	+	+++	-	Livestock
+	++		-	++	+	+	+++	Infrastructure
++	+++	++	-	++	+	+	-	Industries
++	+++	+++	-	++	-	+	-	Biodiversity
+++	+	+++	-	++	-	++	-	Health
-	-	-	-	-	-	+++	+++	Human Settlement
++	+	-	-	+	-	+	-	Energy

Source: NAPA (2005)

In above table the sectors more related to the water and sanitation sector are Infrastructure (e.g. related to water infrastructure), health (e.g. related to sanitation and hygiene education) and Human Settlement (e.g. related to sanitation chambers).

5 Effects on Water Supply and Sanitation

The contexts of vulnerability of water and sanitation to climate change stimuli include variability and extremes. It is likely that the gradual change phenomenon such as temperature rise and erratic behaviour of rainfall will lead to increased water demand and drought while sea level rise and salinity intrusion will deteriorate water quality in the coastal region. Climate change related extreme

Climate change would increase saline intrusion through several means:

- directly pushing the saline/fresh waterfront in the rivers through higher sea levels
- lower river flows from upstream, increasing the pushing effect from the sea
- upward pressure on the saline/fresh water interface in the groundwater aquifers (every cm of sea level rise will result in a thirty-fold rise of the interface because of the hydrostatic pressure balance)
- percolation from the increased saline surface waters into the ground water systems
- increasing evaporation rate in winter, leading to enhanced capillary action and subsequent salinization of coastal soils

events, particularly cyclone and storm surge, will damage water supply and sanitation infrastructure especially in the coastal regions.

Increases in summer temperature will increase water demand in the urban area for drinking and bathing as well as demand for industrial water for cooling systems. The competition of demand may aggravate the current conflict between domestic and industrial water supplies in the urban areas.

The situation will be different in the rural areas where availability and quality of rivers and artesian wells and pond water in the dry season will deteriorate.

Shortages of safe drinking water are likely to become more pronounced, especially in the coastal belt and drought-prone areas in the north-west of the country. It is also likely that the saline water boundary will be pushed further inland and vast areas will face severe water crisis in the future. People now having access to fresh water will no longer enjoy this service. Due to cyclone and storm surge, huge volumes of saline water will come onto the land area and contaminate freshwater ponds. These will severely damage the existing drinking water sources. For instance ponds for the Pond Sand Filters (PSF) and dug wells may be flooded with saline water. It may also contaminate hand tube wells and other sources.

Climate Change Affect on Health Sector

- Increased water and vector borne diseases
- Increased diseases due to salinity and water logging

It is likely that unavailability and low quality will accentuate the prevailing drinking water crisis in the dry season. This will impose hardship on women and children, who are responsible for collecting drinking water for their families. Increasingly saline drinking water may also result in health hazards, especially for pregnant women and it appears that climate change is likely to adversely affect women more than men.

6 Impact Assessment Methods

A systematic screening for the impact of climate change of the on-going project of the sector is required for a realistic assessment. The following section is taken from the experiences of the different projects under the Danida supported Water and Sanitation projects. These projects are representative of the water and sanitation sector. The following section describes the methodologies and tools developed for screening.

The working definition of climate change screening used has been:

Climate change screening is a systematic process of examining activities, outputs and programmes in order to identify their vulnerability to climate change, including assessment of the extent to which vulnerability is being or could be addressed.

The overall approach of the climate screening is one of asking the following very basic - yet crucial - questions:

- Are programme activities exposed and vulnerable to climate change, i.e. are they at risk?
- If yes, what are the risks? How serious are they?
- Are the risks being dealt with today?
- Are there ways to better deal with the risks?

The screening – that is the asking and answering of those questions above - would gradually lead into the formulation of adaptation options and a climate management plans.

6.1 Development of a Conceptual Framework

Based on literature review and discussion with key stakeholders, a conceptual framework was prepared describing the relationship between the causes of climate change and its observed or potential impacts on the two sectors. This framework or the “risk identification diagrams” for the water & sanitation sector is shown in Figure 1.

The aim of the diagram is to illustrate how the processes through which observed and predicted changes in weather and environment, which are assumed to be the result of climate changes, will impact on the lives and livelihoods of the people. Through this cause-effect analysis, the impacts of the climate changes on the two sectors and on society as a whole have been revealed.

6.2 Development of Climate Screening Matrix

The aim was to develop a screening tool which would be relatively simple and easy to use, and yet at the same time would be able to provide a framework that is fundamentally sound and robust for scaling up. It is also expected that the tool for the water and sanitation sector, or an adapted version, can be used for other sectors as well.

A Screening Matrix was developed (see Annex). Some significant features of the Screening Matrix are given below.

- **Level of screening of a project**
The projects were screened at the component/output level and, if required for climate change context, also at the activity levels. Thus each component/output (or activity) was screened through various parameters shown in the different columns of the matrix.
- **Risk zones**
The major contexts for climate change risks (flood, cyclone, drought, etc.) are dominant in certain geographical areas of the country. Considering the spatial perspective of the contexts of climate change and the type of services provided, the country was divided into five risk zones (Floodplain, Low Water Table Area, Coastal Zone, Haor Basin i.e. tectonically depressed area and Chittagong Hill Tracts/Hilly). A similar kind of “context of risks” and adaptation measures are expected within a risk zone.
- **Climate change hazard and impact on agricultural/water & sanitation services**
A list of possible climate change hazards or contexts (e.g. drought, cyclone, saline intrusion, contaminated water sources, etc.) was prepared. The contexts relevant to the output/activity were identified and subsequently their impacts on agricultural/water & sanitation services were determined. The impacts were classified into some broad categories (e.g. degraded/depleted water resources/environment conditions, damages to production systems/physical infrastructure and deteriorated health) for easy representation.
- **Quantifying climate change risk**
Approaches were taken to quantify risk so that the relative position of the risks of each output/activity could be determined. By quantifying risks it would become possible to rank

the outputs/activities and highlight the most vulnerable ones. These outputs/activities are most in need of adaptation options.

The risk has been defined as the product of severity and frequency ($Risk = Severity \times Frequency$). Severity refers to the degree of impact on the services of the climate change risk event once it occurs. Types of impact factors which were considered included: socio-economic and human losses, degraded/depleted water resources/environmental conditions, and health. (please refer to Risk Identification Diagram in Figure 1). Frequency means the number of occurrences of the climate change event in a particular period. Both severity and frequency were divided into four categories and each category was scored by a number between 1 and 4. Similarly risk, which is the score of severity multiplied by the score of frequency, was calculated and categorized into three levels of risks.

Table 3 below shows the categories of severity, frequency and risk and their corresponding scores.

Thus the score of highest risk would become 16 (High severity score 4 x More frequent score 4) and the score of 1 would represent the lowest risk.

Table 3: The Categories and Scores of Severity, Frequency and Risk

SEVERITY		FREQUENCY		RISK	
Category	Score	Category	Score	Category	Score Range
High	4	More Frequent (once or more in every year)	4	High risk	>8
Moderately High	3	Frequent (once in every 2-5 years)	3	Moderate risk	3-6
Moderately Low	2	Moderately Frequent (once in every 5-10 year)	2	No or Low risk	1-2
Low to None	1	Less Frequent (once in every 10 to 20 years)	1		

- **Adaptation consideration**

The adaptation options against each context of climate change risks were also assessed. The adaptation options that are being dealt with in the present projects were identified. Furthermore, adaptation options that are currently not undertaken, but possible within the scope of the present projects, and finally adaptation options that are possible, but need to be addressed by interventions other than the present project, were determined.

7 Results of the Screening

Below analysis and interpretation of the screening results are given.

Water Supply

The major climate change hazards for each of the five zones were identified and the impacts on the sanitation installations due to the hazards were determined. The climate change hazards and impacts on water supply installations are given in Table 4. The major hazards in the five zones are more or less similar to those described for sanitation. However, one additional but serious hazard in the coastal zone is the saline intrusion which severely impacts the water supply installations.

Sanitation

Similar to water supply, Table 5 below summarizes the different climate change hazards and the impact on the sanitation installations as they appeared from field trips, consultations with key stakeholders, examination of literature, and the screening undertaken in cooperation with the implementing agencies.

Table 4 Main Climate change hazards and impacts on water supply installation in different zones

Ecological/Hydro-	Main Climate Change Hazard	Impact on Water Supply Installations
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geological Zones		
Flood plain	<ul style="list-style-type: none"> – Water logging – Inundation 	<ul style="list-style-type: none"> – Contamination of water sources – Damage of infrastructure
Low water table area	<ul style="list-style-type: none"> – Excessive decline of ground water level – Drought 	<ul style="list-style-type: none"> – Depleted water resources – Increase in repair and maintenance of water installations
Coastal zone	<ul style="list-style-type: none"> – Saline intrusion – Tidal/storm surge – Inundation 	<ul style="list-style-type: none"> – Damage of water installations – Increased salinity of ground water abstracted by hand pumps or other means sources – Drainage congestion
Haor Basin/ Low lying area	<ul style="list-style-type: none"> – Water logging – Inundation 	<ul style="list-style-type: none"> – Damage of infrastructure – Contamination of surface water sources
Chittagong Hill Tracts/ Hilly regions	<ul style="list-style-type: none"> – Drought – Excessive lowering of ground water level – Increased rainfall – Land slide 	<ul style="list-style-type: none"> – Depleted water resources – Damage due to land slides

Table 5 Main Climate change hazards and impacts on sanitation installation in different zones

Ecological/Hydro-geological Zones	Main Climate Change Hazards	Impact on Sanitation Installations
Flood plain	<ul style="list-style-type: none"> – Water logging – Inundation 	<ul style="list-style-type: none"> – Damage of latrine pits – Poor performance of latrines
Low water table area	<ul style="list-style-type: none"> – Excessive lowering of ground water level – Drought 	<ul style="list-style-type: none"> – Depleted water resources (Sanitation with less water is difficult)
Coastal zone	<ul style="list-style-type: none"> – Tidal/storm surge – Cyclone – Water logging – Inundation 	<ul style="list-style-type: none"> – Damage of latrine pits – Damage of latrine superstructure – Poor performance of latrines
Haor Basin/ Low lying area	<ul style="list-style-type: none"> – Water logging – Inundation 	<ul style="list-style-type: none"> – Damage of latrine pits – Poor performance of latrines
Chittagong Hill Tracts/ Hilly	<ul style="list-style-type: none"> – Excessive lowering of ground water level – Drought – Increased rainfall – Land slide 	<ul style="list-style-type: none"> – Depleted water resources (Sanitation with less water is difficult) – Damage due to land sliding

7.1 Risk Assessment and Rating

The definition of risk (severity x frequency) and how it is categorized into different levels (i.e. High, Medium and Low) are described earlier. The risk rating diagram in Figure 1 illustrates the level of risks within different zones for water supply and sanitation.

The scores of severity and frequency (see Table 3) for different hazard events for a specific output, and in the different zones, are plotted in the x-axis and y-axis, respectively. The diagrams show that the risks due to different hazards in different zones are located throughout the whole diagram. This indicates the varying level of risks depending on the location and type of hazards.

Figure 2 (a) shows that the water supply installations are at high risk in the Coastal Belt, Low Water Table, Flood Plain and Haor zones. The handpump tubewells are at the highest risk in the Coastal Belt due to saline intrusion. This situation may deteriorate even further in the future due to the sea level rise and saline front moving more inland. Similarly, Figure 2 (b) shows that the sanitation installations are at “high” risk level in the Coastal Belt, Flood Plain and Haor Basin zones, the risk being highest in the Coastal Belt for tidal/storm surges.

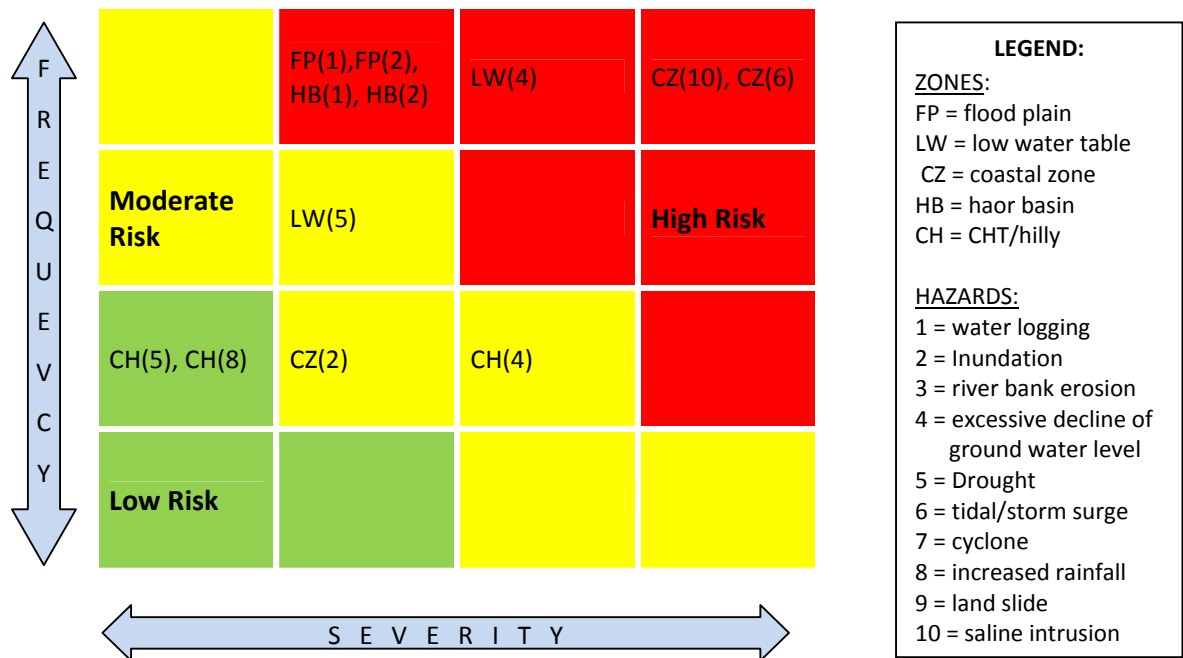


Figure 2 (a): Risk Rating Diagramme for Water Supply



	Moderate Risk		High Risk
CH(8)	FP(3), CZ(1), CZ(2)		
Low Risk	CH(5),CH(4), CH(9)		CZ(1)

Figure 2 (b): Risk Rating Diagramme for Sanitation

8 Identification of Adaptation Options

Three aspects of adaptation options are discussed here: i) adaptation measures already being taken up (by the projects), ii) options possible but not yet to be taken up, and iii) options available but need to be taken outside the scope of the present projects.

8.1 Water Supply Installations

The adaptation status of Water Supply installations are shown in Table 6. The adaptation options are not considered in most cases. Some measures, although taken on a limited scale, are very effective. For example the levels of tube well platforms are raised so that they are above the flood level. Another good example is fixing an extra pipe to raise the level of handpumps during floods. After flooding the extra pipe is removed. This practice has been adopted in many areas of the country for a long time and by doing so people are coping with frequent floods. There are also some adaptation options available within the scope of the present projects. To address the problem of excessive lowering of ground water levels new types of handpumps can be used to abstract ground water from greater depths. Raising the level of the banks of the ponds used for drinking water can be done to protect them from flood waters. R&D activities are also suggested within the scope of the present projects, emphasis is given to test desalinisation plants in the coastal saline zones.

Table 6 Adaptation Options for Water Supply

Present adaptation measures	Options available within the scope of the present project	Options available outside the scope of the present project
<p>Not considered or on a limited scale:</p> <ul style="list-style-type: none"> – Raising the level of tubewell platforms – Fixing extra pipe length to raise the level of hand pumps during floods 	<ul style="list-style-type: none"> – Using appropriate/new types of pumps – Protection of surface water sources (e.g. raising the banks of ponds) – R&D for appropriate technologies (e.g. desalination plants) 	<ul style="list-style-type: none"> – Establishment of Water Safety Plan (WSP) – Establishing disaster and post disaster management (with integration of water, sanitation and hygiene services) – Flood control measures – Integrated water resource management – Coastal zone protection and drainage improvement measures – Tree plantation, land erosion control

One option that is necessary and that needs to be taken outside the scope of the projects is the introduction of a Water Safety Plan (WSP). WSP is a routine inspection, maintenance and protection measure. Similarly to that of sanitation installations, cross-sectoral adaptation interventions such as flood control measures, integrated water resource management and establishing disaster management mechanisms are recommended for water supply.

8.2 Sanitation Installation

Table 7 summarizes the adaptation options. Virtually no adaptation measures are considered at present by the different projects. Only in limited scale, improved water supply is provided in low water table areas which help in better operations of the latrines. There are opportunities to take up some adaptation options within the present projects. These are building stronger latrine chambers (superstructure) to withstand cyclones especially in the coastal zone and raising the plinth of the latrines to keep them above the flood level in flood plain and Haor zones. Technical solutions and appropriate technologies for flood plains and for hilly areas are still not well known. Concerted research and development (R&D) activities aimed at developing appropriate technologies, which to some extent is possible with the scope of the present projects, could be suggested.

Table 7 Adaptation Options for Sanitation Installation - Hardware

Present adaptation measures	Options available within the scope of the present project	Options available outside the scope of the present project
<p>Not Considered or only in limited scale</p>	<ul style="list-style-type: none"> – Raising plinth of latrines – Stronger superstructure – R&D for appropriate technologies 	<ul style="list-style-type: none"> – Flood control measures – Integrated water resource management – Coastal zone protection measures – Establishing disaster and post disaster management (with integration of water, sanitation and hygiene services) – Tree plantation, land erosion control

However, in order to have a comprehensive solution for sustainable sanitation installations, some measures outside the scope of the present projects are necessary. Examples are flood control and

integrated water resources management. Coastal zone protection is strongly suggested. Similarly, land erosion control measures such as tree plantations for hilly areas are suggested. Furthermore, the establishment of disaster management systems and the integration of water, sanitation and hygiene services is suggested.

9 Next Steps

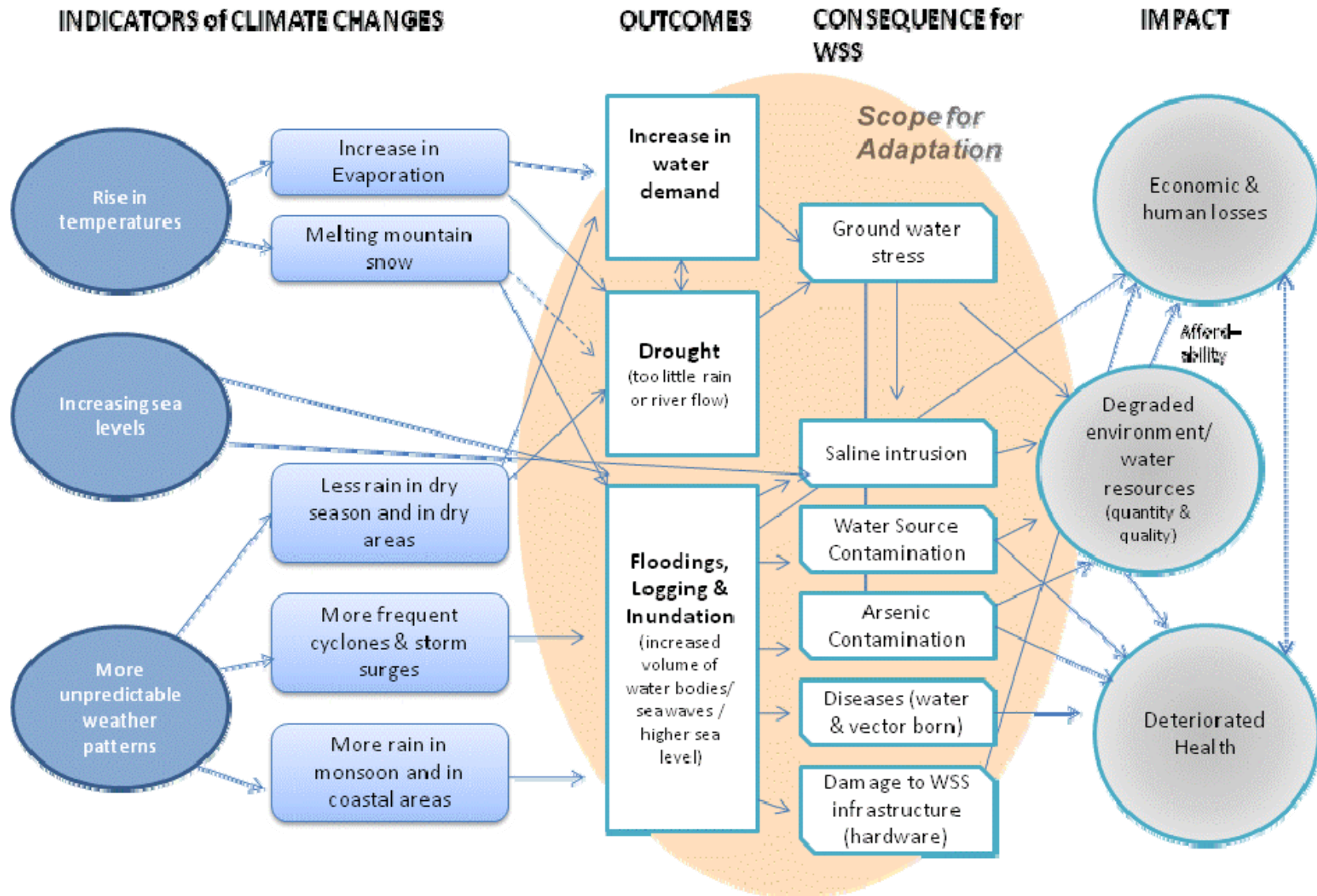
One issue that also came out clearly is that adaptation options for the water and sanitation sector is not only limited to that single sector. It would need linkages and actions with other sectors such as the water resource management sector, health sector and disaster management.

Therefore, future adaptation options need to be undertaken at three levels

- Within the scope of the communities (community level adaptation)
- Sector level adaptation
- Cross-sectoral adaptation

In addition to the more technical options for adaption (such as changes in technologies, design criteria or implementation/training manuals) there is a continued need to build awareness and capacity among the communities and sector professionals on the impact of climate change and what can be done about it.

Figure 1: Risk Identification Diagram - Water Supply and Sanitation Sector



Screening Matrix for development projects in Water Supply and Sanitation Sector

Activity/ Output	Ecological/ Hydro - geological	Contexts of Climate Change Risks (List each climate change risk applicable to current activity - insert a new row for each risk – refer to list of risks)	Types of impact on WSS service delivery by climate change risks identified in column 3	PRESENT			FUTURE (year 2030)	ADAPTATION CONSIDERATIONS (ongoing and future)			COMMENTS
				Severity (Impact on WSS services) (Very Severe=4, Severe=3, Moderate =2, Low to None =1)	Frequency of climate change risk parameter (Less Frequent =1 Moderately frequent = 2,Frequent = 3, More Frequent = 4)	Level of Climate Change “Risk” related to the activities (Multiplic ation of column 5 an 6)	Level of Risk (Comp ared to present) (Less =1 Same = 2 More = 3)	Is the identified Climate Change “Risk” being dealt with in present project (1 = not consid ered; 2= limited scale; 3= mode rately; and 4 = fully considered) (prepare description if 3 or 4)	Are there immediate further adaptation options available for addressing risk <u>within</u> the present project (Yes/No), if yes prepare a list with priority)	Are there additional adaptation options available <u>outside</u> the scope of the present project (Yes/No), if yes prepare a list with priority)	
1	2	3	4	5	6	7	8	9	10	11	12
Output 1:											
Output 2:											
Output 3:											

Guiding Notes and Definitions

1. **Output/Activity**
2. **Agro-ecological Zone:**
 - a. Floodplain
 - b. Low Water Table Area (similar to Drought Prone)
 - c. Coastal Zone
 - d. Haor Basin (tectonically depressed area)
 - e. Chittagong Hill Tracts/Hilly
3. **Contexts of Climate Change Risks include:**
 - a. Drought
 - b. Cyclone
 - c. Tidal/Storm Surge
 - d. Saline Intrusion
 - e. Contamination of water sources
 - f. Increased Rainfall
 - g. Decreased Rainfall
 - h. Water Logging/Inundation
 - i. Increased General/Severe Flooding
 - j. Increased Riverbank Erosion
 - k. Increased Sedimentation
 - l. Increased Average Temperature
 - m. Others
4. **Types of Impacts of WSS service delivery:**
 - a. Degraded/depleted water resources – quantity
 - b. Degraded water resources – quality
 - c. Damaged physical infrastructure
 - d. Deteriorated health
 - e. Others
5. **Severity:** Refers to the degree of current/future potential impact on the delivery of WSS services of the climate change risk event once it occurs. Severity is a function of how climate risk parameters influence on service delivery and how this is impacting/will impact on target area or group (i.e. size and severity of area affected; number and severity of beneficiaries affected, etc.). Types of impact factors to be considered will include: economic and human losses, degraded/depleted water resources, and health.
Severity will be divided into 4 levels as follows: High = 4, Moderately High = 3, Moderately Low = 2, Low to None = 1
6. **Frequency:** Frequency has also been categorised under 4 categories depending on occurrence of the event. 1=Less Frequent, means possibility of occurrence once in every 10 to 20 years; 2=Moderate Frequent, means possibility of occurrence once in every 5-10 year; 3=Frequent, means possibility of occurrence once in every 2-5 years; 4=More Frequent, means possibility of occurrence in once or more in every year
7. **Level of Climate Change “Risk” related to the activities** = Severity (5) x Frequency (6)
8. **Expected Future Level of Climate Change “Risk” related to the activities** = (Less =1 Same = 2 More = 3)
9. **Climate Change “Risk” being dealt with in present activities (ongoing adaptation).**
10. **Immediate further adaptation options available for addressing risk within the framework of present activities.**
11. **Immediate options for new/additional adaptation activities outside present activities.**
12. **Comments**