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Support for a Disaster Management Information Network (DMIN)

Disaster Management Information Link Report

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Acronyms

ADPC	Asian Disaster Preparedness Center
AFD	Armed Forces Division
ASC	Academy for Sustainable Communities
AVD	Ansar and Village Defense
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BB	Bangladesh Betar
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BIWTA	Bangladesh Inland Water Transport Authority
BMARL	Bangladesh Amateur Radio league
BMD	Bangladesh Meteorological Department
BP	Bangladesh Police
BRRI	Bangladesh Rice Research Institute
BTTB	Bangladesh Telegraph and Telephone Board
BTV	Bangladesh Television
BWDB	Bangladesh Water Development Board
CCC	Chittagong City Corporation
CDMP	Comprehensive Disaster Management Programme
CEGIS	Center for Environmental and Geographic Information Services
CFAB	Climate Forecast Applications in Bangladesh
CFIS	Community Flood Information Systems
CPCS	Contract for Professional Consulting Services
CPP	Cyclone Preparedness Programme
CRA	Community Risk Assessment
CRIMS	Central Relief Management Information System
CSFFWS	Consolidation and Strengthening of Flood Forecasting and Warning
DAE	Department of Agriculture Extension
DC	Deputy Commissioners
DCC	Dhaka City Corporation
DEMRS	Disaster and Emergency Response Sub Group
DER	Disaster Emergency Response (Group)
DFID	Department of International Development
DGF	Directorate General of Food
DMB	Disaster Management Bureau
DMC	Disaster Management Committees
DMIC	Disaster Management Information Centre
DMIN	Disaster Management Information Network
DoMC	Department of Mass Communication, Mol
DoS	Department of shipping
DRAS	Drought Assessment (a model)
DRM	Disaster Risk Management
DRR	Directorate of Relief and Rehabilitation (internationally used)
DRR	Directorate of Relief and Rehabilitation
EC	European Commission
EU	European Union
ECMWF	European Center for Medium range Weather Forecasting
EMIN	Environmental Monitoring and Information Network

EOC	Emergency Operation Centre
EOP	Emergency Operations Centre
ERA	Emergency Response Agencies
ERD	Economic Relation Division
EWS	Early Warning System
FFWC	Flood Forecasting and Warning Centre
FSCD	Fire Service and Civil Defense
GoB	Government of Bangladesh
GSB	Geological Survey of Bangladesh
GSHAP	Global Seismic Hazard Assessment Program
GTS	Global Telecommunication System
HF	High Frequency
ICDDRB	International Centre for Diarrhoeal Disease Research, Bangladesh
ICT	Information and Communication Technology
IGA	Information Generation Agencies
IMDMCC	Inter Ministerial Disaster Management Coordination Committee
IRA	Information Generation Agencies
IVR	Institute for Volunteering Research
IWM	Institute of Water Modeling
JMA	Japan Meteorological Agency
JMREMP	Jamuna-Meghna River Erosion Mitigation Project
LDRRF	Local Disaster Risk Reduction Fund
LGRD	Local Government and Rural Development
MoA	Ministry of Agriculture
MoFDM	Ministry of Food and Disaster Management
Mol	Ministry of Information
MoU	Memorandum of Understanding
NGO	Non Government Organization
PIRDP	Pabna Irrigation and Rural Development Project
PM	Project Manager
PPPDU	Policy Programme and Partnership Development Unit
PTWC	Pacific Tsunami Warning Center
SCC	Sylhet City Corporation
SMS	Short Messaging Service
SOD	Standing Orders on Disaster
SODM	Standing Order on Disaster Management
SPARRSO	Space Research and Remote Sensing Organization
SWC	Storm Warning Center
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNO	Upazila Nirbahi Officer
UNOPS	United Nations Office for Project Services
UP	Union Parishad
VHF	Very High Frequency
WARPO	Water Resource Planning Organization

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Executive Summary

The Comprehensive Disaster Management Programme (CDMP) through its Component 5b: Support for a Disaster Management Information Network (DMIN) has committed to establish an effective disaster risk management mechanism in the country. ADPC under this EC supported component is providing technical support to design, test and demonstrate a DMIN down to household level. The present document: "Disaster Management Information Link Report" is a key milestone to this endeavor and documents to date developments on disaster management information sharing network and its existing links and gaps. From a systematic understanding of the links and gaps of the existing disaster management information network it also compiles recommendations for further improvements. The recommendations for further improvements will also be validated further quantitatively through an extensive empirical assessment in the next step of the ongoing project and a design will be developed for pilot testing at ground level.

Scope and objectives of the report

The scope of this report is to review and analyze existing links, status of different initiatives, gaps and identify the needs and recommendations for strengthening for establishing an effective disaster management information network and early warning information systems in the country. With this scope the key objectives of the present report are to: a) identify the existing links and gaps of the disaster management information network through a secondary review of the "DMIC Need Assessment Report" (earlier developed in the project); b) identify further the existing links and gaps of information network at various levels by an analytical presentation of the existing status of links from source to destination; c) critically analyze the suggested improvements for strengthening the information network at various levels in future; and d) outline the recommendations for strengthening links and filling gaps in the operationalization process of the DMIN network down to household level.

Methodology

The report on "Disaster Management Information Links" is developed using an adaptive methodological framework and developed through a number of activities. Useful existing secondary information were tapped to understand the status of the various levels of information links, gaps and recommendations. The methodological measures undertaken to come up with this document are as follows: a) review of DMIC Needs Assessment Report; b) review of existing early warning initiatives for major hazards; c) meeting/discussions with the early warning source agency representatives; d) discussion with district, upazila and union level institutional representatives for recommendations for improvement; e) community level interviews with local knowledgeable people to reflect on local issues of concern; f) internal brainstorming sessions within ADPC-BCAS expert team to identify the technical recommendations, and g) drafting, revision and finalization of the document to take stock of the comments received from CDMP.

Organization of the report

The report is organized in five sequential chapters. In the first Chapter, the project background and scope of the report were pre-outlined to situate the nature and context of the report. The review activities started from the second Chapter where the review of "DMIC Needs Assessment Report" (earlier prepared under CDMP with consultant support) was outlined. The following Chapter (three) puts forward an analytical account and review of the hazard specific existing Early Warning Systems (EWS) and preparedness initiatives undertaken by different agencies in the past years. The review work was carried out by the major prevailing hazards in the country. Existing EWS and preparedness initiatives for flood, cyclone,

river bank erosion, tsunami, flash flood and drought are outlined in this Chapter. The issue of climate change trend is also talked about briefly as in Bangladesh the climate change is anticipated to bring changes in both frequency and intensity of the hazards in coming years. In Chapter four, an elaborated analysis of institutional links and gaps in the existing early warning and disaster management information systems were looked at and discussed systematically. This chapter includes discussion from the source to destination of information sharing systems. Focus was given to national news, media and popular sources and global popular sources. The final chapter of the document comes up with the synergic conclusions, needs and recommendations for strengthening the disaster management information network in the country. Banking on earlier analyses of the report, the concluding chapter outlines the recommendations for future development of disaster management information network in the country.

Findings of the “DMIC Needs Assessment Report” Review

The DMIC Needs Assessment Report was reviewed for: a) identifying gaps and further needs to enhance effectiveness of early warning system from sources to communities; b) identifying areas where further thrust would be required to meet the demands raised by local level disaster affected communities; and c) providing inputs in designing activities for strengthening existing links and filling gaps where appropriate. Some of the following important issues are outlined in the report:

- The DMIC Need Assessment Report discussed about the possible roles, and complied expectations of different institutions including national, local and community level.
- It calls for an institutional mechanism and additional mandates to deliver expected needs of DMIC and DMIN in the country. It was suggested that the mechanism needs to be developed between information providers, disseminators, local and community users.
- The local government agencies and NGOs require hazard information to take effective risk reduction, emergency response and rehabilitation measures. They can play an important role in informing community members to sensitize them to the issues and solutions that they may adopt.
- It was identified that the vulnerable communities and local level institutions do not receive sufficient hazard information.
- It was identified that the information base are not provided with gender delineated manner but the need for male and female varies by disasters for effective risk reduction, emergency response and longer-term rehabilitation.
- The document mentioned that communities need new and additional information which are not available and even if available are not available at community and local levels.
- It was identified that some of the hazard information requested by the community and local level organizations is not available in easy understandable format.

However, from the review it emerged that there is a significant scope of identification of links and gaps specific to hazard information base and as a mechanism for improving these situation DMIC and DMIN can play a major role in near future. It identified that more detailed analysis of utility, appropriateness, cost-effectiveness, sustainability, production and dissemination issues, and feedback from field testing is required to confirm the viability.

Existing Early Warning Systems

The report looks carefully into the existing early warning systems developed for various hazards in the country. Through a reviews of primarily and secondary sources of the respective institutional documentations, project documents and or research outputs and consultation with the source agencies a clear state of the hazard specific EWS was outlined in the document. A brief account of these existing systems is shown by hazard below:

Flood: For flood it was found that a well developed flood early warning system is existing in the country and has evolved historically through the various flood forecasting initiative under the Bangladesh Water Development Board (BWDB). The Flood Forecasting and Warning Centre (FFWC) was established in 1972 and since then, the FFWC has developed as a formidable center under the BWDB to provide flood forecasting in the country. FFWC has an operational system of collecting and processing hydrologic and related data as input to forecasting models; preparing flood forecasts and warnings on a daily basis and disseminating the forecasts and warnings to a range of government and non-government organizations, media groups and other interested parties on a daily basis. In recent times FFWC was also strengthened through multiple projects and now gradually leading towards a flood forecasting on 10 days lead time but with an operational 72 hours lead time.

Cyclone: The cyclone warning and preparedness model in Bangladesh is regarded in recent time as one of more successful one. The Bangladesh Meteorological Department (BMD) is the responsible agency for cyclone hazard warning. The Storm Warning Center (SWC) under the BMD predicts the cyclone storm and issue the warning. Cyclone warning information includes information regarding the position of the storm, direction and rate of movement and area likely to be affected with some specific geographical locations, approximate time of commencement of gale winds (speed more than 32 km/h or 52 km/h), maximum wind speed expected and approximate height of storm surge/tide and areas likely to be affected. In the coastal areas the Cyclone Preparedness Programme has been already proved to be one of the most effective programs in the region. However, there are scopes of further development of the cyclone warnings and messaging systems as well as more location specific hazard modeling with a greater lead time.

River Bank Erosion: For river bank erosion prediction, Bangladesh Water Development Board (BWDB) with support from CEGIS has developed a morphological and riverbank erosion prediction method. This was primarily based on satellite image processing and morphological predictions. Since 2002, this type of prediction has started through predicting morphological developments in the Jamuna River at the Pabna Irrigation and Rural Development Project (PIRDP), and FAP 21. In 2004 onward, BWDB is providing predictions for selected areas and rivers including the Jamuna and the Padma. At this point, the riverbank erosion predictions are primarily in a developmental state and river specific.

Tsunami: At present, Bangladesh do not have any facilities or modeling capacity for tsunami hazard detection. Primarily, tsunami advisory or warning information is available through Pacific Tsunami Warning Center (PTWC) and Japan Meteorological Agency (JMA). Both Japanese and US system have their own models for Tsunami detection and forecasting. BMD is the responsible agency for the tsunami receiving the warning systems from JMA and PTWC and generate warning at national level. BMD disseminates the information through Cyclone Preparedness Program (CPP) and other important government agencies in the coastal areas. At this point, dissemination channel for cyclone and tsunami are quite homogenous for the coastal areas of Bangladesh.

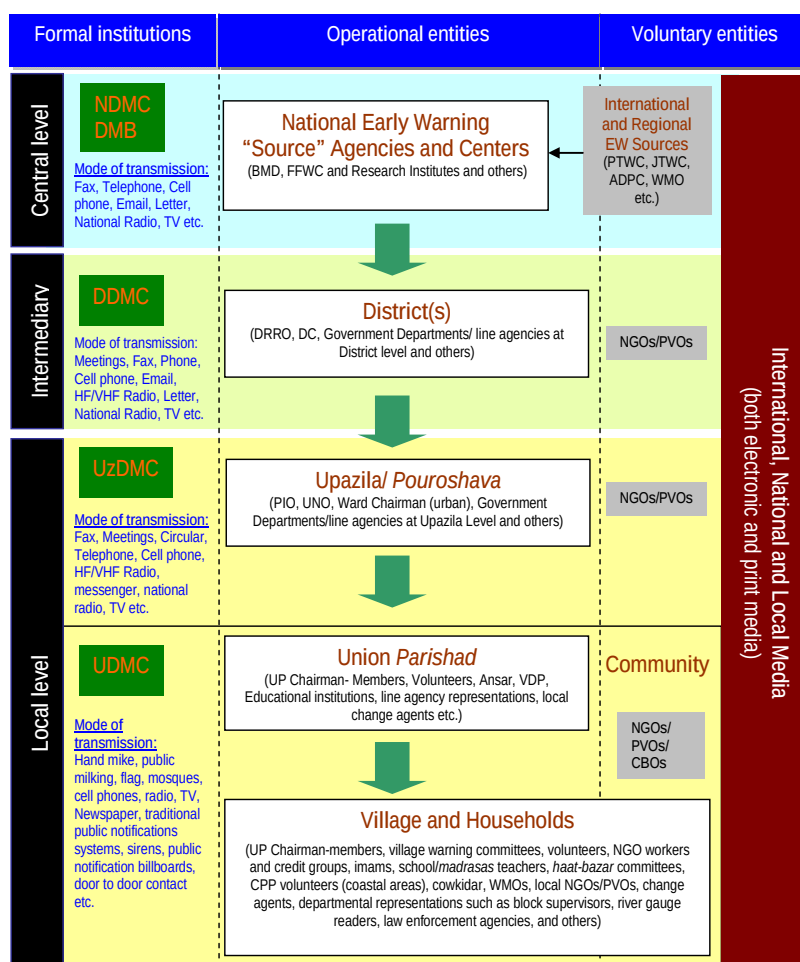
Flash flood: At present, the flash flood situation for the northeastern districts is predicted using the river water level and rainfall estimation. FFWC takes a lead on this and the lead time is quite limited. However, there is an experimental flash flood forecasting now underway by the ADPC Regional Multi-hazard Early Warning Center in Thailand where the latest ECMWF derived climatological data are used to provide prediction on the flash flood situation for the northern Bangladesh. Extensive high computational methods are applied for this experimental flash flood forecasting system. The method has a good potential for future institutionalization and proactive incorporation into the national and regional system.

Drought: Drought and its intensity in the country are characterized primarily based on moisture retention capacity of the soil and infiltration. No major numerical prediction of drought is present in the country at the moment. BMD provides some forecasting information and based on available climatological information to the Ministry of Agriculture and Department of Agricultural Extension (DAE). It gives indication of rainfall predication and possibility of continued low/insignificant rainfall. Beside these limited forecasting, Bangladesh Agricultural Research Council (BARC) along with CEGIS in past few years, have developed a drought assessment model called “DRAS”. The DRAS model was piloted in various selected sites with BARC and DAE in various agro ecological zones and holds a good potential to develop on a national scale. The FFWC has also some plans for developing forecasting information on drought in future.

Linkages from Source to Destination

From the analysis of the early warning institutional setup in the Chapter four, it was found that there are primarily vertical and horizontal both types of agencies involved in the early warning system in Bangladesh with varied efficacy.

It was found that in the vertical formation there are various layers of agencies are involved with the early warning system. At the top, the major early warning source agencies are functional. Two major ones are: BMD and FFWC. National research institutes are also helping government such as IWM, BARC, CEGIS, SPARRSO and others. These set of agencies can be identified as **“central level agencies”**. Some **“International and regional sources”** are also contributing to the national agencies in various initiatives of early warning systems. Agencies like ADPC, JMA, SMRC, IMD, PTWC, JTWC, TSR, ECMWF are among others. This layer of risk information providers are usually the source agencies or support to the national source agencies in a technical manner.



It was found that the **“intermediary level”** comprised of primarily the district level stakeholders and line agencies play a significant role in relaying the information down to a local level. In between source and community, there are many organizations both governments and non-governments use the information in playing roles for disaster management based on their mandates or voluntary basis. The district level can entities is observed that is the major decision making unit and major issuer of the administrative order to initiate the disaster information related machinery. The overall national level early warning system information

seemingly flow through the district administration and respective attached offices in each district.

It was found that the early warning information goes from the intermediary level to the "**local level**" which is comprised of the upazila, union and the voluntary sectors. The community level stakeholders including the village and households combinedly are also part of the locale levels and are the prime user of the information for action at ground level. The households suppose to receive information from this layer of local level mediators.

The inter-linkages of the agencies and the three layers of central to local level and the linkages of community level are shown in the above diagram. The diagram also shows that the three different cross sections: **formal institutions**, **operational entities** and **voluntary entities** are also present in the horizontal domain of the disaster information network in the country.

Gaps in the existing linkage

Particularly during the field interactions it was found that although the overall links are there for dissemination of early warning information up to ground level but there **are several layers of gaps existing** in the practical setting. These gaps are creating information communication delay, lack of action; ambiguity of the prioritization of action, confusions and isolation of the households in some cases.

At household level various culturally **suitable and effective modalities** of risk communication and information dissemination is missing. In some cases, the technological lags are there, but in many cases although there are some modalities and communication technologies such as cell phone, loud speakers are there, but these are never involved systematically or endowed for risk communication prior the event.

It was found, however, where ever some projects or initiatives were undertaken some sort of mobilization and awareness towards risk communication is there. Particularly, in the coastal areas a good example of cyclone early warning system is evident through the CPP and BDRC volunteers at ground level. A conscious attempt should be taken centrally to identify the better practices and innovative identification of hazard specific community early warning systems in a gradual manner. Under the present project some of these improved practices can be further acknowledged and piloted for further efficacy.

At local and community level, although there are some good examples existing but the sustainability of these methods for local disaster information sharing modalities are under stark challenge both on financial and technical ground. Some of the recommendations that emerged from the field discussions are reported in the recommendation section of the report. **Sustainability** of the disaster management information networks and technologies below the upazila level is a major challenge and in this challenge a well concerted action and planning is needed combining the efforts of government agencies, NGOs in the ground, civil society entities, local government and the community level change agents. Setting up an adequate institutional framework for such initiative is also an essential step to consider.

Auditing of the Hazard specific Early Warning Systems

In the Chapter four, an analysis of the status and gaps in the disaster management information link was outlined. The performance on source-destination connectivity, information content type, dissemination mode, information/material quality, lead-time, disaster management /response setup etc. are also looked at in this analysis. A comparative account of this auditing is outlined in the following table by hazard and issues.

	EWS source agencies	EWS availability stage	Source to destination connectivity	Information content type	Community Dissemination mode	Information/material quality	Timing/lead-time of the early warning	Disaster management/response setup
Riverine Flood	FFWC (BWDB), CFAB, BMD, SPARRSO, ADPC-GTech, ECMWF	Existing stage	Good	Bulletin, SMS, Fax, Call	Flag, agency instruction, local government notification, news media	Good	2-7 days with improved accuracy	Moderate
Flash Flood	FFWC, IWM, BMD, SPARRSO, ADPC (ECMWF)	Developmental stage	Poor	Bulletin, SMS, Fax, Call	Flag, agency instruction, local government notification, news media	Medium (experimental)	24 hours (Experimental)	Moderate
Cyclone	BMD, SPARRSO, IMD, TSR, ADPC	Long standing, Redundant systems available	Very good	Bulletin, SMS, Fax, Call, Megaphone, Door to Door through volunteers	Flag, agency instruction, local government notification, news media	Very good	Very good. 72 hours	Good
Tsunami	BMD, PTWC, JMA, IOTWS	<u>Regional:</u> existing, <u>National:</u> Developmental	Medium	Bulletin, SMS, Fax, Call, Megaphone, Door to Door through volunteers	Flag, agency instruction, local government notification, news media	Good	Depending on the epicenter. But in general threat of long distant tsunami	Moderate
Drought	SRDI, SMRC, DAE, CEGIS (DRAS model)	Experimental stage	Poor	Agricultural departmental notification (DAE, Irrigation etc.)	Official notification	Poor	Not available	Poor
Earthquake	BUET, SoB, ADPC (ongoing micro-zoning study), USGS	Micro-zonation underway	Poor	Micro-zonation mapping, land use planning	Not developed	Not developed	None	Very poor
Riverbank erosion	BWDB-CEGIS, JMR EMP	Developmental stage	Poor	Maps, Satellite imagery, BWDB notification	Land zoning and are planning	Good	Seasonal	Moderate (structural measures are taken)

Recommendations for strengthening DMIN

The report has taken into account of various layers of recommendations some of the key points are as below:

Recommendations from last mile and community level interactions

A large number of recommendations came from the field and community interaction. Most of these recommendations are related to last mile communication, mass notification of

warnings, essence of local level institutional entities, public participation/engagement, capacity enhancement and so forth.

- People talked about the updating of **existing danger levels for flood, signal systems for cyclone and tsunami**, Establishment of **siren system and flags systems for mass community notification**, and innovation of including billboard/website/internet based public notification at local level, were also recommended heavily. Use of traditional systems and facilities such as mosques for warning dissemination and so forth. It was also pointed out that government should provide **early warning information directly to the upazila level** through innovative ways without making any administrative lag from the district levels.
- It was recommended that **technical and human capacity development** including access to modern communication hardware equipments for warning dissemination and regular training for stakeholders at union and community level are essential.
- Establishment of **adequate institutional setup for early warning systems at local level** was also pointed out prominently. It was recommended that “Early warning information centers” can be established for timely warning dissemination at each union level.
- Increased public **participation, education and awareness** programmes are recommended as a key to strengthen disaster information systems at local level and recommended for building capacity of the UDMCs, volunteers and community based systems in general. It was recommended further that inclusion of media in a proactive way is essential to this process.
- It was also recommended that **coverage of warning and forecasts** should be increased as per local needs and geographical distribution and at the same time Warning coverage should be more precise to location and communities.

Technical recommendations for national level interactions

There are several key recommendations came from technical arrangement of national level setups and improvement of effectiveness of the DMIN system in the country. Some of the key ones are outlined below:

- It was recommended that **DMIN should get connected as an “end-to-end” system with the local, national, and regional systems of hazard information**. It should be connected with source providers (i.e. BMD and FFWC), regional watch providers (i.e. ADPC, PTWC) and warning centers (e.g. JTWC, TSR) and essentially with the downstream part of the operationalization up to union level (i.e. UDMC). A design is essentially needed for such an end-to-end link.
- **Innovative ways to keep DMIC functional in non-emergency situation** was recommended. For instance, DMIC can provide agricultural risk information or livelihoods improvement related educational information during the non-emergency mode and become engaged with the stakeholders.
- Key organizations involved in the EWSs (from source to destination) should be strengthened to **increase their coordination**, and the utilization and effectiveness of hazard forecast and warning services. Beyond the Standing Order for Disaster Management, the **Standing Operating Procedures (SOPs)** should be developed and reviewed for early warning and for sector based early warning and preparedness

considering the focus of strengthening the DMIN process. SOPs can facilitate towards a better coordination among agencies.

- From technical perspective it was recommended that capacities of local level institutions and local community level representatives should be build more on the end-to-end risk information sharing. The local level institutions should be capable of receiving the early warning information from the source or upper levels, should have capabilities of interpreting the early warning information and make an impact outlook (either analogically to the existing experiences of their hazards such as last flood or damage) and capable of taking actions by themselves for response options. In this line **comprehensive capacity building of the local level stakeholders** on right kind of risk communication and dissemination is essential.
- Some positive realization came when the team has made reconnaissance field visits to some of the project areas where some early warning system initiatives were undertaken. Particularly, from the project areas of CFAB and FFWC covered flood prone pilot areas, CPP covered coastal areas and CEGIS covered pilot erosion prone areas it was found that through these early warning system projects there are some good tools for local level communication under development and testing in a proactive way. Some **good tools of local level hazard information dissemination are emerging and have started to get popular at community level in respective pilot project areas**. These are promising example and technically quite sound. These can be replicated in the other areas after successful testing under the DMIN project. However, the big question in this line is the institutional sustainability for these tools as well as the suitable replication attempts into other areas. This is a question to be answered in future course of time.

The recommendations outlined above and in the disaster management information link report are working recommendations and these will be made more comprehensive in future through extensive consultations and field assessment with various stakeholders in selected pilot areas. Next round of activities of the on-going project will look into these recommendations further and plans to come up with a quantitative validation from ground level.

1. Introduction

1.1 Background

Bangladesh as a deltaic country is largely prone to devastating natural calamities on a regular basis. The geographical location and geopolitical conditions of Bangladesh often create these prime penetrations towards multiple vulnerabilities. Bangladesh annually and inter-annually experiences cyclones, tornadoes, river erosion, floods, drought and other extreme natural events. These adverse phenomena greatly hinder the development of the country in lost lives, assets and infrastructure. The magnitude of poverty, increasing due to rural-to-urban migration and high population density, exacerbates vulnerability to catastrophic episodes that affect lives and livelihoods.

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. CDMP is a strategic institutional and programming approach that is designed to optimize the reduction of long-term risk and to strengthen the operational capacities for responding to emergencies and disaster situations including actions to improve recovery from these events.

Through the initiatives taken in the past, the Government of Bangladesh, the Ministry of Food and Disaster Management (MoFDM), Disaster Management Bureau (DMB) and other relevant stakeholders have demonstrated significant commitment towards implementing a comprehensive disaster management strategy.

In July 2005, the European Commission Delegation to Bangladesh, concerned about the capacity of vulnerable communities to withstand earthquake, tsunami and other hazards, assessed national disaster management programmes and proposed some specific project designs to address some of the gaps in the system. In August 2006, the EC approved a contribution agreement to complement the UNDP/DFID components with three new components. The overall CDMP components are structured in the following manner shown in the table below:

Table 1-1. CDMP component structure

Strategic Focus	Corresponding Components
1. Professionalising the disaster management system	1a Policy, Program and Partnership Development Unit (PPPDU) 1b Professional Development
2. Mainstreaming of risk management programming (partnership development)	2a Advocacy and Awareness 2b Capacity Building
3. Strengthening of community institutional mechanisms (community empowerment)	3a Program Gap Analysis 3b Risk Reduction Planning 3c Local Disaster Risk Reduction Fund 3d Support for Livelihood Security – Hazard Awareness
4. Expanding risk reduction programming across a broader range of hazards	4a Earthquake and Tsunami Preparedness 4b Climate Change and Research
5. Strengthening emergency response systems (operationalising response)	5a Disaster Management Information Centre 5b Support for a Disaster Management Information Network
6. Food security	

Source: CDMP

Under the Component 5b of the CDMP, CDMP is expected to develop and establish an appropriate disaster risk management mechanism in the country through appropriate

institutional arrangements. Establishment of Disaster Management Information Network (DMIN), which is the main purpose of the present project, is one of the major components of the overall disaster management strategy. The EC component is providing a major support towards this development of the DMIN for CDMP and MoFDM.

In this line, Asian Disaster Preparedness Center (ADPC) Thailand has signed a Memorandum of Understanding (MoU) with CDMP and other Bangladeshi Disaster Management related agencies to provide technical assistance to establish and enhance a technical support towards this comprehensive strategy-program development for Bangladesh. In December, 2007, ADPC has entered into a new contract agreement with CDMP for professional consulting services.

The present document is the "Disaster Management Information Link Report" of this ongoing project titled "Design, Test and Demonstrate a DMIN Down to Household Level" contract agreement number BGD/01/004-CDMP/EC/5b/PC-1 under the CDMP Component 5b. Support for a Disaster Management Information Network (DMIN). The overall consultancy agreement will be implemented in 1 year and 8 months (i.e. 20 months) time starting December, 2007 and ending in 31 August, 2009. ADPC implementing the project in a partnership with Bangladesh Center for Advanced Studies (BCAS) and in consultation with the CDMP and MoFDM.

1.2 Project Goal and Objectives

The Comprehensive Disaster Management Program (CDMP) under the Ministry of Food and Disaster Management (MoFDM) sets the overall **goal** of Disaster Management Information Center (including this ADPC assisted current support project) as below:

"...to implement an effective information sharing system to be operational among the disaster management agencies and communities for all hazards and in all sectors in all normal and emergencies times throughout the nation and regionally to support sustainable risk reduction and emergency response capacity".

Under the Component 5b: Support for a Disaster Management Information Network (DMIN) the following objectives and scope of work tasks will be carried out.

The following key **objectives** will be derived for the Technical Assistance under the proposed Consultancy Services as provided in the logical framework is to see:

- a) a disaster management Network is operational and demonstrated down to the household level;
- b) hazard messages "links" are effective (both ways- from data sources to household) to occur through an integrated information dissemination, coordination system;
- c) disaster preparedness messages are successfully transmitted through one fully integrated hazard risk communication network.

1.3 Scope of the ADPC support project

To achieve these goal and objectives of this support initiative to DMIN, the following **Scope of Work** (as per ToR and technical proposal) are also outlined by the project document. These are also the major activities vis-à-vis tasks that are to be carried out under the ADPC support project. These six tasks outlined are:

- a) **Activity 1.1** Establish status of existing links for information dissemination between source and community level
- b) **Activity 1.2** Review options for strengthening existing links and filling gaps where appropriate
- c) **Activity 1.3** Based on a participatory approach, agree upon appropriate target communities for one or more hazard types in both urban and rural settings:
 - ◇ Seasonal & slow onset e.g. climate change and annual flood
 - ◇ Seasonal & Rapid onset e.g. river erosion, flash flood, tornado and cyclone
 - ◇ Non-seasonal & rapid Onset e.g. tsunami, and anthropogenic factors
- d) **Activity 1.4** Carry out mock "Drills" for rapid onset "emergency" hazards
- e) **Activity 1.5** Undertake post-event audits to assess information flow between warning source, through intermediate levels to *upazila* and then onward transmission to union, community and household
- f) **Activity 2.1** Design and test, where appropriate, information network(s) to cover hazard types related to priority as defined in terms of risk exposure by component 1.

The overall inter-relationship of the above activities will eventually lead towards development of a community hazard warning system and provide support to the establishment of the Disaster Management Information Network. This inter-relationship of the activities is outlined diagrammatically in the figure 1-1.

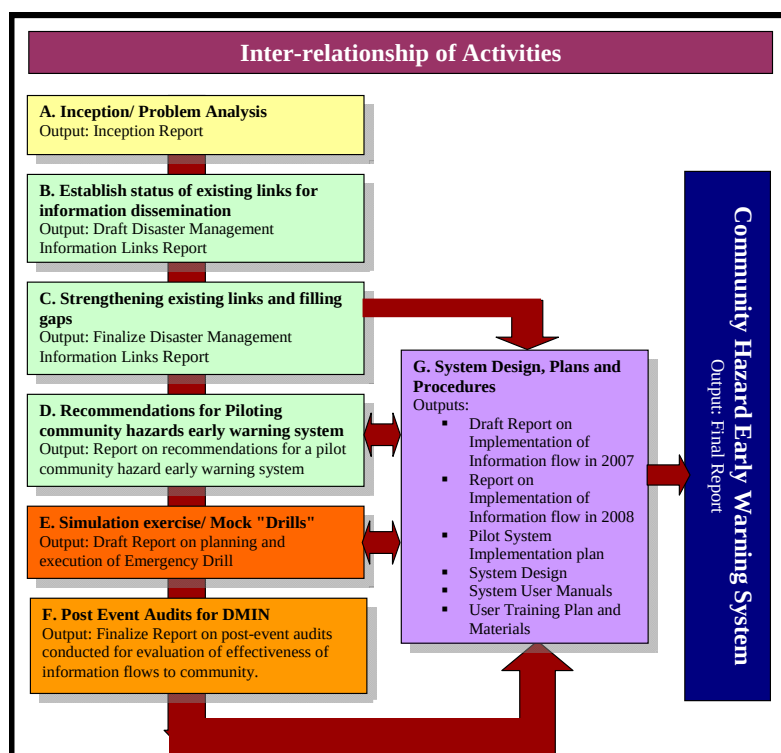


Figure 1-1. Figure Inter-relationships of the activities of the ADPC support project.

1.4 Scope and objectives of the present report

1.4.1 Scope

The primary scope of this report is to review and analyze existing link status of different institutes and information needs for effective disaster management and early warning information system in the country. The report summaries various levels of needs of national level Institutions, local agencies and of the community.

It looks critically into the gaps and status of the institutional linkages of disaster management information exchange including early warning sources to destinations. Existing early warning system and institutional links including flood forecasting system, cyclone early warning information systems, drought forecasting situation, tsunami warning issues and so forth.

This report builds on the secondary reviews, review of existing initiatives (projects, programs, application and research) of early warning for major hazards, initial outreach meetings with selected agencies at national level and reconnaissance field visit to local level and communities to situate a clear picture of the existing situation of disaster management information system.

As it is shown in the figure 1-1, the present document is part of a series of documents that this support project is planned to come up with. The scope of this report is to establish the existing status of the disaster management information links and gaps and find recommendations for improvement. The follow up activities and reports such as recommendations for piloting, simulation exercise at ground level, post event auditing along with this report will contribute towards "System Design" of an operational disaster management information network that would be effective from source to household level.

1.4.2 Objectives

The prime objectives of the report can be outlined as below:

- a) Identify the existing links and gaps of the disaster management information network through a secondary review of the "DMIC Need Assessment Report" (earlier developed in the project). This would lead toward mapping of the disaster management information needs to existing and missing information links;
- b) Identify further the existing links and gaps of information network at various levels by an analytical presentation of the existing status of links from source to destination, document the information content descriptions by hazards, analyze quality of these information contents, timing and frequency of these information dissemination and evaluate the overall disaster management significance;
- c) Critically analyze the suggested improvements for strengthening the information network at various levels in future; and
- d) Identify the recommendations for strengthening links and filling gaps in the operationalization process of the DMIN network down to household level

1.5 Overall methodological framework of the report

The “Disaster Management Information Link” report is developed taking an adaptive methodological framework and through a host of activities. The activities gradually developed and useful information tapped to understand the status of the various levels of information links, gaps and recommendations. Some of the activities undertook to develop the report can be outlined as below:

- Review of DMIC Needs Assessment Report
- Review of existing EW initiatives for major hazards
- Meeting/discussion with representatives of the EW source agencies
- Agency outreach to the national level agencies
- Discussion with district, upazila and union level institutional representatives
- Community level interviews with local knowledgeable people
- Internal brainstorming sessions within ADPC-BCAS expert team, and
- Drafting, Revision and Finalization Process with CDMP-ADPC

The following figure gives a conceptual methodological framework in a diagrammatic manner to show how various activities mentioned above have contribute cumulatively towards this present document.

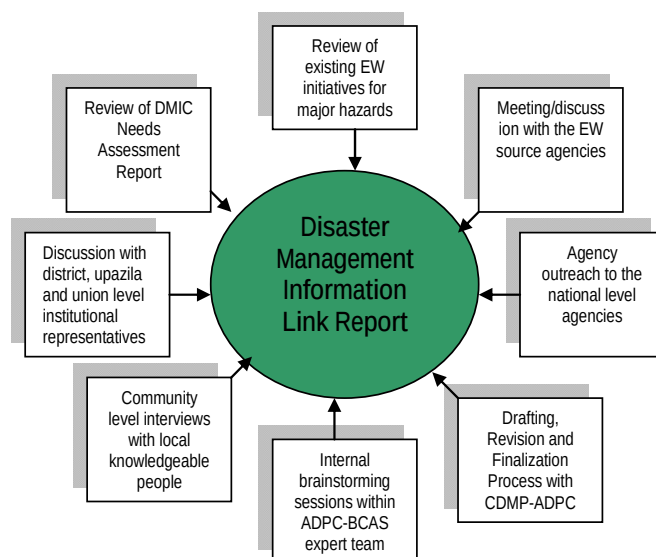


Figure 1-2. Methodological framework of the DM Link Report compilation and finalization.

1.6 Structure of the report

Disaster Management Information Links report contains five chapters. In Chapter **one** which is the introductory chapter includes backgrounds, project goals and objectives, scope of the ADPC support project, scope of the report and brief information on the structure of the report.

The chapter **two** is on the “Review of DMIC Needs Assessment Report”. This chapter has focused on purpose and methodology of the review, contents and coverage of the report. Needs of different types of information for institutions and communities at different levels, and information product have been reviewed in this section. This chapter has also summarizes identified gaps and institutional links and gaps as well.

Chapter **three** discussed on review of Early Warning Systems (EWS) and preparedness initiatives undertaken by different agencies in the country. The review work was carried out by the major prevailing hazards in the country. The hazards those were considered for reviewing EWS and preparedness initiatives are flood, cyclone, river bank erosion, tsunami, flash flood and drought. Climate change trend has also been included in the discussion as Bangladesh is particularly vulnerable to climatic risks. The climate change contexts are anticipated to change the frequency and intensity of the previously mentioned hazards. Thus a clear understanding on the trends and how these trends are accounted are also important to understand in early warning.

The chapter **four** includes analysis of institutional links and gaps focusing on the disaster information source providers activities as well as what kind of message they provide and other related questions on the disaster warning systems and their links. Flood Forecasting and Warning Centre (FFWC), Bangladesh Meteorological Department (BMD), Pacific Tsunami Warning Centre (PTWC) and Disaster Management Information Centre (DMIC) and other forms of sources and information management entities with their systems are reviewed analytically. This chapter includes discussion from the source to destination of information sharing systems. Focus was also given on national news, media and popular sources and global popular sources.

The fifth and **final** chapter is on "Conclusion: Needs and Recommendation". Banking on the previous analysis of the chapters this section outlines the generic needs and provides the recommendations for future development in the disaster management information links in the country.

2. Review of DMIC Needs Assessment Report

Disaster Management Bureau (DMB) along with other stakeholders has demonstrated significant commitment towards implementing a comprehensive disaster management strategy in Bangladesh. The Comprehensive Disaster Management Programme (CDMP) under the Ministry of Food and Disaster Management is expected to develop and establish Disaster Risk Management (DRM) mechanism in the country through appropriate institutional arrangements to deal with all disasters and for all sectors. Establishment of Disaster Management Information Centre (DMIC) and Disaster Management Information Network (DMIN) are two the major components of the Comprehensive Disaster Management Programme.

The United Nations Office for Project Services (UNOPS) has prepared a Need Assessment Report for Disaster Management Information Centre (DMIC) in June 2006. The purpose of the report was to understand needs of national, local and community stakeholders for different types of information for disaster management and willingness to share the information they have; capacity of Information Communication Technology (ICT) to receive, use and send information; and information flow link between and among different ministries and agencies at different levels.

2.1 Purpose of the review

The Comprehensive Disaster Management Programme has awarded a project, as stated earlier, to the Asian Disaster Preparedness Centre (ADPC) and Bangladesh Centre for Advanced Studies (BCAS). It is recognised that Disaster Management Information Network (DMIN) should be designed, tested and demonstrated based on present thinking and level of discussion both on institutional structure, sharing and needs of information. It is to be noted that the UNOPS has already prepared a document on needs for Disaster Management Information Centre (DMIC) and therefore review of this document is being considered as a starting point for DMIN.

The main purposes of the review exercise of the DMIC Need Assessment Report are to:

- a) identify gaps and further needs to enhance effectiveness of early warning system from sources to communities;
- b) identify areas where further thrust would be required to meet the demands raised by local level disaster affected communities;
- c) provide inputs in designing activities to be carried out under "1.2 - review options for strengthening existing links and filling gaps where appropriate" of the Comprehensive Disaster Management Programme (Component 5b), Support for a Disaster Management Information Network (DMIN).

2.2 Methodology of the review

The review methodology has followed the conceptual framework below where it considered review of content keeping three key questions/indicators in mind. The conceptual framework used for review is given below in Figure 2-1.

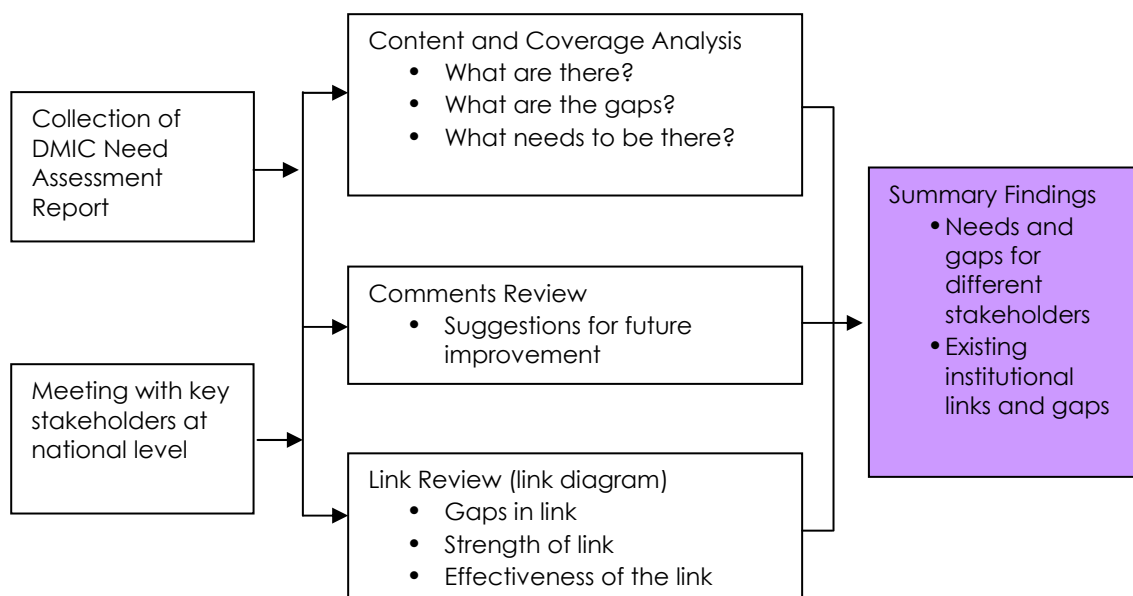


Figure 2-1. DMIC Need Assessment Report review methodology

2.3 DMIC Needs Assessment Report

2.2.1 Contents and Coverage

The DMIC Need Assessment Report contains five chapters and ten appendixes. The introductory chapter gave background of the project, purpose of the document, glossary of the key terms and scope of the DMIC Need Assessment Report. The second chapter on "National Level Institutions' Needs" contains needs assessment methodology, SOD information flows, needs of CDMP components for DMIC support, institutional needs, and requested DMIC functions. The third chapter is on "Community and Local Level Institutions' Needs" which contains objective and scope of the local level study, needs for information, and conclusions. Chapter four is on "Information Products" which contains daily operations, risk reduction, emergency response, and disaster recovery. ICT Infrastructure Needs is the last chapter of the report which contains national and local level ICT capacities and gaps.

All phases of the Disaster Management have been examined and categorized using sections such as the as a) daily operations of the DMIC, b) risk assessment, c) risk reduction, d) early warning and emergency response, and e) disaster recovery.

Necessity for more effective and better coordinated information management systems with a goal to improve coordination among agencies at all levels for easy access to appropriate, timely and accurate information before, during and after emergency situations has been highlighted at the very beginning of the report. It has stated that the Emergency Operations Centre (EOC) of the Ministry of Food and Disaster Management (MoFDM) is the responsible agency for coordination but is ill-equipped and lacks adequately skilled professional staff to carry out its required functions. Without modern telecommunication networks and integrated management systems, the EOC depends on district and Upazila authorities to report critical information for decision-making using traditional communication methods that delay response.

The DMIC Need Assessment Report considered three dimensions as scope of the report i.e. hazards managed, stakeholders served and disaster management phases handled. In terms of hazard, it covers cyclone including storm surges, flood (river and flash flood), earthquake, erosion and drought considering available resources and time. However, discussion at local and community levels brought out more hazards and vulnerability issues, for examples salinity

intrusion. The report also provided nature of the hazards but modification and further elaboration is necessary.

It is reported that the Ministry of Food and Disaster Management (MoFDM) has directed the CDMP to address primarily the needs of government institutions that contribute to disaster management and other stakeholders secondarily.

2.2.2 National Level Institutions' Needs

Section on "National Level Institutions' Needs" analysed Standing Orders on Disaster (SOD) to extract functions that should be supported by the DMIC. These include information flow, and liaison among Control Rooms and Emergency Operation Centres (EOC). The DMIC will support information flows and mechanisms for liaison among Control Rooms and Emergency Operations Centres as prescribed in the SOD.

The institutions identified in the SOD required establishment of Emergency Control Rooms when directed or when situations indicate the needs. It is stated that the DMIC should support the requirement by encouraging linkages between those agencies and the DMIC, for example, with their registration as DMIC portal users, subscriptions to DMIC early warning alerts and bulletins, and use of DMIC collaborative tools for emergency response coordination.

The DMIC need assessment report also records that the DMIC would require support from other CDMP components which was expressed by DMIC component managers. These include Policy Programme and Partnership Development Unit (PPPDU) for public relations, material and media work. Professional Development, Advocacy and Awareness, and Capacity Building components are for a) news of academic programs and scholarships, seminars, workshops and conferences, b) platform for web-based Computer-Based Training, courses, c) storage and retrieval of training material, d) production facilities for television, video projection and radio presentations, transparencies, posters, workshop handouts and fliers, and e) dissemination media: web, email, fax.

Program gap analysis component is for required database of community risk reduction programs while Risk Reduction Planning Component would be required to Community Risk Assessment (CRA) support tools, and risk reduction action tracking. Local Disaster Risk Reduction Fund (LDRRF) would be required for project tracking tools while Urban Search and Rescue component will provide inputs on inventory of city corporations' rescue equipment and GIS tools for presentation of urban vulnerability maps and relief resource inventories.

Climate change and research component can provide data and information on hazard trends in climate change context; show predicted impact of temperature and rain on long time horizon, localized and segregated by season, related to livelihood activities and the crop calendar; present localized hazard scenarios corresponding to changed climate parameters; present distant learning content in computer based training modules through DMIC portal page.

DMIC Need Assessment Report captures views of the Ministry of Food and Disaster Management, Directorate of Relief and Rehabilitation, Disaster Management Bureau, Donors, Primary Information Providers and Major NGOs. Views expressed by the Ministry of Food and Disaster Management suggested that the DMIC should not exactly replace the Emergency Operations Centre, with its useful location in the MoFDM's Secretariat premises close to the nexus of multi-sectoral emergency response controls in the Prime Minister's Office. The EOC should become a remote mirror of the DMIC operations room, offering capability to manipulate and display DMIC information independently of DMIC operators, to support high-level operational decision-making. As an entity of the Ministry, the DMIC should

respond to direction and reflect the Ministry's management directives in its periodic budgets and plans. It should prepare operations status reports to inform the Ministry of its actual performance.

A key role of the Relief and Rehabilitation Directorate is the administration of relief and rehabilitation programs in a timely manner. The Central Relief Management Information System (CRIMS), hosted by the DMIC, is a project management tool to support the administration of these programs. The DMIC should also maintain a database that can report localized supply and demand for relief and recover materials, based on inputs from the Directorate General of Food, field reports and vulnerability analyses.

The Disaster Management Bureau (DMB) needs to maintain an accurate and current understanding of the status of risk reduction and emergency response activities conducted by all GoB agencies at all levels. With implementation of the SOD requirements on the DMCs and other GoB agencies for delivering action plans and reports, the DMIC will provide this visibility.

Donors are beginning to regard disaster risk reduction as a cross-cutting consideration in their development programs, and are allocating funds accordingly. They need to be informed of the Ministry of Food and Disaster Management's initiatives to establish a proactive risk reduction culture across all GoB sectors, in NGOs and in communities. Providing visibility into these programs is an important function of the DMIC. In emergency situations, donors need to make decisions about whether and how to allocate resources. They need timely, coherent situation reports to understand how the emergency fits their criteria for engagement. The DMIC should provide an interface to the information that informs them adequately and in good time. The Global Disaster Alert and Coordination System, operated by OCHA-Geneva, offers an opportunity to attract the immediate attention of donors with its automated assessment and alert functionality. The DMIC should link with this organization.

The DMIC Report stated that there are currently two most significant providers of early warning information, BMD and FFWC, have no expectations to receive information from the DMIC, but they are eager to transfer responsibility for dissemination of their early warnings to DMIC. This would simplify their operations to a useful extent and allow them to concentrate on the scientific activity of generating the information rather than the distraction of disseminating it. The Centre for Environmental and Geographic Information Services, which presently produces annual main river erosion predictions and is developing approaches to model flood plain water levels, is also keen to use the DMIC as its dissemination organ. The Institute of Water Modeling has models with similar purposes and has also expressed willingness to share its outputs through the DMIC.

Cyclone Preparedness Program needs risk reduction and early warning information for all coastal zone hazards.

The DMIC Need Assessment Report stated that it has carried out limited consultation with key national and international non-government organizations due to time and resource limitations but recognised needs to discuss their needs and expectations from DMIC. General suggestions made by non-government organizations on collaborative linkages with other risk reduction initiatives, receive hazard early warnings and situation reports, and remain aware of other agencies' emergency relief activities.

Information users section of the DMIC Need Assessment Report provided requests for various kinds of risk reduction (Table 2-5) and emergency response (Table 2-6) information where the DMIC should focus to meet most users' needs. It is to be noted that these lists are long and therefore, an effort is necessary for further analysis on priority areas where DMIC should give more of its efforts.

Table 2-7 and Table 2-8 of the DMIC need assessment report show the needed information items that can be provided. Less positively, the tables also show that some required information items have no expressed source and some shareable information items have no declared users. Where a needed information item is not available, the DMIC should look for means to provide it.

The DMIC Need Assessment Report stated that the list of respondents includes no one with emergency response expertise. It is also suggested to identify specific experts in Bangladesh and elsewhere, and interviewing them. However, review of analyses of responses to recent large-scale disasters, including the Indonesian tsunami of 2004, supports the view that coordination of many, diverse, autonomous and often incompetent actors is the key issue, stated in the report. In these circumstances, information is the resource with the most leverage to alleviate suffering, by giving those actors a common understanding of the situation with respect to casualties and damage, and needs and availability of relief resources. The common observation during these events is that un-coordinated actors bring redundant or useless relief materials to locations, leaving other locations in want. Disaster management experts look for lessons to learn from actual events. To meet that need, DMIC should offer access to a database that characterizes past and future disasters according to a plan that supports the purpose.

The functions of the DMIC have been listed in Table 2-9 and stated that they are candidates for implementation although some may not be feasible because of technical, institutional or financial constraints. It is to be noted that the DMIC ICT Strategy discusses these functions in more details including barriers to effective information sharing. It has stated that long-established custom and its inherent inertia may resist the introduction of new information sharing mechanisms. Even when implemented, information sharing is a difficult activity that requires near-constant attention to maintain useful performance on all sides of the institutional relationships. It has also listed some of the institutions with which the DMIC must formalize data sharing agreements.

2.2.3 Community and Local Level Institutions' Needs

Community and Local Level Institutions' needs part stated that objective of the local level study was to assess the needs of communities vulnerable to hazards and to know the requirements of those information and hazard details. It was hoped that such information would help them in taking up measures with regard to preparation, response and rehabilitation. This section capture information needs of the five hazards i.e. river and flash flood, cyclone, riverbank erosion, drought and *monga*. It has provided perception of the community on different disasters. It is to be noted that *monga* is vulnerability, not hazard.

Regarding community and local level information needs for risk reduction, it has stated that institutions and community individuals can take steps to eliminate, avoid or reduce hazard risks by using localized and scientific knowledge of the nature of hazards. They can make action plans to cope with hazards by building cyclone shelters, flood shelters, and embankments, supporting livelihood diversification, improving medical facilities, protecting tube wells, raising latrine heights, raising household plinth heights, planting hazard-resistant crops, and so on.

Information needs for local level institutions for risk reduction are vulnerability of settlements and infrastructure, availability of shelter, availability of relief food and medicine, possibility of erosion induced flooding, availability of land for rehabilitation, source of water for irrigation and domestic during drought period, opportunities for alternative employment, availability of relief food stocks and programs. It calls for a wide range of participation of different organizations both from government and non-government organizations.

Early warning is outmost necessity for institutional and community stakeholders to deal with imminent hazards stated in the need assessment report. During an emergency, institutions want damage and relief resource information, and all stakeholders want to know how the hazard conditions will change over the coming days. Community members want to know what the authorities are doing to respond to the emergency and how they can avail themselves of assistance.

Consultation at community level shows that the community wants prediction of flood and rainfall information. Women in particular want to know the flood timing and extent, and daily predictions of water level change at their location. They believe that this will help them to assess if their land and homestead may be inundated, so that they can take necessary preparatory measures, such as moving livestock to higher ground or evacuating the household to a flood shelter. River floods create drinking water scarcity and people want to know about potable water availability during flood time, which is a health issue due to the increase of water-borne disease when tube-wells become overtopped and contaminated by flood waters.

In the erosion affected areas people want to know when and where the erosion will occur. Both male and female respondents expressed strong needs for information regarding where they can go for shelter and resettlement in the event of their homesteads being eroded, to help them to prepare for the physical shift they might need to make. The need for information about availability of relief materials, credit and employment figures prominently. People in the drought prone area expect drought, but their concern about the intensity of drought in a particular year. They would benefit from prediction of rain to understand when they will have respite from drought. Other needs include information on availability of water for irrigation of agricultural crops as well as for drinking and other domestic purposes. All female respondents seek information on availability of water for drinking and domestic purposes. Men want to know about the availability of relief in the effect of crop failure.

Local government institutions at the district, upazila and union levels, and NGOs expressed needs for information to cope with hazards, summarized in Table 3-6 of the DMIC Need Assessment Report. They receive some information on some of the hazards, but to date it has been insufficient and at times unreliable. Report also includes information need to address rehabilitation.

Table 2-1. Institutional needs for emergency response information

Hazard type	Information sought
River flood	Onset of flood Flood extent Depth and Duration of flood Changes in water level Areas and population expected to be affected Availability of shelter Availability of food and medicine as relief
Flash flood	Flood prediction Prediction of rainfall Expected time of flood recession Depth of flood Areas and population expected to be affected Availability of shelter Availability of food and medicine as relief
Riverbank erosion	Erosion prediction Possibility of erosion induced flooding Area expected to be eroded Time when erosion expected

Hazard type	Information sought
	Population expected to be affected Availability of shelter and land for rehabilitation, resettlement Availability of food relief
Drought	Duration of drought condition Possibility of rain Source of water for irrigation Water for drinking and other domestic purposes Population expected to be affected Availability of food relief

The Table 2-2 below provides summary of information needs for different stakeholders ranging from national to local levels.

Table 2-2. Summary of Identified Information Needs for National, Local and Community

Expected Role of DMIC	General Role and Means	Risk Reduction	Preparedness	Emergency Response	Relief and Rehabilitation
Overall Role	Support institutions to deal with all disasters and for all sectors (bridging role) Link with the Global Disaster Alert and Coordination System, operated by OCHA-Geneva.	Not specified in the DMIC Report	Not specified in the DMIC Report	Not specified in the DMIC Report	Maintain a database that can report localized supply and demand for relief and recover materials along with Central Relief Management Information System.
National Level Institutions'	Information flow and liaison among Control Rooms and Emergency Operation Centres (EOC). Link institutions to DMIC portal, subscriptions to DMIC early warning alerts and bulletins, and tools for emergency response coordination.	Inputs from other relevant components of CDMP. Example, Community Risk Assessment (CRA) support tools, and risk reduction action tracking, inputs from Climate change and research component, dissemination media: web, email, fax etc.	Not specified in the DMIC Report	Not specified in the DMIC Report	Not specified in the DMIC Report
Local Level Institutions'	Not specified in the DMIC Report	Collaborative linkages with other risk reduction initiatives, receive hazard early warnings and situation reports. Information on vulnerability of settlements and infrastructure, availability of shelter, availability of relief	Request for a long list of information.	A database that characterizes past and future disasters according to a plan that supports the purpose. Want damage and relief resource information, and all stakeholders want to know how the hazard conditions will change	Want to remain aware of other agencies' emergency relief activities.

Expected Role of DMIC	General Role and Means	Risk Reduction	Preparedness	Emergency Response	Relief and Rehabilitation
		food and medicine, possibility of erosion induced flooding, availability of land for rehabilitation, source of water for irrigation and domestic during drought period, opportunities for alternative employment, availability of relief food stocks and programs.		over the coming days.	
Community Level	Not specified in the DMIC Report	Localized and scientific knowledge of the nature of hazards (<i>inputs can be derived from CRA</i>)	Request for a long list of information Want prediction of flood and rainfall information. Women in particular want to know the flood timing and extent, and daily predictions of water level change at their location. When and where the erosion will occur, where they can go for shelter and resettlement in the event of their homesteads being eroded. Need information	want to know what the authorities are doing to respond to the emergency and how they can avail themselves of assistance	Not specified in the DMIC Report

Expected Role of DMIC	General Role and Means	Risk Reduction	Preparedness	Emergency Response	Relief and Rehabilitation
			about availability of relief materials, credit and employment		
Community Level	Not specified in the DMIC Report	Not specified in the DMIC Report	Want information on intensity of drought in a particular year. Prediction of rain to understand when they will have respite from drought. Information on availability of water for irrigation of agricultural crops as well as for drinking and other domestic purposes	Not specified in the DMIC Report	Not specified in the DMIC Report
Data and Information Providers (FFWC, BMD, CEGIS, IWM)	Eager to transfer responsibility for dissemination of their early warnings to DMIC	Not specified in the DMIC Report	Not specified in the DMIC Report	Not specified in the DMIC Report	Not specified in the DMIC Report
Donors	Not specified in the DMIC Report	They need to be informed of the Ministry of Food and Disaster Management's initiatives to establish a proactive risk reduction culture across all GoB sectors, in NGOs and in communities	Not specified in the DMIC Report	Not specified in the DMIC Report	They need timely, coherent situation reports to understand how the emergency fits their criteria for engagement.

2.2.4 Information Product

It is reported that the DMIC will support the information needs of all phases of disaster management and come up with a list of activities which are given below.

Daily Operations

It is suggested that information related to daily operation will be uploaded in the web site and users will view portal screens and download archived material from the portal for their day-to-day work. It is suggested that the following material will be available in the portal:

- SODM, directives and SODM-required reports
- Records from the hazard/disaster incidence and impacts database
- Disaster management best practices and literature
- Training resources: materials, lesson plans, CBT modules
- Information-sharing MOUs
- DMIC user directory/ contact/ expertise lists
- News feed bulletins
- Forum contributions

Risk Reduction

The DMIC Need Assessment Report stated that CRA contractors and CDMP staff will access vulnerability information in maps and tables, risk assessment reports, risk reduction action plans and status reports. DMIC members will view inventories of food relief provided by the Director General of Food when assessing readiness for relief distribution. MoFDM procurement officers will review contract performance histories of CRA and other contractors when assessing bids for new contracts.

It appears from the section of the report that DMIC need to prepare several reports as part of risk reduction activities for which it needs timely and effective information flow. Types of report that DMIC needs to be produced would require linking both government and non-government organizations particularly in risk assessment, risk reduction action plan and status report. Once, CDMP completes CRA and RRAP exercise for the whole country then central level information will be available. Therefore it needs intermediate strategy to receive information from different stakeholders to support risk reduction activities by DMIC.

Emergency Response

Table 4-1 of the DMIC Need Assessment Report suggests early warning information products and media that could meet some of the needs of stakeholders consulted at national, local and community levels. More detailed analysis of utility, appropriateness, cost-effectiveness, sustainability, production and dissemination issues, and feedback from field testing is required to confirm them as viable.

Institutions that track disaster impacts will use the DMIC to enter, store and access damage reports. The network of DMIC workstations in the district and upazila centers will automate the D-form process described in the SOD, allowing users at all levels assess to disaggregated damage information.

With GIS resources and real time data of adequate quality, the DMIC can quantify localized supply and demand for relief materials, giving responders information to correct over- and under-supply situations.

Similarly, with sufficiently accurate and timely contributions of situation information, institutional actions and intentions by on-site responders, DMIC can present real-time coordination information that gives actors a common understanding of the state of an emergency and enables them to productively apply resources, with less redundant effort and smaller gaps in service.

Disaster Recovery

Similar to the emergency relief situation, disaster recovery actors could use localized resource supply and demand information to identify over- and under-supply of recovery materials. DMIC would provide a GIS tool that would represent the locations of available and required quantities of recovery resources in map or tabular form, assessable from any internet-connected computer, to meet this need.

The Central Relief Management Information System presently under development to support the DRR's management of upazila level relief projects will be hosted by the DMIC and will provide project management reports.

Other agencies should be able to publish their recovery project plans and status reports in the DMIC portal to inform one another of their actual and intended activities. These documents would facilitate linkages that will reduce redundant recovery effort, increase effort applied to gaps and share lessons learned.

Information Communication and Technologies

ICT capacity of national level institutions' has been evaluated and categorized as good, adequate, inadequate, and poor. Table 5-1 of the DMIC Need Assessment Report shows that many of the institutions have good or adequate ICT capacity to communicate reliably and efficiently with the proposed DMIC for risk reduction and emergency response functions. Others, with inadequate or poor capacity, should take action to upgrade it as recommended but need to revisit.

Many local level institutions have adequate ICT capacity and are in a position to communicate reliably with the proposed DMIC for risk reduction and emergency response activities.

Most of the institutions considered IVR or phone link to be useful if necessary training is arranged. Many think that submitting or accessing brief data using standard telephones sets by phone link from upazila or union level field offices is acceptable. IVR is suitable for community level participants as well as for the institutional officers. Proper training and awareness generation would be useful in these cases.

It is reported that more than eight staff per organization possess personal mobile phones, which appears to be the most common media of communication and should be considered useful for communication with the DMIC in case of emergency. SMS transmission for dissemination of localized messages is useful for early warning. The DMIC should support e-mail, web, SMS, IVR and courier service for sharing information.

Some institutions possess data, which might be useful to others but not accessible to them at this moment due to administrative reasons or conservative attitudes. The users within the institution itself normally use those data. DMIC should play an important role for sharing data under such conditions.

Considering the present telecom scenario of Bangladesh, for the field level institutions and members of the community, transfer of information through voice calls and SMS messages will play an important role for another few years.

The following table 2-3 provides suggested DMIC information products and media to support their disaster management objectives.

Table 2-3. DMIC information products and media

Name of Hazard	Information Product	Media
cyclone	▪ Cyclone shelter locations and capacities ▪ relief material inventory ▪ early warning map with probable storm path and vulnerable upazilas ▪ damage reports ▪ rehabilitation resource inventory	web web web, email, fax, TV email, fax, courier Web
Flood	▪ flood shelter locations and capacities ▪ relief material inventories ▪ early warning water level predictions ▪ damage reports ▪ rehabilitation resource inventory	web web web, email, fax, TV email, fax, courier web
Earthquake	▪ vulnerability maps ▪ building quality assessment database ▪ emergency equipment status ▪ situation and damage reports ▪ rehabilitation resource inventory	web web web email, fax, courier web
Erosion	▪ vulnerability maps of infrastructure and probable bank line movement.	web, email, courier
Drought	▪ computer model that analyzes location variables including rain forecasts, irrigation resources, soil types and crop requirements for water, to predict drought	web, off-line computer
General	▪ disaster management knowledge base ▪ training materials ▪ resource directories ▪ emergency response coordination tools ▪ early warning/alert subscription	Web SMS, email, IVR

2.4 Summary of Identified Gaps

It is revealed from the DMIC Need Assessment Report that different types of information are necessary for different types of stakeholders to address disasters. It has also produced list of information needs and seems a wish list. It is also important to note that need for information for male and female varies by disasters for effective risk reduction, emergency response and longer-term rehabilitation.

Local government agencies and NGOs require hazard information to take effective risk reduction, emergency response and rehabilitation measures. They can play an important role in informing community members to sensitize them to the issues and solutions that they may adopt. Presently, vulnerable communities and local level institutions receive little hazard information. The DMIC must ultimately meet this need.

The DMIC Need Assessment Report discussed possible roles, and complied expectations of different institutions including national, local and community level. It calls for institutional mechanism and additional mandate to deliver expected job of the DMIC and DMIN is beginning toward meeting the needs. Mechanism need to be developed between information providers, disseminators, local and community users.

It is clear from the community and local level discussions on risk reduction, emergency response and rehabilitation that it needs new and additional information which are not available and even if available are not available at community and local level. Some information requested by the community and local level organizations is not available in easy understandable format.

In terms of earthquake, there is no effective special initiative for rescue operation, resource and rehabilitation. The link that has been identified in DMIC NAR report is not well defined in terms of effectiveness. These diagrams show the existing information flow networks and do not show the strength of the links, which need to be identified to strengthen DMIN. These links represent general information flow based on institutional role. But types of information for different hazards are different. So these links should be hazard based.

DMIC Need Assessment Report suggested that early warning information products and media that could meet some of the needs of stakeholders consulted at national, local and community levels. More detailed analysis of utility, appropriateness, cost-effectiveness, sustainability, production and dissemination issues, and feedback from field testing is required to confirm them as viable.

The text box summaries content gaps need to be strengthened to increase effectiveness of existing information flow from source to community.

2.5 Summary Analysis of the Institutional Links and Gaps

The DMIC need assessment report has shown institutional link and types of information flow among various agencies. Appendix D of the needs assessment report has shown the following information flow link and types of information.

- a) Bangladesh Meteorological Information Flow link with different institutions and types of information flow. The information flow is primarily warnings and weather bulletin which are one way information flow.
- b) Cyclone Preparedness Programme flow link shows institutional link and types of information flow. It shows both way information flow between CCP Headquarter and CCP field office. It also shows information sources primarily BMD and MoFDM.
- c) Information Flow among the Disaster Management Committees at Different levels.
- d) Disaster Risk Reduction information flow link
- e) Institutional and Information flow link of Disaster Management Bureau
- f) Institutional link and information flow of FFWC
- g) Institutional link and information flow of

The DMIC need assessment report stated that the DMIC will server primarily to the government organizations and then others. This government directive to focus primarily on government institutions has potential to limits cooperation with other important stakeholders who are in one hand information providers and also contribute significantly in disaster management particularly emergency and rehabilitation period. A clear mandate needs to be developed for DMIC and information flow mechanism among different stakeholders and institutions.

It is to be noted that Positive role of national and international non-government organizations is well recognized in disaster management. Therefore, Disaster Management Information Network (DMIN) needs to include both national and international non-government organizations to make the network comprehensive and effective.

Different parts of the country are facing different types of hazards and therefore, specific focus is necessary to identify local level organizations.

All organizations/institutions mentioned in the Standing Order have not been consulted due to several constraints and their views on information needs can not be incorporated.

Community level discussion has not happened in the coastal areas. Incorporation of emerging slow onset disaster like salinity intrusion that has been mentioned while local and community discussed happened.

The DMIC Report has shown link among the institutions but strength link has not been assessed. Frequency of interaction among the agencies varies by types of hazards and time. Therefore frequency of interaction among the agencies at present can be viewed as strength of link which will be carried out under 1.2 activities. The following can also be used for assessing strength of link and gaps:

- Feedback
- Relevance of information
- Coordination of the agencies in emergency period
- Chain of command of the agencies
- Understanding capability of information user and its use.
- Receipt capacity
- Human capacity
- ICT Capacity

The DMIC needs to address regional as well as global links. Because there are some hazards like flood, cyclone, Tsunami etc. could be occurred regionally. Data and information on these types of hazards are available in many organizations like SMRC, Indian Meteorological Department, Nepal Hydrology Department, China Bureau of Hydrology, NOAA, and Pacific Tsunami Warning Center etc. So regional and Global networks should also be addressed properly to strengthen DMIC. This information might have importance in mapping nature of disasters, developing tools of preparedness activities, undertaking response measures etc.

In discussion about ICT capacity national level stakeholders have traditional capacity where few staffs can get opportunity to use technology. And local and community level stakeholders still depend on mass media, postal, courier delivery.

Different agencies' role in different hazards, institutional responsibilities, and monitoring systems in normal and emergency period are not well. The emergency response coordination will be difficult task for DMIC among other agencies control room. This is not necessary for DMIN to coordinate of all the agencies control room in an emergency period. The agencies, which are playing vital role for specific hazard, DMIC can coordinate with them on a priority-basis. Because some agencies are not involved in information dissemination in emergency period.

National level institutions have relatively stronger information link than local level institutions. ICT capacities and gaps in national level institutions are very well. Local level institution in general suffer from more severe ICT capacity limitations. The following gaps are shown in NAR:

- Area based community and local level (NGO) stakeholders are not included in the need assessment report which could play a vital role in different hazards; early warning information dissemination.
- Early warning using SMS, web and also technical languages are not often understandable because technical capability and IT knowledge of the community is very poor.

- Present early warning information dissemination agencies do not have links with other information sources like BARL, CCC, IR.
- Specific hazard relevant agencies coordinate systems are weak like link GSB, BMD, and BES.
- When DMIC starts in full swing operation, then some of the agency will feel relaxed which may create a gap of information dissemination.
- Few agencies does have direct link with data source. They collect hazard information from media or other agencies.
- BBS has no link among the agencies.
- There is no direct link with CCC, BARL, IR and data source.

Some of the generic **gaps** in the EWSs can be identified as below:

- Multi-hazard integrated early warning system is absent
- Various hazard has differential sources but at the same time differential paths of dissemination
- Inadequate maintenance and upgrading of system;
- Insufficient lead time;
- Shortage of funds and leadership for disseminating hazard warnings
- Deficiencies in the accuracy and reliability of forecasts;
- Limited coverage;
- warnings are not always well understood by the communities;
- the process of feedback mechanism from the downstream or community is often absent or inadequate;
- Lack of ownership by an large a local level
- And so on.

Table 2-4. Hazards managed by different agencies

Name of the Agency	Need	Sharing
Armed Forces Division	Disaster management training, awareness programs, disaster preparedness status, mitigation action status, Topographic, infrastructural and hazard incidence information, reports of causalities, losses and damages, situation reports.	Mock exercise support. Communication and response resources.
Bangladesh Agricultural Research Council	Irrigation resource information extent, depth, duration of inundation, salinity intrusion, land loss to erosion, crop losses due to hazards, Climatic and meteorological data to understand cropping variations, crop vulnerability to hazards. Reports of losses and damages.	Land crop sustainability maps.
Bangladesh Amateur Radio league	Situational information, weather and other emergency warnings, public orders from authorities, reports of casualties, losses and damages.	Transmission resources during mock exercises. Situational information weather and other emergency warnings.

		public orders from authorities.
Bangladesh Betar	Weather bulletins, reports of casualties, losses and damages, relief reports.	Weather bulletins, reports of casualties, losses and damages, relief reports.
BBS	Disaster/Hazard information	Everything they have, in 7 wings: National Accounting, Census, Agriculture, Industry and Labour, Computer, Demography and Health and Finance Management information Systems
Bangladesh Red Crescent Society	Hazard and disaster information other agencies disaster management activities, Tornado and nor'wester research information, flood vulnerability, socio-economic information to identify poverty-vulnerabilities earthquake risk, Situation report, reports of casualties, losses and damage, Information on disasters and consequent, health problem, sitreps, resource request.	Program details, Emergency activities
BTTB	Early warnings, Cyclone, Earthquake, Tsunami as per the requirement of the situation.	Awareness building information, Emergency situation
Bangladesh Inland Water Transport Authority	Cyclone, Tornado, Flood awareness information, Training material, Mock-exercise support, Early warning for cyclone, flood situation report to support reuse operations, Sitreps, Request support readiness	Losses damage, Rehab progress
Bangladesh Meteorological Department	Field information to weather paths, Nature of hazards, Socio-economic data for vulnerability assessment, seismic data to support earthquake prediction, Earthquake vulnerability map.	Processed met data (not raw data) Meteorological.
Department of Mass Communication, Mol	Any information that the GoB wants disseminated or acquired , Public meetings	GoB training, awareness, capacity development information workshops damage reports
Department of shipping	Flood awareness information, training material Cyclone, awareness information, training material. Early warnings for cyclone, flood	Flood awareness information, training material Cyclone awareness information, training material
Directorate General of Food, MoFDM	Crop acreages, yields, productivities employment situation	Food inventories at CSDs, LSDs

	Flood warnings, Cyclone warnings, Damage reports, Situation reports Prediction of hazard severity, onset and duration, real time situation reports from all actors, and localized reports of relief materials inventories	
Disaster Management Bureau	Awareness information problems Situation reports weather/news bulletins.	Awareness programs, situation reports, casualties, damage reports
Directorate of Relief and Rehabilitation	Relief materials inventories, preparedness reports Situation reports, relief reports, damage reports.	Preparedness reports coordination/direction to DMCs, other agencies Situation reports, relief and recovery requirements
Disaster and Emergency Response Sub Group	Information for preparation for emergency response and recovery Early warning information for multi-agency coordination, real time situation information	Hazard incidence history database Response coordination information
Emergency Operations Centre, MoFDM	Early warnings situation reports, Damage reports, Flood warnings, Prediction of hazard severity, onset and duration, real time situation reports from all actors, and localized reports of relief materials <i>inventories</i>	MoFDM directives, situation reports, damage reports
FFWC	Hydrological and meteorological data, regional basin data, vulnerability to erosion-induced flooding	Information for agricultural decisions, river linking issues Early warning of river and flash flooding, rainfall, vulnerability, Flood warning.
Fire Brigade and Civil Defence Directorate	Vulnerability information, support for awareness of building code 1993, availability of rescue equipment to borrow. Early warnings situation reports	
SPARRSO	ALOS imagery (SAR Data)	NOAA imagery, annual flood extent map, annual crop productivity maps
WARPO	Arsenic information, health issues, salinity intrusion, erosion predictions, BWDB data.	Arsenic information, health issues, salinity intrusion, erosion predictions, NWRD data sets, drought map, ground water zoning map Early warnings –weather

Synopsis of the important issues outlined in the report are important for follow up action. Some such synoptic conclusions can be taken from the review of the DMIC Need Assessment Report are as follows:

- The DMIC Need Assessment Report discussed about the possible roles, and complied expectations of different institutions including national, local and community level.
- It calls for an institutional mechanism and additional mandates to deliver expected needs of DMIC and DMIN in the country. It was suggested that the mechanism needs to be developed between information providers, disseminators, local and community users.
- The local government agencies and NGOs require hazard information to take effective risk reduction, emergency response and rehabilitation measures. They can play an important role in informing community members to sensitize them to the issues and solutions that they may adopt.
- It was identified that the vulnerable communities and local level institutions do not receive sufficient hazard information.
- It was identified that the information base are not provided with gender delineated manner but the need for male and female varies by disasters for effective risk reduction, emergency response and longer-term rehabilitation.
- The document mentioned that communities need new and additional information which are not available and even if available are not available at community and local levels.
- It was identified that some of the hazard information requested by the community and local level organizations is not available in easy understandable format.

3. Review on existing EWS and Preparedness Initiatives

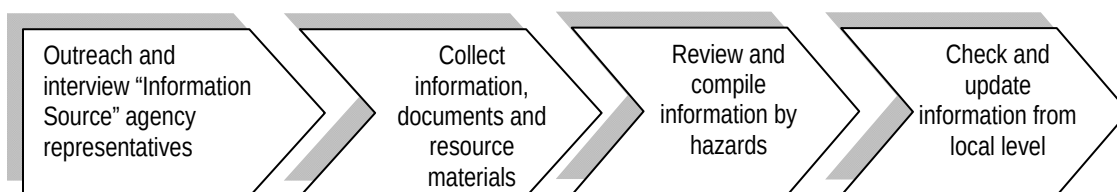
3.1 Process of review

In this Chapter, a technical review of the Early Warning Systems (EWS) existing for the major hazards in Bangladesh are discussed. Review of each of the major hazards with their profound prediction, forecasting, technical preparedness measures, tools/models are carried out to better understand the existing context of hazard specific early warning system in operation.

In this respect, the following major hazard EWSs (and for earthquake preparedness only) were explored:

- Flood
- Cyclone
- Riverbank erosion
- Earthquake (preparedness initiatives)
- Tsunami
- Flash flood
- Drought, and
- Climate change (as a trend that are anticipated to increase other hazards)

The reviews are based on primarily on the secondary sources of the respective institutional documentations, project documents and or research outputs. The institutionally shared information through our outreach and discussions with respective sources agencies such as FFWC, BMD, ADPC EWS and so forth are carried out to collect more context based documentations. Agencies have shared their information with a good willingness and with a great deal on commitment towards developing a central level DMIN. The source agencies are also expressed their willingness to support DMIN through consultation and information sharing in future. ADPC-BCAS field team has carried out an outreach and interviewed the disaster management information source agencies and related institutions with a simple checklist and collected documents and information that are used in this Chapter and in the following two chapters as well in a sequential manner. The process of collection of information and validation remained as below:



3.2 Flood

The Flood early warning system in Bangladesh has evolved historically through the various flood forecasting initiative under the Bangladesh Water Development Board (BWDB) after the independence of the country. In 1972, under the newly independent Bangladesh the Flood Forecasting and Warning Centre (FFWC) was established. Since then, the FFWC has developed as a formidable center under the BWDB. They have a comprehensive system of collecting and processing hydrologic and other data as input to forecasting models; preparing flood forecasts and warnings on a daily basis and disseminating the forecasts and

warnings to a range of government and non-government organizations, media groups and other interested parties.

Besides the FFWC, the recent development of the Flood EWS, including the preparation of flood forecasting and warnings, has been evolved through several projects including:

- Consolidation and Strengthening of Flood Forecasting and Warning Services (CSFFWS)
- Environmental Monitoring and Information Network (EMIN)
- Community Flood Information Systems (CFIS)
- Climate Forecast Applications in Bangladesh (CFAB) Phase I and II, and
- Development of Regional, Basin Flood Forecast Model for use in Bangladesh

3.2.1 Flood forecasting system by FFWC

FFWC as part of the BWDB is responsible for flood forecasting and its dissemination within Bangladesh. Flood forecasting models of FFWC developed on MIKE 11, one-dimensional modeling software used for the simulation of water levels and discharges in the rivers. For real-time flood forecasting, FFWC uses Flood Watch, a decision support system developed in ArcView GIS, which integrates database, modeling system, model outputs and dissemination of forecasts.

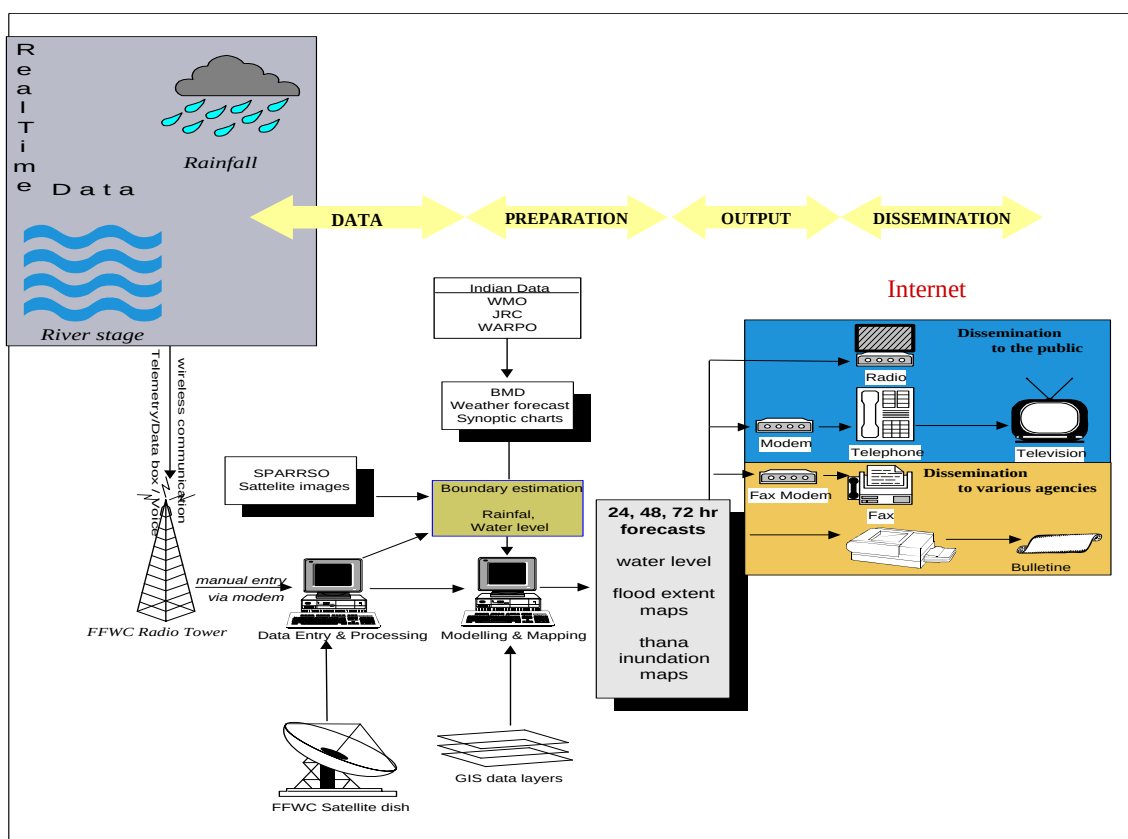


Figure 3-1. FFWC operational system network (Source: FFWC)

The warning information is disseminated through FFWC's traditional dissemination process (Fax, Telephone, e-mail). The overall warning generation and dissemination process has shown in the diagram 3-1. Flood forecasting system collects real time data, compiles, processes, and prepares outputs for dissemination on a daily basis. The more extensive description of the content messages and the kind of data and lead time they share are also discussed in the next chapter.

3.2.2 Community Flood Information Systems (CFIS)

For the community level dissemination of flood information in various projects, a method called Community Flood Information Systems (CFIS) was experimented collaboratively by BWDB, WARPO, Riverside Technologies Inc., CEGIS, BDPC and EMIN project (from 2001 to 2006). CFIS aimed to disseminate information on the flood extent, duration and depth of water/water levels to the community before the flood occurs. The system was based on a GIS-based flood forecasting information software called WATSURF, which uses a correlation model of a 248 square km study area. It is a simple gauge-to-gauge correlation-based tool that uses forecasted water levels from the FFWC as input. The calculated water levels are then used to generate flood water levels in the study area using GIS technology. The conceptual diagram of the CFIS is shown in following Figure 3-2.

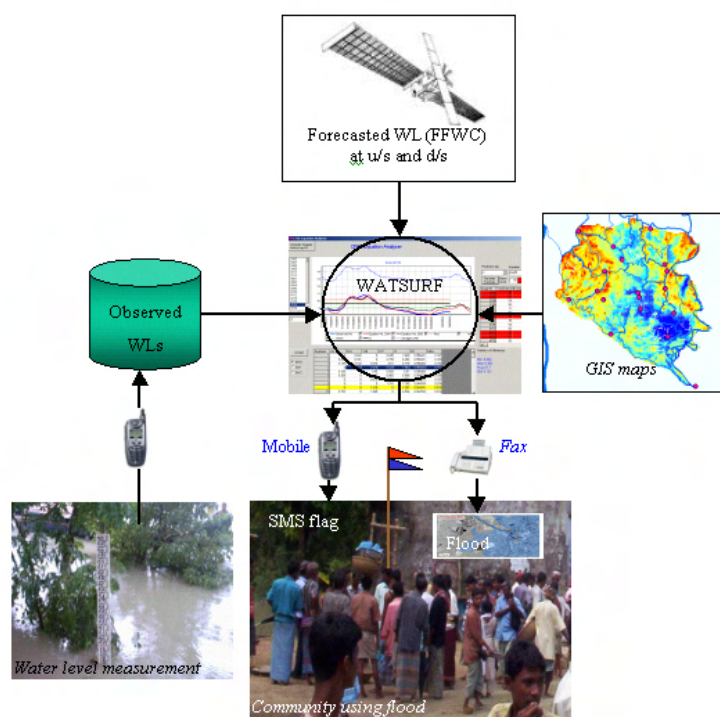


Figure 3-2. The Conceptual Diagram of CFIS piloted through several projects such as CFIS, EMIN and CFAB (Source: CEGIS 2005).

The CFIS system disseminated flood warnings derived from WATSURF to several pilot mouzas. Selected individuals in the community serve as the operators to receive a daily text message with flood warnings and operate the flag system and bulletin board to inform the community of the flood warning. The message and symbols were designed with participation of the local people.

CFIS system has helped raise some level of awareness amongst local people about the flood forecasts and warnings. Flood warnings were conveyed to local people by change agents and volunteers who explained the implications and interpretation of different types of warnings and helped with flood preparedness.

Flood management committees were formed involving local elites, local government elected representatives and officials, and non-government organizations WATSURF based CFIS system has its limitations due to its simple computational method including the calculated water levels are mainly reliable when there is full connectivity of floodwaters on the floodplain and are sensitive to backwater effects.

3.2.3 Climate Forecast Applications in Bangladesh (CFAB)

The CFAB project aimed to reduce societal vulnerability to climate hazards such as floods/droughts arising out of climate variability of the country through generation and application of climate and flood forecast information in an innovative way. CFAB aims to develop forecasts schemes for short (1-6 days), medium (20-30 days) and long (1-6) months time scales and incorporate these schemes into the FFWC and BMD. CFAB prepares climate forecast data to improve the performance and the lead-time of flood forecasts.

CFAB project started in November 2000, and was implemented by the Program on Atmospheric and Oceanic Sciences (PAOS) at the University of Colorado/ Georgia Institute of Technology (GATECH), Atlanta, USA, with assistance from the Asian Disaster Preparedness Center (ADPC), Bangkok, Thailand. The project was implemented with the active involvement of key stakeholders in Bangladesh through their participation in the CFAB Steering Committee. The key stakeholders included the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Department of Agriculture Extension (DAE), Disaster Management Bureau (DMB), Institute of Water Modeling (IWM), Centre for Environmental and Geographic Information Services (CEGIS) and CARE-Bangladesh. In 2003, CFAB developed a three-tier, overlapping forecast system, to significantly improve the lead-time of the forecasts being prepared by FFWC and BMD:

- Short-range forecasts of rainfall and river discharge in probabilistic form provided each day with 6-10 days lead time;
- Medium range forecasts of average 5-day rainfall and river discharges, updated every five days, with 20-30 day lead time; and
- Seasonal outlook starting at the beginning of the monsoon season and updated each month, providing 1-6 months lead-time.

Evaluation found that these forecasts and found that the lead-time for FFWC forecasts could be increased from 48 hours to 120 hours using the discharge data forecasted by CFAB at the upstream boundaries of the model.

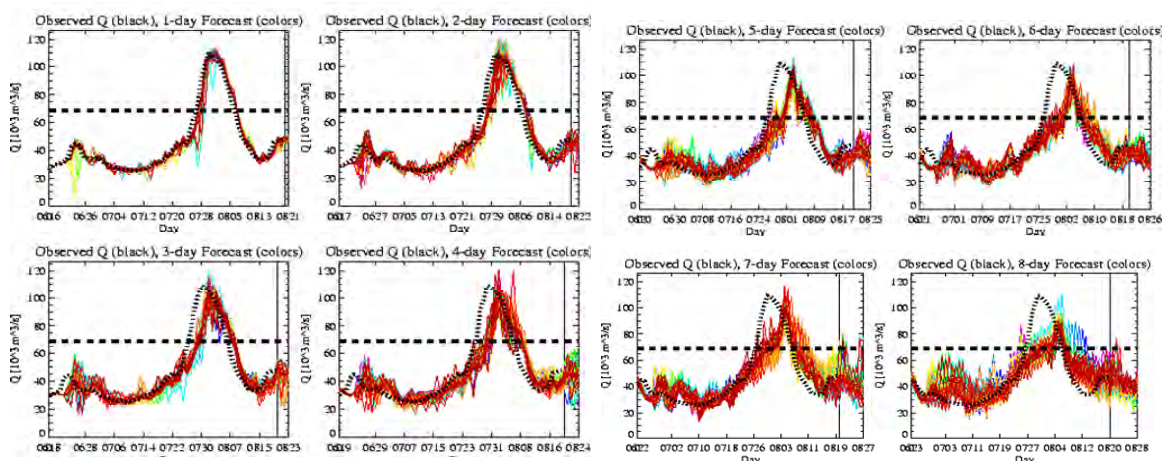


Figure 3-3. An example of 1-10 day flood forecasts using ECMWF precipitation forecasts under CFAB (for Brahmaputra Discharge Forecasts 2007).

Based on positive evaluation results, Government of Bangladesh (GoB) endorsed a project to further develop CFAB to improving climate/flood forecast technology and transferring the technologies to Bangladesh institutions (BMD and FFWC). As an interim measure, until CFAB Phase II starts, the Flood Forecast Technology for Disaster Preparedness in Bangladesh Project is being implemented. The project involves the Climate Forecast Application Network (CFAN), Georgia, USA further developing the climate/flood forecast technology and transferring the technology to Bangladesh institutions CFAN is a network comprised of a

group of Georgia Institute of Technology scientists from the School of Earth and Atmospheric Sciences dedicated to providing applications of climate forecast products, building capacity and transferring technology to the developing world. The major institutional arrangement for CFAB I and II are outlined in the following diagram:

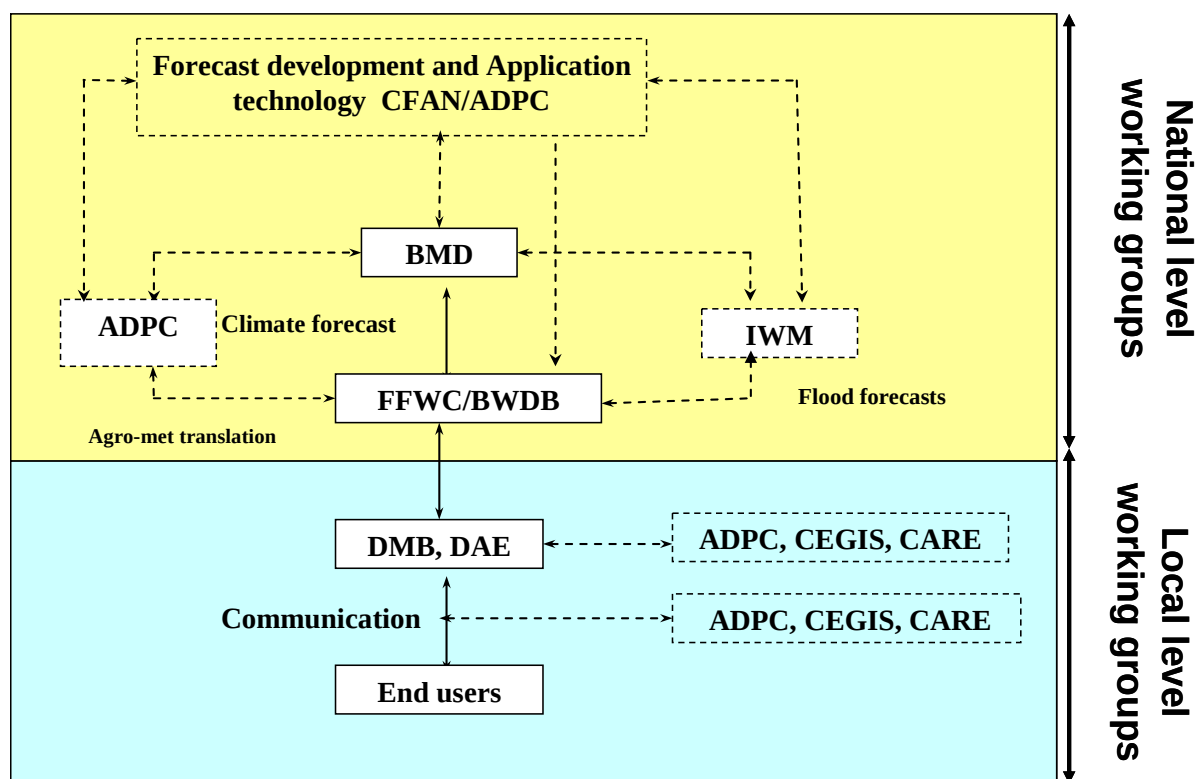


Figure 3-4. Institutional linkages for CFAB (Source: ADPC: 2008)

3.3 Cyclone

The cyclone warning and preparedness model in Bangladesh is regarded in recent time as one of more successful ones. The Bangladesh Meteorological Department (BMD) is the responsible agency for cyclone hazard warning. The Storm Warning Center (SWC) under the BMD predicts the cyclone storm and issue the warning. The STP Model (i.e. regression model) and STEEPER Model (i.e. steering-cum-persistence model) is used for tracking the prediction of cyclone.

The cyclone warning information includes information regarding the position of the storm, direction and rate of movement and area likely to be affected with some specific geographical locations, approximate time of commencement of gale winds (speed more than 32 km/h or 52 km/h), maximum wind speed expected and approximate height of storm surge/tide and areas likely to be affected.

According to the Standing Order (SOD) of the Government, cyclone warning messages are issued as follows in three different stages warning stage: 24 hours in advance, danger stage: minimum 18 hours in advance and great danger stage: minimum 10 hours in advance. The level of warning is proposed to change after the 2007 cyclone SIRD. The warning information was disseminated to all concerned ministries, departments, non-governmental agencies and media about the probable threat and updates the situation for efficient response. The Cyclone Preparedness Program (CPP) which is basically an emergency HF/VHF radio bulletins issues from BMD through a community volunteer network activate and use mostly for the

cyclone warning. A regular and frequent contact establish with radio and television transmission with BMD. The warning dissemination flow shown in the figure below:

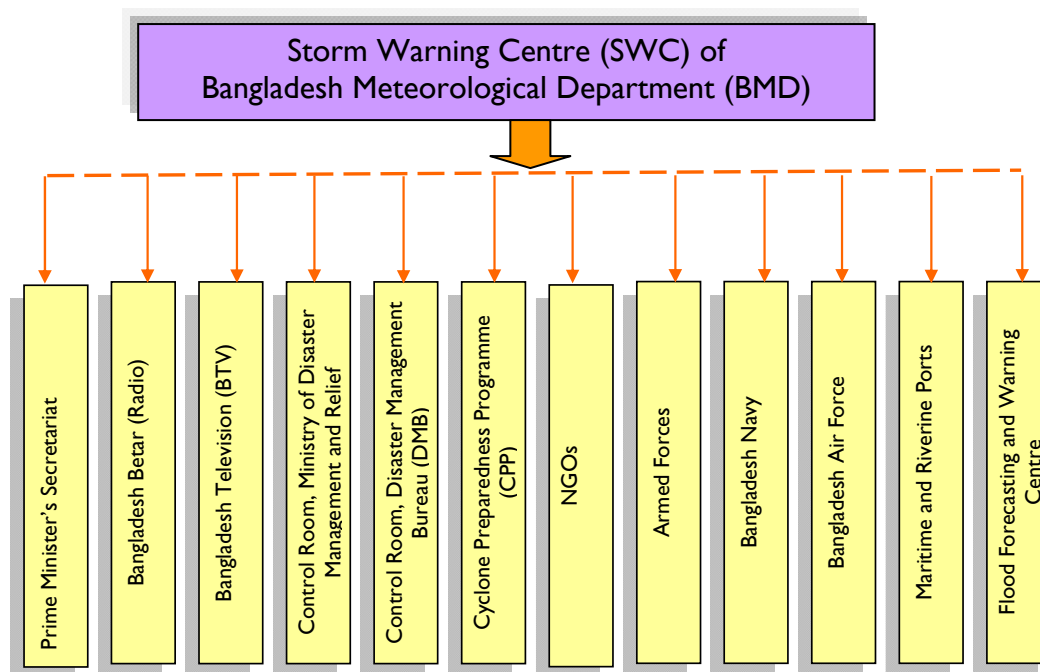


Figure 3-5. Cyclone warning dissemination flow of BMD

BMD is the first sources of cyclone forecast and Cyclone relevant information. BMD has link with Global Telecommunication System (GTS) and they collect regional wind direction temperature and relevant all information.

BMD disseminate warning message at first to the Prime Ministers office, Bangladesh Betar, BTV, FFWC and Air Force office who has Micro wave link. Then BMD disseminate warning message of all stakeholders near about fifty agencies who are relevant with disaster management by Fax, where fifty minutes will consume by these process.

Cyclone Preparedness Programme is one of the leading organizations for cyclone disaster management. Cyclone Preparedness Programme receives warning message first from BMD and then DMB, DRR, MoFDM and other stakeholders by Fax and disseminate it to thirty-two CPP field offices.

Cyclone Preparedness Programme coordinates with BMD in pre disaster period near about thirty times in a month and during cyclone it's more than sixty times. Cyclone Preparedness Programme also coordinates with BDRCS, DMB, DRR Local Government and all Disaster management Committee and takes preparation of evacuation of people, shelter management, social work, ensure shelter facilities and management, first-aid service and coordinate with local Government.

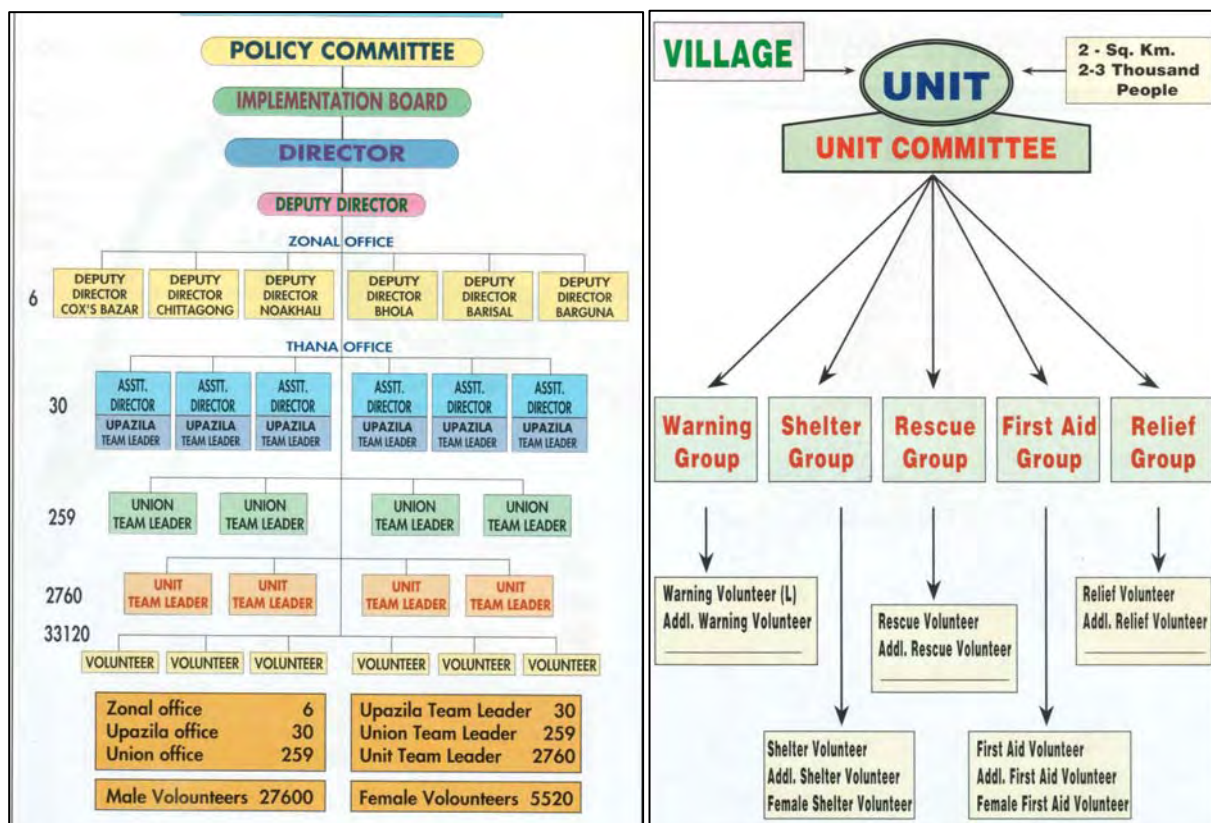


Figure 3-6. Institutional arrangements for CPP program (the central organogram on the left and the structure of the local level committee on the right). Source: CPP.

3.4 Riverbank erosion

For river bank erosion prediction, Bangladesh Water Development Board (BWDB) with support from CEGIS developed a morphological and riverbank erosion prediction method based on satellite images. Since 2002, this kind of prediction has been started through predicting morphological developments in the Jamuna River at the Pabna Irrigation and Rural Development Project (PIRDP), and FAP 21. In 2004 onward, BWDB-CEGIS is yearly predicting the bank erosion along both banks of the Jamuna and Padma rivers under the framework of the Jamuna-Meghna River Erosion Mitigation Project (JMREMP) and the Environmental Monitoring and Information Network for Water Resources Project (EMIN).

The prediction of bank erosion is based on the empirical method developed by CEGIS-BWDB for the Jamuna-Meghna-Padma Rivers. At this point the prediction of riverbank erosion is primarily in a developmental state and river specific.

The prediction is made one year ahead using information on the planform characteristics of the river as observed in dry season satellite images. The planform of a river is highly dependent on the stage (level of water) of the river. From January to early March the water levels of the Jamuna and Padma rivers remain at their lowest without varying much over time.

Early prediction is more desirable to the end users but the time of predictions is heavily dependent on the availability of cloud free images at the beginning of the year. This method is also then be followed up by the ground truthing. The prediction of bank erosion on the dry season satellite images is made on the basis of a developed prediction method and field observations.

The method gives a vulnerability assessment and predicted erosion map. Geographical coordinates of educational institutions, health centers, *hat-bazars* (market places), growth centers, and launch/ferry *ghats* along both banks of the Jamuna River are also displayed in the erosion vulnerability map. River bank erosion changes the location of settlements, schools, growth centers launch/ferry *ghats* and the alignment of embankments and roads. An example of erosion prediction and vulnerability assessment for 2005 made for the JMPREM and EMIN projects in the figure 3-7.

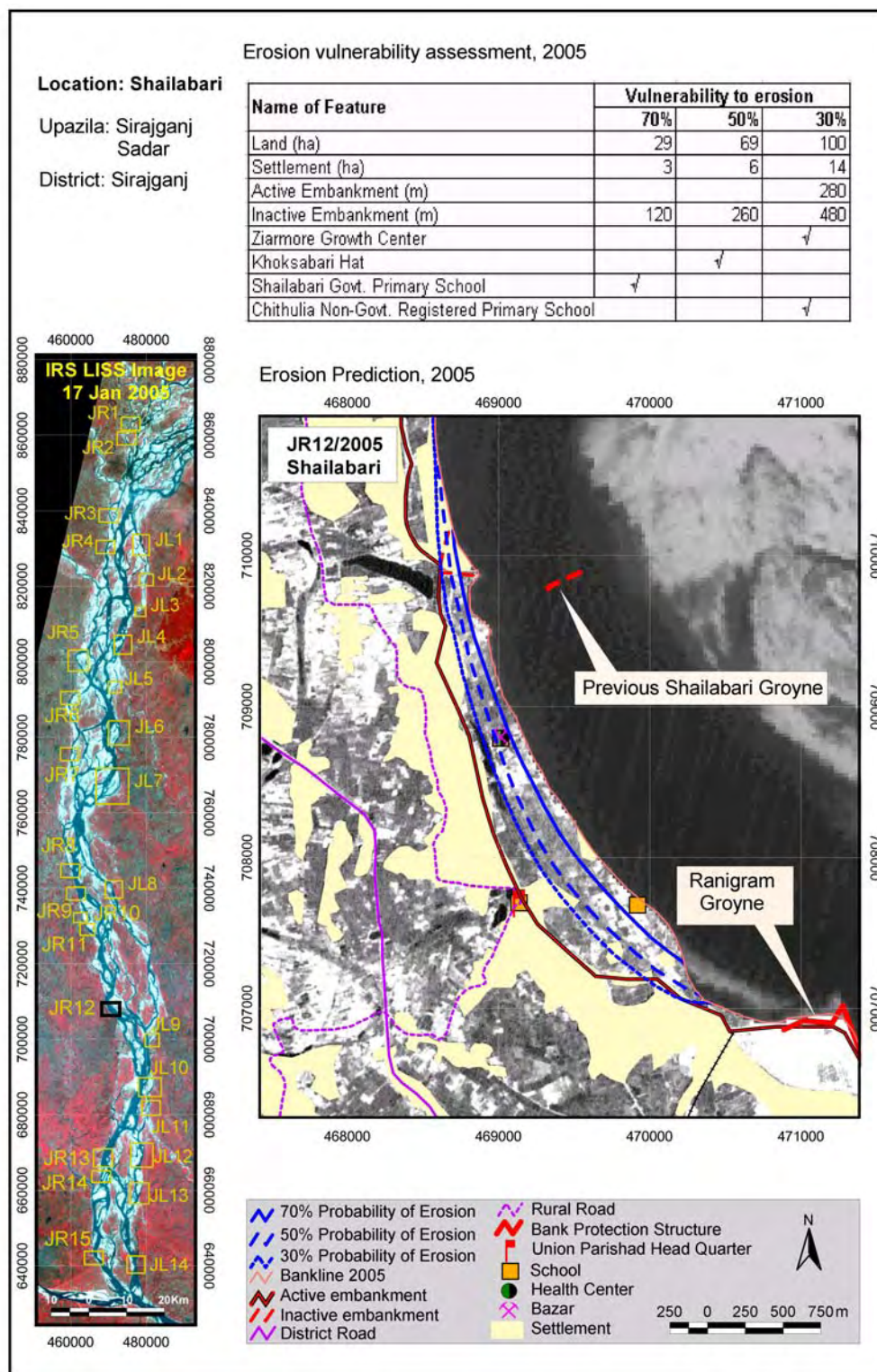


Figure 3-7. erosion prediction and vulnerability assessment for 2005 (Source: JMREMP 2005)

3.5 Earthquake

Bangladesh lies in a region with low to high seismic hazard that increases in the northern and eastern parts of the country. Historically, earthquakes in the M6.0-7.0 range have been experienced in Chittagong, Dhaka and Sylhet divisions while events in the M5.0-6.0 range have been experienced in Khulna and Rajshahi divisions. Significant earthquake hazard exists for the urban centers like Chittagong, Dhaka and Sylhet. A strong event may result in severe damage and destruction of massive proportion with severe consequences for the entire country. These urban centers are fast growing and influence the economic developments of much of the country. It is, therefore, essential to have a realistic understanding of the nature, severity and consequences of likely damage/loss that a possible event could cause on the urban centers since a strong earthquake affecting major urban centers like Dhaka, Chittagong; Sylhet may result in damage and destructions of massive proportions and may have disastrous consequences for the entire country.

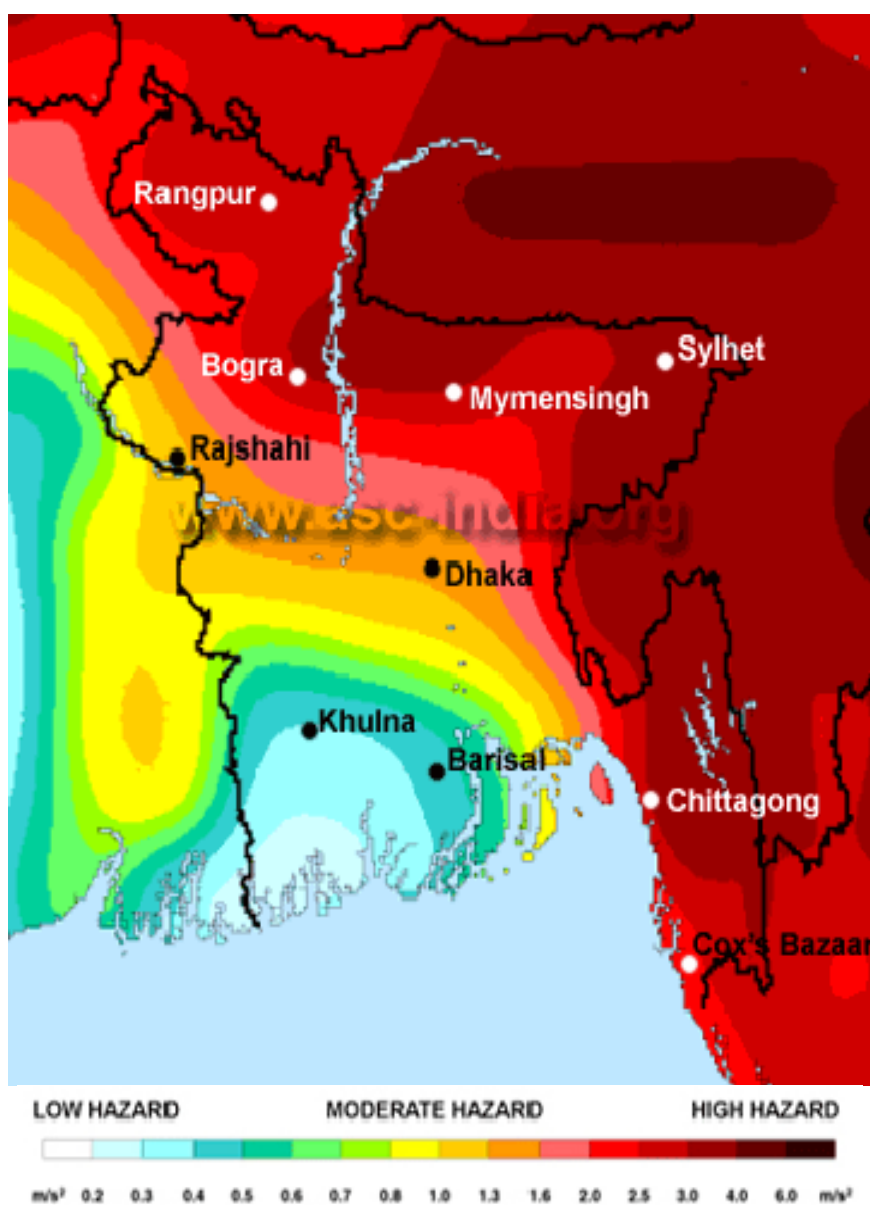


Figure 3-8. GSHAP Data Bangladesh (Source: ASC)

During the last few years, a number of actions have been initiated to reduce the vulnerability against earthquakes. These initiatives include:

- Preparation of macro and micro-zonation maps and a more accurate assessment of seismic hazard. Legislation has been enacted to enforce the National Building Code and the procedure for issuing building permits and approving building design is being streamlined. Micro zoning of three major cities are underway now from the CDMP respective component.
- A bilingual (English and Bangla) manual for earthquake resistant design and construction of non-engineered structures has been published. Some of the weak buildings have been identified and retrofitted.
- A public awareness campaign has been launched by the Disaster Management Bureau of the Government in cooperation with NGOs and Dhaka City Corporation. An earthquake drill was also held in one of the most vulnerable areas of the city.
- An Earthquake Preparedness Program (similar to the Cyclone Preparedness Program in the coastal areas of Bangladesh, operated jointly by the Bangladesh Red Crescent Society and Government of 8. Forum DKKV/CEDIM: Disaster Reduction in Climate Change 15./16.10.2007, Karlsruhe University Bangladesh), under which 40,000 volunteers may be mobilized within a short period) is being prepared.
- An awareness program for Ward Commissioners (elected public representatives) of Dhaka City Corporation has been launched. Training programmes for Fire Service and Civil Defense Personnel, and medical doctors and nurses, have been organized. A plan for undertaking post-earthquake search, rescue and overall management has been drafted by the Armed Forces Division. The Dhaka city has been divided into 8 zones and detailed plans for search, rescue and post-earthquake management have been prepared. The government has prepared an inventory of equipment available with various government and private agencies in and around Dhaka and additional equipment is being procured to make up the deficiency.
- Adoption of specific program activity on Seismic Hazard and Vulnerability Mapping of Dhaka, Chittagong and Sylhet City Corporation area by CDMP Bangladesh.

At present, the seismic hazard map for three major cities of the country: Dhaka, Chittagong and Sylhet is prepared based on geological engineering maps and fault maps. The vulnerability maps are also under development through a building survey and using the HAZUS methodology. The risk maps will be available shortly for probabilistic scenario earthquake in the country. The risk maps will be used for generation of contingency plans to be used for preparedness planning of earthquake hazards

3.6 Tsunami

The Bangladesh Meteorological Department (BMD) is the responsible agency for the tsunami hazards. At present, there are no provisions or facilities available within the country for tsunami hazard detection. Primarily, tsunami advisory or warning information is available through Pacific Tsunami Warning Center (PTWC) and Japan Meteorological Agency (JMA) by Global Telecommunication System (GTS), fax and email. BMD disseminate the information accordingly through Cyclone Preparedness Program (CPP) (i.e. Emergency HF/VHF radio bulletins issues from BMD through a community volunteer network) and other important government agencies through phone and fax. Disaster Management Information Center (DMIC) is designed to disseminate information and sharing among disaster management agencies and communities for tsunamis.



Figure 3-9. End-to-end tsunami detection, warning and preparedness process (Source: US IOTWS: 2008).

Two pieces of information are very crucial to detect the tsunami hazard: those are seismic and tidal data information with a minimal delay. In Bangladesh, one seismic station working in the north western part and GOB is in process of implementing a project for the establishment of three new earthquake monitoring stations. All the tidal data are available through GTS. A quick and accurate decision making process for tsunami hazard is still lacking in Bangladesh and which needs to be strengthened with adequate technical expertise in the future.

The figure 3-9 provides a diagrammatic overview of the “end-to-end tsunami” detection, warning and preparedness process. This process is built on NOAA’s DART system and is developing through the Indian Ocean Tsunami Warning Systems (IOTWS) process in the Indian Ocean region where Bangladesh is also a national stakeholder.

3.7 Flash Flood

At this point, the flash flood prediction particularly in the northeastern districts in Bangladesh is predicted using the river water level and rainfall estimation. However, often this approach adopted by the FFWC and BWDB gives a very short lead time. Particularly, this threatens the *boro* crop harvesting session in the northeastern part of the country.

However, there is an experimental and developmental approach now underway by the ADPC Regional Multi-hazard Early Warning Center in Thailand where the latest ECMWF derived climatological data are used to provide prediction on the flash flood situation in the northern Bangladesh.

Extensively high computational methods are applied for this experimental development of flash flood early warning system in Bangladesh. The method has a great potential for future institutionalization and proactive incorporation into the national and regional system.

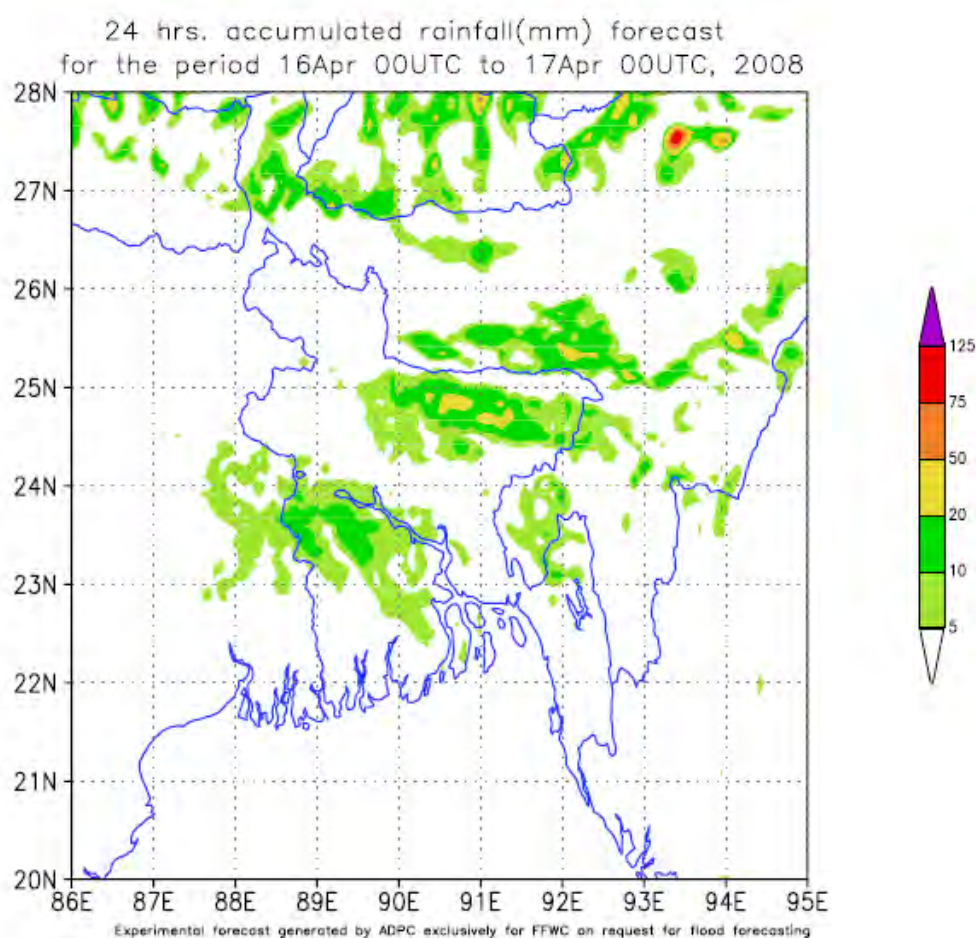


Figure 3-10. ADPC experimental forecasting of the flash flood situation in the northern part of Bangladesh (Source: ADPC, EWC)

3.8 Drought

Drought and drought intensity in Bangladesh are characterized primarily based on moisture retention capacity of the soil and infiltration. No major numerical prediction of drought is present in Bangladesh at the moment. However, in terms of climatological and agro-meteorological forecast for 7 days, 10 days, monthly and three months BMD provides some forecasting information and disseminate those to the Ministry of Agriculture, Department of Agricultural Extension (DAE) and Food and Agricultural Organization (FAO). It gives indication of rainfall predication and possibility of continued low/insignificant rainfall.

BARC along with CEGIS in past few years, have developed a drought assessment model called Drought Assessment or DRAS in short. The DRAS model was piloted in various selected sites with BARC and DAE in various agro ecological zones. This model has a good potential to be mainstreamed in the national drought situation prediction system in future. A conceptual framework of the DRAS model is shown in the figure below.

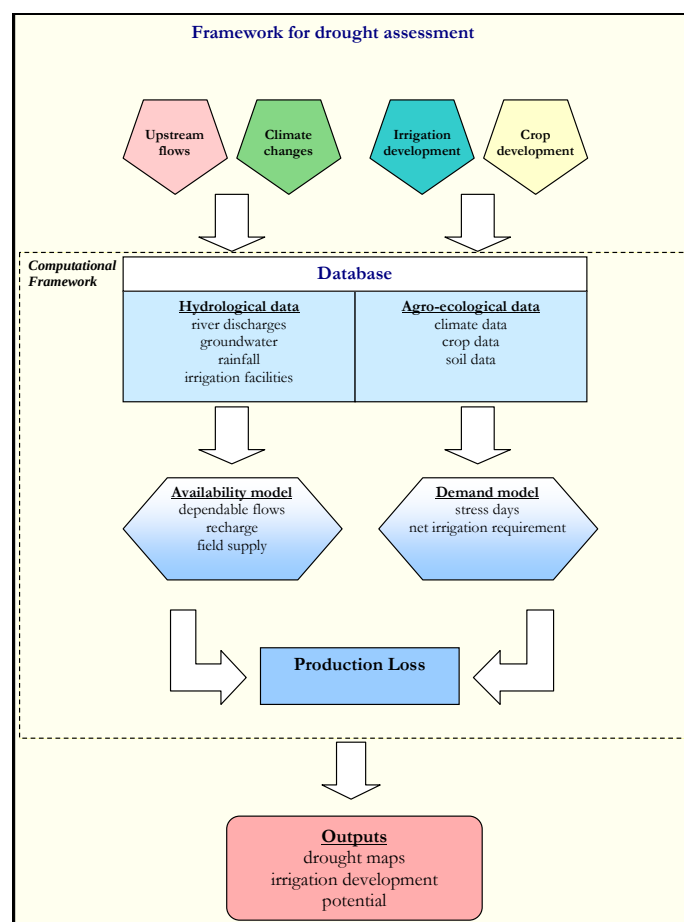


Figure 3-11. Conceptual framework of DRAS model (CEGIS: 2001)

3.9 Climate change trend

The present thrust of the Disaster Management Information Network development is to cover extreme climatic events such as flood, cyclone and storm surges, drought, earthquake etc. It is revealed from the Disaster Management Information Centre (DMIC) Need Assessment Report that different stakeholders need information beyond extreme events for preparedness to deal with disasters. At the same time, CDMP has also recognized need to address climate change as one of the elements of disaster management.

Considering the above, the DMIN project team proposing to include disaster related to climate change and bring it as part of Disaster Management Information Network. It will equip the DMIN with additional resource to prepare different stakeholders to deal with long-term aspect of disasters.

It is revealed from the scientific assessment and projections also that future trend of climate change and changes in frequency and intensity of natural disasters particularly floods (riverine and flash flood), cyclone and storm surges, and droughts are linked. Considering this link in mind, this section on climate change trend focuses on different approaches and models those are being used in Bangladesh to predict future trend of climate and climate change.

CDMP has already developed the Climate Change Database under it's sub-Programme 4: Research Information Management Component 4(B): Establishing an Integrated Approach to Climate Change Risk Management at National and Local Levels and in particular under the Climate Change Cell. Climate change cell has already started compiling the climate change induced disaster related information in their newly developed Climate Change Database. This initiative needs essential linkages and particularly in introducing Climate Forecasting Applications which are essentially linked up with the early warning information provider such as BMD, SPARSO and FFWC. DMIN can also be gradually linked up with the national and sub-national network through the central DMIN portal. However, the details modalities on incorporation or the climate change related information on can be developed at later with a more focused discussion and initiative.

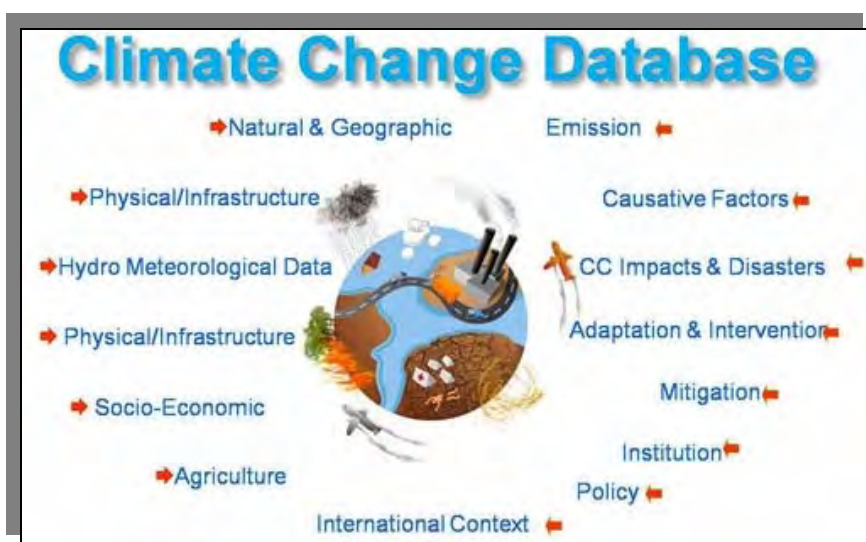


Figure 3-12. Climate Change Database of Bangladesh (Source: Climate Change Cell, 2008)

4. Analysis of Institutional Links and Gaps

4.1 Methods of the analysis

The present chapter provides a review of the existing status, links and gaps of the disaster management information system from an institutional and technical perspective. Various levels of early warning system setup in the country are looked at from hazard specific approach as well as from a comparative point of view of multi-hazard perspective in the context. The issues that are taken into analysis, in this chapter, are as follows:

- Inter-linkages from source and destination;
- Auditing of existing links and gaps;
- Analysis of information sources;
- Information content description;
- Information quality assessment; and
- Timing and frequency.

The above information is analyzed from a multiple source of information including secondary sources, agency discussions and field findings from two districts and so forth. In the field visits, discussions were carried out with various levels from district level and down to village level representatives through a Rapid Rural Appraisal (RRA) method. Following checklist was administered to collect information in a qualitative mode.

RRA Checklist for local level reconnaissance
Generic background information about the area ▪ Hazard composition of the area ▪ Damage profile Early warning dissemination and communication mechanism ▪ Early warning information access and receptivity ▪ From whom they receive warning information (source) and who they send to? ▪ Warning communication mode ▪ Who are the local level warning and information dissemination agents? ▪ Early warning information/message type and contents ▪ Understanding of the early warning information ▪ Early warning lead-time and information need Early warning response capacity (of the local institutions) ▪ Institutional set-up for early warning (structure, operations, problems, suggestions) ▪ Institutional roles and responsibilities on response ▪ Human, technical and financial capacity Cross-cutting issues and recommendations ▪ Women's perception, role and responsibilities ▪ Local perceptions /traditional knowledge on early warning ▪ Recommendations for strengthening existing links and gaps

4.2 *Inter-linkages from Source and destination*

Sources of information for disaster management vary on the basis of respective nature of hazards. Different organizations deal with different hazards. In previous Chapter, the primary source agencies of disaster information and their respective early warning process and products are described with respect to specific hazards.

From the analysis of the early warning institutional setup in the country, it was found that institutional entities are engaged both at vertical layers as well as horizontal scales. This horizontal and vertical setup of existing hazard based early warning systems in the country can be clearly portrayed in the Figure 4-1.

The inter-linkages of the agencies and the three layers of central to local level and the linkages of community level entities are shown in the following diagram. The diagram (figure 4-1) also shows the three different cross sections of formal institutions, operational entities and voluntary entities in a sequential manner. The following diagram was produced on the basis of empirical institutional setup observed from source to destination of the disaster management information setup existing in Bangladesh.

Central/national level

In Figure 4-1, we can see that in the vertical formation there are various layers of agencies are involved with the early warning system. At the top it the major early warning source agencies are functional. Two such main source agencies are: Bangladesh Metrological Department (BMD), and FFWC of BWDB. At national level BMD generates information on cyclone warning. FFWC at national level also provides flood related risk information. FFWC also receives some information on specific parameters from BMD and SPARRSO as well. FFWC at national level is responsible for all different kind of floods in Bangladesh. Such as riverine flood, flash flood in the northern part of Bangladesh, tidal flood in coastal areas and also for urban floods in the cities and secondary cities. However, effective systems for all kind of flood forecasting is yet to develop at an advanced level while riverine flood system has developed quite at a good level. Other national research institutes are also helping government such as IWM, BARC, CEGIS, SPARRSO and others. This set of agencies, that are operating primarily from the central level are often identified as the “*central/national level agencies*”.

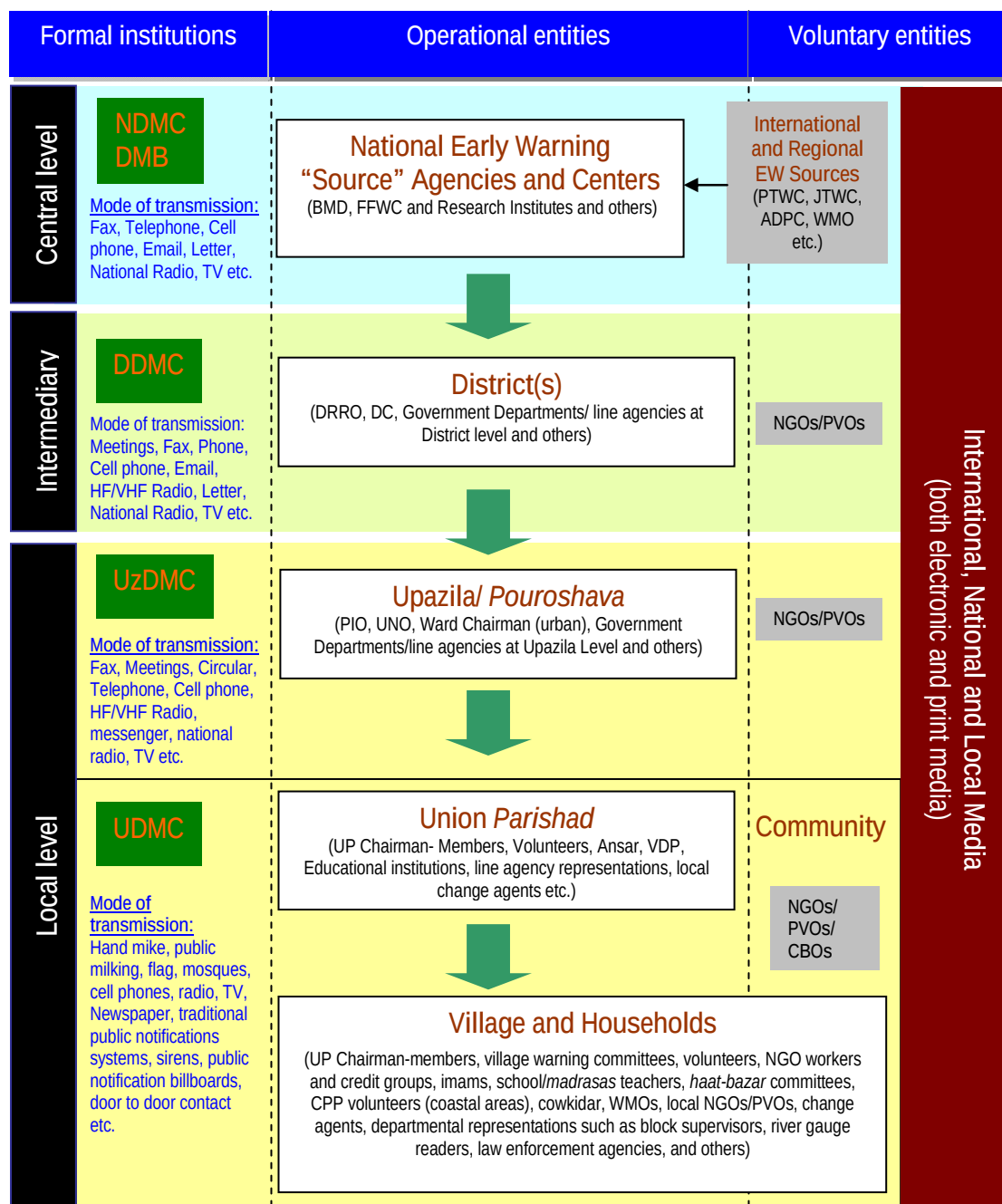


Figure 4-1. Various level of agencies observed in the link between sources to destination (Source: ADPC-BCAS: 2008).

International and regional sources

However, some “*International and regional sources*” are also contributing such as Asian Disaster Preparedness Center, JMA, SMRC, Indian Meteorological Department, Nepal Hydrology Department, China Bureau of Hydrology, NOAA, Pacific Tsunami Warning Center, JTWC, TSR and so forth. These are also contributing through central level agencies but are actually regional information providers.

Intermediary level

In the early warning dissemination and forecasting the “*intermediary level*” also play a significant role in relaying the information down to a local level. In between source and community, there are many organizations both government and non-government

organization use the information in playing roles for disaster management based on their mandates or voluntary basis. The district level can be identified as the intermediary level entity in the overall early warning system information flow route in Bangladesh.

Local level

The ultimate destination of information in Disaster Management Information Network is the vulnerable community or end users. The early warning information goes from the intermediary level to the local level. It was observed that at operation and also at a voluntary level Upazila, Union and the community level including the village and households combinedly comprise of the “*local level*”.

Gaps in the existing linkage

Particularly during the field interactions it was found that although the overall links are there for dissemination of early warning information up to ground level but there **are several layers of gaps existing** in the practical setting. These gaps are creating information communication delay, lack of action; ambiguity of the prioritization of action, confusions and isolation of the households in some cases.

At household level various culturally **suitable and effective modalities** of risk communication and information dissemination is missing. In some cases, the technological lags are there, but in many cases although there are some modalities and communication technologies such as cell phone, loud speakers are there, but these are never involved systematically or endowed for risk communication prior the event.

It was found, however, wherever some projects or initiatives were undertaken some sort of mobilization and awareness towards risk communication is there. Particularly, in the coastal areas a good example of cyclone early warning system is evident through the CPP and BDRC volunteers at ground level. A conscious attempt should be taken centrally to identify the better practices and innovative identification of hazard specific community early warning systems in a gradual manner. Under the DMIN initiative some of these improved practices can be further acknowledged and piloted for further efficacy.

At local and community level, although there are some good examples existing but the sustainability of these methods for local disaster information sharing modalities are under stark challenge both on financial and technical ground. Some of the recommendations that emerged from the field discussions are reported in the recommendation section of the report. **Sustainability** of the disaster management information networks and technologies below the upazila level is a major challenge and in this challenge a well concerted action and planning is needed combining the efforts of government agencies, NGOs in the ground, civil society entities, local government and the community level change agents. Setting up an adequate institutional framework for such initiative is also an essential step to consider.

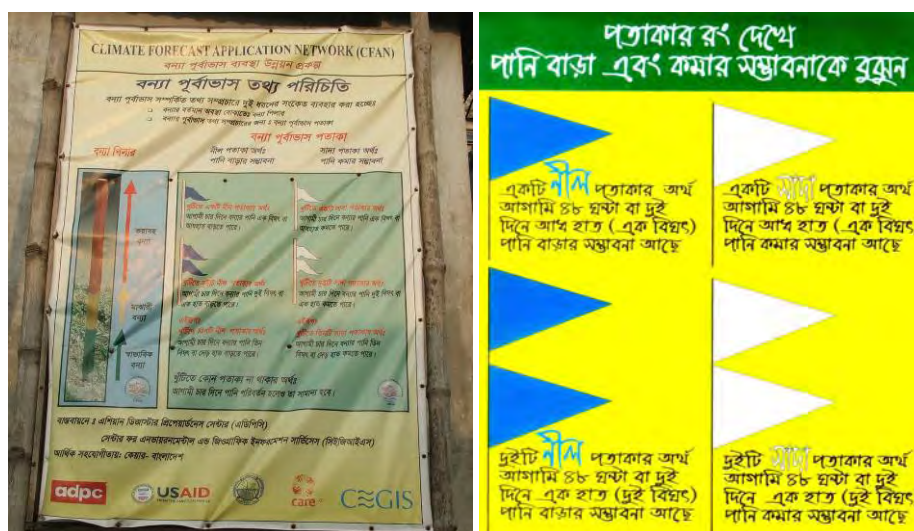
Inter-linkages and flow of information

Besides the generic institutional setup, there are existences of hazard specific institutional functioning in the country. A schematic diagram of some major hazards are shown (figure-4-2) to depict a hazard specific disaster information flow and its institutional setup in a sequential manner.

Case 1: flood information flow from source to destination

For the flood related hazard information, FFWC of BWDB operates as a central agency and they takes input from various research institution nationally and internationally to increase their accuracy and lead-time for flood forecasting. Agencies as SPARSO, BMD, G-Tech,

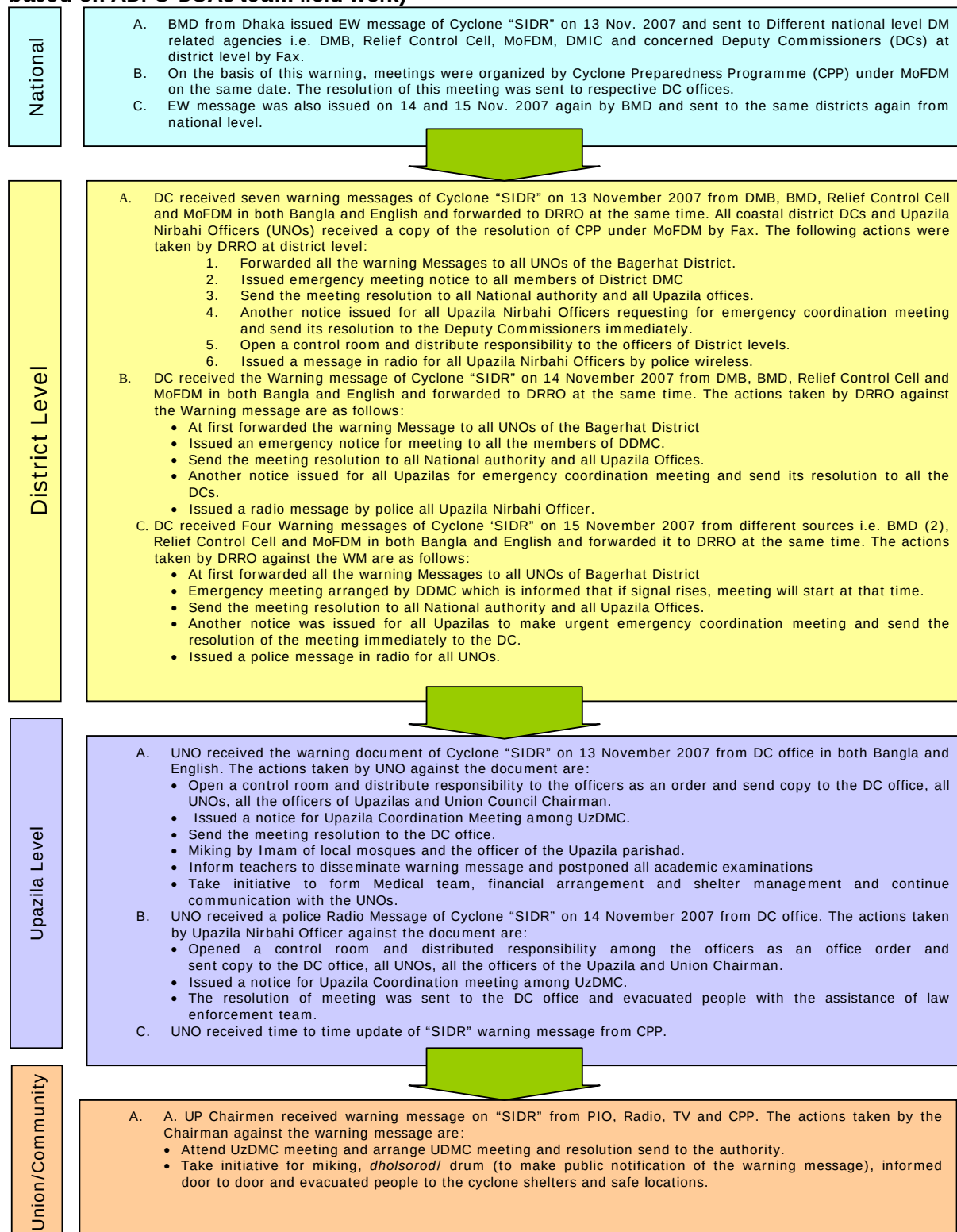
ADPC and others provide them assistance in increasing their lead-time of warning. From central level FFWC provides warning and flood forecasting products to the district level offices of District commissioners and BWDB executive engineers through various modes including fax and email. In pilot areas on a project testing basis with RTI and CEGIS CFIS initiative they also provide SMS based warning communications. However, the CFIS is still in its testing phase and the CFAB project which is now helping FFWC to develop lead time is under research and development stage. At district level BWDB Executive Engineer's division office (district based usually) coordinates with other departments and works with the district administration or DRRO closely in operation. At Upazilla level, flood information goes through the UNO offices and PIO was found to be the lead person who organizes the activities at UNO office to circulate the flood information to the UzDMC members and local government representatives through meeting resolution, quick letters or through mobile phone systems. At down to union level in the community UP members and chairman plays a central role in rolling the message out to the local agents, volunteers, traditional leaders, teachers and a host of destination points. The warning messages then reach to the farmers and community households from local mode of communications. At village level often the flag systems are also used. Particularly under the CFAB pilot areas the flag systems are adopted as a local notification system.



Case 2: information flow during cyclone SIDR (November, 2007)

In case of documenting the linkages of Cyclone related early warning information an empirical case was recorded from the field. The recent case of cyclone SIDR early warning was looked at from source to destination. The following diagram can depict the each level of information flow of SIDR early warning and the respective actions taken in each level.

Figure 4-2. A case study on the Early warning information flow during cyclone SIDR (source: based on ADPC-BCAS team field work)



Case 3. River erosion map and information demonstration at local level

In the river erosion prone areas in Sirajgonj district BWDB with CEGIS was found in process of developing a local level erosion prediction method. At locale level under this river erosion prediction initiative localized river erosion vulnerability maps were found demonstrated in the union parishad, UNO offices and at local level public places. These products are found to be understood to a significant level by the local communities, particularly by the local government representatives. In the field, it was observed that these area wise demarcation of vulnerable zones are tried out using flags in the most vulnerable areas. The local government representatives along with the BWDB local officials are found in charge of managing these flags and the dissemination of information among the local communities for preparedness and voluntary resettlements. However, there are ample of score remaining to take this pilot based erosion information to a greater scale. At this point, under the JMREMP project of BWDB this is developing in its own pace.



Local level early warning dissemination and communication mechanism

From the field interactions it was prominent that people and institutions have differential level of early warning information access. The routes they receive these information often vary significantly as well. During the reconnaissance visits in the flood prone areas it was found that down to districts level the early warning information flows through a formal channel. In the **district** headquarter, the district relief and rehabilitation officer (DRRO) receives the warning and information from two major sources. First, DRRO receives the information directly from the national level from disaster management bureau. In case of flood, the flood information also comes from the Flood forecasting warning center based in Dhaka. They receive a bulletin from them where river level water height is mentioned. It was observed that during the flood situation DRRO also call up the districts offices of Bangladesh Water Development Board where they also monitor and record of local level river gauges and water level. In case of criticality, DRRO informs the districts collector (DC), the head of administration of at districts level for coordination meetings and issues immediate letters to Upazila Administration as well as the line agencies in the districts.

At the **Upazila** level, the early warning information is received from district level and UNO the upazila administrative head with the support from a project implementation officer (PIO) calls emergency coordination meeting and informs the local government elected representatives along with a pre-set coordination committee for disaster management in the Upazila. Letters are issued from the UNO office to the local governments and other important sources. For a sample of such letter please refer to the annex 10. For sectoral groups also information often comes from national headquarters in the form of office order and in many cases as letters from higher authorities. Such an office order is shown in the Annex-11. However, in all these channels the formal mode of communication remains as the prime modalities of information flow and dissemination and formal disaster management committees are formed but found functioning in a relative efficacy at local level. It was found that the technical and financial capacity of the upazila level early warning information dissemination is also low as they (at the point of observation) was not sufficiently endowed with financial support for widespread information dissemination or with technical communication hardware to reach to all the

sections of upazilas. At present, most of the upazilas have fax and telephone systems which they rely on for receiving faxes from national and district level.

Down to upazila level at **union and community**, the elected chairman and members of the respective union parishad are found the major connections between the communities and the formal early warning groups operating under the upazila administration. It was found that the local government representatives through their own local networks try to disseminate the disaster information to the local communities. Local elites, groups and civil societies also try to support the elected representatives. However, this system was found "highly informal" and clear institutional gap of early warning system is persisting at ground level. Disaster communication and information flow needs to be systematized for this level and a "accountability based" risk information sharing should be set up. **The local level NGOs could be an important collaborating partners with the formal DMCs and local government entities.** As the national NGOs have a linkages with their MFI target groups at ground level, these MFI can also be linked up in an innovative way for future systematization of the process. This issue might require further investigation and piloting prior institutionalization. It was also found from the ground level that a host of agents are operating at community level for information sharing to the households but any organized method or modality is actually missing. Various local agents such as teachers, religious leaders, mosques, *hat-bazar* (i.e. market) committees, voluntary groups, youth clubs, telephone/cell service providers/outlets are there but no mechanism to involve them and use for disaster communication and dissemination is actually persisting at ground level.

In all the spheres, however, it was found that **no round the clock (24X7) system** is actually present at ground level for warning and dissemination. In most of the cases, the information is delayed upto the next day time for any concrete action on the ground. This leads to a automatic loss of time. For sudden onslaught hazards this could be a major problem and needs to be addressed carefully. In the CPP operated cyclone prone areas it was observed that the system is a bit improved and due to existence of the CCP and BDRC encouraged voluntary system people are more aware and more used to respond to the early warning systems. On the other hand, in the riverine areas people often take "wait and watch" approach and rely on their own sources of information and observation of the river water heights. However, even in the CPP covered coastal areas it was observed the communication technology and hardwares they are using is aging with volunteers and the maintenance of the necessary risk communication equipments are often a problem as well. **Awareness and risk knowledge** building programs and events on early warning information sharing is a clear need at ground level. Participation of women and other vulnerable groups in the process is crucial and specific modalities for inclusion is missing and a need for development.



Understanding of early warning message contents are also found to be a bit problem for the communities. During reconnaissance many people from the flood prone are pointed out that the danger level for flooding is not always the correct connotation for the local floods. The danger level for rivers and the local areas often vary quite significantly. Similarly, in the coastal areas people talked about coming up with a simple mode of cyclone early warning rather than a ten step warning code available at present.

Inter-linkages information flow from various sources found at local levels a synoptic overview of what is received at what level, from whom people receive that information, what was the transmission mode, who do they transmit further and which mode are briefly discussed in the following Table.

Table 4-1. Local level early warning information transmission in a pilot area.

Level s	Institution	Question relating to EW information	Responses
District	DRRO	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. BWDB, DMB, CDMP, Radio, TV, Newspaper, Local Knowledge
		3. What is the transmission mode?	3. Fax, Radio, TV, Newspaper, E-mail
		4. Who they give it to?	4. Disseminate to UNO office, NGOs, PIO office, Press Club, Donor
		5. How do they transmit?	5. By telephone and fax
	BWDB	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. FFWC
		3. What is the transmission mode?	3. Fax, Telephone, Telex, Radio, TV, Internet
		4. Who they give it to?	4. Disseminate to UNO office, NGOs, UNO, Press Club, Donor, Development agency
		5. How do they transmit?	5. By telephone and fax
	DLO	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. DRRO
		3. What is the transmission mode?	3. Fax, Post, Physically
		4. Who they give it to?	4. Disseminate to Upazila Livestock office
		5. How do they transmit?	5. By telephone and fax
	DAE	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. Own, Radio, TV, Newspaper
		3. What is the transmission mode?	3. Fax, Telephone, Telex, Radio, TV, Newspaper
		4. Who they give it to?	4. Disseminate to Upazila DAE office
		5. How do they transmit?	5. By telephone and Orally
	ADC	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. BWDB, DMB, CDMP, Radio, TV, Newspaper, Local Knowledge
		3. What is the transmission mode?	3. Fax, Telephone, Telex, Radio, TV, Newspaper
		4. Who they give it to?	4. Disseminate to UNO office, NGOs, PIO office, Press Club, Donor
		5. How do they transmit?	5. By telephone and fax
	NDP (NGO)	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. Radio, TV, Newspaper, own worker
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to their field office
		5. How do they transmit?	5. By own workers
	GKS (NGO)	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. Radio, TV, Newspaper, own worker
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to their field office

Level s	Institutio n	Question relating to EW information	Responses
		5. How do they transmit?	5. By own workers
Upazila	PIO	1. What do they get?	1. Early warning messages
		2. From whom they get?	2. DC, DRRO, Radio, TV, Newspaper, community member
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to union chairman
		5. How do they transmit?	5. By own workers, own self, Miking
	NDP	1. What do they get?	1. Early warning information
		2. From whom they get?	2. Radio, TV, Newspaper, own worker, PIO
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to their union facilitator
		5. How do they transmit?	5. By own workers
Union	Union Parishad Chairma n and member	1. What do they get?	1. Early warning information
		2. From whom they get?	2. PIO, Radio, TV, Newspaper, community member
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to their UP members and community members
		5. How do they transmit?	5. By local community networks workers and miking
Village	Livelihood group member s	1. What do they get?	1. Early warning information
		2. From whom they get?	2. Radio, TV, Newspaper, NGOs, ,bazar
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to their union facilitator
		5. How do they transmit?	5. By local community workers
	Women	1. What do they get?	1. Early warning information
		2. From whom they get?	2. Radio, TV, Newspaper, community member
		3. What is the transmission mode?	3. Radio, TV, Orally
		4. Who they give it to?	4. Disseminate to community member
		5. How do they transmit?	5. Door to door verbally to neighbors

Source: ADPC-BCAS field visits.

4.3 Auditing of the existing links and gaps

Parallel to this, the team has also developed (see table 4-2) an auditing of the existing links and gaps of various hazard-based early warning systems in Bangladesh. In this analysis following issues were relatively compared:

- EWS source agencies
- EWS availability stage
- Source to destination connectivity (in project areas)
- Information content type transferred to local level
- Community Dissemination mode
- Information/material quality
- Timing/ lead-time of the early warning
- Disaster management/response setup (in pilot areas)

It was found that for the cyclone prediction the main source is BMD. BMD takes input from SPARRSO and other external international and regional agencies such as IMD, TSR, ADPC and so forth. The system has been a long standing one, have redundancy in detection and has relatively most proven source to destination system in the country. CPP and BRCS provide a fantastic role in developing this process. The communication modes are Bulletin, SMS, Fax, Call, Megaphone, Door to Door through volunteers, flag, agency instruction, local government notification, news media and so forth. The lead-time is about 72 hours from the sources.

For riverine floods the source is primarily FFWC of BWDB and they take input from BMD, ADPC, G-Tech and ECMWF. Dissemination at national level is good and in some pilot areas have developed. However, mass level awareness with good lead times is still to achieve. FFWC is in process of developing a lead time from their traditional 72 hours to a 10-day forecasting. For Flash flood there is an experimental method developing through an active collaboration with the Early warning center of ADPC. FFWC is working jointly on this with ADPC. However, for the local level dissemination this is still under development stage.

Similarly for drought, there is a national system developed and still under experimental stage. This needs to be experimented further and there are good scopes of developing some promising models such as DRAS model and can be tagged up usefully with DAE for extension services on a regular manner.

For riverbank erosion, BWDB with CEGIS has developed a model for targeted areas of Jamuna, Padma and Meghna river. This is still in a very experimental stage but has a good potential for future. From the field observation it was found that in the pilot area the vulnerability maps are growing peoples' attention. However, for coastal erosion a model development is in a very experimental stage through the JMREMP project of BWDB.

For earthquake no early warning is available but the micro zonation and contingency planning is underway as preparedness measures for the major cities such as Dhaka, Sylhet and Chittagong. ADPC is facilitating this process to GoB and CDMP. For tsunamis a support project is underway and at present BMD taking input from PTWC is disseminating the PTWC messages in the community. In the 12 September, 2007 last time BMD issued warning with DMB and a large number of people evacuated in the coastal areas.

Among other miscellaneous hazards, for urban fire no scientific methods are available. But Bangladesh fire brigade uses a response service down to upazila levels.

In most of the cases, it was found that except the cyclone warning system (also Tsunami through the same dissemination system) a considerable gap is persisting beyond the upazila level for a timely dissemination of information to the community. At this point, it was found that the official transmission from the central to local/upazila level there has been a formal system but from upazila to union and then to community level the early warning route are not yet formalized thereby there is a operational lack persisting at that level for a wider dissemination of warning systems.

Besides, there has been ambiguity with some warning information systems as well such as the signal system of the cyclone warning, tsunami warning and content messages of the flood warning.

The timeliness and location specificity is also a major issue for the flood warning. At the same time the flash flood warning system has not developed adequately yet.

The information linkages for the major hazards are shown in the figure 4-3 showing how the horizontal and vertical agencies are involved in various hazard early warning systems.

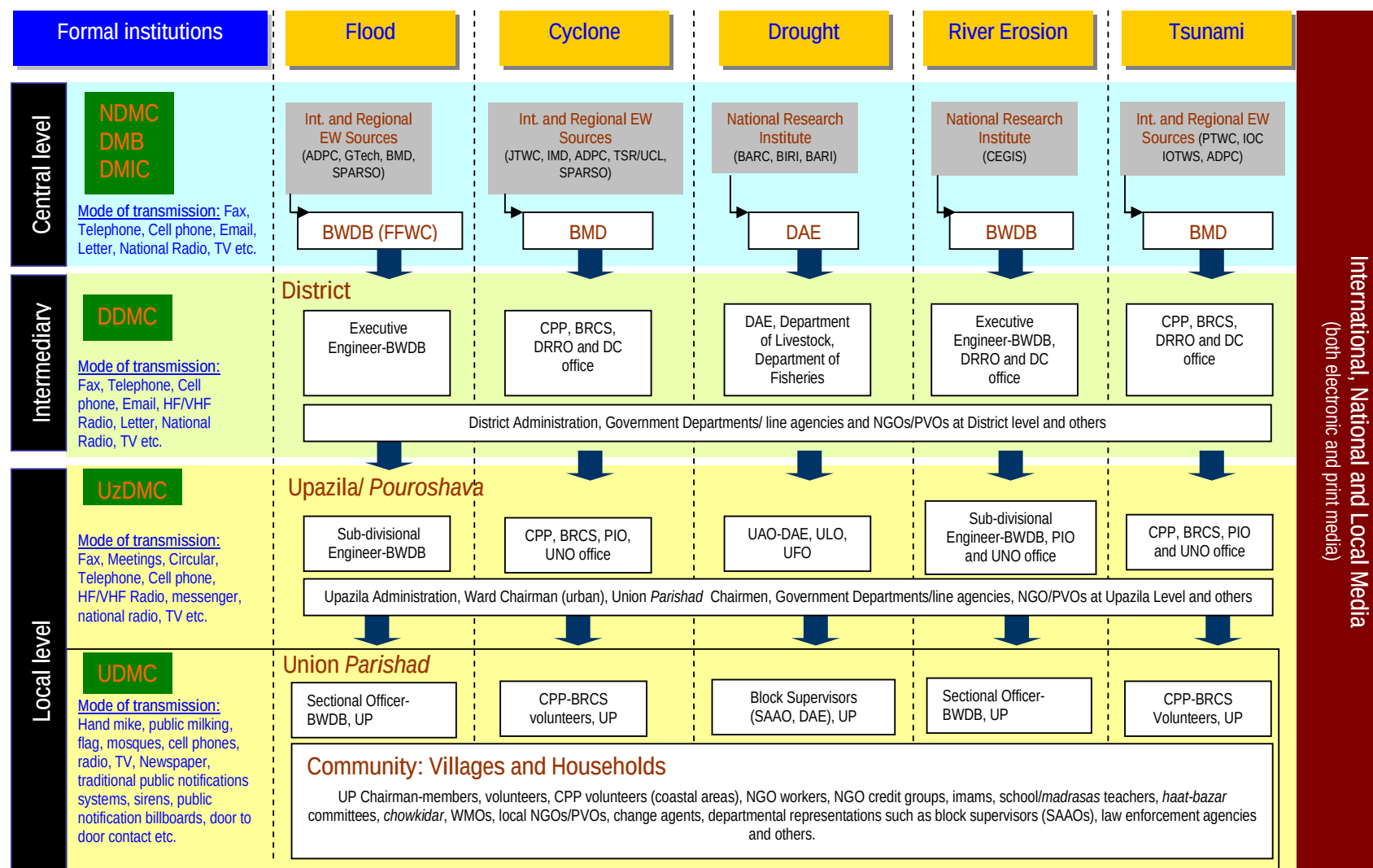
Table 4-2. Auditing matrix of existing links and gaps of various multi-hazards EWS in Bangladesh

	EWS source agencies	EWS availability stage	Source to destination connectivity (in project areas)	Information content type transferred to local level	Community Dissemination mode	Information/ material quality	Timing/ lead-time of the early warning	Disaster management/ response setup (in pilot areas)
Riverine Flood	FFWC (BWDB), CFAB, BMD, SPARRSO, ADPC-GTech, ECMWF	Existing stage	Good	Bulletin, SMS, Fax, Call	Flag, agency instruction, local government notification, news media	Good	2-7 days with improved accuracy	Moderate
Flash Flood	FFWC, IWM, BMD, SPARRSO, ADPC (ECMWF)	Developmental stage	Poor	Bulletin, SMS, Fax, Call	Flag, agency instruction, local government notification, news media	Medium (experimental)	24 hours (Experimental)	Moderate
Cyclone	BMD, SPARRSO, IMD, TSR, ADPC	Long standing, Redundant systems available	Very good	Bulletin, SMS, Fax, Call, Megaphone, Door to Door through volunteers	Flag, agency instruction, local government notification, news media	Very good	Very good. 72 hours	Good
Drought	SRDI, SMRC, DAE, CEGIS (DRAS model)	Experimental stage	Poor	Agricultural departmental notification (DAE, Irrigation etc.)	Official notification	Poor	Not available	Poor
Tsunami	BMD, PTWC, JMA, IOTWS	<u>Regional:</u> existing, <u>National:</u> Developmental	Medium	Bulletin, SMS, Fax, Call, Megaphone, Door to Door through volunteers	Flag, agency instruction, local government notification, news media	Good	Depending on the epicenter. But in general threat of long distant tsunami	Moderate

Earthquake	BUET, SoB, ADPC (ongoing micro-zoning study), USGS	Preparedness and mitigation measures are in developmental stage (micro-zonation underway)	Poor	Micro-zonation mapping, land use planning	Not developed	Not developed	None	Very poor
Riverbank erosion	BWDB-CEGIS, JMREMP	Developmental stage	Poor	Maps, Satellite imagery, BWDB notification	Land zoning and are planning	Good	Seasonal	Moderate (structural measures are often taken by BWDB and local govt.)
Coastal erosion	BWDB-CEGIS, IWM, JMREMP	Experimental stage	Poor	Maps, Satellite imagery, BWDB notification	Land zoning and are planning	Good	Seasonal	Moderate (structural measures are often taken by BWDB and local govt.)
Urban Fire	National Fire Brigade and Services	Non-scientific methods exist	Medium	Phone call, inter-personal communication	Fire brigade services, bells, community response	Simple	Not available	Limited
Climate change trend	UNFCCC, National research institutes	GCM and RCM models existing and local downscaling are underway	Poor	Policy formulation, NAPA, Adaptation project development, mainstreaming exercise	Education and awareness raising	Complicated	Modeling results are available	Up-scaling of adaptation started but way to go.

Source: ADPC expert team analysis.

Figure 4-3. Multi-hazard EWS Information Linkages from “source to destination” by various types of hazards in field trip areas



Source: ADPC-BCAS: 2008 (based on field and outreach experiences)

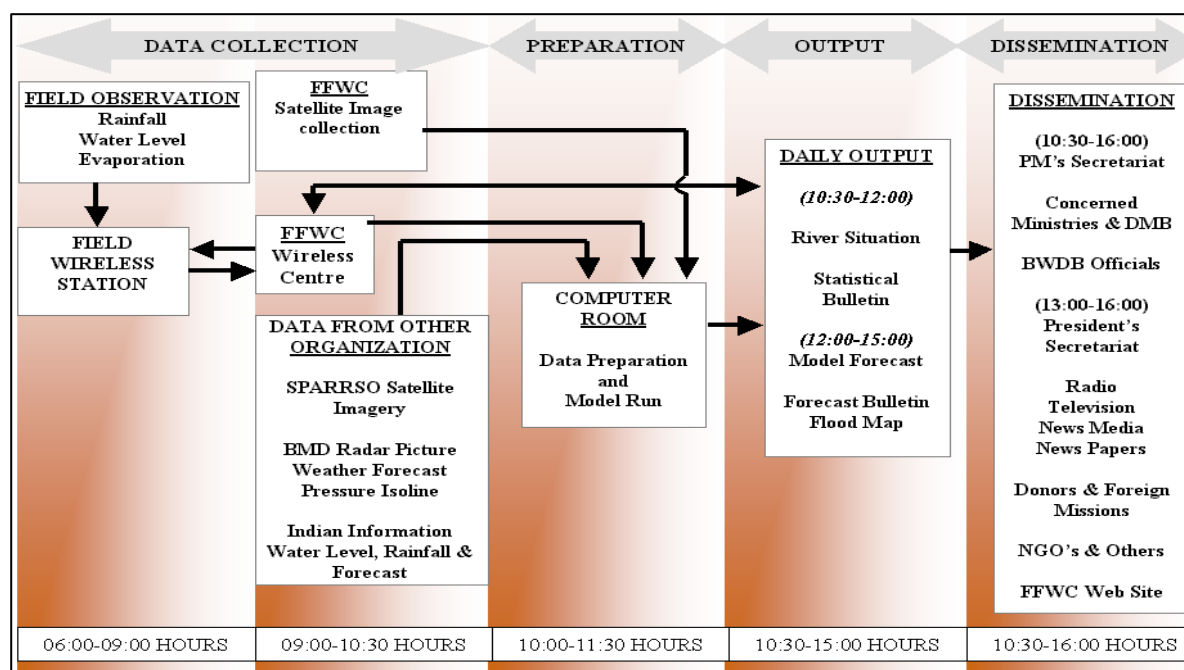


Figure 4-5. FFWC daily activity flow chart (Source: FFWC 2007)

4.4.1 Flood forecasting bulletin and content

A daily bulletin, based on observed data and results of forecast models, is prepared, and distributed by FFWC at around 12:00 noon to various administrative tiers. The detailed daily activity for that information is shown in the figure 4-5.

The bulletin, mostly in tabular form, include the following:

- a cover page showing geographical, environmental settings of Bangladesh and location of all monitoring stations;
- river stage of all monitoring stations with respect to danger level, followed by rise/fall of water level on the respective date;
- rainfall situation for a specific date, followed by monthly normal and cumulative rainfall;
- summary of rainfall and river situation based on major findings;
- 24- and 48-hour forecasts for some important stations affected by shallow, moderate, and severe flooding;
- flood warning messages that display trends of water levels (if close to or exceeds the danger levels, at which flooding becomes a serious threat); and
- a detail statistics on river stage and rainfall for three consecutive days.

Some of the products that FFWC shares through their regular and emergency network (shown in Table 4-3) are shown in the following section:

Table 4-3. Existing Flood Warning Product Dissemination Routes

Dissemination Medium	FFWC Product	Recipient Group
Hard Copy (hand delivered), Fax and Email	Bulletins	Prime Minister's Office, government ministries, BWDB officials, government organizations
Fax and/or Email only	Bulletins	DMB, DMIC-CDMP, NGOs, embassies, international donor and aid organizations, news media

Internet	Bulletins, plots, flood map, Thana status	General public, international
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Output-1. A sample FFWC regular flood bulletin – “River Situation” (2 page bulleting in this respective date)

RIVER SITUATION AS ON 24-04-2008 AT 06:00 HOURS

SL	RIVER	STATION NAME	RHWL (m)	D.L. (m)	W A T E R 23-04-2008	L E V E L 24-04-2008	+ Rise - Fall in cm	Abov D.L in c
BRAHMAPUTRA BASIN								
1	DHARLA	KURIGRAM	27.52	26.50	22.66	22.84	+ 18	
2	TEESTA	DALIA	52.97	52.25	50.50	50.30	-20	
3	TEESTA	KAUNIA	30.52	30.00	26.84	26.85	+ 1	
4	JAMUNESWARI	BADARGANJ	32.92	32.16	27.94	27.93	-1	
5	GHAGOT	GAIBANDHA	22.81	21.70	16.77	16.77	0	
6	KARATOA	CHAKRAHIMPUR	21.41	20.15	15.77	15.77	-1	
7	KARATOA	BOGRA	17.45	16.32	10.84	10.84	0	
8	BRAHMAPUTRA	NOONKHAWA	28.10	27.25	21.80	21.90	+ 10	
9	BRAHMAPUTRA	CHILMARI	25.06	24.00	18.79	18.91	+ 12	
10	JAMUNA	BAHADURABAD	20.62	19.50	14.50	14.54	+ 4	
11	JAMUNA	SERAJGANJ	15.12	13.75	8.31	8.40	+ 9	
12	JAMUNA	ARICHA	10.76	9.40	3.57	3.64	+ 7	
13	OLD BRAHMAPUTRA	JAMALPUR	18.00	17.00	11.33	11.31	-2	
14	OLD BRAHMAPUTRA	MYMENSINGH	13.71	12.50	5.71	5.71	0	
15	BURIGANGA	DHAKA	7.58	6.00	1.51	1.52	+ 1	
16	BALU	DEMRA	7.13	5.75	1.79	1.87	+ 8	
17	LAKHYA	NARAYANGANJ	6.93	5.50	1.85	1.83	-2	
18	TURAG	MIRPUR	8.35	5.94	1.91	1.91	0	
19	TONGI KHAL	TONGI	7.84	6.08	3.11	3.57	+ 46	
20	KALIGANGA	TARAGHAT	10.21	8.38	1.97	1.95	-2	
21	DHALESWARI	REKABI BAZAR	7.66	5.18	1.65	1.63	-2	
22	BANSHI	NAYARHAT	8.39	7.32	1.79	1.78	-1	
GANGES BASIN								
23	KARATOA	PANCHAGARH	72.65	70.75	67.53	67.53	0	
24	PUNARBHABA	DINAJPUR	34.40	33.50	27.96	27.96	0	
25	ICH-JAMUNA	PHULBARI	-	-	25.64	25.63	-1	
26	MOHANANDA	ROHANPUR	23.83	22.00	12.34	12.32	-2	
27	MOHANANDA	CHAPAI-NAWABGANJ	23.01	21.00	12.10	12.09	-1	
28	LITTLE JAMUNA	NAOGAON	16.20	15.24	5.27	5.27	0	
29	ATRAI	MOHAMEDPUR	19.89	18.59	12.78	12.78	0	
30	GANGES	PANKHA	24.14	21.50	14.21	14.22	+ 1	
31	GANGES	RAJSHAHI	20.00	18.50	8.30	8.55	+ 25	
32	GANGES	HARDINGE BRIDGE	15.19	14.25	5.40	5.66	+ 26	
33	PADMA	GOALUNDO	10.21	8.50	3.02	3.06	+ 4	
34	PADMA	BHAGYAKUL	7.58	6.00	2.12	2.17	+ 5	
35	GORAI	GORAI RLY BRIDGE	13.65	12.75	4.32	4.32	0	
36	KUMAR	PARIDPUR	8.76	7.50	1.11	1.10	-1	

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SL	RIVER	STATION NAME	RHWL (m)	D.L. (m)	W A T E R 23-04-2008	L E V E L 24-04-2008	+ Rise - Fall in cm	Above D.L. in cm
MEGHNA BASIN								
37	SURMA	KANAIGHAT	15.26	13.20	5.04	4.98	-6	
38	SURMA	SYLHET	12.44	11.25	3.65	3.45	-20	
39	SURMA	SUNAMGANJ	9.75	8.25	3.35	3.20	-15	
40	KUSHIYARA	AMALSHID	18.28	15.85	6.70	6.61	-9	
41	KUSHIYARA	SHMOLA	14.46	13.50	5.24	5.13	-11	
42	MANU	MANU RLY BR.	20.42	18.00	13.68	13.67	-1	
43	MANU	MOULVI BASAR	13.25	11.75	6.38	6.38	0	
44	KHOWAI	HABIGANJ	11.93	9.50	6.12	6.09	-3	
45	BHUGAI	NAKUAGAON	26.01	25.00	19.50	19.51	+ 1	
46	SOMESWARI	DURGAPUR	15.20	13.00	10.73	10.71	-2	
47	KANGSHA	JARIAJANJAIL	13.37	9.75	5.10	5.01	-9	
48	MEGHNA	BHAIRAB BASAR	7.66	6.25	2.08	2.06	-2	
49	GUMTI	COMILLA	13.56	11.75	6.99	6.82	-17	
50	GUMTI	DEBIDGAR	-	-	3.03	2.54	-49	
51	MEGHNA	*CHANDPUR L.W.L.	-	4.00	1.00**	0.95**	-5	
		*CHANDPUR H.W.L.	5.35	-	1.85***	1.80***	-5	
SOUTH EASTERN HILL BASIN								
52	MUHURI	PARSHURAM	16.33	13.00	9.87	9.85	-2	
53	HALDA	NARAYAN HAT	18.05	15.25	11.90	11.90	0	
54	HALDA	PANCHPURI	11.55	9.50	3.35	3.37	+ 2	
55	SANGU	BANDARBAN	20.38	15.25	4.80	4.80	0	
56	MATAMUHURI	LAMA	15.46	12.25	6.32	6.32	0	
57	FENI	RAMGARH	21.42	17.37	12.48	12.48	0	

NOTE: WATER LEVEL AT STATION ABOVE DANGER LEVEL UNDERLINED.
- DATA NOT AVAILABLE

L.W.L.: Lowest Water Level.

RHWL: Recorded Highest Water Level.

D.L.: Danger Level.

* : Tidal Station

** : Low Water Level of the Previous Day

*** : High Water Level of the Previous Day

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BWDB, DHAKA.

Danger level:

Danger level at a river location is the level above which it is likely that the flood may cause damages to nearby crops and homesteads. In a river having no embankment, danger level is about annual average flood level. In an embanked river, danger level is fixed slightly below design flood level of the embankment.

Output-2. A sample FFWC regular flood bulletin – “Rainfall Situation” (2 page bulleting in this respective date).

RAINFALL SITUATION AS ON 24-04-2008 (IN MM)

SL NO	STATION	MAXIMUM FOR APRIL	NORMAL FOR APRIL	RAINFALL FOR 2008			TOTAL UPTODATE (UPTO 24-04-2008)
				22-04	23-04	24-04	
BRAHMAPUTRA BASIN							
1	KURIGRAM	282.5	119.2	0.0	0.0	0.0	88.8
2	DALIA	242.4	102.1	0.0	0.0	0.0	30.0
3	KAUNIA	332.5	113.3	0.0	0.0	0.0	93.0
4	RANGPUR	189.9	164.8	0.0	0.0	0.0	49.8
5	CHILMARI	315.5	116.8	0.0	0.0	0.0	73.5
6	DEWANGANJ	434.3	129.0	0.0	0.0	0.0	23.0
7	GAIBANDHA	0.0	101.7	0.0	0.0	0.0	0.0
8	SERAJGANJ	314.8	110.9	0.0	0.0	0.0	30.0
9	BOGRA	242.6	89.4	0.0	0.0	0.0	8.5
10	JAMALPUR	345.8	116.4	0.0	0.0	0.0	38.5
11	MYMENSINGH	346.2	145.3	0.0	0.0	0.0	28.7
12	DHAKA	318.0	159.1	0.0	0.0	0.0	76.3
13	TANGAIL	267.7	112.7	0.0	0.0	0.0	11.7
GANGES BASIN							
14	PANCHAGARH	172.8	68.6	0.0	-	0.0	50.2
15	DINAJPUR	188.5	69.9	0.0	0.0	0.0	15.7
16	PAUNA	-	76.0	0.0	0.0	-	9.0
17	NAOGAON	378.5	69.9	0.0	-	0.0	20.3
18	MOHADDEBPUR	-	-	0.0	0.0	0.0	0.0
19	KUSHTIA	250.8	83.0	0.0	0.0	0.0	23.1
20	RAJSHAHI	227.2	59.3	0.0	0.0	0.0	25.0
21	ROHANPUR	-	-	-	-	-	0.0
22	C. NAWABGANJ	-	-	0.0	0.0	0.0	41.9
23	JESSORE	329.9	82.7	0.0	0.0	0.0	29.5
24	KHULNA	276.0	87.2	0.0	0.0	-	13.0
25	SATKHIRA	326.3	93.0	0.0	0.0	0.0	94.2
26	FARIDPUR	483.1	517.7	0.0	0.0	0.0	32.5
27	MADARIPUR	0.0	0.0	-	-	-	0.0
28	BARISAL	311.5	105.0	0.0	0.0	-	1.0
29	PATUAKHALI	306.7	109.8	0.0	0.0	0.0	2.0
30	BARGUNA	-	-	0.0	0.0	0.0	32.2
MEGHNA BASIN							
31	KANAIGHAT	1096.0	457.0	0.0	0.0	0.0	131.0
32	SYLHET	928.9	386.5	0.0	0.0	0.0	142.0
33	SUNAMGANJ	0.0	287.0	0.0	0.0	0.0	225.0
34	SHWOLA	994.7	403.7	0.0	0.0	0.0	158.0
35	MOULVI BAZAR	0.0	263.0	0.0	0.0	0.0	10.0
36	MANU RLY BR	0.0	262.8	0.0	0.0	0.0	20.0
37	HABIGANJ	0.0	228.2	0.0	0.0	0.0	14.1
38	SHERPUR	-	-	0.0	0.0	0.0	46.0
39	DURGAPUR	0.0	160.0	0.0	0.0	0.0	75.9
40	LORERGAH	-	-	0.0	0.0	0.0	173.0
41	NAKUAGAON	-	-	0.0	0.0	0.0	27.0
42	JARIAJANJAIL	-	-	0.0	0.0	0.0	38.0
43	BHAIRAB BAZAR	388.8	167.7	0.0	0.0	0.0	28.0
44	COMILLA	571.3	182.5	0.0	0.0	0.0	23.7
45	CHANDPUR	0.0	144.7	0.0	0.0	0.0	2.0

cont/2

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SL NO	STATION	MAXIMUM FOR APRIL	NORMAL FOR APRIL	RAINFALL FOR 2008			TOTAL UPTO DATE (UPTO 24-04-2008)
				22-04	23-04	24-04	
SOUTH EASTERN HILL BASIN							
46	PARSHURAM	561.9	166.9	0.0	0.0	0.0	34.3
47	NARAYANHAT	172.8	68.6	0.0	0.0	0.0	2.0
48	NOAKHALI	0.0	156.0	0.0	0.0	0.0	2.0
49	PANCHPUKURIA	0.0	147.0	0.0	0.0	0.0	0.0
50	BANDARBAN	786.0	161.7	0.0	0.0	0.0	0.0
51	RANGAMATI	0.0	119.0	0.0	0.0	0.0	0.0
52	LAMA	0.0	109.0	0.0	0.0	-	0.0
53	CHITTAGONG	0.0	152.0	0.0	0.0	0.0	0.0
54	RANGARH	0.0	119.0	0.0	0.0	-	15.0
55	COX'S BAZAR	0.0	81.0	0.0	0.0	0.0	0.0
56	TEKNAP	-	-	0.0	-	-	-

NOTE: RAINFALL AT STATIONS ABOVE 50 MM UNDERLINED.
- DATA NOT AVAILABLE

In General, 50 mm or above rainfall in one day causes stress on local drainage system leading to localised flood.

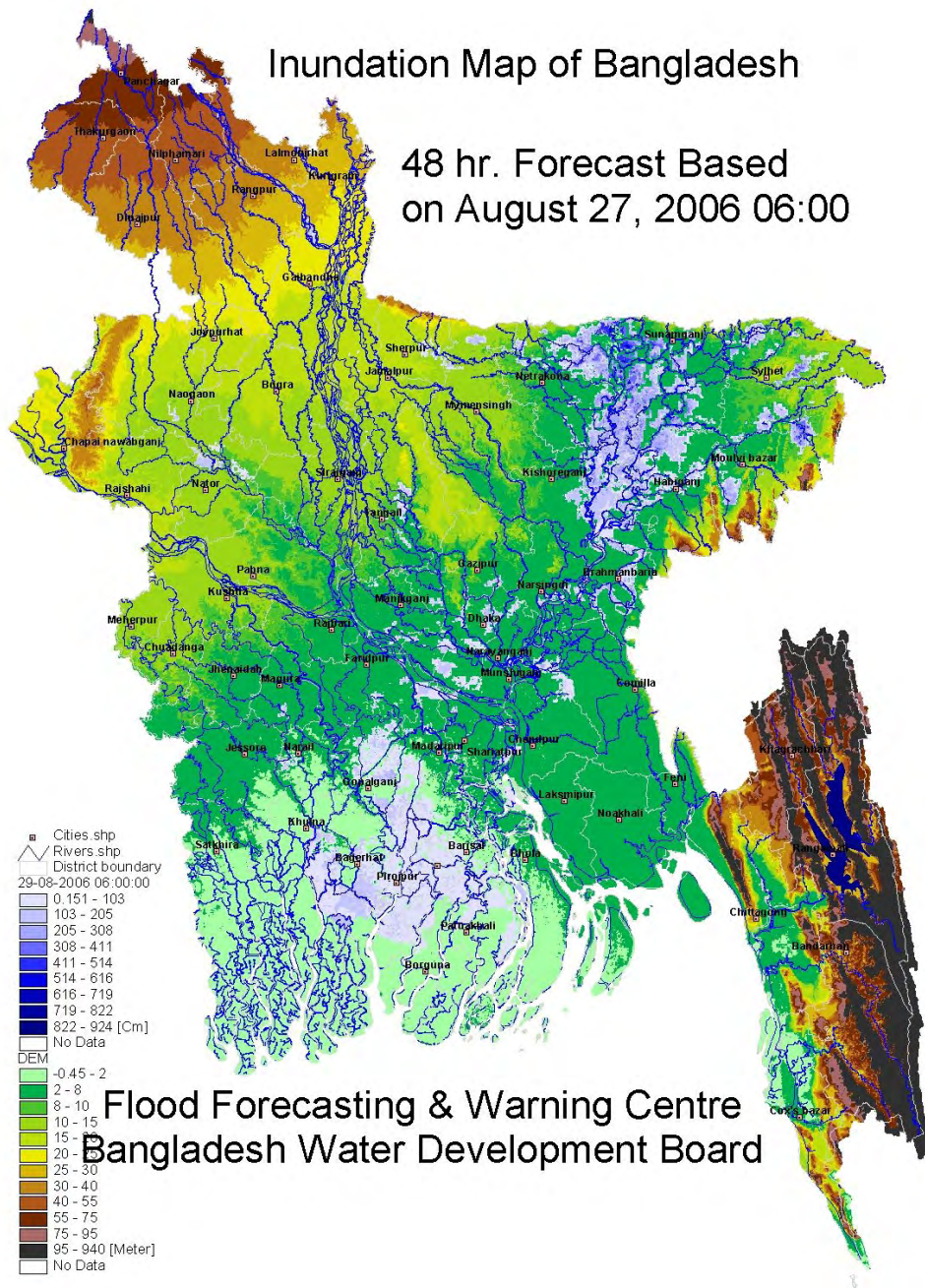
DUTY OFFICER
FLOOD INFORMATION CENTER
BWDB, DHAKA

300 mm or more rainfall in consecutive 10 days impedes the drainage and likely to cause rain-fed flood in the area.

Output-3. Is a 10-day Water Level Forecasts on the Major Rivers of Bangladesh. This is an additional forecasting beyond the traditional 24-48-72 hours and comes from the CFAB-FFS Model using Climate Forecast Applications in Bangladesh (CFAB) prediction data.

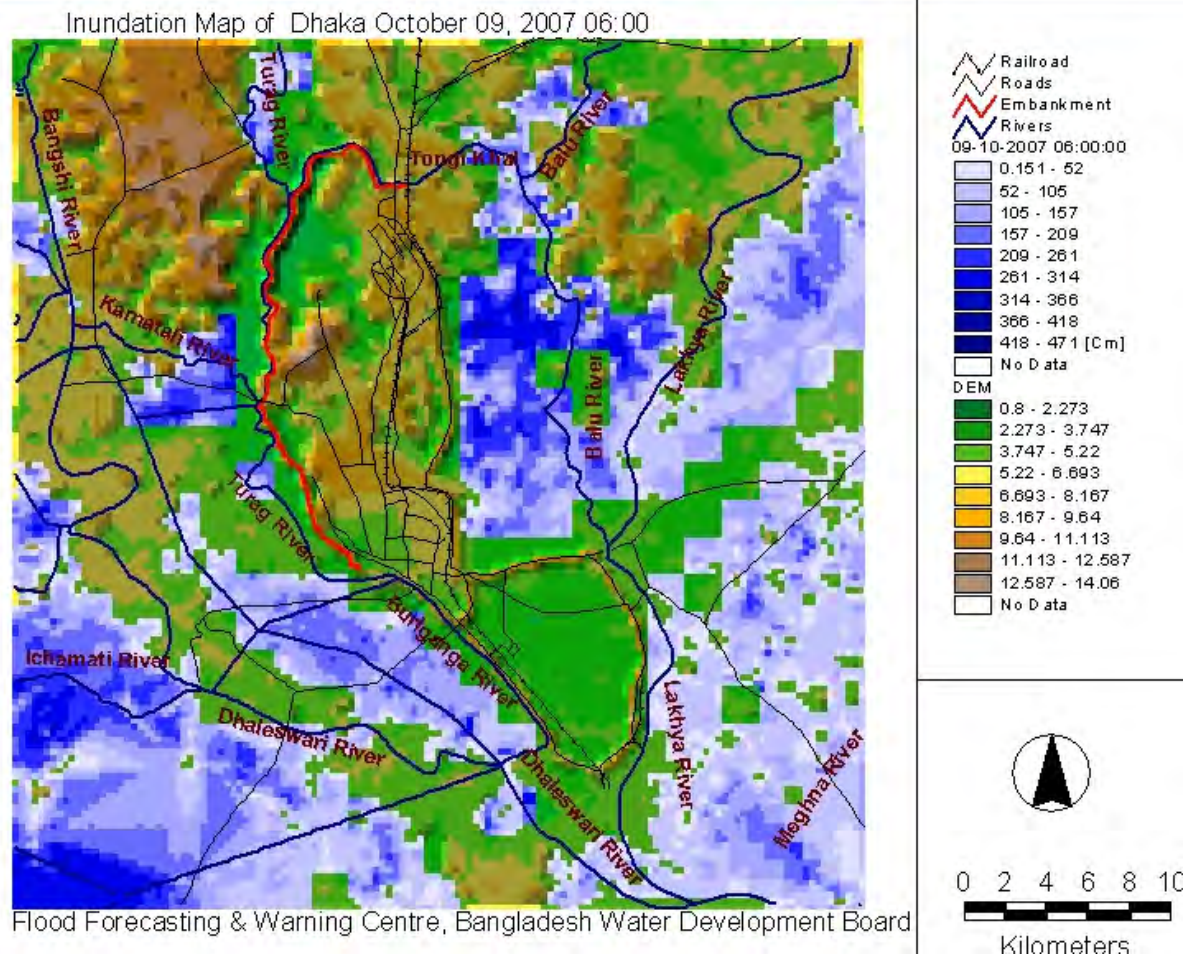
Forecast made on: 24-06-2007													
			today	1-day	2-day	3-day	4-day	5-day	6-day	7-day	8-day	9-day	10-day
			fore-	fore-	fore-	fore-	fore-	fore-	fore-	fore-	fore-	fore-	fore-
			cast	cast	cast	cast	cast	cast	cast	cast	cast	cast	cast
Water Level in [m]			24-06	25-06	26-06	27-06	28-06	29-06	30-06	01-07	02-07	03-07	04-07
River	Station	D.L	0600	0600	0600	0600	0600	0600	0600	0600	0600	0600	0600
Jamuna	Serajganj	13.75	13.50	13.57	13.67	13.85	13.95	13.90	13.93	13.92	13.65	13.52	13.63
				13.50	13.38	13.30	13.28	13.23	12.99	12.91	12.82	12.72	12.69
				13.55	13.54	13.60	13.77	13.74	13.50	13.40	13.24	13.10	13.15
													Mean
Jamuna	Aricha	9.40	8.52	8.57	8.53	8.76	9.02	9.02	9.01	9.08	8.95	8.80	8.83
				8.55	8.41	8.42	8.41	8.35	8.24	8.14	8.09	8.05	8.07
				8.56	8.48	8.58	8.71	8.73	8.59	8.48	8.40	8.34	8.39
													Mean
Tongi Khal	Tongi	6.08	4.83	4.95	5.06	5.16	5.26	5.38	5.48	5.57	5.66	5.73	5.78
				4.95	5.06	5.15	5.22	5.29	5.35	5.40	5.45	5.49	5.53
				4.95	5.06	5.15	5.24	5.33	5.41	5.49	5.54	5.59	5.64
													Mean
Turag	Mirpur	5.94	4.57	4.71	4.82	4.90	5.04	5.17	5.27	5.36	5.44	5.50	5.53
				4.71	4.81	4.87	4.95	5.00	5.06	5.10	5.14	5.18	5.22
				4.71	4.81	4.89	4.99	5.08	5.16	5.22	5.27	5.31	5.34
													Mean
Buriganga	Dhaka	6.00	4.18	4.33	4.42	4.51	4.67	4.80	4.90	4.98	5.06	5.11	5.13
				4.33	4.41	4.47	4.55	4.60	4.65	4.68	4.72	4.77	4.81
				4.33	4.42	4.49	4.61	4.70	4.77	4.82	4.86	4.91	4.94
													Mean
Balu	Demra	5.03	4.52	4.63	4.74	4.85	4.95	5.06	5.18	5.28	5.37	5.45	5.52
				4.63	4.74	4.84	4.93	5.01	5.09	5.16	5.22	5.28	5.33
				4.63	4.74	4.85	4.94	5.03	5.13	5.21	5.28	5.35	5.40
													Mean

Output-4. A sample of Inundation map is based on the 48 hours forecasting.



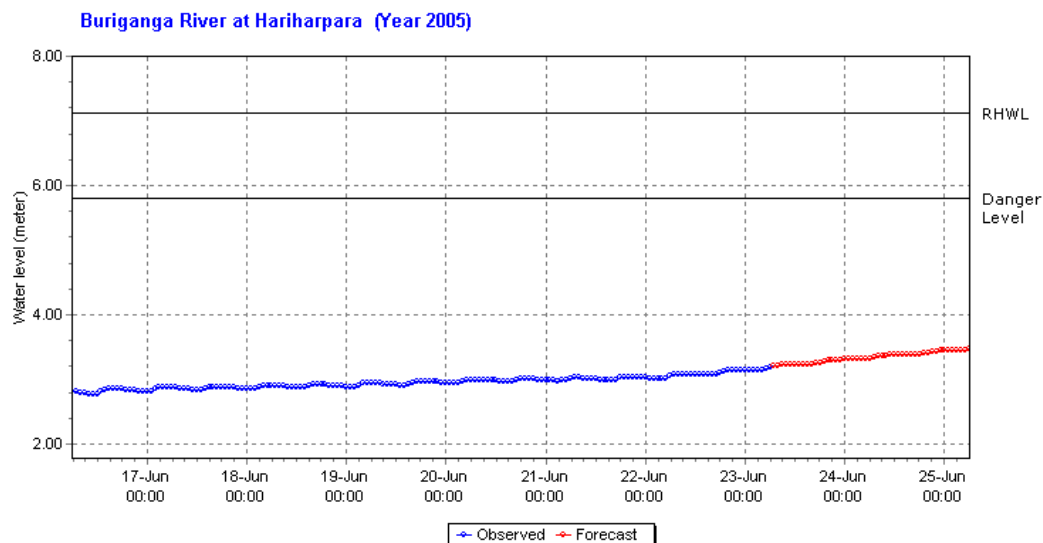
Source: FFWC, May 2008.

Output-5. A sample of urban inundation map (for Dhaka city in this case) produced by FFWC and based on their flood forecasting data.



Source: FFWC, May 2008.

Output-6. A sample of a hydrograph that FFWC shares on the observed and predicted water level of the respective rivers.



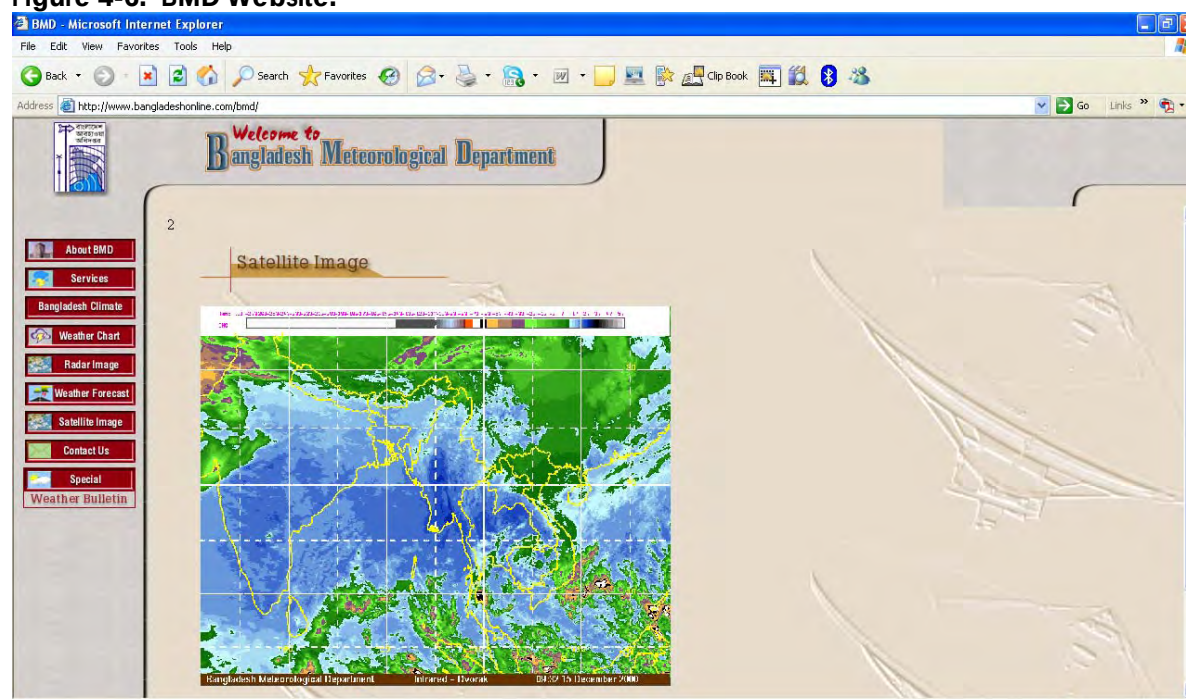
Source: FFWC, May 2008.

4.5 Bangladesh Meteorological Department (BMD)

Different types of information for early warning issued by BMD are tropical cyclone warning, Nor'wester warning, heavy rainfall warning, squall warning, heat wave warning, cold wave warning and fog warning. BMD produces most of the information for early warning dissemination.

The Bangladesh Meteorological Department, under the ministry of Defense is the main data source of cyclone, heavy rainfall, squall, heat wave, cold wave. This institution collects data through its own radar observation stations, Microwave and VSAT link. Then they firstly generate or disseminate data FFWC and then president's office and prime minister's office and then electronic media, print media, different organizations, ports, air force, Navy and Army along with MoFDM and finally they disseminate to other ministries, GOs, NGOs and related interested party including media through the DMB and government channels.

Figure 4-6. BMD Website.



Source: <http://www.bangladeshonline.com/bmd/>

BMD is using 35 source observation stations, 10 pilot balloons, 12 Agromet, 4 radar station observatories. Recently the BMD has set up 4 seismic observatories for earthquake related data collection and monitoring. But observatories among of that 4 is not in operation. Only one Chittagong observatory station is in operation.

To provide weather forecasts for public, farmers, mariners and aviators on routine basis and also to issue warning for severe weather phenomena such as tropical cyclones, Tornados, nor wasters, heavy rainfall heat and cold waves warnings. The BMD exchange meteorological data, forecasts and warnings to meet national and international requirements. This institution also provides meteorological data, radar echoes and satellite imageries and weather forecast for flood and storm warning centre at Dhaka and Rajshahi divisions. There are geophysical and metrological centre at Chittagong, Sylhet, Barishal and Khulna divisions.

Global Telecommunication system is being used for data information speed only 2400 bps only where normally broad band internet speed is now running on 240 kbps. Daily weather forecast products are being delivered to the media and around over 22 line agencies, ministries and departments.

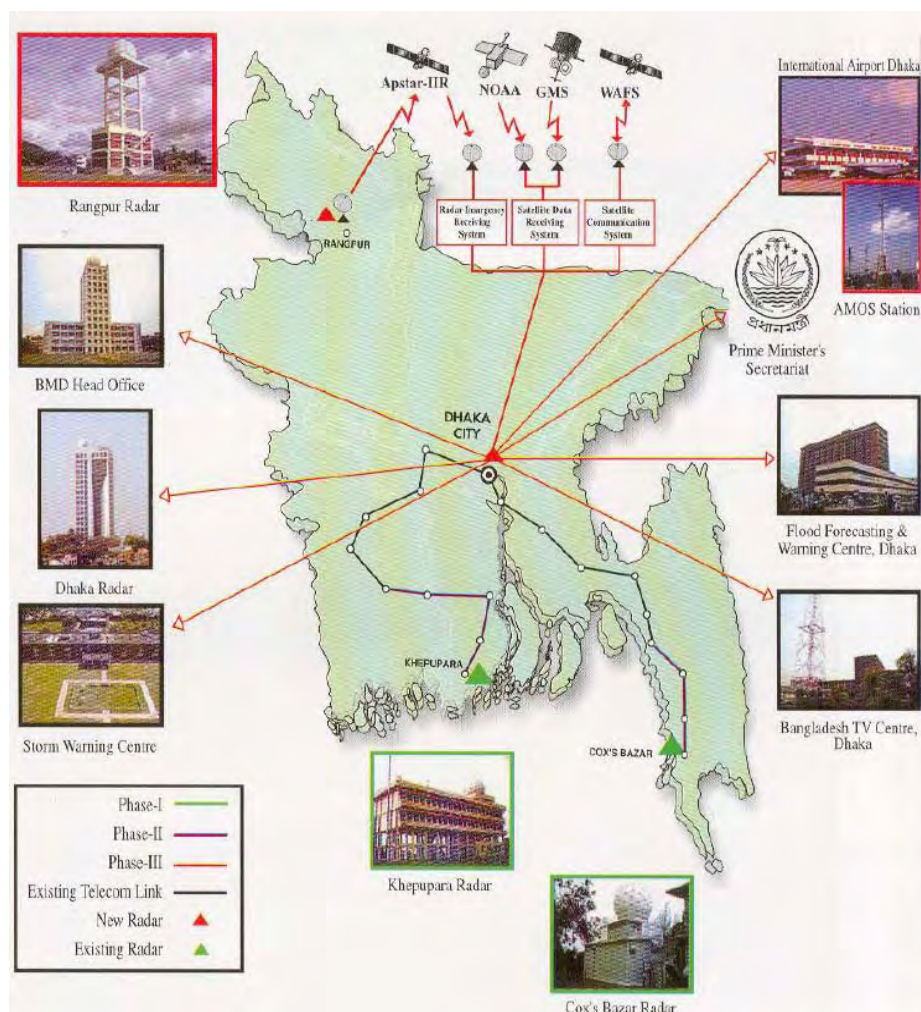


Figure 4-7. BMD network in the country (Source: BMD: 2007)

4.5.1 Cyclone information contents and bulletin

Various types of information take place in the content of cyclone early warning information. The types of information generally included in the content are:

- Severity
- Wind speed within the cyclone
- Speed of the cyclone
- Direction
- Distance from the coast
- Signal
- Possible areas to be inundated by tides and surges

Early warning system of cyclone is much developed compare to other hazards. This is due to frequent experiences of cyclone over the last few decades. This warnings are easy understandable to the coastal community. Yet, some problems have been observed in this system. Sometime, community does not relay on the warning they receive. Through the early

warning, the community has to make realize that the warning is able to protect their lives and resources. Some information regarding awareness and importance of warning are needed to include in the warning content.

SPECIAL WEATHER BULLETIN (November 14, 2007 at 0830)

THE SEVERE CYCLONIC STORM "SIDR" (ECP 968 HPA) WITH A CORE OF HURRICANE WINDS OVER EAST CENTRAL BAY AND ADJOINING SOUTH EAST BAY MOVED SLIGHTLY NORTHWARDS AND NOW LIES OVER EAST CENTRAL BAY AND ADJOINING AREA WAS CENTERED AT 06 AM TODAY (NOVEMBER 14, 2007) ABOUT 960 KMS SOUTH-SOUTHWEST OF CHITTAGONG PORT, 880 KMS SOUTH-SOUTHWEST OF COX'S BAZAR PORT AND 925 KMS SOUTH OF MONGLA PORT (NEAR LAT 14.0° N & LONG 89.2° E). IT IS LIKELY TO INTENSIFY FURTHER AND MOVE IN A NORTHLY DIRECTION.

MAXIMUM SUSTAINED WIND SPEED WITHIN 74 KMS OF THE STORM CENTER IS ABOUT 165 KPH RISING TO 185 KPH IN GUSTS /SQUALLS. SEA WILL REMAIN VERY HIGH.

MARITIME PORTS OF CHITTAGONG, COX'S BAZAR AND MONGLA HAVE BEEN ADVISED TO KEEP HOISTED WARNING SIGNAL NUMBER FOUR (R) FOUR.

ALL FISHING BOATS AND TRAWLERS OVER NORTH BAY HAVE BEEN ADVISED TO REMAIN IN SHELTER TILL FURTHER NOTICE.

[Source: Bangladesh Meteorological Department – BMD]

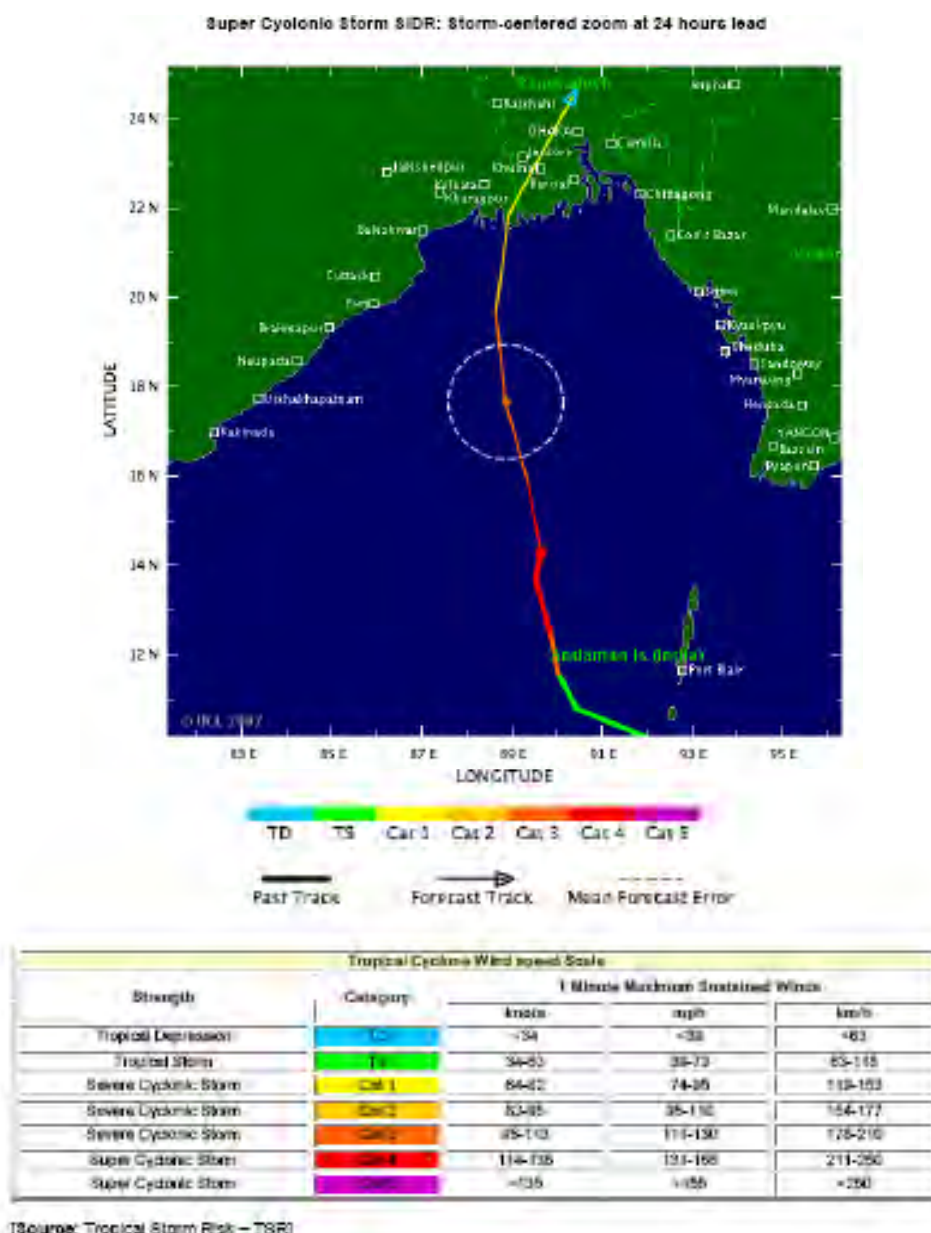


Figure 4-8. Cyclone bulletin contents

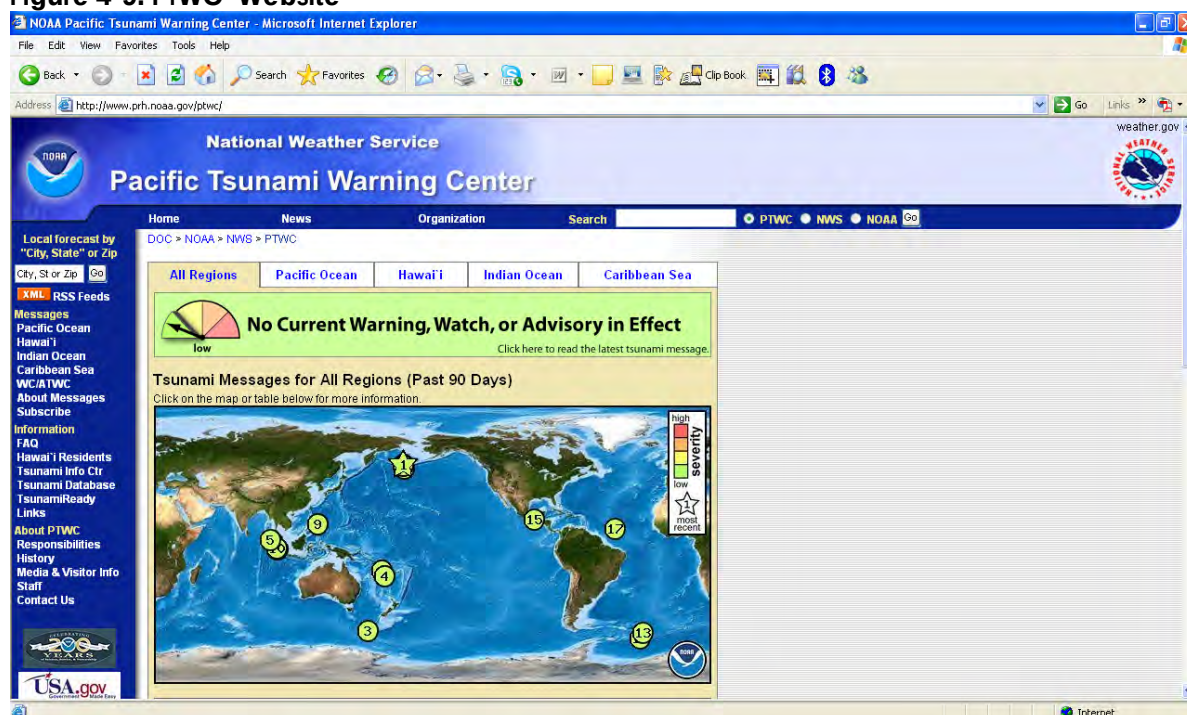
Various types of other bulletins circulated by BMD both in Bangla and English from the central headquarters are placed in the annex 1-7 for detailed information. BMD produces information bulletin on a daily, monthly, seasonal and for the severe weather or special cases and circulates to a specific set of target group pre-defined to the hazard occurrences.

4.6 Pacific Tsunami Warning Center (PTWC)

For generating the tsunami warning and information for Indian Ocean countries including Bangladesh, at the moment, the Hawaii based “Pacific Tsunami Warning Center (PTWC)” of NOAA plays the key role. The UNESCO-IOC driven Indian Ocean Tsunami Warning Systems (IOTWS) is now working in six different groups to develop a tsunami warning system for the Indian Ocean Region. In near future, PTWC will transfer their responsibility to a regional watch provider and that will be providing tsunami information to the regional countries. ADPC is a strong candidate for this role of regional watch provider in Indian Ocean region.

At present, Bangladesh along with other Indian Ocean countries receive tsunami warning bulletin and other relevant information from PTWC to directly to BMD and DMB. BMD takes the national responsibility to generate warning for the country through the execution and authorization from DMB and MoFDM. BMD in Bangladesh also receives further advisory messages from Japan Meteorological Agency (JMA) for further validation and so forth.

Figure 4-9. PTWC Website



Source: <http://www.prh.noaa.gov/ptwc/>

4.6.1 Tsunami information bulletin and content

The tsunami bulletin from PTWC comes from a very simple bulletin format (see figure 4-11). The tsunami bulletin messages can come up with four different types of messages which are explained below:

- **Tsunami Warning:** issued when a potential tsunami with significant widespread inundation is imminent or expected. Warnings alert citizens that widespread, dangerous coastal flooding accompanied by powerful currents is possible and may continue for

several hours after arrival of the initial wave. Warnings also alert emergency management officials to take action for the entire tsunami hazard zone. Initial warnings are normally based only on seismic information.

- **Tsunami Watch:** issued to alert emergency management officials and coastal citizens of an event which may later impact the Watch area. The Watch area may be upgraded to a Warning or Advisory (or canceled) based on updated information and analysis; thus, emergency management officials and coastal citizens should prepare to take action. Watches are normally based on seismic information without confirmation that a destructive tsunami is underway.
- **Tsunami Advisory:** issued due to the threat of a potential tsunami capable of producing strong currents or waves dangerous to those in or near the water. Coastal regions historically prone to damage from tsunami-induced currents are at greatest risk. The threat may continue for several hours after the initial wave arrival, but significant widespread inundation is not expected for areas under an Advisory. Advisories are normally updated to continue the Advisory, expand/contract affected areas, upgrade to a Warning, or cancel the Advisory.
- **Tsunami Information Bulletin/Statement:** issued to inform emergency management officials and coastal citizens that an earthquake has occurred. Normally, Information Statements indicate there is no threat of a destructive tsunami affecting the issuing TWC's Area of Responsibility, thereby preventing unnecessary evacuations. Information Statements may be re-issued with additional information.



Figure 4-10. The graphical view of recent tsunami location and meter used by PTWC website.

In Bangladesh, the national tsunami warning is circulated from BMD in case of tsunami risk occurrence. In September 12, 2007 (the most recent one) earthquake occurrence information leading to a tsunami warning was circulated by BMD in Bangladesh. This was followed by the information received from PTWC and JMA respectively. A sample of that tsunami information is shown in the Figure 4-12. A detailed information bulleting is shown in the annex-3.

TSUNAMI BULLETIN NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1722Z 08 AUG 2007

THIS BULLETIN IS FOR ALL AREAS OF THE INDIAN OCEAN.

... TSUNAMI INFORMATION BULLETIN ...

THIS MESSAGE IS FOR INFORMATION ONLY.

THIS BULLETIN IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1705Z 08 AUG 2007
COORDINATES - 6.2 SOUTH 107.6 EAST
DEPTH - 384 KM
LOCATION - JAWA INDONESIA
MAGNITUDE - 7.5

EVALUATION

A DESTRUCTIVE TSUNAMI WAS NOT GENERATED BASED ON EARTHQUAKE AND HISTORICAL TSUNAMI DATA. THIS EARTHQUAKE IS LOCATED TOO DEEP INSIDE THE EARTH TO GENERATE A TSUNAMI IN THE INDIAN OCEAN.

THIS WILL BE THE ONLY BULLETIN ISSUED BY THE PACIFIC TSUNAMI WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

THE JAPAN METEOROLOGICAL AGENCY MAY ISSUE ADDITIONAL INFORMATION FOR THIS EVENT. IN THE CASE OF CONFLICTING INFORMATION...THE MORE CONSERVATIVE INFORMATION SHOULD BE USED FOR SAFETY.

Figure 4-11. The usual format of the Tsunami Bulletin that is issued by PTWC.



22. BANGLADESH ARMY, FAX: 8754455,8712196
23. REUTERS Fax: 8312976



Government of the People's Republic of Bangladesh
Bangladesh Meteorological Department
Storm warning Centre
Agargaon, Dhaka-1207

Phone: 8113071
FAX: 8118230
E-mail: swcbmd@yahoo.com

Fax Message DATE: 12.09.2007

EARTHQUAKE OCCURRENCE MESSAGE, DATED 12.09.2007

An earthquake occurred on 12 September 2007 at 17 hours 09 minutes 46 Seconds (BST). The distance of the Epicentre was about 3718 kms from Agargaon, Dhaka Seismic Observatory (near southern Sumatra of Indonesia). The magnitude of the earthquake was 8.5 in Richter scale (Great).

Possibility of Tsunami Generation:

It may generate Tsunami wave in the Bay of Bengal of the North Indian Ocean that may reach Bangladesh coast after midnight tonight (early morning of 13 September 2007).

(Md. Rubyet Kabir)
Asst. Meteorologist
For Director
12, 1830 BST

Figure 4-12. September 12, 2007 Earthquake occurrence and tsunami information by BMD.

4.7 Disaster Management Information Center (DMIC)

The Disaster Management Information Centre (DMIC) is planned to facilitate the national disaster early warning related information collection, analysis and dissemination of information for risk reduction and emergency response.

As it is shown in the following diagram (figure 4-12), DMIC is proposed on one hand, as a central hub of the information collection and early warning recipient agency for MoFDM ranging from sources such as BMD, FFWC, CEGIS, IWM, MoFDM and so forth. On the other hand, also a central dissemination Emergency Operation Center for early warning related information collection, analysis and dissemination.

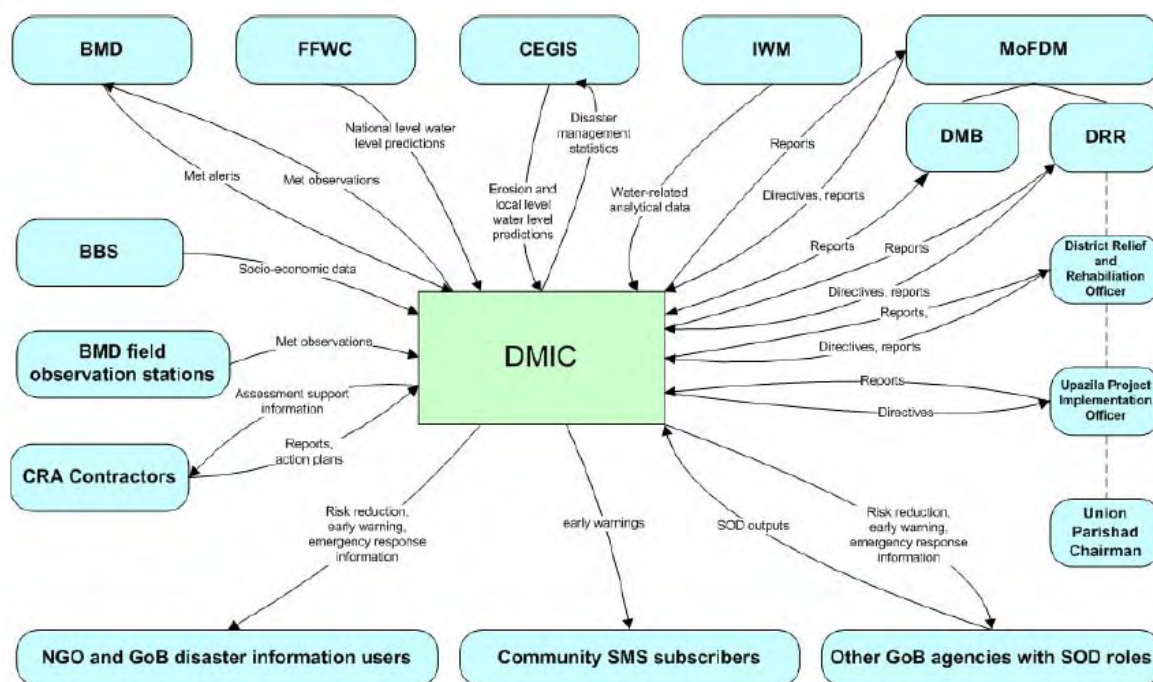


Figure 4-13. DMIN and other sources connectedness as specified in the DMIN portal specification document (Source CDMP: 2006)

The scope of DMIC includes implementation of a communication network to link the system with government agencies and NGOs concerned with disaster management at the regional, national and local levels, and with community members, to support hazard risk reduction, emergency response planning, early warning generation and dissemination, and community education and awareness programmes. The proposed function of the DMIC is outlined in the Table 4-4.

DMIC at this point, started operating as a central information dissemination center from CDMP and providing "situation report" on the major hazards and disaster situation in the country. A sample format of DMIC situation report is shown below.

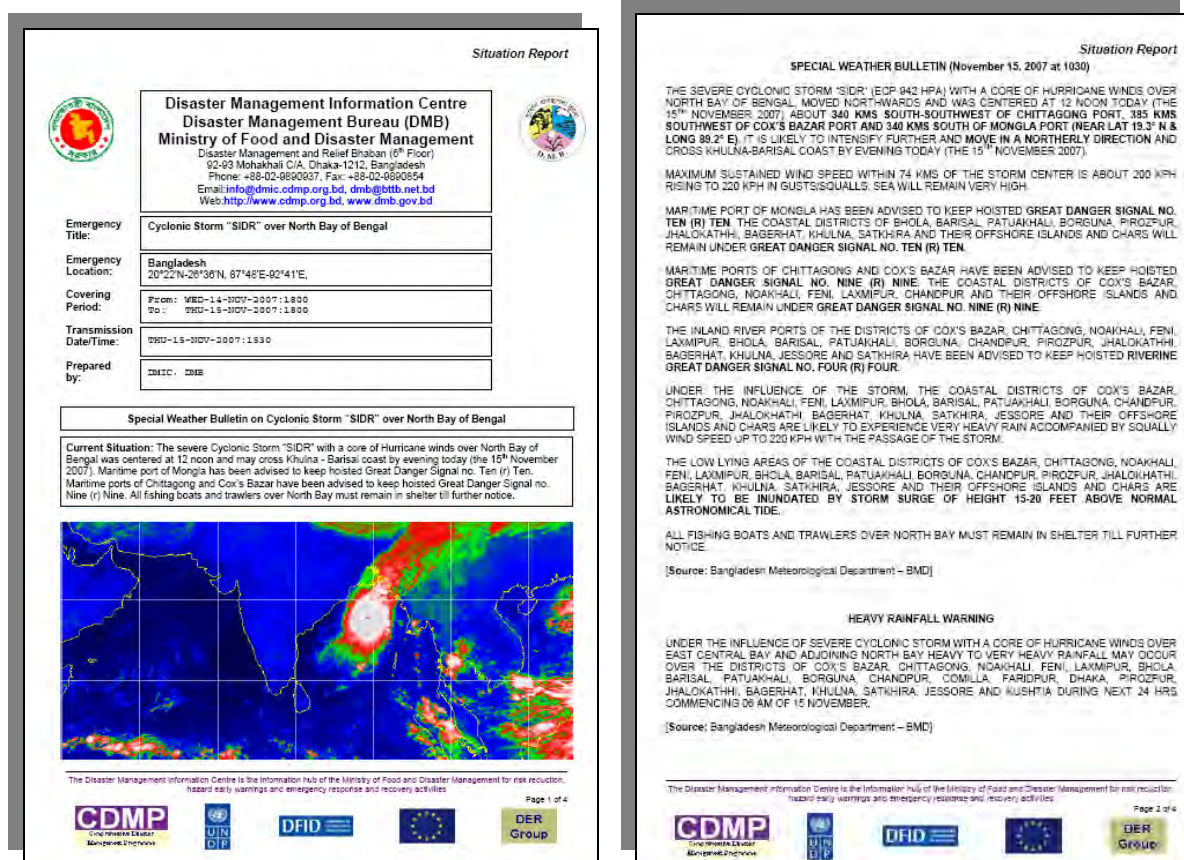


Figure 4-15. Situation Report circulated by DMIC (Source: DMIC: 2007).

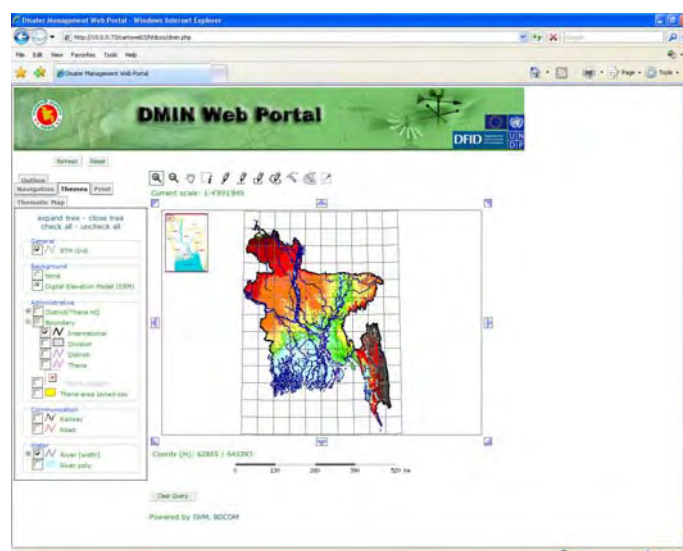


Figure 4-16. A screen shot of the working version of the DMIN web portal.

DMIC is now in process of developing the "DMIN web portal" through its support services from IWM and BDCOM and this platform is envisioned to be a portal where the disaster management information network will be integrated to operate from source to down to household level.

4.8 National news, media and popular sources

In sharing and generating the hazard related information of all kinds including prediction and forecasting or even mobilization related information a big set of sources are available in Bangladesh in the form of news media, electronic media, and some popular sources as well. Various newspapers have remained active for a long time in Bangladesh particularly reporting the damages and rehabilitation related information. However, recent focus on prediction, forecasting related information and foresightedness have been quite popular in media as well. The electronic media remained as a very fast growing sector in Bangladesh in the past decade or so. These sets

of “agency of new kind” remain as a major strength for public mobilization and civil society awareness in the Bangladeshi community.

ইউফাক	প্রথম আলো
জনকণ্ঠ	সূর্য
তোরাথালী ওয়েব	মানবজমিন
জাতিবন্ধু	ইতকিলাত
নয়া দিগন্ত	আমার দেশ
সমকাল	সংবাদ
The Daily Star	The Independent
THE BANGLADESH OBSERVER	NEW AGE
The New Nation	The Financial Express

The civil society driven popular sources initiatives are also quite effective in Bangladesh. The NIRAPAD network, Red Crescent bulleting, DER initiative of WFP and among others who can be shown as demonstrable initiatives.

Situation Report

❖ Flood

01. Food & Job Crisis mounted in flood-hit villages, 24 Sep, 2007
02. Tsunami Alert: Go Safe Place Immediately, 12 Sep, 2007
03. Flood may not be that severe, 11 Sep, 2007
04. 2nd Wave of flooding Doubles the Woes, 9 Sep, 2007
05. Address Schools; Minimize Drop Outs
06. Flood recedes in the up and aggravates in the down - Cry for Food; Fear for Disease
07. Worse still ahead, woes heightens, 2nd August, 2007
08. Worsening flood spreads over 32 districts!!! 30 July 2007
09. Floods Engulf Low Villages Of Several Districts, 22 July 2007
10. Flood situation likely to aggravate further in NE Bangladesh
11. Flood-2007 Situation Report 13 June 2007

Source: <http://nirapad.org/>

INFORMATION BULLETIN

BANGLADESH: MONSOON FLOODS

13 October 2005

The Federation's mission is to improve the lives of vulnerable people by mobilizing the power of humanity. It is the world's largest humanitarian organization and its millions of volunteers are active in over 181 countries.

In Brief

This Information Bulletin No.005/2005 is being issued for information only. The Federation is not seeking funding or other assistance from donors at this time.

For further information specifically related to this operation please contact:

- In Dhaka: A.S.M. Arman, Acting Secretary, General Bangladesh Red Crescent Society, email: arman@brcs.org, phone: +88 02 911 7114, mobile: +88 02 911 7114
- In Dhaka: Saharwanur Samad, Head of Delegation, email: saharwanur@brcs.org, phone: +88 02 914 1631, mobile: +88 0171 527 631, fax: +88 02 914 1631
- In India: Bob McEwen, Head of Regional Delegation, phone: +91 11 2621 6571, mobile: +91 93 1608 1334, email: Bob.McEwen@icrc.org
- In Geneva: Haron Osman, Regional Officer, Asia-Pacific Department, email: haron.osman@icrc.org, phone: +41 22 749 4773, fax: +41 22 733 0993 or 733 0993, email: nelly.kandian@icrc.org, phone: +41 22 749 2500, fax: +41 22 731 9595

All International Federation assistance tends to adhere to the Code of Conduct for the International Red Cross and Red Crescent Movement.

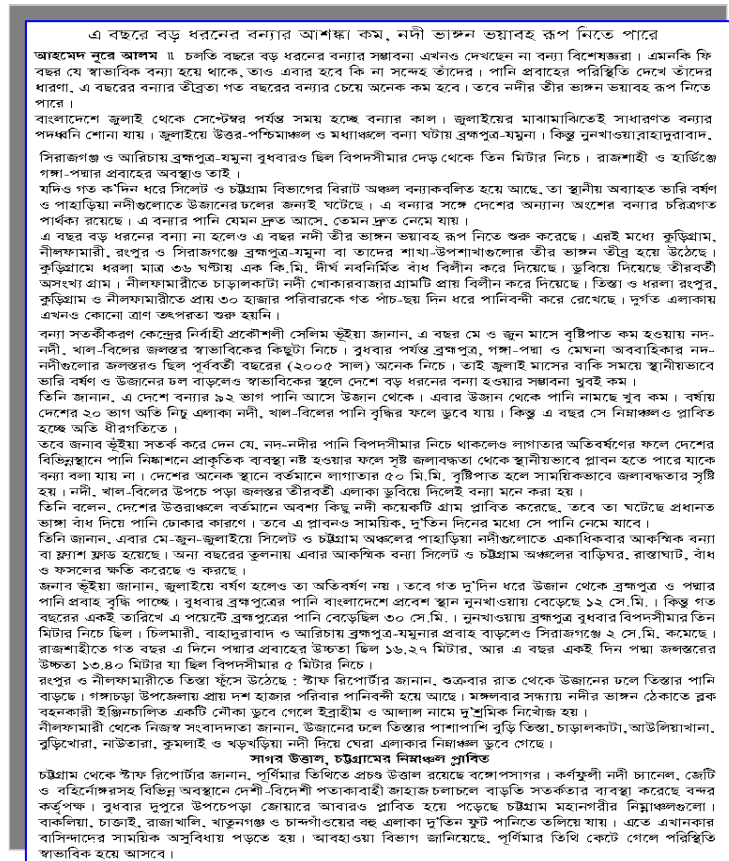


Figure 4-17. News, media and popular source products

4.9 Global popular sources

At the same time, there are also several other popular sources of hazard related early warning systems available globally which provide some specific disaster related information for Bangladesh. Such selected global popular sources are as follows:

- Global Disaster Alert Coordination System (GDACS) – for multi-hazard
- US Geological Services (USGS) – for earthquake
- Humanitarian Early Warning Services – for multi-hazard
- Reuters Alertnet – multi-hazard

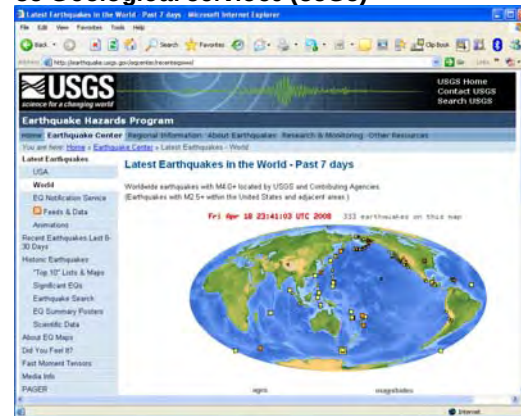
These are also shown in the following web addresses.

Humanitarian Early Warning Services



Source: http://www.hewsweb.org/home_page/default.asp

US Geological Services (USGS)



Source: <http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes>

Figure 4-18. Global popular sources

Table 4-5. A SWOT analysis of existing early warning systems.

	Strength	Weakness	Opportunity	Threat
Organizational capacity	Involvement of many organizations with sound experience of different aspects of EWS Nationally recognized as being important Comprehensive EWS developed for cyclone affected areas Development partners are supportive	Weak coordination among main stakeholders Overlapping of functions exist No guidelines for the use of flood forecasts for infrastructure managers including BWDB Operational focus on post-disaster responses Functions only upto district level No effective upward feedback mechanism established Lack of disaster risk communication technologies	Models developed for involving upazila/union organizations and communities Involvement of private sector Updating SODs to incorporate Early warnings Upgrading organizations Introduce disaster risk planning to all GoB and NGO infrastructure development activities	Shortage of resources to fully participate in the EWS
Resource endowment	Receives revenue allocation	Insufficient funds for maintenance of existing hydrologic monitoring system Donors significant funders of EWS but limited GoB allocation Cellular companies and business communities are not thickly involved	Divert funds from relief to preparedness	Cuts in GoB and/or donor funding Declining GoB and/or donor interest in water sector
Tools and methods	Right technology to prepare accurate flood forecasting Local expertise growing Models available to extend the forecast coverage	Only 3 day forecasts readily available No significant forecasting for flash flood or storm surge or for urban areas Deficiencies in the accuracy and reliability of flood forecasts and warnings	Improve coverage through using more modern technologies e.g., CFAB Linking flood forecasting to infrastructure managers and communities for emergency maintenance	Insufficient GoB funds for operation and maintenance Reliant on national institutions to upgrade

	Strength	Weakness	Opportunity	Threat
Human capacity	Adequate local expertise for many aspects of EWS Sufficient staff for existing system	Shortage of staff for enhanced system Regular transfer of trained/ experienced GoB staff out of EWS	Training of new staff by national organizations Developing relevant skill-mix of staff Clarify roles and tasks of staff working on EWS	No career path for EWS specialists in government
Information	Accurate and reliable hazard forecasting information being prepared and distributed nationally No cost to end-users Increasing awareness of EWS	Responsibilities for packaging information not clear Not area specific Not easily understandable by local communities and infrastructure managers Limited access to upstream information Dissemination media may not be accessible by local communities Lead time is not sufficient to meet the requirements of users Not packaged to meet requirements of end users Lack of continuous input data Not response-orientated	Expanding sources of input data FF data can improve design of water resource management schemes	Reliability Inaccurate input data Absence of regional cooperation
Coverage	Forecasts prepared for majority of the country	FF not relayed beyond district level Flood plain not covered in detail Infrastructures are not covered Flash flood and storm surge areas not covered	FF can be extended to upazila level FF can be transmitted to all infrastructure managers	Inaccurate data Shortage of funds
Effectiveness	Strong support for EWS expressed at national workshops	No monitoring and feedback system	Expand coverage and lead time	Relief still dominates GoB and donor activities

	Strength	Weakness	Opportunity	Threat
	on floods System effective within administration arena Reliable flood warnings available during high floods	Shortage of documentation showing response to FF&EW Limited preparedness planning Flood warnings not understood	Clarify roles and responsibilities of those working in EWS Integrate preparedness planning into upazila/union plan books	
Sustainability	BWDB, BMD, DMB and other GoB organizations mandated to EWS District, Upazila and Union DMCs being strengthened by CDMP	Inadequate GoB funding Focus on post-disaster measures continues Lack of effective demand No one organization responsible for Flood EWS Weak coordination between Flood EWS organizations	Shift mindset from post-disaster to preparedness	Short attention span of government interest Shortage of funds Lack of political will Weak local government institutions No requirement for disaster risk assessment on government or non-government planning

5. Conclusions: Needs and Recommendations

The needs and recommendations for strengthening effective disaster management information link is multi-faceted. In this section, some of such needs and recommendations are outlined briefly. These are captured from three different sources:

- a) initial outreach and discussion with various selected representatives of selected agencies and information source departments/NGOs/institutions;
- b) from the review of the secondary information including the DMIC Needs Assessment Report; and
- c) internal team discussion.

5.1 *Some of the needs revealed at institutional level*

From discussions and reviews carried out in preparations of this report, revealed that following types of issues need to be addressed in future for strengthening the disaster management information link and capacity at an institutional level in the country. These are relating to:

- information and communication;
- awareness and capacity building;
- financial support;
- enabling policy for monitoring performance and effectiveness;
- logistical and material support;
- human support and so on.

It is to be noted that most of the organizations expressed their own capacity building related issues in their identification of needs. When more specific information was discussed with particular agencies a wide variety of needs emerged. These are documented by agencies below:

Disaster Management Bureau (DMB) representative suggested that the Ministry of Food and Disaster and DMCs should be much more active. Web based information sharing system is necessary for an effective DMIN. It is also to be ensured that DDMC and UzDMC check their emails regularly and update information accordingly through giving proper training. DMB suggested for assessment of community's adaptation capacities. SMS using mobile is also recommended by DMB.

Cyclone Preparedness Programme (CPP) plays an important role in disaster warning dissemination. They have suggested that CPP plays an important role in setting up wireless network at village levels. However, CPP representative felt that the field areas are needed to expand more under these networks. It was recommended that the mass media should use local language in sharing the warning and weather bulletin. According to the CPP representative, the DMB needs to have direct microwave links and skilled manpower for maintaining proper functions for early warning and setting up a disaster management information related network. They gave emphasis on community mobilization and awareness building for an active DMIN. A need for setting up a strong mobile network was expressed and it was informed that there is a large need to establish and increase in number of VHF wireless networks at village level for taking early warning down to household level.

Bangladesh Meteorology Department (BMD) representative also focused on building their institutional and capacity in early warning systems. It was suggested that more equipments, including observatory, radar, balloon, computer, fax for collection of accurate data and prepare accurate early warning messages are needed. They suggested for a web-based

information dissemination system for faster flow of information. According to the informant, disaster related organizations must be more responsible and more interactive for a proper information management network. Training for the staffs of BMD is also necessary for keeping flow of information into disaster management network. BMD representative also suggested that for building awareness of the local people a comprehensive program should be undertaken.

Flood Forecasting and Warning Center (FFWC) was found playing a significant role in disaster management in a very operational manner. FFWC representatives suggested that establishment of a committee for monitoring disasters round the year is necessary. It is also necessary to provide fax and relevant ICT to the local educated persons of most vulnerable areas for quick receive of warnings at the community level. FFWC should introduce forecasting of flood warning two times in a day. Weather bulletins and warning language should be easily understandable to the local people. FFWC also expressed their need for enhancement of their manpower.

Geological Survey of Bangladesh (GSB) recommended ensuring timely response and integration among the agencies who work in addressing similar disaster. They gave emphasis on the suggestions and recommendations for implementing a good DMIN. The respondent also suggested that training for the scientific officers is needed to build capacity of GSB. GSB needs available image and data and support for technology and fund. They also suggested to minimize the bureaucratic complexity.

Bangladesh Inland Water Transport Authority (BIWTA) suggested for own capacity building rather improvement of DMIN. The authority suggested to make easy access to information and to raise awareness among the crews, masters and other staffs of different vessels. They also suggested available communication materials including walky-talky, cell phone, high speed internet connection etc.

Institute of Water and Flood Management (IWFM) representatives suggested for hazard based information networks is quite essential but at the same time a central disaster management information network is quite needed. The representatives suggested that cyclone warning information should be strengthened through linking BMD directly to each district level Deputy Commissioners (DCs) and Disaster Management Committees (DMCs). It was suggested that flood warning system must be made easy, understandable and acceptable to the community because rise of 2 or 3 cm water level at river stage does not have much meaning to the community. IWFM also suggested that lead-time of flood forecasting must be increased and it should be more than five days. At present, some work is going on in this line.

Local Government Engineering Department (LGED) representative gave similar suggestion of IWFM regarding early warning system of flood. They also suggested increasing manpower at Upazila level, developing field level human resources through training for collecting appropriate information, increase allocation for research etc.

Dhaka City Corporation (DCC) representatives suggested that DMB through DMIC should monitor and follow up the activities assigned to the different agencies under SOD. These could be done through more collaborative and regular meetings with relevant stakeholders.

Department of Shipping suggested that frequency of interaction among concerned organizations must be increased for an effective disaster management information network. The interactions could be increased through organizing weekly or monthly meeting and regular teleconference. It emerged that they have not yet included in the disaster management information network in their own system as a unique unit. ICT capacity of the agency was found low. The suggestion is that providing ICT support, It is also necessary to prepare a contingency plan for marine transport. This department also suggested that the

network should be made people friendly and given ownership to the community or mass people. Bottom up approach should be followed for establishing an effective disaster management information network.

Bangladesh Disaster Preparedness Center (BDPC), one of the relatively prominent NGOs working in the field disaster preparedness, recommended for capacity building of DMIC. They suggested that DMIC website needs to contain all types of information for all hazards. DMIC should have a data bank of all hazards. BDPC also suggested to build a data network consisting of GOs and NGOs and a website containing various types of data needs to be developed. All disaster management committees are needed to ensure very easy access to information.

Emergency Support Corp., a volunteer group, suggested need for improvement of coordination with different agencies and modifying early warning information systems. Fire Service and Civil Defense gave emphasis on capacity building. They suggested for training to their field level people for data collection properly. They also suggested increasing their manpower.

5.2 Recommendations for strengthening

During the review, discussion with the national agency representatives and in the field trips several layers of recommendations for strengthening the early warning systems and for developing an effective disaster information came up. In the section below three layers of such recommendations: a) on last mile communication and setup; b) from technical perspective; and c) for local capacity development are reported.



Figure 5-1. Local based warning dissemination methods are clearly recommended

5.2.1 Recommendations on last mile communication and setup

A large number of recommendations came from the field and community interaction. Most of these recommendations are related to last mile communication, mass notification of warnings, essence of local level institutional entities, public participation/engagement, capacity enhancement and so forth.

- People talked about the updating of **existing danger levels for flood, signal systems for cyclone and tsunami**, Establishment of **siren system and flags systems for mass community notification**, and innovation of including billboard/website/internet based public notification at local level, were also recommended heavily. Use of traditional systems and facilities such as mosques for warning dissemination and so forth. It was also pointed out that government should provide **early warning information directly to the upazila level** through innovative ways without making any administrative lag from the district levels.
- It was recommended that **technical and human capacity development** including access to modern communication hardware equipments for warning dissemination and regular training for stakeholders at union and community level are essential.
- Establishment of **adequate institutional setup for early warning systems at local level** was also pointed out prominently. It was recommended that "Early warning information centers" can be established for timely warning dissemination at each union level.
- Increased public **participation, education and awareness** programmes are recommended as a key to strengthen disaster information systems at local level and recommended for building capacity of the UDMCs, volunteers and community based systems in general. It was recommended further that inclusion of media in a proactive way is essential to this process.
- It was also recommended that **coverage of warning and forecasts** should be increased as per local needs and geographical distribution and at the same time Warning coverage should be more precise to location and communities.

Box: Some of detailed recommendations emerged from the field interaction

Last mile communication/messaging and technology related recommendations:

- Existing "Danger levels for flood" needs to be upgraded with latest scientific information
- A homogeneous signal system needs to be developed
- Siren system needs to be developed for mass community alerting
- Flag system should be introduced for flood early warning in a wider scale
- Signal number should be improved with explanations
- Community leaders like Imams, teachers, elites and UDMC members including women members should be linked with local level early warning system
- Marine sea safety regulations should be implemented/enforced properly
- More mosques should be linked up with the warning dissemination systems
- Modern equipments are needed for warning dissemination at household level
- Number of skilled manpower should be increased at Cox's Bazaar meteorological office.
- Disaster relevant activities, particularly, on warning issues should be strengthened with support of ICT and Internet facilities.
- More FM radios and mobile phones should be in the community
- Sufficient amount of hand mikes should be there in each villages
- Full coverage siren should be there for rapid onset hazards (e.g. tsunami)

Local level institutional setup and related recommendations:

- A designated person needs at UZ for coordination of early warning
- Early warning information centers needs to be setup at each union level
- Government should provide early warning information to upazila level directly through quickest possible early warning technologies
- Every union should have at group of trained unit for early warning and dissemination
- In each UP meeting, an agenda on disaster should be mainstreamed and decisions should be announced to the community
- Upazila level budget meetings should be open and should include budget for community based disaster management including early warning information sharing
- Coordination and integration among different government agencies i.e. Department of Agriculture Extension (DAE), Livestock, Fisheries and NGOs are needed for an effective early warning system at community level
- UDMC must be very active and should have training on early warning systems
- Strong networks of government and NGOs are
- At least some Govt. level representative should be with UP members during the dissemination period. This would increase peoples level of trust on the warning

Public participation and awareness related recommendations:

- More volunteers need to be appointed with some small amount of honorariums
- Capacity of the UDMC and volunteers are needed to build for early warning information dissemination on a periodic basis
- Male-female participation should be equal in the disaster management related meetings
- Community based organization needs to set up for awareness building
- Building awareness on different issues like fishing in bad weather, giving importance on the early warning during cyclone, etc. are needed at community level
- Media should be more proactively involved to make people understand the various early warning and dissemination systems at community level
- Mobilization seminar, discussions and training on disaster warning system should be launched at different levels from district to communities

5.2.2 Technical recommendations

There are several key recommendations came from technical arrangement of national level setups and improvement of effectiveness of the DMIN system in the country. Some of the key technical ones are outlined below:

- **Key organizations involved in the early warning system (from source to destination) should be strengthened** to increase their technical capacity for downscaling hazard information, local level coordination, and utilization-effectiveness of hazard forecast and warning services should be based on local needs. Their coverage in terms of expansion into district levels should be a consideration for future.
- It was recommended that **DMIN should get connected as an “end-to-end” system with the local, national, and regional systems of hazard information**. It should be connected with source providers (i.e. BMD and FFWC), regional watch providers (i.e. ADPC, PTWC) and warning centers (e.g. JTWc, TSR) and essentially with the downstream part of the operationalization up to union level (i.e. UDMC). A design is essentially needed for such an end-to-end link.
- **Innovative ways to keep DMIC functional in non-emergency situation** was recommended. For instance, DMIC can provide agricultural risk information or livelihoods improvement related educational information during the non-emergency mode and become engaged with the stakeholders.

- Key organizations involved in the EWSs (from source to destination) should be strengthened to **increase their coordination**, and the utilization and effectiveness of hazard forecast and warning services. Beyond the Standing Order for Disaster Management, the **Standing Operating Procedures (SOPs)** should be developed and reviewed for early warning and for sector based early warning and preparedness considering the focus of strengthening the DMIN process. SOPs can facilitate towards a better coordination among agencies.
- From technical perspective it was recommended that capacities of local level institutions and local community level representatives should be build more on the end-to-end risk information sharing. The local level institutions should be capable of receiving the early warning information from the source or upper levels, should have capabilities of interpreting the early warning information and make an impact outlook (either analogically to the existing experiences of their hazards such as last flood or damage) and capable of taking actions by themselves for response options. In this line **comprehensive capacity building of the local level stakeholders** on right kind of risk communication and dissemination is essential.
- Some positive realization came when the team has made reconnaissance field visits to some of the project areas where some early warning system initiatives were undertaken. Particularly, from the project areas of CFAB and FFWC covered flood prone pilot areas, CPP covered coastal areas and CEGIS covered pilot erosion prone areas it was found that through these early warning system projects there are some good tools for local level communication under development and testing in a proactive way. Some **good tools of local level hazard information dissemination are emerging and have started to get popular at community level in respective pilot project areas**. These are promising example and technically quite sound. These can be replicated in the other areas after successful testing under the DMIN project. However, the big question in this line is the institutional sustainability for these tools as well as the suitable replication attempts into other areas. This is a question to be answered in future course of time.
- A monitoring, evaluation systems and **feedback mechanism from one layer to another** should be developed. At present it was found that the system is primarily one-way and goes from top to down through the administrative channels. But the modalities for other-way functioning should also be thought of. Particularly, for stakeholder need based early warning system information packages are quite essential. For instance, for flood forecasting people at community level are looking for three major articulating questions: a) when the flood is coming; b) how high will be the flood level; and c) how long the flood will stay in their respective areas. But at this point, the source providers like FFWC is providing information on a generic river water level but not at a local level addressing these three questions very effectively outside their pilot areas. Capabilities should be developed in this line vis-à-vis a hunt should be for improved systems as well.
- Information flow at community level needs should be a priority. The local level systems flow should be analyzed and **community based forecasting techniques should be encouraged**. Warning coverage should be more precise and more

location and community specific. Coverage of forecasts and warnings should be increased as per local need and geographical distribution

- Cost effectiveness is an essential **element for the sustainability of the disaster management information communication tools** at community level. The CCP program has proved its efficacy in sustaining a long time as it was never based on very high tech or resource intensive modalities of information dissemination. This lesson should be considered for devising newer information communication tools and giving it away to the communities. In the initiation period, communities may show a great deal of interest of any “high tech and relatively expensive” mode of information communication. But in long run the sustainability of those both in terms of technical maintenance, updatability and financial questions should be a major consideration.
- The **advanced but multi-user and multi-sectoral communication technologies** can be analyzed in the context of rural Bangladesh. Reflecting on more people oriented and readily usable by multi-sectoral options can be looked at in future. Technologies such as the “Tetra System” of communication and so forth can be analyzed for future low cost but multiple user usability. Innovative experiences from other low income countries can be analyzed and looked as future options.
- One of the major institutional recommendation came from both the technical discussions as well as from the field interaction is for enhancing the speed of the disaster management information flow the present system driven by the district administrative and government channels are operational upto district level. With some capacity building, human resource mobilization and technological facilitation this system upto upazila level can be strengthened relatively in short time. DMIC and DMB support is also in process of making a large number of DMIC in the country reaching upto upazila level. But for the level down to upazila to community level coordination should be there. At least four (or more) set of groups should be coordinated for efficacy. These four set of groups are:
 - a) local government (e.g. UPs),
 - b) NGOs (with their large network of micro finance institutional networks,
 - c) civil society and community stakeholders; and
 - d) government agencies and administration.

For local level warning dissemination a single group solely is not enough to reach information, keep trust upon the information and capability to respond to warnings. A local level people oriented coordination mechanism should be there and the setting may vary from community to community.

In spite of continued onslaught of multiple disasters, Bangladeshi communities historically have shown a great deal of community resilience at level. Scientific institutions needs to build on these resilience elements of the community and facilitate with more precise form of science based hazard information. In this respect, DMIC and the DMIN network with its present track may play a key role.

The recommendations emerged from this disaster management information link report contributes towards this endeavor. The recommendations documented here are will be made more comprehensive in future through further extensive consultations in several areas taking a scientific and vulnerability approach. Field assessment with various stakeholders in selected pilot areas are already planned under the project. Next round of activities of the on-going project will look into these recommendations further and plans to come up with a quantitative validation and concrete testing of a DMIN design at ground level.

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Glossary of Terms

Catchment Area	A river's catchment (or basin) is the land area from which rainfall will ultimately contribute to the river discharge. The catchment area of the Ganges, Brahmaputra and Meghna Rivers are 907 X 103 km², 583 X 103 km² and 65 X 103 km², respectively, of which only 8% lies in Bangladesh. More than 90% of the water that flows into the Bay of Bengal enters Bangladesh through its borders with India.
Disaster	A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. <i>A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.</i>
Danger level	In Bangladesh danger level at a river location is the level above which it is likely that the flood may cause damages to nearby crops and homesteads. In a river having no embankment, danger level is about annual average flood level. In an embanked river, danger level is fixed slightly below design flood level of the embankment. The danger level at a given location needs continuous verification as e.g. embankments may be breached, but it is not done continuously by FFWC, whereby some danger levels may be not precise.
Disaster risk management	The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.
Early warning	The provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response. <i>Early warning systems include a chain of concerns, namely: understanding and mapping the hazard; monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings. (UN/ISD: 2004)</i>
Floods	The floods in Bangladesh are divided into monsoon river flood, flash flood, local rainfall flood and storm surge flood. Monsoon river flood is an annual event forced mainly by intensive river inflow through Ganges, Brahmaputra and Meghna Rivers and rainfall over Bangladesh as causes the water level in the rivers to rise and fall

slowly during the monsoon season. Flash flood occurs only in the northeastern Bangladesh in the period pre- to post-monsoon forced by intense rainfall in the Meghalaya Hills and in parts of eastern Bangladesh in the post-monsoon. Local rainfall flood is, as the name states, forced by local heavy rainfall over a location inside Bangladesh. Storm surge flood is a coastal phenomenon forced by cyclones hitting the Bangladeshi coastline.

Flood forecasting	To predict water level conditions in Bangladesh FFWC collects measurements of water level and rainfall, satellite pictures and simulates the water level conditions by use of a numerical model of the Bangladeshi river network. Every day during most of the monsoon season the model simulates the water level conditions during the previous 7 days (hind-cast simulations) and during the coming 3 days (forecast simulation). More precisely the forecasting starts during early monsoon when one of measuring stations show a water level 60 cm below danger level. For obvious reasons no measurements exist in the forecasted period and simple relations estimate boundary conditions for the numerical model during this period. The uncertainties of the estimated boundary conditions propagate into the model domain. Results from the model simulations are used to provide flood forecasting and warning.
Hazard	A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.
Forecast	Definite statement or statistical estimate of the occurrence of a future event (UNESCO, WMO). This term is used with different meanings in different disciplines.
Mitigation	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.
Natural hazards	Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. Natural hazards can be classified by origin namely: geological, hydro-meteorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.
Preparedness	Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Monsoon	Bangladesh is characterized by a tropical climate, i.e. cool, dry winter from November to January with predominantly northeasterly monsoon winds; hot, humid summer from April into October; and wet monsoon from June to September with predominantly southwesterly monsoon winds. Flooding in Bangladesh occurs during the wet monsoon period.

Public awareness	The processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.
Public information	Information, facts and knowledge provided or learned as a result of research or study, available to be disseminated to the public.
Risk	The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions. <i>Conventionally risk is expressed by the notation</i> <i>Risk = Hazards x Vulnerability. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability. Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.</i>
Super Model	FFWC simulates the water level conditions in Bangladesh by use of a numerical model of the Bangladeshi river network. The model is named the "Super Model" and is based on measurements of the topography of Bangladesh and the general numerical hydrodynamic model system named MIKE 11 developed at DHI Water & Environment. To run the Super Model information on water level and rainfall is needed to force the model: water level boundaries are e.g. found upstream in Ganges and Brahmaputra and downstream in Meghna River. The Super Model has been run at the FFWC since 1998.
Vulnerability	The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community impact of hazards. For positive factors, which increase the ability of people cope with hazards, see definition of capacity.
Warning	FFWC disseminates flood warnings during most of the monsoon season. The warning is related to the measured and forecasted water levels and the danger levels: a) normal flood: water level is more than 50 cm below danger level; b) moderate flood: water level is between 50 cm below danger level and 50 cm above danger level; and c) severe flood: water level is 50 cm above danger level. Warnings are disseminated through a daily flood bulletin, e-mail, FFWC home page, newspapers, radio and television.
Water level	BWDB and other government departments refer water levels to the Public Works Datum (PWD). PWD is a horizontal datum believed originally to have zero at a determined Mean Sea Level (MSL) at Calcutta. PWD is located approx. 1.5 ft below the MSL established in India under the British Rule and brought to Bangladesh during the Great Trigonometric Survey.

Annexes

Annex 1. A sample warning message issued by BMD (in English).



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ আবহাওয়া অধিদপ্তর
আগারগাঁও, ঢাকা-১২০৭।

Phone: 8113071, 8116634
FAX: 8118230
Email: swcbmd@yahoo.com

Date: 05/06/2007

WARNING MESSAGE

Deep convection is taking place over North Bay. Under its influence squally weather is likely to affect the ports.

Maritime ports of Chittagong, Cox's Bazar and Mongla have been advised to hoist Local Cautionary Signal No. Three (R) Three.

All fishing boats and trawlers over North Bay have been advised to come close to the coast and proceed with caution till further notice.

(Md. Shadequl Alam)
Meteorologist
For Director
05, 1200 BST

TO,

- 01) Hon'ble Chief Adviser, Fax: 8113244
- 02) Hon'ble Chief Adviser Monitoring Cell, FAX: 8115900
- 03) MINISTRY OF DEFENCE, FAX: 8117945
- 04) CPP, FAX: 933 8401
- 05) DMB, FAX: 8851615
- 06) NHQ, FAX: 8754270
- 07) SHIPPING MINISTRY, FAX: 9660311, 9562007
- 08) RELIEF CONTROL ROOM, FAX: 7169623, 7174148
- 09) BIWTA, FAX : 9551072
- 10) BTV, FAX: 8312927
- 11) BETAR, FAX: 8612021
- 12) FFWC, FAX 9557386
- 13) UNB, FAC: 9344556
- 14) BSS, FAX 9883424
- 15) MMO, CTG, FAX: 031-740788
- 16) CDMP, Fax: 9890854



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

Phone: 8113071, 8116634

Annex 2. A sample warning message issued by BMD (in Bangla).



Govt. of the People's Republic of Bangladesh
Bangladesh Meteorological Department
Agargaon, Dhaka-1207.

Phone: 91183846634
FAX: 8118230
Email:
bmddhaka@bttb.net.bd
bmdswc@bdonline.com

তারিখ : ১০/০৬/২০০৭ইং

সতর্কীকরণ বার্তা

উত্তর বঙ্গোপসাগরে মৌসুমীবায়ু প্রবল থাকার কারনে বন্দর সমূহের উপর দিয়ে ঝড়ে
হাওয়া অব্যাহত থাকতে পারে।

চট্টগ্রাম, কক্সবাজার ও মংলা সমুদ্র বন্দর সমূহকে ৩ নম্বর (পুনঃ) ৩ নম্বর স্থানীয় সতর্ক
সংকেত দেখিয়ে যেতে বলা হয়েছে।

উপকূলীয় জেলা কক্সবাজার, চট্টগ্রাম, নোয়াখালী ভোলা, পটুয়াখালী, বরিশাল,
চাঁদপুর, বরগুনা, পিরোজপুর, ঝালকাঠি, বাগেরহাট, খুলনা এবং সাতক্ষীরার নিম্নাঞ্চল এবং
তাদের অদূরবর্তী দ্বীপ ও চর সমূহ জোয়ারের পানিতে প্রাণিত হতে পারে।

উত্তর বঙ্গোপসাগরে অবস্থানরত সকল মাছ ধরার নৌকা ও ট্রলার সমূহকে পরবর্তী
নির্দেশ না দেওয়া পর্যন্ত উপকূলের কাছাকাছি থেকে সাবধানে চলাচল করতে বলা হয়েছে।

এস. এম. মাহমুদুল হক
আবহাওয়াবিদ
পরিচালকের পক্ষে
১০, ১১১৫ বিএসটি

বিতরণঃ-

1. RADIO (NEWS), BANGLADESH BETAR, FAX: 8113359
 2. RADIO (PROGRAM), BANGLADESH BETAR, FAX: 8117850
 3. BTV, FAX: 8312927
 4. ATN: 8111876
 5. NEWS PAPERS
 6. APB:9115602
- BSS

Annex 3. A sample “earthquake” occurrence message issued by BMD.



22. BANGLADESH ARMY, FAX: 8754455,8712196
23. REUTERS Fax: 8312976



Government of the People's Republic of Bangladesh
Bangladesh Meteorological Department
Storm warning Centre
Agargaon, Dhaka-1207

Phone: 8113071
FAX: 8118230
E-mail: swcbmd@yahoo.com

Fax Message

DATE: 12.09.2007

EARTHQUAKE OCCURRENCE MESSAGE, DATED 12.09.2007

An earthquake occurred on 12 September 2007 at 17 hours 09 minutes 46 Seconds (BST). The distance of the Epicentre was about 3718 kms from Agargaon, Dhaka Seismic Observatory (near southern Sumatra of Indonesia). The magnitude of the earthquake was 8.5 in Richter scale (Great).

Possibility of Tsunami Generation:

It may generate Tsunami wave in the Bay of Bengal of the North Indian Ocean that may reach Bangladesh coast after midnight tonight (early morning of 13 September 2007).

(Md. Rubyet Kabir)
Asst. Meteorologist
For Director
12, 1830 BST

Copy to:

1. Cabinet Secretary, Fax: 7162013
2. Principal Secretary to the Hon'ble Chief Adviser, Fax: 8113244
3. Mr. Kamrul Hasan, Secretary, Ministry of Defence, Fax: 8117945
4. Secretary, Ministry of Agriculture, FAX: 7163080 ,7163799
5. Secretary, Ministry of Food and Disaster Management, FAX: 7167040
6. Secretary to the Hon'ble Chief Adviser, FAX: 8113243
7. System Analyst Computer Cell to the Hon'ble Chief Adviser's Secretariat Fax: 9123616
8. Brig. Gen.S. M. Sultan Uddin Iqbal, BIRPROTIK, Jt. Secy. (W&D), MoD, FAX: 8117945
9. Assistant Military Secretary to the Hon'ble President, Bangha Bhavan, Dhaka, Fax: 9566593.
10. SSF, FAX:8111351
11. CPP, FAX: 933 8401
12. DMB, FAX: 8851615
13. NHQ, FAX: 8754270, 9885633
14. RELIFE CONTROL ROOM, FAX: 7169623, 7174148
15. BTV, FAX: 8312927
16. BETAR, FAX: 8113359, 8612021
17. UNB, FAX: 9344556
18. BSS, FAX 9557929
19. MMO, CTG, FAX: 031-740788
20. CDMP, Fax: 9890854
21. BAF (Dhaka), Fax: 8754830-3537(Ext.)
22. BANGLADESH ARMY, FAX: 8754455
23. REUTERS Fax: 8312976

Annex 4. A sample daily "Weather Forecast" issued by BMD.



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ আবহাওয়া অধিদপ্তর
আপারগাঁও, ঢাকা-১২০৭।

Phone: 8113071, 8116634
FAX: 8118230
Email: bmdswc@bdonline.com

No. SWC-30(14)/99/Part-2/

Date: 08.04.2008

From: Director

Bangladesh Meteorological Department

To: D.G. Special Security Force

FAX : 8111351

Subject: Weather Forecast for Dhaka –Chittagong - Dhaka valid from 08, 0900 BST
to 08,1600 BST.

A. Route Forecast

- i) Sky : Partly cloudy, tempo. cloudy
- ii) Weather : Weather may remain mainly dry with partly cloudy sky on the route.
- iii) Surface wind : NW/N'y 10-15 kph.
- iv) Surface Visibility: 4-5 Kms, reducing to 3000 m or less in mist/haze.

B. Wind:

Height	Dhaka	Chittagong
1000 ft	240-290°/05-10 kts	280-320°/10-15 kts
2000 ft	240-290°/10-15 kts	280-320°/15-20 kts
3000 ft	270-330°/15-20 kts	290-360°/20-25 kts
5000 ft	270-330°/20-25 kts	290-360°/20-25 kts

C. Terminal Forecast

	Dhaka	Chittagong
Weather	Weather may remain mainly dry with partly cloudy sky over the area.	Weather may remain mainly dry with partly cloudy sky over the area.
Surface wind	W/NW'y 08-12 kph .	NW/N'y 10-15 kph .
Visibility	4-5 Kms, reducing to 3000 m or less in mist/haze.	4-5 Kms, reducing to 3000 m or less in mist/haze.
Sky	Partly cloudy, tempo. Cloudy.	Partly cloudy, tempo. Cloudy

(S.M.Mahmudul Huque)

Meteorologist

For Director

Annex 5. A sample daily "Weather Forecast" issued by BMD.



Agg. 10/01/08



Government of the People's Republic of Bangladesh
Bangladesh Meteorological Department
Storm warning Centre
Agargaon, Dhaka-1207

Phone: 8113071
FAX: 8118230
E-Mail: swcbmd@yahoo.com.

No. Jha: Sa:-20(15)/96/

Dated, Dhaka : 01-04-2008

Forecast Valid for 24 Hours Commencing 09 AM Today:

Synoptic Situation: A low lies over West Bengal and adjoining Western part of Bangladesh. Trough of low lies over Southeast Bay and adjoining area.

Forecast: Rain/ thunder showers accompanied by tempo. gusty/squally wind is likely to occur at one or two places over Rajshahi, Dhaka, Khulna, Barisal, Chittagong and Sylhet divisions.

Temperature: Day temperature may remain nearly unchanged over the country.

Wind direction and speed at Dhaka: SW/S'ly 06-10 Kph. tempo. W/NW'ly 50-60 Kph.

RH at 06 AM of Dhaka: 72 %

Today's sunset at Dhaka: 06-15 mts.

Tomorrow's sunrise at Dhaka: 05-49 mts.

Outlook for next 72 hrs: Little change.

Rainfall for last 24 hours (till 06 AM today) and maximum temperature of yesterday, minimum temperature of Today:

Name of Divisions	Name of Stations	Rain fall (mm)	Max. Temp (°C)	Min. Temp (°C)	Name of Divisions	Name of Stations	Rain fall (mm)	Max. Temp (°C)	Min. Temp (°C)
Dhaka	Dhaka	00	34.0	23.2	Sylhet	Sylhet	23	28.4	18.8
	Mymensingh	00	28.2	22.5		Srimangal	08	31.6	20.0
	Tangail	00	32.4	21.0					
	Faridpur	00	33.7	21.6		Rajshahi	00	36.0	23.4
	Madaripur	00	34.0	22.1		Ishurdi	00	34.4	22.6
Chittagong	Chittagong	00	30.3	24.4	Rajshahi	Bogra	00	33.3	21.6
	Sandwip	00	31.8	23.6		Rangpur	17	30.5	19.7
	Sitakunda	00	xx	xx		Sayedpur	00	30.8	xx
	Rangamati	00	34.0	22.8		Dinajpur	00	31.4	20.2
	Comilla	00	32.0	23.8					
	Chandpur	00	34.2	23.7	Khulna	Khulna	02	34.2	22.0
	M.Court	00	33.0	22.0		Mongla	00	35.6	24.0
	Feni	00	31.6	24.1		Satkhira	27	33.8	19.6
	Hatiya	00	32.0	xx		Jessore	01	35.0	21.7
	Cox's Bazar	Trace	33.0	24.2		Chuadanga	00	34.6	xx
	Kutubdia	00	34.0	xx	Barisal	Barisal	00	33.5	22.5
	Teknaf	00	31.8	23.4		Patuakhali	00	33.5	23.0
						Bhola	00	33.0	22.5
						Khepupara	00	32.2	xx

(Md. Sanaul Hoque Mondal)
Meteorologist
For Director

To,

1. Cabinet Secretary, Fax: 7162013
2. Principal Secretary to the Hon'ble Chief Adviser, Fax: 8113244
3. Mr. Kamrul Hasan, Secretary, Ministry of Defence, Fax: 8117945
4. Secretary, Ministry of Agriculture, FAX: 7163080
5. Secretary, Ministry of Food and Disaster Management, FAX: 7169623, 7174148
6. Secretary, Ministry of Water Resources, FAX: 7162400
7. Secretary to the Hon'ble Chief Adviser, FAX: 8113243

Annex 6. A sample long term – “Monthly Weather Forecast” issued by BMD (in Bangla).



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ আবহাওয়া অধিদপ্তর
ঝড় সতর্কীকরণ কেন্দ্র
আগারগাঁও, ঢাকা-১২০৭।

Phone: 8113071, 9135742, 8116634
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Email: swcbmd@yahoo.com

Monthly Forecast

বিষয়ঃ জুলাই, ২০০৭ ইং - এর দীর্ঘমেয়াদী পূর্বাভাস।

দীর্ঘমেয়াদী পূর্বাভাস প্রদানের নিমিত্তে গঠিত বিশেষজ্ঞ কমিটির নিয়মিত বৈঠক বাংলাদেশ আবহাওয়া অধিদপ্তরের ঝড় সতর্কীকরণ কেন্দ্র, ঢাকায় ০৩ জুলাই, ২০০৭ইং তারিখ সকাল ১১:০০ ঘটিকায় অনুষ্ঠিত হয়।

উক্ত বৈঠকে জুন, ২০০৭ ইং-এ সংঘটিত আবহাওয়ার বিভিন্ন তথ্য/উপাত্ত পর্যালোচিত হয়। পর্যালোচনাকালে কমিটি লক্ষ্য করে যে, জুন, ২০০৭ ইং -এ বাংলাদেশে গড় বৃষ্টিপাতের পরিমাণ ও দিন সংখ্যা নিম্নরূপ ছিল:

বিভাগ	বিভাগীয় বৃষ্টিপাতের গড় পরিমাণ (মিমিঃ)	স্বাভাবিক বৃষ্টিপাত (মিমিঃ)	বৃষ্টিপাতের গড় দিন সংখ্যা	স্বাভাবিক বৃষ্টিপাতের দিন সংখ্যা	বৃষ্টিপাতের বিচ্যুতি (%)
ঢাকা	৬১৫	৩৫৫	১৮	১৪	৭৩.৩
চট্টগ্রাম	৬৯৩	৫৮৯	১৮	১৭	১৭.৬
সিলেট	৭৩৫	৬৩৪	২০	২০	১৫.৯
রাজশাহী	৪৫৭	৩৪৭	১৪	১৩	৩১.৪
খুলনা	৩০০	২৯৮	১৫	১৪	০.৭
বরিশাল	৪১৬	৪৮৩	১৭	১৭	-১৩.৯

জুন, ২০০৭ ইং মাসে বরিশাল বিভাগে স্বাভাবিক অপেক্ষা কম, খুলনা বিভাগে স্বাভাবিক এবং অন্যান্য বিভাগে স্বাভাবিক অপেক্ষা অধিক বৃষ্টি হয়েছে। সামগ্রিকভাবে সারাদেশে স্বাভাবিক অপেক্ষা প্রায় ২০.১% বেশী বৃষ্টি হয়েছে। মৌসুমী বায়ু প্রবাহ সারাদেশে ১০ই জুনের মধ্যে বিস্তার লাভ করে এবং এটি সক্রিয় থাকার কারণেই সারাদেশে স্বাভাবিক অপেক্ষা বেশী বৃষ্টি হয়েছে। গত মাসে বঙ্গোপসাগরে দুইটি গভীর নিম্নচাপ সৃষ্টি হয় এবং ভারতের পূর্ব উপকূল অতিক্রম করে। জুন মাসে দেশে গড় বাষ্পীভবন ৩.৯৭ মিঃমিঃ ছিল। মৌসুমী বায়ুর আগমন, মৌসুমী নিম্নচাপ, বৃষ্টিপাতের পরিমাণ, বৃষ্টিপাতের দিনসংখ্যা ও গড় বাষ্পীভবন জুন, ২০০৭ ইং মাসের পূর্বাভাসের সাথে সংগতিপূর্ণ ছিল।

প্রাপ্ত আবহাওয়া উপাত্ত, আবহাওয়া মানচিত্র, জলবায়ু রিগ্রেশন ও এনালগ মডেল এবং উপগ্রহ চিত্র ইত্যাদির যথাযথ বিশ্লেষণ পূর্বক কমিটি কর্তৃক জুলাই, ২০০৭ ইং -এর পূর্বাভাস নিম্নে প্রদত্ত হলঃ

বিভাগ	(পূর্বাভাস) বৃষ্টিপাতের পরিমাণ (মিমিঃ)	স্বাভাবিক বৃষ্টিপাত (মিমিঃ)	(পূর্বাভাস) বৃষ্টিপাতের দিন সংখ্যা	বৃষ্টিপাতের স্বাভাবিক দিন সংখ্যা	মাটির আর্দ্রতা (৫০ সেঃমিঃ পর্যন্ত) %
ঢাকা	৩৫০-৪৫০	৩৭৯	১৫-১৯	১৭	২৫-৩৫
চট্টগ্রাম	৬৫০-৮০০	৭২০	১৮-২২	২০	২৮-৩৫
সিলেট	৫৫০-৬৭০	৫৭৯	১৮-২৪	২১	২২-৩২
রাজশাহী	৩৬০-৪৬০	৩৮৫	১৫-১৮	১৭	২৩-৩২
খুলনা	৩২০-৪০০	৩৪১	১৬-২০	১৮	২৮-৩৮
বরিশাল	৪৭০-৬০০	৫১৯	১৯-২৪	২২	২৮-৩৫

১। জুলাই মাসে বঙ্গোপসাগরে ২-৩টি মৌসুমী নিম্নচাপ সৃষ্টি হতে পারে।

২। এ মাসে সামগ্রিকভাবে দেশে স্বাভাবিক অপেক্ষা (১০-১৫%) অধিক বৃষ্টিপাতের সম্ভাবনা আছে।

৩। বন্যাঃ এ মাসের দ্বিতীয়ার্ধে দেশের উত্তর-পূর্বাঞ্চল ও মধ্যাঞ্চল স্বাভাবিক বন্যার সম্ভাবনা আছে।

৪। কৃষি আবহাওয়াঃ দেশে গড় বাষ্পীভবন ৩.২৫ - ৩.৭৫ মিঃমিঃ এর সম্ভাবনা রয়েছে।

ড. সমরেন্দ্র কর্মকার
পরিচালক (চলতি দায়িত্ব)
ও
চেয়ারম্যান, বিশেষজ্ঞ কমিটি

Annex 7. A sample long term – “Three Month Weather Forecast” by BMD (in Bangla).



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ আবহাওয়া অধিদপ্তর
বাড় সতর্কীকরণ কেন্দ্র
আগারগাঁও, ঢাকা-১২০৭।

Phone: 8113071, 8116634
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নং- বাঃসঃ(সমন্বয়)-১৩(১৮)/২০০৫/ত্রৈমা/

তারিখঃ - ০৬ - ২০০৭ ইং

জুন- আগস্ট, ২০০৭ ইং -এর আবহাওয়া পূর্বাভাস

General Condition (সাধারণ অবস্থা):

- মে, ২০০৭ ইং -এ Southern Oscillation Index (SOI) এর মান ছিল -২.৭ (Bureau of Meteorology, Australia) যা - এপ্রিল, ২০০৭ ইং অপেক্ষা ০.৩ বেশী।
- মে, ২০০৭ ইং মাসে চট্টগ্রাম ও সিলেট বিভাগে প্রায় স্বাভাবিক এবং অন্যত্র স্বাভাবিক অপেক্ষা কম বৃষ্টি হয়েছে। সামগ্রিকভাবে সারাদেশে স্বাভাবিক অপেক্ষা প্রায় ২৫.৪% কম বৃষ্টি হয়েছে। দেশের উপর দিয়ে কম সংখ্যক পশ্চিমা লঘুচাপ অতিক্রম করায় এবং পূর্বালী লঘুচাপের সাথে পশ্চিমা লঘুচাপের যথাযথ সন্মিলন না ঘটায় সারাদেশে কম বৃষ্টি হয়েছে। নিম্নচাপ/ঘূর্ণিঝড় সৃষ্টি, বৃষ্টিপাতের দিনসংখ্যা, তাপপ্রবাহ ও কালবোশেখীর পূর্বাভাস মে, ২০০৭ ইং মাসের পূর্বাভাসের সাথে সংগতিপূর্ণ ছিল।
- প্রাপ্ত আবহাওয়া উপাত্ত, আবহাওয়া মানচিত্র, জলবায়ু রিগ্রেশন ও এনালগ মডেল এবং উপগ্রহ চিত্র ইত্যাদির যথাযথ বিশ্লেষণ পূর্বক জুন - আগস্ট, ২০০৭ ইং-এর পূর্বাভাস নিম্নে প্রদত্ত হলঃ

বিভাগ	জুন, ২০০৭		জুলাই, ২০০৭		আগস্ট, ২০০৭		মে, ২০০৭ মাসে মাটির আর্দ্রতা (৫০ সেঃমিঃ পর্যন্ত) %
	স্বাভাবিক বৃষ্টিপাত (মিঃমিঃ)	পূর্বাভাস বৃষ্টিপাত (মিঃমিঃ)	স্বাভাবিক বৃষ্টিপাত (মিঃমিঃ)	পূর্বাভাস বৃষ্টিপাত (মিঃমিঃ)	স্বাভাবিক বৃষ্টিপাত (মিঃমিঃ)	পূর্বাভাস বৃষ্টিপাত (মিঃমিঃ)	
ঢাকা	৩৫৫	৩০০-৪০০	৩৭৯	৩৫০-৪০০	৩১০	৩০০-৩৫০	২৫-৩৫
চট্টগ্রাম	৫৮৯	৫০০-৬০০	৭২০	৭০০-৭৫০	৫৫৬	৫০০-৬০০	৩০-৩৮
সিলেট	৬৩৪	৬০০-৭০০	৫৭৯	৫৫০-৬০০	৪৫৬	৪৩০-৪৮০	২৫-৩৫
রাজশাহী	৩৪৭	৩০০-৪০০	৩৮৫	৩৫০-৪০০	৩২২	৩০০-৩৫০	২২-৩০
খুলনা	২৯৮	২৫০-৩৫০	৩৪১	৩২০-৩৬০	২৯৮	২৭০-৩২০	২৫-৩২
বরিশাল	৪৮৩	৪০০-৫০০	৫১৯	৪৯০-৫৪০	৪৩৩	৪০০-৪৫০	২৫-৩৫

- জুন মাসের ১০ তারিখের মধ্যে সারাদেশে দক্ষিণ-পশ্চিম মৌসুমী বায়ু (বর্ষা)-র বিস্তারলাভ করবে।
- জুন - আগস্ট মাসে বঙ্গোপসাগরে ৩-৫টি মৌসুমী নিম্নচাপ সৃষ্টি হতে পারে।
- জুন- আগস্ট মাসে সামগ্রিকভাবে দেশে স্বাভাবিক অপেক্ষা (১০-১৫)% বেশী বৃষ্টিপাতের সম্ভাবনা আছে।
- মৌসুমী বায়ুর আগমনের সাথে সাথে তাপপ্রবাহ প্রশমিত হবে।
- বর্ষাঃ জুন মাসের দ্বিতীয়ার্ধে দেশের উত্তর-পূর্বাঞ্চল ও মধ্যাঞ্চল স্বাভাবিক বর্ষার সম্ভাবনা আছে। জুলাই মাসের শেষার্ধ্বে ত্রাঙ্গপুত্র-গঙ্গা-মেঘনা অববাহিকায় স্বাভাবিক বন্যার সম্ভাবনা আছে যা আগস্ট মাস পর্যন্ত অব্যাহত থাকতে পারে।
- কৃষি আবহাওয়াঃ দেশে গড় বাষ্পীভবন ৩.৭৫-৪.২৫ মিঃমিঃ এর সম্ভাবনা রয়েছে।

কৃষি মন্ত্রণালয়,
বাংলাদেশ সচিবালয়, ঢাকা।
ফ্যাক্সঃ ৮৬১৭০৪০।

ড. সমরেন্দ্র কর্মকার
পরিচালক (চলতি দায়িত্ব)

অনুলিপিঃ-

- সচিব, মন্ত্রিপরিষদ বিভাগ, বাংলাদেশ সচিবালয়, ঢাকা। ফ্যাক্সঃ ৭১৬০৬৫৬।
- সচিব, কৃষিমন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা। ফ্যাক্সঃ ৭১৬৭০৪০।
- সচিব, প্রতিরক্ষা মন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা। ফ্যাক্সঃ ৮১১৭৯৪৫।
- সচিব, দুর্যোগ ব্যবস্থাপনা ও ত্রাণমন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা। ফ্যাক্সঃ ৭১৬৯৬২৩।
- সচিব, পানি সম্পদ মন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা। ফ্যাক্সঃ ৭১৬২৪০০।

Annex 8. List of agencies visited by the study team members at various levels

List of professionals and agencies contacted at “National level”

Sl No.	Name of respondent and Designation	Name of Agency	Address
1.	Sujit Kumar Devsharma Additional Director	Bangladesh Meteorological Department (BMD)	Abhawa Bhaban, Agargaon, Dhaka-1207, Bangladesh. Tel: (88-02)-8116634, 8119832, 8113071, 9118448 Email: bmdhaka@bttb.net
2.	Mr. A. Z. MD. Zahedul Islam, Senior Scientific Officer	Space Research and Remote Sensing Organization (SPARSO)	Agargaon, Sher-e-Bangla Nagar, Dhaka-1207.
3.	a) Md. Sizedul Karim Chowdhury, Project Director and b) Sajedul Islam, Assistant Engineer	Flood Forecasting and Warning Center (FFWC), Bangladesh Water Development Board (BWDB)	a) 72 Green Road, Dhaka-1215 (hydrology Branch) and b) WAPDA building, Motijheel (warning Branch)
4.	Engr. Saiful Alam Principal Scientific Officer	Water Resources Planning Organization, Ministry of Water Resources (WARPO)	House No-103, Road No- 1, Banani, Dhaka-1213, Bangladesh. Phone: +880-2-8814217, +880-2-8814554, +880-2-8814556 Website : www.warpo.gov.bd
5.	Anisul Haque, Director	Institute of Water and Flood Management (IWFM), BUET	BUET, Dhaka. Tel: 8614640-4, 8110189, Fax: 8613026
6.	Abu Saleh Khan Principal Specialist and Head of Flood Division and Jahir-ul Haque Khan Head of Coast, Port and Estuary Management Division	Institute of Water Modeling (IWM)	House # 496, Road # 32, New DOHS Mohakhali, Dhaka.
7.	Engr. Mohammed Rezaul Karim Executive Engineer	Local Government Engineering Department (LGED)	LGED HQ, Level 5, Sher-E-Bangla Nagar, Agargaon, Dhaka-1207, Bangladesh. Website: www.lged.gov.bd
8.	Priyo Jyoti Khisa Director	Disaster Management Bureau (DMB)	Ministry of Food and Disaster Management Disaster Management & Relief Bhaban (4th Floor). 92-93, Mohakhali C/A, Dhaka-1212, Phone : 880-2-8859637, Email: dmb@bttb.net.bd
9.	Md. Habibur Rahman Addl. Director (Monitoring)	Field Service Wing Department of Agricultural Extension	Khamarbari, Farmgate, Dhaka-1215, Bangladesh Telephone: 880-2-8115267 E-mail: dgdaedhk@citechco.net
10.	Md. Badiuzzaman Assistant Director, Operation	Fire Brigade and Civil Defense Directorate	Fulbaria, Dhaka-1000, Bangladesh. Phone: 9558880, 9555555, Fax: 9565657, Email: dgfire@bttb.net.bd

11.	Aminul Kawser Dipu ESC Coordinator	Emergency Support Corps (ESC)	House#34/1,Road#11,Dhanmandi R/A, Dhaka-1209, 8157548, 01711234098, 01713038208, Email:esc@agni.com
12.	Prof. Dr. Mehedi Ahmed Ansary	Bangladesh Earthquake Society (BES)	Room-644, Department of Civil Engr., BUET, Dhaka-1000, Bangladesh. Email:bdeqsoc@yahoo.com Web: www.geocities.com/bdeqsoc
13.	Reshad Md. Ekram Ali	Geological Survey of Bangladesh (GSB)	153, Pioneer Road, Segunbagicha, Dhaka. Phone: 9344394, Cell: 01712149323 (Contact person: Rashed Md. Ekram Ali), Fax: 880-2- 9339309.
14.	Md. Rafiqul Islam Deputy Director DM Coordinator & in Change	Bangladesh Red Crescent Society (BRCS)	684-686 Bara Maghbaszar, Dhaka- 1217,Tel: 9330188-9, 9338898, Fax- +880(02)9352303, info@bdracs.org
15.	Engr. Md. Shohidul Alam, Director	Bangladesh Telegraph and Telephone Board (BTTB)	37/1,Eskaton Garden,Dhaka,Bangladesh. Tel:8311500,8824131,Fax:8312577,988 84768. Email: salam@bttb.net , Website: www.bttb.gov.bd
16.	Md. Fokhrul Islam Producer (News)	Bangladesh Television (BTV) Rampura, Dhaka.	BTV Bhaban, Rampura, Dhaka. 01716776330
17.	Sultan Ahmed Deputy Director	Bangladesh Inland Water Transport Authority (BIWTA)	BIWTA Bhaban, 141-143, Motijheel C/A Dhaka-1000. Phone No : 9556151-55 Fax : 880-2-9551072, E-Mail : biwta@bttb.net.bd
18.	Suman SMA Islam, Humanitarian Assistance Coordinator	CARE Bangladesh	Pragati RPR Center (Level-12), 20-21, Kawran Bazar, Dhaka-1215, Bangladesh. Tel: 9112315, 81114207, Fax: 8114183, Email: biswas@carebangladesh.org
19.	Pia Afreena Huq Principal Specialist	Center for Environmental and Geographic Information Services (CEGIS)	House#6, Road#23/C, Gulshan-1, Dhaka. Tel: 8821570-2, Fax: 8823128, 8855935. Email: cegis@cegisbd.com
20.	Md. Hasanul Amin Director (Admin)	Cyclone Preparedness Program (CPP)	BRCS ,684-686 Bara Maghbaszar, Dhaka-1217, Tel: 9330188-9, 9338898, Fax:+880(02)9352303, info@bdracs.org
21.	Sirajul Islam Chief Town Planner	Dhaka City Corporation (DCC)	Chief Executive Officer: 2nd Floor, Nagar Bhaban Room # 201, Phon:9563510,& Secretary: 2nd Floor, Nagar Bhaban Room# 202, 9563507
22.	Md. Nizamul Kabir Deputy director	Department of Mass Communication, Mol	AGB Building, Segunbagicha, Dhaka-1000
23.	Mahbubul Alam Chief Inspector	Department of Shipping	141-143, Motijheel C/A, Dhaka-1000, Bangladesh. Tell:9555128, Fax: 716863, Mail: dosdgdbd@bttb.net.bd
24.	Shekh Abdul Ahad	Bangladesh Bureau	Parishankhan Bhaban, E-27/A,

	Director	of Statistics (BBS)	Argargaon, Dhaka. Phone # 880-2-9118045, 8115942, Fax # 880-2-9111064, E-mail : ndbp@bangla.net, Web: www.bbs.gov.bd
25.	Md. Abdul Khaleque Additional Chief Engineer	Roads and Highways Department	Sarak Bhaban, Ramna, Dhaka Bangladesh
26.	Md. Humayun Kabir Deputy Assistant Director (Ansar- training)	Ansar and VDP Director General	Malibagh, Dhaka, Bangladesh. Tel: 7214951-5, Fax: 7124958, 7124959. Email: info@ansarvdp.gov.bd, ansarvdp@yahoo.com, Website: www.ansarvdp.gov.com
27.	Mainullah Chowdhury Lieutenant Cornel	Armed Forces Division	Prime Minister's Office, Dhaka Cantonment, Dhaka, Bangladesh. Tel: 8750011/4334 Website: www.bangladeshnavy.org
28.	Moloy Chaki Program Coordinator	Bangladesh Disaster Preparedness Centre (BDPC)	House-52, Road-13/C, Block-E Banani, Dhaka 1213, Tel: 8815074, 8816296
29.	Sayed Asifa Ashrafi, Program Officer- Risk Reduction Theme	Actionaid	House CES (E), 19, Road 128, Gulshan-1, Dhaka
30.	Nurul Amin Bagmer Program Manager- EDP	Islamic Relief	House #24, Road # 5, Block-K, Baridhara, Dhaka-1212, Bangladesh. Phone: 88-2-8819392, 9893458, Fax: 8825119, Email: bna@isiamicrelief.bd.org
31.	Armana Ahmed, Fund & Institutional Development officer	International Centre for Diarrhoeal Disease Research, Bangladesh. (ICDDRb)	68 Shahid Tajuddin Ahmed Sharani Mohakhali, GPO Box-128 1212 Dhaka Bangladesh, Telephone: +880 2 88 11 751 FAX: +880 2 88 23 116 / 26 050 E-mail: info@icddrb.org Web: http://www.icddrb.org

List of professionals and agencies contacted at district level

Sirajganj district

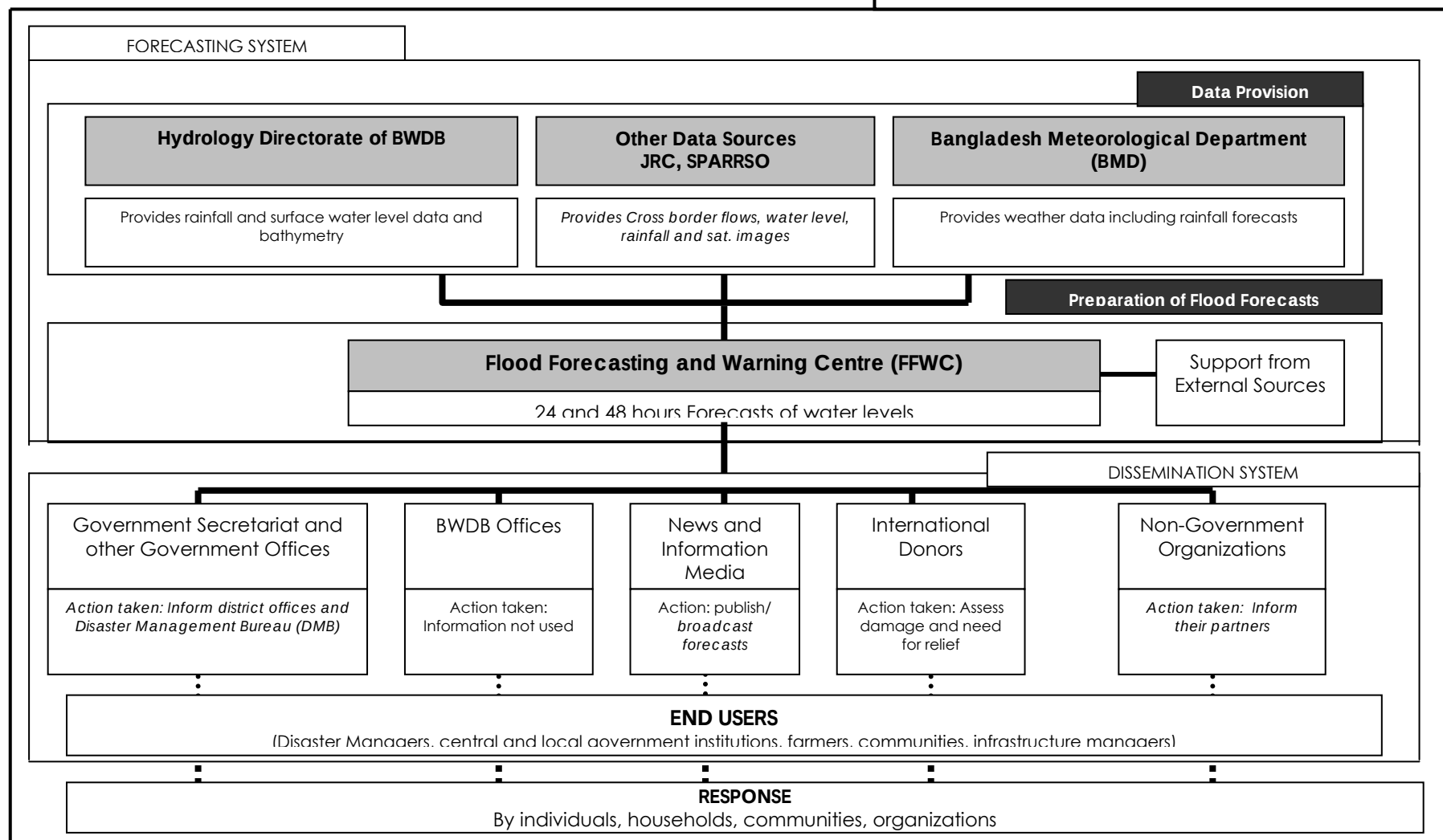
SL.	Name of respondent and Designation	Name of Agency	Address
1.	Dulal Krishna Saha, Additional Deputy Commissioner (ADC) (General)	District Disaster Management Committee	Deputy Commissioner Office, Sirajganj.
2.	Mr. Abul Khayer District Relief and Rehabilitation Officer (DRRO)	District Disaster Management Committee	Deputy Commissioner Office, Sirajganj.
3.	Dr. Binoy Kumar Sarker District Livestock Officer	District Livestock Office	District Livestock Office, Sirajganj.
4.	Kazi Monowar Hossain, District Controller (Food)	District Food Controller Office	Sirajganj Sadar, Sirajganj.
5.	Md. Nizamul Haq Bhuyan, Executive Engineer	Bangladesh Water Development Board (BWDB)	Sirajganj Sadar, Sirajganj.
6.	Habibur Rahman, Deputy Director	Department of Agriculture Extension (DAE)	Sirajganj Sadar, Sirajganj.
7.	Mr. Amir Hossain, Director	Gono Kalyan Sangstha (GKS)	Gono Kalyan Sangstha (GKS) office, Sirajganj Sadar, Sirajganj.
8.	Mr. Pores Sharker, Programme Manager,	National Development Programme (NDP)	Sirajganj Sadar, Sirajganj
9.	Mr. Zinder Ali, Project Implementation Officer (PIO)	Upazila Disaster Committee, Project Implementation Officer (PIO)	Kazipur, Sirajganj.
10.	Mr. Azit Kumar Sarker, Project Implementation Officer (PIO)	Upazila Disaster Committee, Project Implementation Officer (PIO)	Sadar Upazila, Sirajganj
11.	Md. Ziaur Rahman, Accountant	National Development Programme (NDP), Accountant	Kazipur Upazila, Sirajganj
12.	T. M Atiqur Rahman, Chairman	Union Parishad	Kazipur Sadar Union, Kazipur, Sirajganj.

Cox's Bazaar district

Sl No	Name of respondent and Designation	Institute/Agency Name	Address
1	Mr. Abdul Aziz, (DRRO)	District Disaster Management Committee	Main road, Cox's Bazaar
2	Shamsul Kabir, (Executive Engineer)	Bangladesh Water Development Board (BWDB)	Motel road Cox's Bazaar
3	Shah Alam, Deputy Director	Department of Agriculture Extension (DAE)	Pan Bazaar, Andarson road
4	Md. Golam Faruk Talukder	Department of Livestock	Cox's Bazaar Sadar
5	Promir Ranjan Ghosh (Upper Division Clerk)	Department of Food	Motel road Cox's Bazaar
6	Kabir Ahmed, (District Officer)	Department of Fisheries	Cox's Bazaar Sadar
7	Shekh Mujakka Jaher (Executive Engineer)	Local Government and Engineering Department	Cox's Bazaar Sadar
8	Harun ar Rashid, (Disaster officer)	World Vision (NGO)	Cox's Bazaar Sadar
9	Masudur Rahman, (PIO)	Upazila Disaster Management Committee (Sadar Upazila)	Sadar Upazila, Cox's Bazaar.
10	Belal Hossain, (Upazila Officer)	Department of Agriculture Extension (DAE)	Sadar Upazila, Cox's Bazaar.
11	Dr. Md. Mizanur Rahman, Upazila Officer	Department of Livestock	Sadar Upazila, Cox's Bazaar.
12	Mamun Ar Rashid, Upazila Officer	Cyclone Preparedness Centre (CPP)	Sadar Upazila, Cox's Bazaar.
13	Sirajul Islam, Abdul Gafur and Rezaul Karim, (UP member)	Choto Moheshkhali union Parishad	Choto Moheshkhali union Parishad

Annex 9. Existing warning system (Adopted from ADB: 2006)

EXISTING EARLY WARNING SYSTEM



Annex 10. Example of a letter with “warning message” from UNO office that goes to the respective Union Parishads, communities and responsible authorities in the community.

বাহক যোগে

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
উপজেলা নির্বাহী অফিসারের কার্যালয়
সদর, কক্সবাজার

স্মারক নং-উনিঅ/সদর/কক্স/ধর্মসভা/০৭-২২২ তারিখ : ১৫ নভেম্বর ২০০৭ / ০১ আশ্বইন ১৪১৪

জরুরী বিজ্ঞপ্তি

সংশ্লিষ্ট সকলের অবগতির জন্য জানানো যাচ্ছে যে, বঙ্গোপসাগরে সৃষ্ট নিম্নচাপটি ঘূর্ণিঝড়ে রূপ নিয়েছে। ‘সিডর’ নামক ঘূর্ণিঝড়টি প্রবল বেগে উপকূলীয় এলাকার দিকে ধেয়ে আসছে। আবহাওয়া অফিস থেকে কক্সবাজার উপকূলবর্তী এলাকায় ৯ নম্বর মহা-বিপদ সংকেত দেখিয়ে যেতে বলা হয়েছে। বর্ণিত ঘূর্ণিঝড়টি আজ দুপুর নাগাদ উপকূলীয় এলাকা অতিক্রম করার সম্ভাবনা রয়েছে। তাই ঘূর্ণিঝড় মোকাবেলার জন্য সকল ইউনিয়ন পরিষদ চেয়ারম্যান-মেম্বর ও ইউপি সচিবদেরকে জনগণকে নিরাপদ স্থানে আশ্রয়ে চলে যেতে সর্বাত্মক সহযোগিতার করার জন্য এবং উপজেলা পরিষদের কর্মকর্তা-কর্মচারীকে পরবর্তী নির্দেশ না দেয়া পর্যন্ত / দূর্যোগ পরিস্থিতি স্বাভাবিক না হওয়া পর্যন্ত কর্মস্থলে উপস্থিত থাকার জন্য অনুরোধ করা গেল।

উল্লেখ্য, উপজেলা নির্বাহী অফিসারের কার্যালয়ে একটি নিয়ন্ত্রণ কক্ষ খোলা হয়েছে, যার টেলিফোন নম্বর- ০৩৪১-৬৩৭১৫।

স্বাক্ষরিত/১৫/১১/০৭
উপজেলা নির্বাহী অফিসার
সদর, কক্সবাজার
ফোন-৬৩৭১৫

স্মারক নং-উনিঅ/সদর/কক্স/ধর্মসভা/০৭-২২২ তারিখ : ১৫ নভেম্বর ২০০৭ / ০১ আশ্বইন ১৪১৪
অনুলিপি-সদয় অবগতি ও কার্যক্রম গ্রহণের জন্য-

- ১। জেলা প্রশাসক, কক্সবাজার।
- ২। জেলা ত্রাণ ও পুনর্বাসন অফিসার, কক্সবাজার।
- ৩। উপজেলা..... অফিসার, সদর, কক্সবাজার।
- ৪। চেয়ারম্যান.....(সকল) ইউপি।
- ৫। জনাব.....।
- ৬। অফিস কপি।

প্রশাসনিক কর্মকর্তা
উপজেলা নির্বাহী অফিসারের কার্যালয়
সদর, কক্সবাজার।

Annex-11. A sample of the notice flows to the sectoral agencies (here an office order from the national to local level is shown for livestock sector below)

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পশুসম্পদ অধিদপ্তর
কৃষি খামার সড়ক, ফার্মগেট, ঢাকা-১২১৫

স্মারক নং-শাখা-৩/দ-৩/২০০৭/

তারিখ :

“কার্যালয় স্মারক”

দেশের বেশ কয়েকটি জেলা বন্যা কবলিত হওয়ার সংবাদ বিভিন্ন পত্র-পত্রিকায়, বেতার এবং টেলিভিশনের সংবাদের মাধ্যমে জানা যায়। যে সকল জেলায় বন্যা কবলিত হইয়াছে সে সকল জেলার প্রতিটি উপজেলায় ভেটেরিনারি মেডিক্যাল টিম গঠন করার জন্য পরামর্শ দেওয়া হইল। বন্যা কবলিত জেলার কর্মকর্তা/কর্মচারীগণের সকল প্রকার ছুটি বাতিল করা হইল।

বন্যা আক্রান্ত এলাকায় বন্যাকালীন সময়ে এবং বন্যা পরবর্তী সময়ে করণীয় বিষয় (সংযুক্ত) সম্পর্কে জনগণের সচেতনতা বৃদ্ধির লক্ষ্যে পরামর্শ দেওয়ার জন্যও বলা হইল। বন্যা আক্রান্ত জেলা সমূহ হইতে সংযুক্ত ছক মোতাবেক নিয়মিত প্রতিবেদন অধিদপ্তরের বার্ড ফ্লু কন্ট্রোল রুমে প্রেরণ করার জন্য অনুরোধ করা হইল।

স্বা/-
(সুনীল চন্দ্র ঘোষ)
মহা-পরিচালক(চঃ দাঃ)
পশুসম্পদ অধিদপ্তর, বাংলাদেশ, ঢাকা।
তারিখ : ৩০/০৭/২০০৭ খৃঃ।

স্মারক নং-শাখা-৩/দ-৩/২০০৭/২১৪(৭৩)

অবগতি ও প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য অনুলিপি প্রেরণ করা হলোঃ

১-৬৪। জেলা পশুসম্পদ কর্মকর্তা,.....।
৬৫-৭০। উপ-পরিচালক, বিভাগীয় পশু সম্পদ দপ্তর, ঢাকা বিভাগ, ঢাকা/চট্টগ্রাম বিভাগ, চট্টগ্রাম/খুলনা বিভাগ, যশোর/ রাজশাহী বিভাগ, রাজশাহী/বরিশাল বিভাগ, বরিশাল।
৭১। পরিচালক, সম্প্রসারণ, পশুসম্পদ অধিদপ্তর, বাংলাদেশ, ঢাকা।

স্মারক নং-শাখা-৩/দ-৩/২০০৭/
সদয় অবগতির জন্যঃ

১। সচিব, মৎস্য ও পশুসম্পদ মন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা।

(সুনীল চন্দ্র ঘোষ)
মহা-পরিচালক(চঃ দাঃ)
পশুসম্পদ অধিদপ্তর, বাংলাদেশ, ঢাকা।
তারিখ : ৩০/০৭/২০০৭ খৃঃ।

স্মারক নং-ব-১১/০৭/
পত্রের স্বাক্ষরকারী প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য নির্দেশ গ্রহণে অনুরোধ করা হলো :-

১-১। উপজেলা পশুসম্পদ কর্মকর্তা, সদর/কাছপুর/চাঁদপুর/রাঙ্গামাড়া/সাহস্রাদপুর/কাহারুল/বেকুচি/চৌহালী, সিরাজগঞ্জ।
১০। অফিস কপি।

তারিখ-
(ডাঃ রবজিৎ কুমার চক্রবর্তী)
জেলা পশুসম্পদ কর্মকর্তা,
সিরাজগঞ্জ।



Asian Disaster Preparedness Center

Safer communities and sustainable development through disaster risk reduction