

# Flood mitigation through best management practices

MD. KHALEQUZZAMAN

MILLIONS of people are experiencing severe floods this year. While the annual floods are essential and desirable for overall growth of floodplain and delta plain, as well as for the economy, the major floods such as those that occurred in 1954, 1974, 1987, 1988, and 1998 are destructive and cause serious threat to lives and economy. So far, over 142 people in Bangladesh have lost their lives to flooding. More than 11 million are affected by this year's flood. Total property damage in the Ganges-Brahmaputra-Meghna (G-B-M) basin is yet to be determined.

It is imperative that flood damage to property and lives be minimised in the G-B-M basin. However, before any solution to prevent or mitigate flood damage can be prescribed, we need to analyse possible underlying causes of recent unusual and frequent floods in the G-B-M basin in light of hydrodynamic processes that operate in the basin and the land use practices that take place in this region.

## Flood control measures and the outcome

Flood control measures in Bangladesh are mainly limited to building of earthen embankments, polders, and drainage. A total of 5,695 km of embankments, including 3,433 km in the coastal areas, 1695 flood control/regulating structures, and 4,310 km of drainage canals have been constructed by the Bangladesh Water Development Board during the last several decades. Embankments and polders have reduced floodplain storage capacity during floods, leading to an increase in water levels and discharges in many rivers. Furthermore, earthen embankments can easily breach and can be damaged by riverbank erosion. Most of the embankments in Bangladesh have experienced breaching and erosion more than once since their completion.

Despite flood control measures already administered by the government, the total damage to economy, crops, and infrastructures due to floods has steadily increased during the period between 1954 and 1998. According to one study, overall damage to the economy in Bangladesh ranged from Tk. 1200 crores in 1954 to Tk. 10,000 crores in 1998; and crop damage has varied between 0.6 million tons in 1953 and 3.2 million tons in 1988. Furthermore, the number of flood-related deaths increased from 112 in 1954 to 2,379 in 1988.

It is obvious that the flood control measures did not make positive impacts in terms of reducing the flooding propensity and total damage in Bangladesh.

The magnitude and duration of

floods have changed during the last few decades. The flood of 1998 lasted over 70 days in Bangladesh. A prolonged flooding condition prevailed throughout much of the monsoon season in 1999. This begs the questions, "why, despite all the flood control measures taken and the money spent, is the flooding propensity in Bangladesh increasing, and what can be done to reduce such damage in the future?" The answers to these questions lie in understanding of the long-term factors contributing to increased frequency and duration of floods. Once the causes of the problem are determined, then preventive measures can be taken to reduce future damage caused by floods.

## Factors contributing to flooding propensity

Likelihood of flooding in an area can vary greatly with a change in the: (a) amount of surface runoff that results from rain in a watershed, (b) water carrying capacity of a drainage basin, and (c) change in land elevations with respect to riverbeds and sea level. An increase in runoff component of the hydrologic cycle in a watershed, a decrease in water carrying capacity of a drainage system, and a decrease in land elevations will increase flooding propensity in an area. Therefore, the flooding problem and the solutions to such problems can (or should) be analysed in the context of these three fundamental parameters: surface runoff, water carrying capacity of rivers, and changes in land elevations. We need to analyse the changes in land use practices that occurred during the last few decades that have potentially affected the hydrodynamic behaviours of rivers.

**Unplanned urbanisation:** Rapid population growth creates extra pressure on the land and forces to convert agricultural lands into housing developments and roads. Rapid urbanisation has almost undoubtedly aggravated the flooding problem in Bangladesh. Urban population has increased from 1.81 million (4.33 percent of total population) in 1951 to 25.2 million in 1990. The current urban population is more than 30 million (25 percent of total population), and is projected to exceed 58 million (36 percent of total population), by the year 2010.

Unplanned urbanisation can adversely impact flooding situation in a watershed. Prior to urbanisation there exists a longer lag time between the rainfall and peak flow in rivers. After urbanisation the lag time is shortened, peak flow is greatly increased, creating favorable conditions for intense flooding in an area. For example, for a city that is totally served by storm drains, and 60 percent of the land surface is covered by roads and buildings (like

Formulating solutions to flooding problems requires a comprehensive understanding of the geologic settings of the region, and a better knowledge of hydrodynamic processes that are active in watersheds. Only solutions that take into account the underlying long-term factors contributing to flooding problems can prevail.



Dhaka), flooding frequency increases by a factor of six compared to pre-urbanisation period.

Following urbanisation, it is necessary to adjust drainage capacity in a watershed to take into account the "basin development factor (BDF)" in order to accommodate the extra runoff that results due to urbanisation. The amount of adjustment in the carrying capacity of natural streams in urbanized areas depends on the degree of BDF. For an increase of impervious surface by 10 percent in a watershed, a 23 percent increase in the drainage capacity by streams is required. Dhaka is located in the watersheds of Buriganga and Sitalakha rivers. A significant increase in the amount of impervious surface in these watersheds has taken place due to expansion of the Dhaka Metropolitan area over the last few decades. However, no attempts have been taken to increase the carrying capacity of these rivers to accommodate for the BDF. On the contrary, many of the rivers including Buriganga are being filled up with people. The illegal encroachment onto the rivers is contributing to the reduction in water carrying capacity during floods. Moreover, the internal drainage system consisting of tributaries to Buriganga and Sitalakha rivers has been

diminished due to unplanned land use practices. For instance, it is apparent from historic maps that the Dhanmondi and Baridhara lakes are remnants of tributaries to the Buriganga-Sitalakha rivers. Also, filling up of the Dholakhal channel has reduced the runoff capacity from Dhaka. The lack of an efficient storm sewer system in Dhaka also contributes to the reduction of water carrying capacity, causing water logging throughout the monsoon season. According to reports published in national newspapers, Dhaka has experienced serious water-logging problems during the wet months of July to October in 1999, from July to September in 2000, and in July in 2002.

**Riverbed aggradation:** Riverbed aggradation is most pronounced for the Ganges and its distributaries. From the border with India to the point where the Ganges meets the Brahmaputra River, the riverbed has aggraded as much as 5-7 meters in recent years. The average width of the Ganges has decreased from 1.27 km in 1973 to 1.01 km in 1985. Riverbed aggradation is so pronounced in Bangladesh that changes in riverbed level can be observed during one's lifetime. For example, the Old Brahmaputra River was navigable for steamers only about 30 years ago, and is

presently an abandoned channel. This situation is true for many other distributaries of the Ganges and Meghna Rivers, such as the Madhumati, Bhairab, Chitra, Gorai, Ghoraura Rivers, etc. Riverbed aggradation reduces the water carrying capacity of rivers, causing floods due to bank overflow. Siltation of riverbeds in rivers in northern Bihar has been reported in recent years. This recent increase in riverbed levels has undoubtedly contributed to the increased flooding propensity.

**Soil erosion:** Ploughing makes the land surface more susceptible to soil erosion. Surface run-off can easily wash away the topsoil from cultivated lands. This surface erosion reduces land elevation, which in turn increases flooding intensity in an area. According to the Report of the Task Forces (RTF) on Bangladesh Development Strategies for the 1990s, soil erosion is a serious problem in many parts of Bangladesh. Hilly areas in Sylhet, Chittagong and Chittagong Hill Tract districts are more susceptible to soil erosion. About 55 percent of Chittagong Hill Tract area is highly susceptible to soil erosion. Heavy monsoon showers remove the surface soil through runoff. Eroded sediments are deposited on the riverbeds, reducing the water carrying capacity and increasing

flooding propensity in a watershed. Soil erosion also reduces land elevations and increases elevations of riverbeds, contributing to increased flood-depths. The land elevations in other parts of Bangladesh must have reduced over time due to soil erosion as well. Aside from this, the tilting on the mountain slopes of the Himalayas is thought to be responsible for massive soil erosion in Nepal, which eventually causes rapid riverbed aggradation in Bangladesh. Moreover, construction sites in cities can contribute to soil erosion, if silt fences or sediment retention ponds are not employed properly. In Bangladesh, no such measures are in practice at construction sites.

**Deforestation in the upstream region:** A rapid increase in population in the Indian Subcontinent during the 20th century has resulted in an acceleration of deforestation in the hills of Nepal to meet the increasing demands for food and fuel wood. Deforestation of steep slopes is assumed to lead to accelerated soil erosion and landslides during monsoon precipitation, which in turn is believed to contribute to devastating floods in the downstream regions, such as Bangladesh. Deforestation within Bangladesh also contributes to the soil erosion. The amount of forest cover in

Bangladesh was reduced from 15.6 percent in 1973 to 14.6 percent in 1985-86, and eventually to 13.4 percent in 1987. A minimum of 25 percent forest cover is suggested for a healthy ecosystem. The amount of forest cover in Bangladesh at the present time believed to be less than 10 percent.

**Sea-level rise:** The ultimate destination of all rivers is the ocean. The land elevations are measured with respect to the sea level. Therefore, any change in the sea level causes land elevations to change as well. At the present time the sea level is rising globally. If the sea-level rises in an area at rates faster than the rates of vertical growth of floodplain by sedimentation, then land elevations decrease over time. Any decrease in land elevations can cause increased inundation by floods. The rate of local sea-level rise is 7 mm/year in the coastal areas of Bangladesh. According to a study, the local sea level at Chittagong Port has increased by as much as 25 cm between 1944 and 1964. The sea level in the Bay of Bengal is predicted to rise 83 to 153 cm by the year 2050. An increase in the sea level raises the base level of rivers, which in turn reduces river flow. As a consequence, the amount of river discharge decreases, creating a backwater effect further inland. The backwater effect caused by sea-level rise can result in more flooding of lands from "piled up" river water inland. This certainly seems to be one of the contributing factors for the increased flooding intensity in Bangladesh.

## Best management practices as flood control measures

Flooding is a natural phenomenon, which cannot be prevented. Complete flood control is not in the interests of most farmers in Bangladesh. The flood control measures and policies should be directed to mitigation of flood damage, rather than flood prevention. Resources should be allocated to help people adopt a life style that is conformable to their natural environment. Indigenous solutions such as changing the housing structures and crop patterns can help reduce flood damage. Moreover, good governance, appropriate environmental laws, acts and ordinances will be necessary to achieve sustainable economic development and to reduce any environmental degradation. In addition, implementation of an improved real-time flood and drought control warning system can reduce damage caused by floods.

A greater understanding of the processes that contribute to increased flooding propensity, however, can help us mitigate the adverse effects on human lives, the

environment, and the economy. To mitigate flooding propensity in Bangladesh, the government and the people will have to shift their paradigms. We need to adopt the best management practices (BMPs) in agriculture, forestry, land-use planning, water resources management, and urbanisation.

The BMPs pertaining to flood control are those activities that will help reduce surface run-off, will increase the carrying capacity of drainage system, and will increase land elevations with respect to sea level or riverbeds. Examples of BMPs to reduce flooding should include the following features and activities: dredging of rivers, re-excavation of abandoned channels-ponds-lakes, dispersion of dredged sediments to increase village platforms and road elevations in villages, conservation tillage, establishment of vegetated buffer zone along rivers, putting silt fences around construction sites, building sediment retention ponds in construction sites, removal of polders in the coastal areas to enhance sedimentation on delta plain, efficient storm sewer systems in cities, planned urbanisation, watershed-scale land use zoning maps, reforestation, good governance, integrated regional water resources development plans that include participation from India, Nepal, and Bhutan.

## Conclusions

Formulating solutions to flooding problems requires a comprehensive understanding of the geologic settings of the region, and a better knowledge of hydrodynamic processes that are active in watersheds. Only solutions that take into account the underlying long-term factors contributing to flooding problems can prevail.

Structural solutions, such as the building of embankments along the rivers and polders in coastal regions in Bangladesh, will not solve the flooding problems, but will result in many adverse environmental, hydrologic, economic, ecological, and geologic consequences. Solutions to flooding problems can be achieved by adopting and exercising watershed-scale best management practices agriculture, construction, forestry, governance, river and water resources management, urbanisation, flood forecasting, and regional cooperation.

Since Bangladesh is a part of a larger hydrodynamic system, mutual understanding and cooperation among the co-riparian countries in the G-B-M basin will be necessary to formulate any long-term and permanent solutions to the flooding problems.

MD. KHALEQUZZAMAN, Ph.D., is an Associate Professor, Department of Geology and Physics, Lock Haven University, Lock Haven, PA, USA.

# Curtain officially rises on Election 2004

ZAHID HOSSAIN writes from Boston, Massachusetts

THE four-night Democratic Party National Convention, the official curtain-raiser of the US Presidential Election, commences in Boston tonight, and will reinforce the Democrats' election theme: "Stronger at Home, Respected in the World."

The convention aims to introduce the Presidential nominee Senator John Kerry and his running-mate Senator John Edwards to the American people. It is expected to tell, "the story of their lifetime of service to the nation and fight for average Americans, and their vision for a stronger and more secure America."

According to the New York based Campaign Finance Institute and convention host committees, they

have so far collected roughly \$40 million in donations from individuals, labour unions, and corporations. As many as 36,000 visitors are expected to attend the convention.

The choice of Max Cleland to usher in John Kerry's crowning on the final night of the convention underscores the intent to highlight the Democratic nominee's life story and military service. The prominent role of Cleland and a handful of former Swift boat crew members John Kerry commanded in Vietnam on the final night will provide an opportunity to flesh out John Kerry's biography, specially his combat experience, an important asset in a time of war.

The appearance of Cleland, a former Senator from Georgia who lost three limbs as an army officer in Vietnam, also counters the Republican recruitment of Senator Zell Miller

of Georgia to speak at the GOP Convention. Senator Miller, a life-long Democrat, has endorsed President Bush for re-election.

This election-related grand show of the Democratic Party is expected to be addressed by a host of Democratic dignitaries including former Presidents Bill Clinton and Jimmy Carter, former Vice-President Al Gore, Massachusetts Senator Edward Kennedy, Teresa Heinz Kerry, and Elizabeth Edwards. Bill Clinton kicks off the event with a speech in prime-time today.

The former chairman of the New York State Democratic Party Judith Hope, recently expressed her annoyance at the failure to give Senator Hillary Clinton a prominent speaking role at the convention although the convention organisers said, "the former first lady will appear on stage with other female Senators on the opening night of the gatherings, with Senator Barbara Mikulski of Maryland speaking." But Senator Clinton told a New York radio station that she was "not disappointed at all as I have had many opportunities in the past." In any case, John Kerry has requested Senator Clinton to introduce her husband on the first night of the convention, which she has agreed to do.

According to the convention sources, sufficient publicity arrangements have already been finalised to make it successful and effective. Agencies like ABC, NBC, and CBS have lined up with the convention host committee to broadcast one hour on each of the four-nights of the convention. They will do the same in the case of the Republicans who are expected to meet August 30 through September 2 in New York.

As for the security arrangements of such a show of national and international importance, the convention will have an unprecedented level of security by Homeland Security. The head of Homeland Security was in Boston a few days back to see for himself the elaborate arrangements already chalked out to ensure hundred percent security of the convention events. The special security measures will be in place amid warnings that terrorists might target the political gatherings in hopes of disrupting the November Presidential election.

In the meanwhile, Senator John Kerry, his running mate Senator John

Edwards, their advisers, and Democratic party policy-makers are all now extremely busy in formulating campaign strategies and other election programmes for the November Presidential race. John Kerry was recently at his summer home in Nantucket, Massachusetts for four days, basically to finalise his speech to be delivered at the convention and also to fix up the next phase of his campaign strategy. According to the latest New York Times/CBS News Poll, "John Kerry heads toward the Democratic Convention and his best opportunity to make a strong impression on the country."

As the convention sources have indicated, Senator Kerry and his allies will try to take full advantage of the four-day show, specially in turning the focus more towards the Iraq war and its far reaching consequences on the American image abroad and the series of financial woes that the Bush Administration has been inflicting on middle-class households. They will argue that there have been huge job losses under President Bush and that new jobs being created are inferior ones. Issues like medical bills, gasoline prices, and higher college tuition will also likely get the upper hand in the deliberations at the convention.

However, available indications show that John Kerry will present himself as a centrist on economic policy. He will pledge to cut the deficit, move the country towards budget surpluses and recreate the booming economy of the Clinton years. As if to underscore the point, he has recruited most of the economic advisers of the Clinton administration. But in any case, John Kerry will put special emphasis on his most significant economic proposal -- the expensive expansion of government financed health insurance.

The Democratic Party leaders will also try to cover some electoral issues and frame their campaign strategy accordingly in the convention. There is a consensus that at least seventeen states are still undecided and are up for grabs including electoral giants Florida, Ohio, and Pennsylvania. States like Republican-leaning Georgia are also there, and such issues will definitely draw the attention of the policy makers and campaign strategists.

The Republican leaders, on the other hand, have decided to set up a rapid response command centre in

Boston to counter what they term the Democrats' "extreme makeover of John Kerry's record" as has been conveyed by Christine Iverson, the Republican Party spokeswoman. The operation will feature instantaneous e-mail rebuttal and a slew of high profile Republican TV commentators.

On a separate front, a handful of independent pro-Democratic groups have recently picked up more than \$20 million expanding their role as a "shadow party" and leaving their Republican counterparts far behind. With more than \$43 million collected this year, the Democratic leaning organisations have been attacking President Bush in TV ads in key states and potentially could have a major impact in the closing months of the presidential race. "With the ads by the pro-Democratic groups, they have given John Kerry an advantage now and a significant advantage in some markets," said Ken Goldstein, a Professor of the University of Wisconsin who regularly tracks campaign ad spending.

In the meantime, the campaign groups of both Democrats and Republicans have indicated that they would accept \$75 million in public financing for the election campaign, which means that they cannot continue to raise private funds. But the independent groups can continue to raise and spend funds, air political messages, and mobilise voters on the ground.

Finally, and amusingly, a ten-year old donkey from northwest Georgia named Swifty is attending the Democratic Party Convention as a delegate to greet his fellow Democrats for the second time. Although Swifty will not be allowed into the Fleet Centre, he will be greeting voters at Boston Franklin Park Zoo, site of a Boston Promotional event, one of the larger side events of the Convention.

An experienced four-legged conventioneer, Swifty greeted fellow Democrats outside the Staples Centre in Los Angeles four years ago. His owner Morris Powell, 61, of Lookout Mountain recently told journalists that it would take a couple of days to drive the 900-odd miles from Georgia to Boston with a horse trailer in tow. Powell, a farmer and member of the boilermakers union, is a part of the official delegation from Georgia to the convention.

Zahid Hossain is a Senior Research Fellow at the Bangladesh Enterprise Institute.

## CAREER OPPORTUNITY

A widely reputed Group of Industries based at Chittagong is looking for the personnel in following disciplines for their Cold Rolling Mills.

Position	Qualification & Experience
Assistant Engineers	Bachelor of Engineering Degree from a reputed college/university under regular course with minimum 1st class result.
Sub Assistant Engineers	Must be from Mechanical Engineering (1st preference) or Electrical Engineering (2nd preference). 1st Class Diploma in Mechanical/Electrical Engineering.
Chief Financial Officer	Candidate should be a Graduate/Post Graduate from a recognized University and a Chartered Accountant. Should have experience in dealing with all the banks on credit related matters. Candidates working in the Treasury Department of a large reputed company will be preferred.

• Salary will be commensurate with qualification and experience.  
• Candidates should apply with Curriculum Vitae, true copies of certificates in support to their qualification and 2 copies of recent passport size photographs.  
• Please apply within 8 days from the date of advertisement to:

The Advertiser, GPO Box No: 1068, Chittagong.



## Invitation to Bid for Providing Security Services to UNICEF-BCO

UNICEF-Bangladesh invites bids from established/reputable security services companies in Bangladesh, having minimum five years experience with large multinationals/international organizations with efficient guards and effective communication and logistic facilities to provide security services to UNICEF-BCO.

Interested companies are requested to collect detailed Request for Proposal (RFP/2004/033) for above-mentioned services from UNICEF, Reception Desk, Third Floor, Right Wing, Dhaka Sheraton Hotel Annex Building, 1 Minto Road, Dhaka-1000 from Monday, 26 July 2004, between 11:30 to 16:00 hours.

The bid must be dropped on or before 14:00 hours on August 05, 2004 (Thursday) in the "Tender Box" located in UNICEF HR Section.