

Bangladesh and basinwide management of waters of the Ganges and the Brahmaputra rivers.

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I. Country Setting

Bangladesh, located in South Asia has an area of 147,570 sq.km, lying in the delta of the world's three major rivers the Ganges, the Brahmaputra and the Meghna of which 86,000 sq.km (58 percent) is cultivated. The country is bounded by India on the west, the north and the north-east, Myanmar (Burma) on the south-east and Bay of Bengal on the south.

Most of Bangladesh has been built up by the alluvial deposit of the Ganges, the Brahmaputra and the Meghna. The nearly flat topography, while ideal for agriculture, is prone to drainage and flood problems under the prevailing rainfall pattern and river regimes. Most of the land lies less than 20 meters above the Mean Sea Level (MSL). The overall gradient of the river flood plains is less than one-fifth meter per km, except in the extreme northwest where it increases to about two-thirds meter per km.

Bangladesh enjoys generally a sub-tropical monsoon climate. There are three seasons in a year, namely, winter, summer and monsoon. The lowest temperature comes down to 7°C during winter and rises upto a maximum of 40°C during summer. The rainfall in Bangladesh is highly seasonal and is concentrated in a period of four months (June-September) when 80 percent of the total rainfall occurs. Bangladesh receives annual rainfall from about 1,200 mm in the extreme west to about 5,800 mm to the north-east. The average annual rainfall is about 2,300 mm. The geographical setting and the climatic condition of Bangladesh has made the hydrological situation of the country very complex. The country is densely populated and the present population exceeds 130 million. The current density of about 867 persons per sq.km is one of the highest in the world. About 85 percent of the people live in rural areas. The unprecedented growth in population has led to a sharp decline in land man ratio and increasing landlessness which has resulted in migration of people to urban areas. It is apprehended that by the year 2025, forty percent of the country's total population would be living in urban areas.

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River Systems of Bangladesh

Bangladesh is a great delta formed by the alluvial deposits of the Ganges, the Brahmaputra and the Meghna river systems. The country has been blessed with more than 129 rivers including 57 international rivers. The Ganges, the Brahmaputra and the Meghna river systems drain from a total catchment area of about 1.72 million sq.km. through Bangladesh into the Bay of Bengal. Out of this huge catchment area, only 7% lies in Bangladesh. Being the lowest riparian, the country has no control over the huge cross-boundary flows of about 140,000 cumec (4,944,058 cusec) carried into Bangladesh by these rivers during monsoon. However, the flows become so scarce in the dry season that the combined minimum near the Bay of Bengal is only one-twentieth of the peak monsoon discharge. Consequently Bangladesh suffers from the chronic problems of floods during monsoon (June-October) and severe shortage of water during dry season (November-May). This phenomenon is frustrating the developmental efforts of the country. Following is provided very brief descriptions of the basins of the Ganges, Brahmaputra and the Meghna rivers which drain through Bangladesh:

The Ganges Basin : The Ganges basin encompasses an area of about 1,087,001 sq.km. The area in India is 860,000 sq. km, Nepal 147,181 sq.km, China 33,520 sq.km. and Bangladesh 46,300 sq.km. The Ganges rises from the Gangotri glacier in the Himalayas at an elevation of about 7010 meters near the Indo-Chinese border. The river flows generally in south-easterly direction and in the lower reaches it flows eastward and enters Bangladesh near Rajshahi. The river then joins the Brahmaputra near Aricha inside Bangladesh. The length of the main river is about 2550 km. Three major tributaries of the Ganges, the Karnali, the Gandaki and the Kosi flow through Nepal to joint the Ganges in India.

The Brahmaputra Basin : The Brahmaputra basin has a total catchment area of 552.000 sq.km. The area in China is 270,900 sq.km, Bhutan 47,000 sq.km, India 195,000 sq.km and Bangladesh 39,100 sq.km. The Brahmaputra originates in the Himalayan range and collects snowmelt and runoff from the huge catchment lying in China, Bhutan, India and Bangladesh. The river enters Bangladesh near Kurigram and flows southwards and continues to its confluence with the Ganges near Aricha. The total length of the Brahmaputra is about 2,900 km upto Aricha.

The Meghna Basin : The Barak, headstream of the Meghna rises in the hills of Manipur in India. The total length of the river is about 900 km of which 400 km is in Bangladesh. The total catchment area of Meghna river is 82,000 sq.km out of which 47,000 sq.km and 35,000 sq.km lie in India and Bangladesh respectively.

Table 1
Main Features of Major Rivers of Bangladesh

	Brahmaputra	Ganges	Meghna
Length of river (km)	2,900	2,550	900
Length within Bangladesh (km)	270	260	400
Total Basin area (km ²)	552,000	1,087,001	82,000
Basin area within Bangladesh (km ²)	39,100	46,300	35,000
Highest recorded discharge	98,300 (cumec) at Bahadurabad	76,000 (cumec) at Hardinge Bridge	19,800(cumec) at Bhairab Bazar
Lowest recorded discharge	2,860 (cumec) at Bahadurabad	261 (cumec) at Hardinge Bridge	Tidal

II. Bangladesh and IWRM

Water, which is a fundamental need of all living beings, is the single-most important resource for the well-being of the people of Bangladesh. Over the centuries water has been playing the pivotal role not only in the sustenance of life and living but also keeping the wheels of economy and development of this country moving.

Floods during monsoon and scarcity of water during the dry seasons are the two extreme characteristics of water availability in Bangladesh. Both these events cause extreme miseries and hardship to the millions of people. Over the decades Bangladesh has been trying to overcome this twin problem by adopting various measures and projects under different water management endeavors. These measures have brought in significant gains. More than a generation ago this country was haunted by the possibility of widespread famine. Not only has this not materialized but the country today is almost self sufficient in the production of food grains. The principal driving force behind this achievement has been a huge expansion in irrigated area. In terms of water and sanitation too, there have been impressive gains. Thousands of hectares of lands with agriculture, homesteads and other infrastructures have been protected from the wrath of floods in varying degrees.

Despite these achievements, the country is now feeling the pangs of a more chronic and systematic water crisis in terms of both quality and quantity. To cite examples, – most of the country's groundwater, particularly in the shallow aquifers, is now contaminated with a poison called ARSENIC; flood Control measures are being increasingly held responsible for triggering natural imbalance through reduction of flood plain areas and open water fisheries; river erosion is devouring a net amount of 9,000 ha of land every year; salinity ingress from the Bay of Bengal is making further inroads in the southern belt; rivers like Buriganga, Shitalakhya, Karnafully are not only getting dangerously polluted but also creeping towards sad demise; siltation of river beds are seriously reducing the conveyance capacity of the river channels exacerbating the flood situation during the monsoon.

Many agencies and departments are involved in the water sector in Bangladesh, but good governance of water had unfortunately been absent. In its absence much damage has already been done to the bio-diversity of the country. Many adverse and counter-productive situations have arisen due to lack of coordination in development programmes and use of water resources. For a water-dependent country like Bangladesh, such a situation is highly detrimental to its overall development. This needs to be corrected. For this Integrated Water Resources Management (IWRM) would be the best remedy.

A look back at the history would reveal the following serious deficiencies of the past water management practices in Bangladesh:

- lack of integrated approach
- little involvement of stakeholders in water projects
- deficiencies in institutional and legal instruments
- lack of effective inter-agency cooperation
- less focus on stakeholders' interests
- little attention to environmental and social issues
- virtually no attention to quality aspects of water

These mistakes of the past must be remedied because Bangladesh is going to face immense challenges in the water sector in the future some of which are described below:

Challenges in the coming years:

- **meeting basic needs:** to ensure access to safe and sufficient water and sanitation to meet basic human needs which are essential to health and well-being, and to empower people, especially women, through a participatory process of water management.
- **securing the food supply:** to enhance food production, particularly for the poor and vulnerable, through the more efficient mobilization and use, and the more equitable allocation of water for food production.
- **protecting the ecosystems:** to ensure the integrity of ecosystems through sustainable water resources management.
- **basin wide management of international river waters:** to foster cooperation among all co-basin countries for basinwide development and management of water resources of the Ganges, Brahmaputra and Meghna for the benefit of all.
- **managing risks:** to provide security from floods, droughts, pollution and other water-related hazards.
- **valuing water:** to manage water in a way that reflects its economic, social environmental and cultural values for all its uses, and to move towards pricing water services to reflect the cost of their provision. This approach should take account of the need for equity and the basic needs of the poor and the vulnerable.
- **governing water wisely:** to ensure good governance, so that the involvement of the people and the interests of all stakeholders are included in the management of water resources.

Integrated Water Resources Management would be the only tool to face these challenges. In this respect the water management authorities in the country would have to seriously consider the following four key points:

First, it is essential to take a holistic approach to integrated water resources management (IWRM). Decisions must be participatory, technically and scientifically informed, and taken at the lowest appropriate level-but within a framework at the catchment and basin level, which are the natural units by which nature manages water.

Second, technology can and must change radically in order to adapt to the needs of the more water-conscious world. Less wasteful, more sensitive of the environmental and social dimensions of decisions, these technologies will draw on traditional wisdom as much as harness the revolutionary changes taking places in the biological, information, and energy fields. But technology alone will not bring about the more desirable future. This requires behavioral changes at all levels of society-and everywhere. Indeed, technological change is not exogenous, but it will happen only if society provides stimulation and incentives for this innovation.

Third, these institutional and technological innovations and changes will not come about unless water's economic, social, environmental, and political dimensions are adequately taken into account. This means full-cost pricing complemented by targeted subsidies, thus freeing the public sector to focus on what only it can do better-make decisions on welfare and the provision of public goods-and freeing the private sector to do what it does better-provide cost-effective services in an accountable and transparent way and mobilize investment.

Fourth, to bring about changes of the magnitude needed will require enormous funding, appropriately mobilized and targeted. This would need more than doubling investment in the water sector in the country from the current level. It will not come about without the systematic adoption of integrated water resources management, full-cost pricing, targeted subsidies to the poor and marginalized, and mobilization of the vast labor inputs available in poor rural communities. This will require an unrelenting effort at public awareness and at engaging all parties everywhere on water issues and ensuring that the institutional fragmentation that has hampered past endeavors at holistic approaches to water management shall be overcome.

The toughest task under IWRM is going to be managing the allocation of water for direct use to meet human needs and protect the environment. Arbitration of claims among competing users is needed, and it cannot be done in a vacuum. It requires that we shift the framework of analysis from the narrow views of sector users or the artificial boundaries of administrative and political units to the natural boundaries of the

catchments and basins. Only then will the quantity and quality issues be adequately addressed in a coherent framework. This framework incorporates the intersection of three complex and rapidly changing systems: the environment, of which water is a vital part for all living things; the hydrological cycle, which governs the flow and regeneration of water; and the human socioeconomic system of activities.

A holistic, systematic approach relying on integrated water resources management must replace the current fragmentation in managing water in Bangladesh. This should take account of social, economic and environmental factors and integrate surface water, groundwater and the ecosystems through which they flow. For meaningful water management special attention should be paid to the poor, to the role, skills and needs of women. Effective management of water could become a vehicle for collaboration as much as its absence could be a source of conflict. Quantity and quality aspects of groundwater management will be as crucial as surface water management in the years ahead. Integrated Water Resources Management (IWRM) depends on collaboration and partnerships at all levels, based on a political commitment to, and wider societal awareness of the need for water security and the sustainable management of water resources.

In order to realize the goal of IWRM in the country, Government of Bangladesh announced the 'National Water Policy' in January, 1999. This document has set forth policies to manage the water resources in a comprehensive and equitable manner. It is intended to help guide both public and private actions in the country for ensuring optimal development and management of water that benefits both individuals and the society at large. The policy would guide management of the country's water resources by all concerned ministries, agencies, departments, and local bodies that are assigned responsibilities for the development, maintenance, and delivery of water and water related services as well as the private users and developers of water resources. The Policy envisages economic development, poverty alleviation, food security, public health and safety, protection of the natural environment. It also provides principles for public-private sector and GO-NGO collaboration in water management.

The Government intends to follow sound institutional principles and thereby to separate policy, planning, and regulatory functions from implementation and operational functions at each level of government, whilst at the same time holding each institution accountable for financial and operational performance. It also plans progressive withdrawal of central Government agencies from activities that can be accomplished by local institutions and

the private sector, in line with Government's commitment to decentralized decision taking through transparent mechanisms with emphasis on stakeholder participation. The Government will progressively develop an enabling environment consistent with sound institutional principles and policy objectives through a series of measures aimed at providing a coherent and comprehensive set of documents that will make clear the rights, obligations and rules of business required for the sector as a whole.

A 25 year National Water Management Plan (NWMP) has been prepared and would be finalized very soon. Given the geo-physical, economic and socio-cultural context of Bangladesh, it is undoubtedly a tough job for the planners to translate the announced Policy into reality. The planning exercises have been primarily focussed to technical issues like arsenic contamination of groundwater; industrial and municipal pollution affecting water supplies; dry season water shortages; river bank erosion; floods, cyclones and droughts. On management aspects, special attention was directed to issues like inadequate funding for operation and maintenance of existing public infrastructures; financing and delivery of the necessary public infrastructure to meet current and future urban and rural water supply and sanitation services; enforcement of water quality and environmental standards; rationalization of legislation to protect rights to water use and services, clarify agency responsibilities and promote efficient management of water.

A real revolution in water resources management in Bangladesh will come when stakeholders have the power to manage their own resources. The task of politicians is to dispel the idea that water is primarily the government's business. They must facilitate representative participatory processes so that water can be managed locally to meet the aspirations of many stakeholders.

III. Transboundary River Waters and Bangladesh

If the principles of Integrated Water Resource Management are accepted it also must be recognized that Bangladesh is the lowest riparian of more than 50 transboundary rivers. Bangladesh has no control over the flows of these rivers. There are problems of sharing the waters of many of these rivers with the upper riparian. If these problems are not resolved between the riparians through mutual understanding in a spirit of good neighborliness then the IWRM in Bangladesh would remain only a pipedream. The National Water Policy of Bangladesh states that "the Government will endeavor to enter into agreements with co-riparian countries for sharing the waters of international rivers, data exchange, resource planning and long-term management of water resources under

normal and emergency conditions of flood, drought and water pollution". The government of Bangladesh has always made it clear that there will be no dearth of goodwill and efforts on its part to fostering cooperation among the co-basin countries of the Ganges, Brahmaputra and Meghna for basinwide management of water resources of these rivers to the mutual benefit of all.

Indo-Bangladesh Joint Rivers Commission (JRC)

Considering the vital influence and importance of the flows of the trans-boundary rivers on the life and living of the people, Bangladesh had established with India the Indo-Bangladesh Joint Rivers Commission (JRC) in 1972 for working together to harnessing the rivers common to both the countries.

According to the Statute, the JRC has the following functions in particular;

- to maintain liaison between the participating countries in order to ensure the most effective joint efforts in maximizing the benefits from common river systems to both the countries,
- to formulate flood control works and recommend implementation of joint projects,
- to formulate detailed proposals on advance flood warnings, flood forecasting and cyclone warnings,
- to study flood control and irrigation projects so that the water resources of the region can be utilized on an equitable basis for the mutual benefit of the peoples of the two countries, and
- to formulate proposals for carrying out co-ordinated research on problem of flood control affecting both the countries.

Though not listed in the Statute, the JRC was subsequently given the major responsibility to assist the two Governments in formulating arrangements for sharing the flows of the Ganges and other common rivers between the two countries.

Sharing of the Ganges flows

A barrage across the river Ganges was commissioned by India in 1975 only 18 km. Upstream of the Bangladesh border at Farakka to divert bulk of dry season flows for the stated purpose of flushing the silts of the Hoogly river to improve the navigability of the port

of Kolkata in the State of West Bengal of India. Upstream diversion of the precious dry season flows of the Ganges has adversely affected the hydrology, river morphology, agriculture, domestic and municipal water supply, fishery, forestry, industry, navigation, public health and biodiversity in large areas of Bangladesh.

Since the mid seventies, the JRC devoted bulk of its time to address the issue of sharing of the Ganges and other rivers common between the two countries. In all these years, the issue of sharing of the dry season Ganges flows got prominence in the agenda of JRC discussions. As a result, the two countries had been able to conclude Agreements, Understandings and a Treaty for sharing the dry season flows of the Ganges at different times between 1977 and 1996. The first Agreement for sharing the flows of the Ganges for a period of five years (1978-82) was signed between the two countries on 5th November, 1977. Thereafter the two countries signed two Memorandum of Understandings (MOU) in 1982 and 1985 for sharing the Ganges water during 1983-84 and 1986-88. In the years from 1989 to 1996, the dry season flows of the Ganges in Bangladesh reduced drastically in the absence of any sharing arrangement. Thereafter the two countries signed a Treaty on 12th December, 1996 for sharing the dry season flows of the Ganges.

According to the Treaty of 1996, the sharing will be for thirty years and the quantum of waters agreed to be released by India to Bangladesh will be at Farakka (in India). The sharing between India and Bangladesh of the Ganges waters at Farakka will be in 10-day periods from January 1 to May 31 every year and shall be with reference to the following formula :

Availability at Farakka	Share of India	Share of Bangladesh
70,000 cusec or less	50%	50%
70,000-75,000 cusec	Balance of flow	35,000 cusec
75,000 cusec or more	40,000 cusec	Balance of flow

Note : Cusec means cubic feet per second and 35.3147 cusec equals to 1 cubic metre per second (m^3/s)

Subject to the condition that India and Bangladesh each shall receive guaranteed 35,000 cusec of water in alternate three 10-day periods during the period March 11 to May 10.

Augmentation of the dry season Ganges flows

The present dry season availability of the Ganges at Farakka is not enough to meet the requirements of both Bangladesh and India. The dry season flows of the Ganges being received by Bangladesh now are only half of those which formerly entered Bangladesh before commissioning of the Farakka Barrage. Bangladesh needs more water in the Ganges during dry seasons to support the socio-economic development for present and future generations. As such Bangladesh feels the urgency of initiating a process of cooperation amongst the co-basin countries for augmenting the dry season flows of the Ganges. In Article-VIII of the 1996 Treaty, both Bangladesh and India have recognized the need to cooperate with each other in finding a long-term solution to the problem of augmentation of dry season Ganges flows.

Besides India and Bangladesh, Nepal is another co-basin country of the Ganges. The headwaters of some of the major tributaries of the Ganges lie in Nepal which contribute about 40 percent of the annual flows and 71 percent of dry season flows of the Ganges available at Farakka.

Although there is scarcity of water in the Ganges during dry season, plenty is available in the river during the wet monsoon season. While the dry season water availability of the Ganges at Farakka is only 25,900 Million cubic metres (Mm^3) the annual availability in the river at the same location is 550,000 Mm^3 . There is thus ample scope to harness from the monsoon flows of the Ganges.

A portion of the monsoon flows of the Ganges which cause widespread flood damages in the co-basin countries could be conserved in the upstream storage sites (particularly in Nepal) to mitigate flood intensities downstream. This in turn would enable significant augmentation of the dry season flows of the Ganges satisfying the reasonable water needs of all the co-basin countries. In addition, generation of huge amount of hydropower from the storage dams could ease the energy crisis in the basin area and create more job opportunities by facilitating rapid industrialization in different parts. The tremendous pressure on fuelwood in the region as an energy source would also reduce and the forest resources of Nepal in particular shall be saved. The upstream storages would also help improvement of navigation in the basin area, control salinity intrusion in the lower Gangetic delta and control pollution by increasing fresh water supplies during dry seasons. The co-basin partners could, therefore, embark upon cooperation in harnessing the potentials of the Ganges and share the gains. To that end China, India, Nepal and Bangladesh can start negotiations at the political level immediately for constitution of a Ganges River Basin Organization to materialize the multilateral cooperation amongst them for basinwide management of the Water Resources of the Ganges for mutual benefit of all.

International River Basin Organizations for the Brahmaputra and the Meghna Rivers

The water availability in the Brahmaputra and the Meghna river basins are also highly seasonal like the Ganges. Storage of some parts of the monsoon flows of these rivers can easily meet the dry season water demands in the co-basin countries. Like in the case of Ganges, China, India, Bhutan and Bangladesh can start necessary spade work right now to form the Brahmaputra River Basin Organization. Similarly India and Bangladesh can consider constituting the Meghna River Basin Organization. These two International River Basin Organizations will be the best means for basinwide integrated development of the water resources of the Brahmaputra and the Meghna for the overall betterment of the life and living of millions of people of several countries living in the basin areas.

International agencies and Institution like the Asian Development Bank (ADB) and NARBO may have the potential of playing the role of an effective facilitator to forge cooperation amongst the co-basin countries of the Ganges, Brahmaputra and the Meghna rivers.

Conclusion

It is unfortunate that the integrated development and management of water resources of these three major rivers remained neglected with inadequate appreciation of the fact that every year lost meant the loss of a productive multiplier through the creation of wealth and employment that would otherwise have been at work.

Basinwide cooperative management of the waters of the Ganges, Brahmaputra and Meghna is a matter of regional concern because these are transboundary environmental resources. Environmental degradation in one country is bound to ultimately affect the other co-basin countries in some way or another. As such when the environment of one country is adversely impacted, others cannot and should not look the other way. It becomes the collective obligation of all to tackle the situation and take remedial measures in a concerted manner.

Throughout history, human beings have responded to the need to pool their efforts and share resources in the interest of common security. Water, in particular has been one of humanity's historic learning grounds for community building. It is of the highest importance that water is seen as a potential source, not of conflict but of peace and prosperity in this region of ours.

Water if the Ganges, the Brahmaputra and the Meghna rivers are too precious resource to waste when there are millions of poor people dependent on it for their livelihood. It is a tragedy that the people living in these basin areas are still one of the poorest despite the basins' rich endowments. While so much could have been done, achievement in terms of management of the water resources of the three rivers through multilateral cooperation has been practically nil. The potential of the basins is by now fairly well understood by all. While the path of positive riparian cooperation should have been followed towards realization of the bounty of these rivers for the benefit of the millions, controversies prevented agreement in the past. Progress towards mutual cooperation had been impeded by mistrust, fear, misperception and myth. In the interest of all, the political and conceptual problems need to be more purposefully addressed especially as the underlying commonality of interests in the Ganges, Brahmaputra and Meghna is overwhelming. All concerned should wriggle themselves free of their unenlightened and misplaced national interests. The national interests of one cannot be the sum of losses of the others. There cannot be any alternative to beneficial cooperation toward and enlightened path of positive riparian relation.

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