

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF LOCAL GOVERNMENT,
RURAL DEVELOPMENT AND COOPERATIVES (MLGRD&C)
LOCAL GOVERNMENT ENGINEERING DEPARTMENT (LGED)

**THE MASTER PLAN STUDY
ON
SMALL SCALE WATER RESOURCES
DEVELOPMENT
FOR POVERTY ALLEVIATION
THROUGH EFFECTIVE USE OF SURFACE WATER
IN
GREATER MYMENSINGH OF BANGLADESH**

**FINAL REPORT
MAIN REPORT**

FEBRUARY 2006

PACIFIC CONSULTANTS INTERNATIONAL (PCI), JAPAN

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The following foreign exchange rate is applied in the Study:
US\$1.00 = 65.15 Bangladesh Taka (as of September 2005)

PREFACE

In response to a request from the Government of the Peoples Republic of Bangladesh, the Government of Japan decided to conduct a study on “The Master Plan Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh of Bangladesh” and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a team headed by Mr. Keiji Matsumoto of Pacific Consultants International, three times between July 2004 and October 2005.

The team held discussions with the officials concerned of the Government of Bangladesh, and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials of the Government and those concerned in the Peoples Republic of Bangladesh for the close cooperation they have extended to the study.

February, 2006

Ariyuki Matsumoto
Vice-President
Japan International Cooperation Agency

February 2006

Mr. Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency

Dear Mr. Matsumoto,

Transmittal Letter

We are glad to submit the Final Report of “The Master Plan Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water In Greater Mymensingh of Bangladesh”.

The report consists of strategies, priority programs and the scope of follow-on investment projects including effective use of surface water, which has been prepared in consideration of the advices and recommendations of relevant ministries of the Government of Japan and JICA, as well as the discussions with the Bangladeshi counterpart on the Draft Final Report and their comments on the report.

In Bangladesh, agriculture in the dry season is maintaining its production through introduction of groundwater resources for the use of irrigation. However, in recent years, the exhaustion of groundwater resources and contamination by Arsenic has become issues of concern. On the other hand, during the monsoon season, flood and inundation cause damage to crops, limiting the potentials for agricultural production.

Under such circumstance, the Small Scale Water Resources Development Sector Project, with the view of sustainable development and management of water resources, has been implemented by the Local Government Engineering Department with the support of Asian Development Bank and other development partners. However, lessons learned from previous activities indicate the significant importance of District Level Master Plans, which will enable strategic implementation of Small Scale Water Resources Development activities.

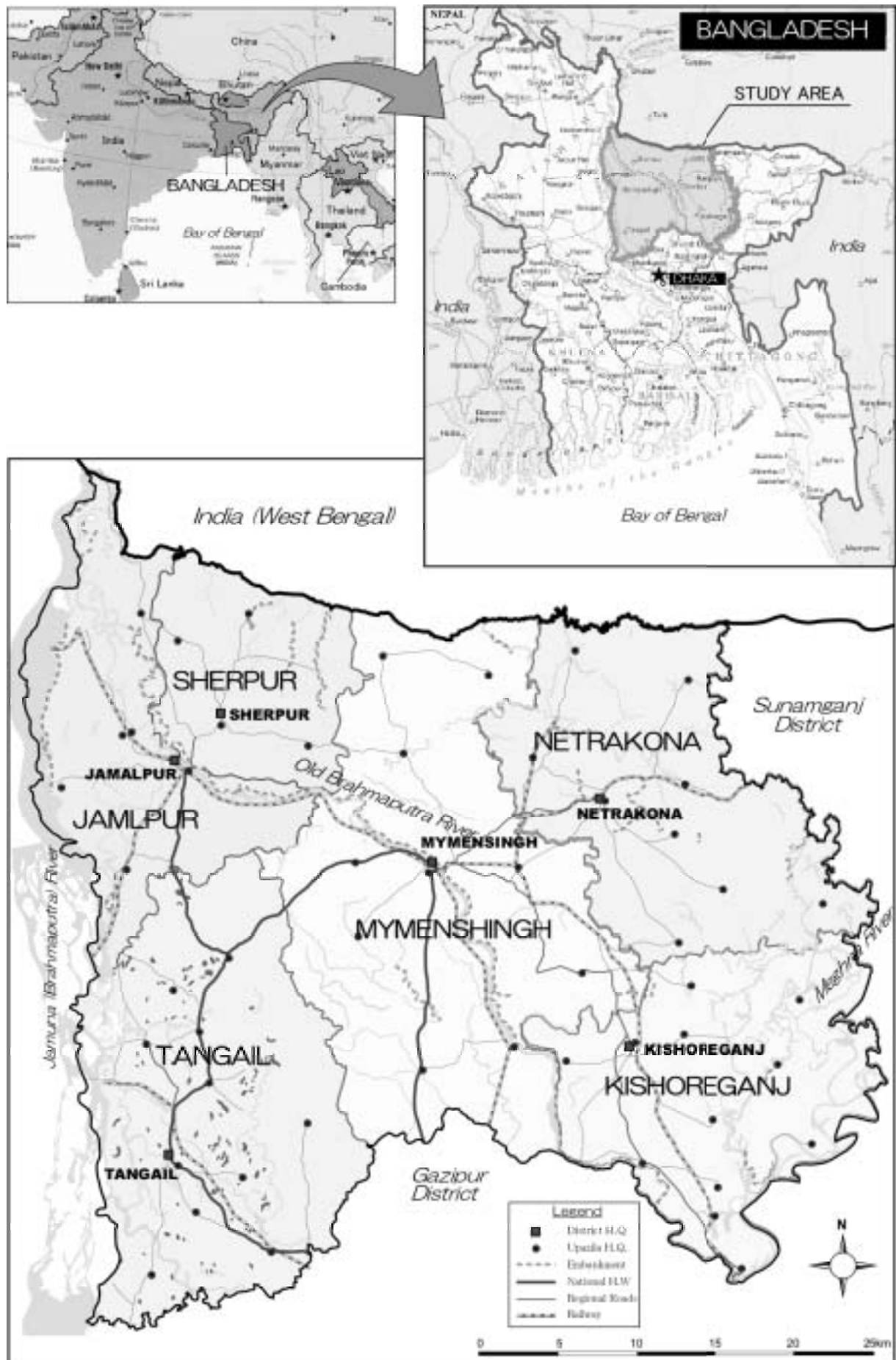
The implementation of the Master Plan proposed in this report will initiate sustainable water resources management, which is the basis of agricultural production. Through realizing such state, the Master Plan will contribute to the alleviation of poverty in the Greater Mymensingh. Furthermore, the technology for development planning, which has been transferred to the counterpart of the Local Government Engineering Department through this Study, will enable the replication of similar Master Plans to other districts of Bangladesh, and will contribute to sustainable water resources development and management throughout the country. It is thus anticipated that this Master Plan be put to implementation as soon as possible, following the implementation schedule proposed in this report.

Taking this opportunity, we express our sincere gratitude to the officials of your agency, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for their valuable advices and recommendations for the study. We are also grateful to the officials of the Local Government Engineering Department of Local Government Division under the Ministry of Local Government, Rural Development & Cooperatives and other public organizations involved in the study for their devoted cooperation and support during the implementation of the study in Bangladesh.







Sincerely yours,







Keiji Matsumoto
Team Leader







The Master Plan Study on Small Scale Water
Resources Development for Poverty
Alleviation through Effective Use of Surface
Water in Greater Mymensingh of Bangladesh









Location Map of the Study Area

	
<p>River and Paddy Fields: Agriculture is one of the major economic activities in the Study Area.</p>	<p>Inundation in the Post-Monsoon Season: Congestion of flood water in the post-monsoon season delays the timing of rice planting.</p>
	
<p>Silted Khal: Many of what used to be a khal is now silted up and utilized as paddy field.</p>	<p>Dried Pond in Village: Many of the ponds in the villages are dried up at the end of the dry season.</p>
	
<p>Elevated Road: Roads, elevated for communication during monsoon season also work as embankments.</p>	<p>Extensive Paddy Fields: Enhancement of agriculture through SSWRD will boost the rural economy.</p>

	
<p>Embankment constructed in SSWRDSP-1: The SSWRDSP-1, which is the preceding case of SSWRDSP has brought promising results.</p>	<p>Regulator constructed in SSWRDSP-1 Operation and maintenance of such regulators are now being done by local stakeholders.</p>
	
<p>Rubber Dam: Rubber dams are also constructed by LGED to utilize surface water resources.</p>	<p>Damaged road: Roads in the Study Area are often damaged by floods, hampering the development of rural areas.</p>
	
<p>Private Fishpond: Private fishponds in the Study Area are regarded as significant potential for economic development.</p>	<p>Traditional Irrigation: Irrigation in the Study Area has largely shifted to groundwater, but traditional styles are also present.</p>

 A black and white photograph showing a roadside market. In the foreground, there is a large, conical pile of light-colored material, likely agricultural produce. Several people are standing around the pile, some appearing to be weighing or handling the goods. In the background, there are simple buildings and trees.	 A black and white photograph of a drying yard. The ground is covered with numerous long, parallel rows of light-colored material, possibly agricultural products, laid out to dry. Several people are visible in the background, some standing and some walking across the yard. There are buildings and trees in the distance.
<p>Roadside Market: The agricultural produce are marketed in rural markets and brought to distant cities</p>	<p>Drying Yard: Many women are seen working in private drying yards in the Study Area.</p>
 A black and white photograph of an indoor setting where three people are seated around a table. They appear to be engaged in a discussion or a meeting. There are papers and some items on the table. The background shows a window with curtains and some posters on the wall.	 A black and white photograph showing a group of people gathered outdoors near a body of water. Some people are standing and talking, while others are sitting on the ground. The background features a wide expanse of water and a line of trees under a cloudy sky.
<p>Field Survey (1): The Study Team visited various government / non government institutions for collection of information</p>	<p>Field Survey (2): Site visits and group interviews to local stakeholders were also frequently conducted.</p>
 A black and white photograph showing a person in a white shirt standing in a dark, cluttered area, possibly a storage room or a workshop. The person is looking towards the camera. There are various items and structures visible in the background, including what looks like a bicycle.	 A black and white photograph of a meeting or discussion. A group of people is seated around a long table in a room with large windows. One person is standing and pointing at a whiteboard or a poster on the wall. The room appears to be a formal meeting space.
<p>Site Survey (3): Interviews with individuals were mainly conducted to gather more specific information.</p>	<p>Counterpart Discussion: Counterpart discussion were done also involving members of SSWRDSP-2 PMO and ADTA.</p>

	
<p>District Workshop: Workshops were frequently conducted to obtain better understanding and cooperation from stakeholders at the district level.</p>	<p>UDCC Consultation Meetings: The subprojects identified in the Study were explained and discussed in all upazilas of the Study Area.</p>
	
<p>PRA (1): PRAs were conducted in six sites of the Study Area to clarify an effective approach to enhance participation of local stakeholders.</p>	<p>PRA (2): In the PRAs, the local stakeholders developed their views on SSWRD and consensus were formed.</p>
	
<p>Central Workshops: Several workshops were held at the central level to share and discuss the findings of the Study.</p>	<p>Signing of M/M on the Draft Final Report: The M/M on the Draft Final Report was signed with JICA and ERD of the Government of Bangladesh on 5th October, 2005.</p>

THE MASTER PLAN STUDY ON SMALL SCALE WATER RESOURCES DEVELOPMENT FOR
POVERTY ALLEVIATION THROUGH EFFECTIVE USE OF SURFACE WATER
IN GREATER MYMENSINGH OF BANGLADESH

SUMMARY OF FINAL REPORT

CHAPTER 1 INTRODUCTION

1.1 Background

Under the provisions of the National Water Policy (NWPo), the Government of Bangladesh (GOB) has carried out the Small Scale Water Resources Development Sector Project (SSWRDSP-1) aiming at rehabilitation and improvement of small-scale water resource management systems. Currently, the second phase of this project (SSWRDSP-2) is being implemented. However, lessons learned from SSWRDSP-1 indicate the significant importance of the preparation of district level small scale water resources development plans (SSWRDPs).

The GOB requested the Government of Japan (GOJ) for technical assistance regarding the preparation of such district plans. In response, the GOJ dispatched a Preparatory Study Team and signed the Scope of Work (S/W) for *the Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh of Bangladesh* (the JICA Study) on February 25, 2004. Based on the S/W, the JICA Study Team started the Study in July 2004.

1.2 The Study

The overall goal of the Study is to secure safe and sustainable water resources management and to increase farmers' income. To realize this, the objectives of the Study are; 1) to formulate Plan for SSWRD in Greater Mymensingh (Mymensingh, Tangail, Sherpur, Jamalpur, Netrakona and Kishoreganj districts) comprising program of priority programs, and the scope for the follow-on investment projects which include effective use of surface water, and 2) to enhance and strengthen the capacity of the counterpart in preparation of the SSWRDP.

The Study consists of the following phases:

Phase I: Field Survey in wet season, Identification of problems on SSWRD in the Study Area (July 2004 ~ November 2004)

Phase II: Field survey and Formulation of Small Scale Water Resources Development Plans (January 2005 – October 2005)

The counterpart institution is Integrated Water Resources Management Unit of Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development and Cooperatives (MLGRD&C). Counterparts of the Study consist of officers of LGED headquarters, District Executive Engineers and Upazila Engineers.

CHAPTER 2 BACKGROUND

2.1 General

The People's Republic of Bangladesh (Bangladesh), with the area of 147,570 km², is located between 20° 34'N and 26° 38'N, and 88° 01'E and 92° 41'E. The country shares its boundaries with India in North, West and most of the East, with Myanmar on some parts of the East, and the Bay of Bengal at South.

2.2 Natural Conditions

(1) Physiography

The Study Area occupies about 11.3% of the country. The old Brahmaputra floodplain (4.46%) and the young Brahmaputra and Jamuna floodplain (2.87%) constitute more than half of the Study Area. Madhupur Tract lying inside the Study area constitutes 1.35%.

(2) Climate

Bangladesh has a subtropical monsoon climate with wide seasonal variations in rainfall, moderately warm temperatures and high humidity. Maximum air temperature ranges between 32 to 38 °C. The water year is the period beginning from April and is divided into the four seasons of Pre-monsoon (Apr-May), Monsoon (Jun-Sep), Post-monsoon (Oct-Nov), and Dry (Dec-Mar).

Season	Hydrological Region							Average
	NW	NC	NE	SW	SC	SE	EH	
Wet	1,393	1,445	2,297	1,299	1,821	1,683	1,934	1,856
Dry	346	511	897	366	486	588	511	504
Annual	1,739	1,956	3,194	1,665	2,307	2,271	2,445	2,360

(3) Water Resources and Floods

Bangladesh is formed by three mighty rivers: the Ganges, the Brahmaputra and the Meghna. Of the area of the 3 catchments (1.55 million km²), only 8% is in Bangladesh. NWMP estimates the amount of surface water resources as: 1,010 BCM¹⁾ of cross-border flows; 340 BCM from local rainfall; 190 BCM of Evaporation losses, and 1,160 BCM available for use.

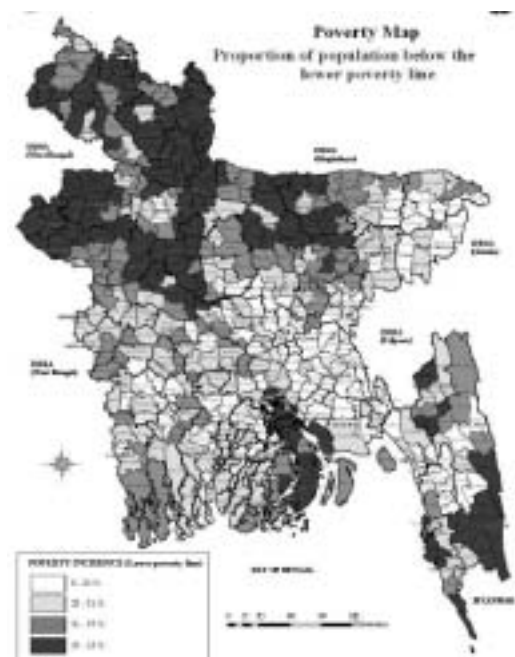
On the average, 20% of Bangladesh is flooded during monsoon season. About 2/3rd of the agricultural land is classified as vulnerable to flooding. On the other hand, agricultural drought is a common phenomenon, particularly in the north-western regions. Depending on the intensity of drought, estimated yield reduction varies from 10 - 70%.

2.3 Socio-economic Conditions

(1) Social Conditions

Bangladesh has a population of 123.2 million (BBS, 2001) with an annual growth rate of 1.48% (1991-2001). The population density is 834/km². Since independence in 1971, Bangladesh has reduced poverty from more than 70% to 50%. About 90 % of poor live in the rural areas with mostly in northern central to west, partially under the Study Area (BBS/WFP, 2004).

Women are in a relatively disadvantaged in terms of basic needs. To ensure women's advancement in various aspects, the GOB declared "the National Women Development Policies" (1997). About 1.8 million people are reported to be unemployed. The "National Strategy for Economic Growth, Poverty Reduction and Social Development" was formulated as an interim Poverty Reduction Strategy Paper (I-PRSP) in 2003, and the final PRSP is now awaiting its approval.



¹⁾ billion cubic meter

(2) Economic Conditions

From a mainly feudal agrarian base, the economy of Bangladesh has undergone rapid transformation towards manufacturing and services. The contribution of the agriculture sector to GDP has gone down from 50 % to 20 % (72/73 – 99/00). The agriculture is, however, still the main employment sector. Industrial production growth has averaged more than 6% over the last 5 years. The export sector, lead by garments has been the engine of this growth. More than 30 % of total government expenditure is covered by foreign economic assistance every year. External debts are accumulated at US\$ 14.7 billion (June 2001). Among the creditors, IBRD shares 43.1%, followed by ADB at 27.2%, and Japan at 19.5%.

(3) Agriculture, Fisheries and Livestock

1) Agriculture

For nearly two decades since the early 1970s, agricultural growth has been predominantly led by food grains, mostly rice. Although acceleration of rice production resulted in increased per capita availability, there has been concern about the sustainability of rice-led agricultural growth. Food self sufficiency has been achieved in the late 1990s, but the cash income of farmers is still low. The number of small farm holdings (<1 ha) were 79.9%. Major agriculture exports are jute, tea and vegetables. Major imports are edible oil, oil seed, pulses, onion, ginger and sugar. Foreign trade balance of agricultural commodities is largely negative.

2) Fisheries

Bangladesh, a country of delta plains, is dominated by the Ganges–Padma, Brahmaputra -Jamuna and Meghna rivers and tributaries. Along with potential inland water resources, the country is also rich in diversity of various fresh water fish species. Production in 2002-2003 is 1,998,197 metric tons with the inland open-water fisheries providing 709,333 metric tons and inland close-water providing 856,956 metric tons, leaving the rest for marine fisheries.

3) Livestock

The livestock farming in Bangladesh was not a high priority issue in the past. The average population of cattle and buffaloes is maintained, but small ruminants, fowls and ducks are increasing. Livestock plays various roles in rural areas, sharing about 6.5% of GDP. Some 20% of the population earns their livelihood through work associated with livestock farming. Livestock resources also play an important role in the sustenance of land less / small farmers.

2.4 Institutions

(1) Government Institutions

A Parliamentary form of government governs the People’s Republic of Bangladesh. There are 41 ministries and 15 divisions, where chief-executive-officer is designated as Secretary who belongs to the Bangladesh Civil Service.

(2) Local Government Institutions

District administrations are managed by the Deputy Commissioners (DC). DC coordinates implementation of central government policies with district offices of each ministry. The upazila is presently managed by the *Upazila Nirbahi (Executive) Officer*. Most ministerial institutes deploy their officials down to Upazila level. Union *Parishads* (UP: Union Council) are the most grass root self-government institutions. Under UPs, there are several *Gram-Sharkars* (Village Governments).

Administration Unit	Number	Avg. population 2001. [in ‘000’] (Enumerated)
Division	6	21,541.2
Zila (District)	64	2,019.5
Upazila	507	254.9
Union	4,484	28.8
Mouza	59,990	2.2
Municipalities	254	
City Corporations	4	

Source: Statistical Yearbook 2002, BBS page 21

(3) Donor Agencies and NGOs

Up to June 2001, a total of US\$ 46,072 million of external assistance was committed. Japan tops the list in terms of cumulative disbursement by bilateral donors. International Development Association is the largest amongst the multilateral development institutions followed by the Asian Development Bank. There are about 1,500 NGOs working in the country.

2.5 Water Resources Development

Since investigations of the Kurg Mission in 1954 and 1958, water resources development has gone under various plans and policies reflecting the needs and environments of each period. One of the mile stones for such plans are the Flood Action Plan (FAP) which was formulated by major amount of works collecting / analyzing information to find ways to cope with the hydrological regime of Bangladesh. After years, the studies of FAP have subsequently lead to the formulation of the National Water Management Plan and National Water Policy, which dictates the directionality of water resources development in the present.

(1) National Water Policy (NWPo)

Under the NWPo (1999), the GOB addresses 16 issues and policies to manage water resources and protection of the environment of the country in a comprehensive, integrated and equitable manner. The NWPo states the responsibility of the sector agencies and local bodies to prepare and implement sub-regional and local water-management plans in conformance to NWMP, and that of the local government to implement small scale FCDI projects.

(2) National Water Management Plan (NWMP)

The National Water Management Plan provides a framework within which all concerned with development, management and use of water resources and water services in Bangladesh can plan and implement their own activities in a coordinated and integrated manner, in premise that they are contributing to the national goals. Programs have been presented in 7 sub-sectoral clusters. Each cluster comprises of a number of programs, with a total of 84 sub-sectoral programs identified. Sub-sectoral programs under the clusters consist of the broad categories of: Cross-cutting programs, National-level programs and regional programs.

(3) Water Resources Development Institutions

At present, the agencies or organizations which have relevant functions in water sector are of four categories: 1) Government agencies including WARPO, Bangladesh Water Development Board and LGED, 2) Local Government Institutions including Municipalities, Parishads (District, Upazila, Unions Grams), 3) Other stakeholders (CBOs, NGOs), and 4) Donor agencies.

(4) The First SSWRDSP

The SSWRDSP-1 was launched in April 1996 with LGED as the executing agency to enhance rural incomes by developing community-based water management cooperative associations (WMCAs) and community-managed small-scale infrastructure. The project aims at sustainable growth in agricultural production and incomes of about 140,000 farm families in western Bangladesh through the establishment of about 300 SSWRD schemes. The Project completed 280 subprojects that benefit 192,600 farm families.

(5) The Second SSWRDSP

After the successful completion of SSWRDSP-1, SSWRDSP-2 aims to improve the development of the water resources sector mainly through participatory O&M of small-scale water resources infrastructure. Under the Project, 300 more subprojects will be implemented in 61 districts of the country by 2009. The Project will not be implemented in the Chittagong Hill Tracts (3 Districts) considering the different conditions.

2.6 Environmental Policies and Institutions

(1) Environmental Policies and Legal Framework

The major environmental policies under force include: National Environmental Policy (1992), Environmental Conservation Act (1995), Environmental Conservation Rule (1997), and Environmental Court Act (2000).

(2) Environmental Organizations and their Roles

The Department of Environment is responsible for the implementation of the Environmental Conservation Act in 1995.

(3) Environmental and Social Consideration (ESC) Required by JICA

This Study has been defined as category B under the Guidelines for ESC (2004). The required procedures include: 1) 1st Screening, 2) Scoping, 3) Survey for ESC, 4) 2nd Screening based on the rough outline of ESC, and 5) Preparation of Final Report.

CHAPTER 3 STUDY AREA

3.1 The Greater Mymensingh Area

(1) The Study Area

The Study Area covers the six Districts (Mymensingh, Tangail, Sherpur, Jamalpur, Netrakona and Kishoreganj) of the Greater Mymensingh. The Study Area is located in the north-central part of the country bordered by the Meghna River and Sunamganj District in the east, Greater Dhaka District in the south, the Brahmaputra River in the west, and the Indian state of Meghalaya in the north. The old Brahmaputra flows from the northwest to the southeast. The Madhupur terrace occupies in the southern part of the Study Area

(2) Local Government Framework

The local administration comprises of 6 Districts, 58 Upazilas (sub-districts) and 558 Unions. The average area of one Union is approximately 3,000 ha with about 28,000 residents/union.

District	Area (km ²)	Population 1996, ('000)	Number of		
			Upazila	Union	Mauza
Jamalpur	2,032	2,111	7	68	757
Kishoreganj	2,689	2,573	13	105	946
Mymensingh	4,363	4,450	12	146	2,172
Netrokona	2,810	1,938	10	85	1,591
Sherpur	1,364	1,279	5	51	446
Tangail	3,414	3,371	11	103	1,954
Study Area Total	16,672	15,722	58	558	7,866

Source: Census of Agriculture 1996, BBS, 2003

3.2 Natural Conditions

(1) Topography

The northern boundary area adjacent to the Mrgaraya Mountains formed alluvial fan with the elevation 40 to 25 m PWD, while the eastern boundary area is a depression called haor with the elevation of 3 to 7 m PWD. The central part of the area is the Brahmaputra floodplain with an elevation of 5 to 20 m PWD. Between the old Brahmaputra and Jamuna floodplain, the Madhupur Tract upraises with the elevation of more than 20 m PWD.

(2) Meteorology

Annual total rainfall observed in Mymensingh is 2,365 mm with max. and min. rainfalls occurring in July (472 mm) and January (8 mm) respectively. Maximum and minimum annual rainfall was observed at Khaliajurii in Netrokona (3,902 mm) and Kalihati in Tangail (1,621 mm) respectively. Average temperature is 25°C with max. and min. temperatures occurring in the months of April (32°C) and January (12°C) respectively.

(3) Hydrology and Water Resources

In the Study Area, there are around 250 rivers. Observations at BWDB non-tidal stations indicate that water levels are high during July-September and low during March-May. Another component of surface water resources are perennial water bodies. There are 2,802 perennial water bodies including 547 beels. These cover 21,921 ha.

Ground water-level fluctuations at a particular site reflect the aquifer, its proximity to major rivers and abstraction rates. National Hydro-chemical Survey assisted by DFID indicate arsenic contamination in the 58 upazilas of the Study Area as: 1) no upazilas have more than 80% contaminated tube wells, 2) 3 upazilas have 60-80% contaminated tube wells, 3) 4 upazilas have 40-60% contaminated tube wells, 4) 9 upazilas have 20-40% contaminated tubewells, and 5) 22 upazilas have 5-20% contaminated tube wells.

(4) Floods

Inundation land classification prepared by BARC/UNDP/FAO in 1995 described the land in 5 Inundation Land Type: 1) highland (flood depth: 0-0.3m), 2) medium highland (flood depth: 0.3-0.9m), 3) medium lowland (flood depth: 0.9-1.8m), 4) lowland (flood depth: 1.8-3.0m), 5) very lowland (flood depth: >3.0m). The Study Area mainly consists of medium highland and highland (80%). However, large areas classified as lowland are seen in Kishoreganj (57%) and Netrakona (28%) indicating the characteristics of the haor area.

3.3 Socioeconomic Conditions

(1) Population

Recent population census was carried out in 1991 and 2001. Population in the Study Area is 15,492 thousand in 2004, and it increased by 10.5% after 1991 census. District wise population indicated in 2001-census were: Mymensingh 4,439,000; Tangail 3,254,000; Jamalpur 2,089,000; Sherpur 1,247,000; Netrakona 1,938,000; and Kishoreganj 2,525,000.

(2) Regional Economy

The major industrial sector in the Study Area is services, covering more than 40%. Agriculture and fisheries covers 30 - 43%, followed by industries. Fisheries sector comes to the second in Mymensingh, Kishoreganj and Netrokona.

Perennial Water Bodies in the Study Area

District	Area (ha)	Number (nos.)	Perennial Water Body Area	
			(ha)	(%)
Jamalpur	206,463	285	2,182	1.1
Kishoreganj	251,060	560	4,599	1.8
Mymensingh	427,144	635	4,943	1.2
Netrokona	286,576	813	5,380	1.9
Sherpur	131,687	159	2,415	1.8
Tangail	344,701	378	2,402	0.7
Total	1,647,631	2,830	21,921	8.5

Source: National Water Resources Database (WARPO)

Note: Actual number of water bodies in the Study Area is 2,802. However, due to sharing same water bodies by adjacent districts, total number of water bodies is as shown above

Economic Indicators of the Study Area

District	Regional GDP 1999/2000	Share of District	Regional GDP per capita		Growth rate for year average	Rank based on per capita
			in Tk.	In US\$		
Bangladesh	2,370,740	100%	18,269	363	5.36	Total 64
Jamalpur	31,429	1.3%	13,834	275	5.97	50
Kishoreganj	38,266	1.6%	13,903	276	4.96	43
Mymensingh	73,117	3.1%	15,430	307	5.58	33
Netrokona	32,020	1.4%	15,410	306	4.99	30
Sherpur	18,842	0.8%	13,748	273	5.61	55
Tangail	47,986	2.0%	13,297	264	4.81	56
Project Area	241,660	10.19%	14,270	284	-	-

Sources: Statistic Yearbook of Bangladesh 2001

(3) Social Infrastructure

The total road length in the Study Area is 32,276 km (1998). Most of them are submerged during monsoon season and are often damaged. There are 1,358 hat bazaars, 40 flood centers and 443 community centers in the Study Area. There are 19,478 educational institutes of which 1/3rd are primary schools, and 2 are universities (1998). There are 4,024 beds installed in health care facilities.

3.4 Agriculture, Fisheries and Livestock

(1) General

Among the total house holdings, 64.6% were farm holdings (1996). 52.0% of the farm holdings belong to small farm (less than 1 ha). Medium and large farm holdings were 11.0% and 1.6% respectively. Rice is the dominant crop in the Study Area cultivated in 77.3% of the area. Both *Aman* and *Boro* were cultivated in more than 30% of the area. Wheat, jute, oil seeds, and maize were cultivated in 4-5% of the area. The cropping intensity was 1.77 (2001).

Numbers of cattle, goats and fowls in the Study Area were 2.5 million, 1.4 million and 10.3 million, respectively (1996). Mymensingh has the largest number of animals among the 6 districts. Non-farm holdings own substantial parts in livestock and poultry. Small farmers also own about 58%.

(2) Union Questionnaire and Interview Survey

In order to obtain necessary information to understand the rural area, the JICA Study Team, in collaboration with LGED counterparts, conducted a Union Questionnaire Survey targeting the Union *Parishad* (UP) Chairpersons of all unions in the Study Area. Interviews to UP Chairpersons were done for four selected unions per district. In addition, interviews to 12 farmers per district were done in the same selected villages. Farmers were selected so that three categories of farmers (large, medium and small) were interviewed.

(3) Agricultural and Livestock Conditions Based on the Results of Interview Survey

Boro (Dec-May) – Fallow (May-Jul) - *T. Aman* (Aug – Nov) is the typical cropping pattern of the area. Most of the area is cropped twice in the year. The weight of agriculture in income is between 70% to 80%. Other major source of income was fisheries. Quality seeds are required for *Boro*, and vegetables. Paddy is usually boiled or par-boiled and milled by Engelberg- type rice mills. Women are hired for drying steamed paddy with a wage of Tk. 50-60 /day.

The main local variety of cattle is raised for meat and milk production. Black Bengal is the most popular among goat species. Goats are widely rearing in the area, but major constraints are lack of finance and lands. Duck-farming is a major animal mainly for egg production.

(4) Fisheries Production

The proportion of fishery industry in DGDP of the Study Area varies from 2% to 12%, with the highest in Netrakona and lowest in Tangail. For annual fisheries production from inland waters, Mymensingh ranks first in terms of total catch (56,523t), followed by Kishoreganj (35,312t) and Netrakona (33,906t). Subsistence fisheries households range from 47% to 85% of the total households.

Area and fisheries production of Beels, 2002

District	Area (ha)	Total Catch (MT)	Catch (kg)/ha
Jalalpur	3,360	2,287	680.7
Kishoreganji	6,837	5,584	816.7
Mymensingh	7,346	5,332	725.8
Netrakona	8,355	8,013	959.1
Sherpur	3,508	2,330	664.2
Tangail	2,333	1,456	624.1
Total	31,739	25,002	4,470.6

Source, Fisheries Statistical Yearbook of Bangladesh (2002), Department of Fisheries

3.5 Water Resources Development

(1) Large Scale Water Resources Development

There are 55 large scale water resources development projects installed by BWDB in the Study Area. The area covered by these projects as indicated in the NWRD is about 300,000 ha. The numbers of large scale projects are: Mymensingh 14; Tangail 11, Jamalpur 7, Sherpur 4; Netrakona 8; Kishoreganj 11. These include 4 cross district projects: 1 in Mymensingh and Jamalpur, 1 in Mymensingh and Kishoreganj, and two in Jamalpur and Tangail.

(2) Small Scale Irrigation and Drainage

In the Study Area, water in the small-size water source, e.g. khals, river tributaries, small ponds etc. is utilized for the supplementary irrigation by the low-lift pumps (LLPs). On the other hand, because most of the water sources except beels are dried up in the dry season, many large farmers installed shallow tubewells (STW) or deep tubewells (DTW) pump systems and obtain irrigation water to grow the Boro HYV or Rabi crops.

(3) Progress of SSWRDSP-2

After entering into effectiveness of the loan on SSWRDSP-2, each Union had submitted proposals to LGED. About 2,335 subprojects (SPs) were submitted to the SSWRDSP-2 in 61 districts (38 SPs/district) by 29 September 2004. According to information obtained from the LGED headquarters, number of proposed subprojects for SSWRDSP-2 and their process of screening in Greater Mymensingh as of 10 February 2005 are summarized in the table:

Progress of Subprojects Screening in the Study Area

Zila	LGI		Proposal Submission		Reconnaissance Passed		Appraisal Passed	Implementation scheduled SP
	Number of Upazilas	Number of Unions	Number of Unions	Number of SP	Number of Unions	Number of SP	Number of SP	
Jalalpur	7	68	26	40	5	5	1	0
Kishoreganj	13	109	40	73	10	11	7	5
Mymensingh	12	146	58	146	13	13	4	3
Netrakona	10	86	38	155	10	13	5	3
Sherpur	5	52	15	21	6	7	1	0
Tangail	11	101	21	29	4	5	3	2
Total / Average	58	562	198	464	48	54	21	13

3.6 Relevant Project/Program in the Study Area

(1) Previous Water Resources Development Projects and Studies in the Study Area

Previous water resources development projects and studies in the Study Area include:

- FAP 3: North Central Regional Study (NCRS)

- FAP 6: North East Regional Water Management Project (NERWMP)
- FAP 3.1: Jamalpur Priority Project Study
- FAP 20: Compartmentalization Pilot Project (CPP)

(2) Agricultural and Livestock Development Projects/Programs

Agriculture and livestock development projects include:

- Soil Fertility and Fertilizer Management Project (SFFP), DANIDA
- Seed Exchange Management Project (Government 2002-)
- Recent projects (Small holder livestock development, Participatory livestock development, Goat development)

(3) Fishery Development Projects/Programs

Fishery development projects / programs include:

- Aquaculture Extension Project
- Community Based Fisheries Management Project Phase 2
- Forth Fisheries Project

(4) Rural Development Project/Programs

The Rural Development Project-21 (Third Rural Infrastructure Development Project/ Northern Rural Infrastructure Development Project) can be identified as the most relevant to this Study. The project supports the strengthening of rural infrastructure in the northern 13 districts. The project area covers five districts of the Study Area except Tangail.

3.7 GIS and Remote Sensing

(1) Satellite Images

In order to identify position of rivers and lakes in the survey areas, land use, inundation during rainy season, infrastructures of water management, etc., satellite images for rainy (ASTER) and dry (IRS) season were used.

(2) Data Collection for GIS

Topographic control data of GPS Station installed by JICA Study (1991-1995) and information from meteorological station of BMD were collected. Existing GIS data of LGED GIS and NWRD of WARPO were collected on: 1) Administrative boundaries, 2) Boundaries and area of BWDB projects, 3) Roads and Railways, 4) Major public buildings, 5) Rivers, and 6) Other related data. SSWRDSP-2 project location maps were collected from LGED headquarters.

(3) Analysis of ASTER Satellite Images

ASTER satellites images analyzed for Land use. Location of waterbodies, and secular changes for major rivers has been done. But faulty point of drainage facilities could not be analyzed. IRS satellite images and generated GIS river data (based on topographic map scale 1/50,000) overlaid for checking for secular changes for major rivers has been done.

3.8 Zoning of the Study Area

(1) Zoning and clusters of the District

Zoning is necessary to formulate different types of strategies for SSWRD reflecting the development needs. The approaches relating to the development needs for SSWRD are: 1) flooding, 2) water resources availability, 3) regional socio-economic conditions, and 4)

agricultural conditions. Considering that the subproject beneficiary area is less than 1,000 ha, government administration levels, etc., the strategy planning shall be at the level of upazilas.

(2) Zoning by Natural Conditions and Flooding

The following items were considered for natural conditions and flooding.

- Elevation and Slope
- Type of Floods and Hydrological Zone
- Groundwater Availability, Arsenic Contamination and Drought Prone Area

(3) Zoning by Socio-economic Condition

The following items were considered for natural conditions and flooding.

- Degree of Industrial Development
- Population and its Density and the Vulnerabilities

(4) Zoning by Agriculture, Livestock and Fisheries Conditions

The following items were considered for natural conditions and flooding.

- Major Issues to be considered for the Agriculture, Livestock and Fishery Development
- Land type
- Agro-ecological zone (AEZ)

(5) Comprehensive Zoning of the Study Area

Land classification by Land type and flood inundation type is almost similar, because the elevated area has less opportunity of inundation by flood except for flash flood area. Agroecological zone is overlapped with land type and flooding conditions, because the Agroecological zoning includes the land type and flood conditions which are a dominant factor in ecological zoning and agriculture. As a result of the comprehensive comparison, upazilas in the Study Area were categorized by the Agroecological and flood inundation type zoning .

Zones	Degree of inundation	Agroecological Zone	Typical Area in the Study Area
Highland	Less than 30 cm	Madhupur Tract	Madhupur tract in Tangail and Mymensingh districts
Medium High Land	30 to 90 cm	Old Brahmaputra Floodplain	Area adjacent to Madhupur tract and river terrace of the old Brahmaputra River left bank
Medium Lowland	90 to 180 cm	Young Brahmaputra and Jamuna Floodplain	Along the old Brahmaputra Rivers and out of active Jamuna floodplain
Lowland	180 to 300 cm	Sylhet Basin and Active Brahmaputra-Jamuna Floodplain	Outside of Haor area in Kishoreganj and Netrakona Districts and along the Jamuna River
Very Lowland	More than 300 cm	Old Meghna Estuarine Floodplain	Haor area in eastern part of Kishoreganj and Netrakona Districts

CHAPTER 4: PROBLEM ANALYSIS IN THE STUDY AREA

4.1 Problem Identified through the Workshops/Interviews in the Study Area

To clarify the main issues concerning water resources use and livelihood in the Study Area, 20 workshops were held at various levels. Problem analyses were carried out in each workshop.

(1) Problem Identification Workshops of Government Officials

Workshops targeting government officials were held at central and district levels. The central

workshop was held with representatives of relevant government agencies, development partners and LGED as participants. District-level workshops were held in all districts of the Study Area. Participants were LGED officials/officers, government district agencies and representative of Union *Parishads*.

(2) Problem Identification Workshops of Villagers in Subproject Areas

Workshops at Union/WMA level were held at 13 unions and WMAs during the period of 9 - 26 Sep 2004. Selection of the workshop sites was done based on the zoning of the Upazilas.

(3) Summary of the Problem Analysis Workshops

Problem analyses were undertaken at each workshop with the core problem defined as “villager’s income is low”. The direct causes identified as the least common multiplier of all the problems identified are: 1) Low agricultural production, 2) Limited work opportunity, 3) Low profit from products, 4) Low fish production, 5) Large family expenditure, and 6) Women cannot earn, low livestock production, etc.

(4) Interviews and Statements at the Workshops

The major findings of the interviews and statements at the workshops are summarized below.

<u>Livelihood:</u>	0.2 ha might be adequate for a small farm family, but more land is required for a share cropper, particularly if one crop is grown. If owned land is not enough, share cropping (or other work) is necessary for self-sufficiency. <i>Boro</i> rice is usually the staple food. Cash by selling other crops is used for buying inputs for <i>boro</i> . Not only landless but also marginal farmers are of overriding importance.
<u>Farming:</u>	Farmers must adopt several countermeasures to minimize impacts of floods. It is difficult for share croppers to plant vegetables in their farmland probably due to instability. Farmers can get more money from farm labor than share cropping if get enough opportunity.
<u>Fishing:</u>	Fulltime fishermen in Begid Beel Subproject fish in Jamuna River and are not effected by the embankments. Normally, villagers mainly fish for own consumption. Many villagers fish when they are not busy. “Beneficiary farmers vs. negatively affected fishermen” is a typical structure of social conflict regarding SSWRDSP-2.
<u>Gender Issues:</u>	For active participation of women, meetings, workshops, etc. need to be carried out at various levels. Some women cannot access NGO’s activities even if they live in Sadar. Limited homestead land is one of the constraints for income generating activities. No adult male in the family directly means hardships of life.
<u>PRA and Subprojects:</u>	PRA teams might not be conducting enough interviews or real bottom-up workshops/meetings. UP Chairmen sometimes did not get consensus below village-level. Explanation of the proposed subproject to the villagers might be insufficient. Accountability and villagers’ participation for decision making are at stake.
<u>Digha Beel Subproject:</u>	There is a purely community-based project in the subproject area and six villages are working together every year. Some influential villagers including UP member and fish businessmen are opposing the subproject possibly due to their illegal occupation of the khals.
<u>Mutabari Khal Khonon:</u>	There was a project where 37 villagers contributed 50-60 villagers each for earthwork and excavated a canal. 95 % of contribution for construction was provided by villagers. Village headmen (gram shankar) and shomaj elders were involved and consensus of 37 villages was reached.

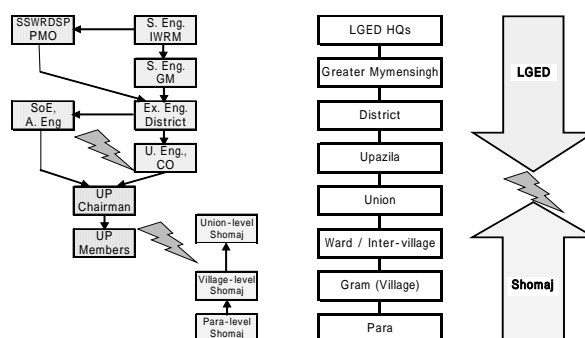
(5) Other Issues

1) PRA used in SSWRDSP-2

The PRA used in SSWRDSP-2 is a step of a project appraisal process by SSWRDSP-2. Therefore, PRA starts from the proposed project, not from the needs of the villagers or their future image. However, PRA workshops should become the venue to talk about the development of the area, to get better consensus among stakeholders and improve subproject design.

2) Communication Gap

There found two major communication gaps in subproject planning. One between Union level and village/*para* level, and the other between project employee and LGED employee line. The former gap hinders getting the consensus of the people and establishing participation and ownership of the people. The latter gap hinders identifying and designing a good subproject. In this context, more participation of Upazila Engineer and Community Organizer to design-discussion meeting seems to be necessary. Also, consensus of *shomaj* elders at village-level and *para*-level should be reached before finalizing the proposal of subproject.



Communication Gap

4.2 Problems of Small Scale Water Resources Development

(1) Problems identified in the Study Area

Problems for small scale water resources development identified in the study area are summarized in the following table

Problems related to Natural conditions:		
- Flat low lying terrain	- Arsenic Contamination	
- Strong Seasonal Bias of Rainfall		
Problems related to Socio-economic Conditions:		
- Poverty/Vulnerability of Farmers	- Gender Issues	- Local Conflicts
- Illegal Land Occupation	- Fragmented Agricultural Area and Small Landholdings	
- Communication Gap between Local Government and Villagers		
Problems related to agriculture, livestock and fisheries:		
(Agriculture)		
- Land development	- Water Related Problems	- Rice Monoculture
- Problems of deficit farmers	- Seed Production and Supply	- Traditional Farming
- Malnutrition by poor protein supply		
(Fisheries)		
- Flood damages	- Shortage of water during dry season	- Lack of freezing storage
- Insufficient fishery extension services	- No management of indigenous fish and conservation area	
- Shortage of improved species/varieties, quality fingerling and fish feed		
- Hard to access for water bodies leasing by poor fishermen		
(Livestock)		
- Feed shortages in dry seasons	- Integrated forestry-livestock farming	- Veterinary services
(Marketing)		
- Poor marketing environment		
Rural Infrastructure Conditions:		
- Damages to roads	- Rural Community Water Supply	- Poor road network

(2) Findings of Farm Household Interview Survey and Union Questionnaire Survey

The survey was conducted to understand/identify profitable farming style. According to the results of farmers' interview survey, farmers expressing their request to the Union Council are summarized in the table.

Farmers Requests to Union.

Requests	Jamalpur	Kishoreganj	Mymensingh	Netrakona	Sherpur	Tangail	Average
Transportation (Marketing)	1	1	2	1	1	1	1.2
Sanitary facilities	2	2	1	2	1	2	1.7
Irrigation	3	3	3	3	3	3	3.0
Seed supply	3	4	4	4	7	5	4.5
Drainage	6	4	6	4	4	5	4.8
Health services	3	7	7	4	5	5	5.2
Fertilizer supply	7	4	4	8	6	4	5.5
Training for new technologies	7	8	7	4	9	8	7.2
Credit services.	9	10	7	10	8	8	8.7
Information services	10	8	10	10	9	10	9.5
Cooperative services	10	10	11	9	9	10	9.8

Source: JICA Farm household survey (2004) <Smaller score shows higher request.>

(3) Lesson Learned by SSWRDSP-1 and Other Rural Development Projects

After completion of SSWRDSP-1, ADTA arranged the Project Final Report and submitted to LGED on January 2003. Appraisal was prepared by ADTA regarding the results and/or issues obtained through the implementation of SSWRDSP-1 and mentioned as the lessons learned in the Report. Additionally Bangladesh University of Engineering and Technology (BUET) and other consultants carried out the evaluation on the implementation of SSWRDSP-1 by the request of the Royal Netherlands Embassy and arranged the External Evaluation of SSWRDSP-1. Major lessons learned were taken into regard for future SSWRDSP implementation.

4.3 Participatory Workshops (PRA)

(1) Objectives and Methodology

The Study Team conducted problem analysis workshops and interviews in September 2004 at 13 potential subproject areas, of which appraisal was finalized for 6 and 7 had failed after pre-screening. Major activities conducted in the PRA are as follows:

Arrangement of workshops with local leaders
- Preparation of gram level workshops to strategically cover all the study area.
- Preparation of one integrated workshop at sub-project level for summary and some consensus building
- Miking by UP Chairpersons, UP Members, <i>matabbors</i> and other local leaders for participation
Gram level interviews and workshops
- Interviews focused on poor villagers
- Mapping, rich-poor profile and other RRA tools if necessary
- Appreciative Inquiry
Integrated workshops
- Presentation of the results of the gram level workshops
- Presentation of observation and analysis by the Team: identification of intra-gram / inter-gram issues, and sub-project / upazila / district level issues if any.
- Discussion especially on inter-gram and sub-project level issues, and on immediate actions

(2) Participatory Planning and Decision Process

1) Immediate actions that could be taken

- UE, AE (SP-2), SoE (SP-2) and other local LGED Staff need to check/rewrite all the sub-project proposals.
- The study of the appraisal teams needs to include potentially affected areas such outside of the project area.

- Project purpose, major project facilities and activities should be clarified.
 - Full and active participation of UEs, AEs (SP-2), SoE (SP-2) and other local LGED staff in project designing is a must.
 - LGED staff at Upazila and District levels need to provide comments to the sub-project proposals on phasing and priority in upazila and district.
 - Copies of all the appraisal reports need to be sent to each district and the upazila(s)
 - Accountability to the villagers and consensus of gram level leaders such as matabbors need to be the pre-requisites for UP Chairpersons to submit sub-project proposals
 - Two-day interviews and three to five gram level workshops need to be conducted in addition to one transect walk and one workshop by the PRA team. A workshop for every one or two grams is recommended.
 - The villagers of neighboring grams and unions must be included to the interviews and workshops by the PRA team.
 - Full explanation to the villagers on major activities, pre-requisites and benefits of WMA is necessary before asking about their promises to join WMA.
- 2) Way Forward
- Original technical sub-project identification needs to be undertaken by LGED and UP Chairpersons are to make proposals from the potential sub-project list. Multiple UP Chairpersons usually need to coordinate before submitting proposals.
 - Under current project design/appraisal system, a concrete image of the sub-project cannot be completely clear before the feasibility study. Major impact assessment and consensus building process, however, is done by the PRA before the feasibility study. It is necessary to clearly separate participatory project design process including consensus building and appraisal process of the sub-project.
 - All the planning process needs to be constructed so that the level of participation goes up gradually through project designing and appraisal toward implementation.
 - Many UEs, AE (SP-2), SoE (SP-2) and other local LGED staff think that sub-project designing is the job of consultants sent by LGED HQ. LGED has to make it clear that it is the job of LGED itself, and arrange human resources and capacity development.
 - Appraisal system of sub-project needs to be transformed from pinpoint appraisal system to areal appraisal system with development plans.

CHAPTER 5

SMALL SCALE WATER RESOURCES DEVELOPMENT POTENTIALS

5.1 Potentials for Water Resources Development

(1) Natural Conditions

1) Surface water resources

About 250 rivers, comprises the river system of the Study Area. These cover up to about 38,000 ha (National Water Resources Database, WARPO). During dry season, they are the precious water sources for irrigation. The eastern part of Netrakona and Kishoreganj districts

are classified as haor areas, characterized by its low altitude and lengthy inundation period. Inundation depth rises up to more than three meters and continue for several months. Though flood protection in such areas are clearly unpractical, production of wheat may be enhanced/stabilized by mitigating early flood damage and promoting post-monsoon drainage. There are about 2,800 perennial water bodies, with a total area of about 1,600,00 ha in the Study Area (WARPO). In regard to the water scarcity in dry season, all water bodies with considerable scale are of some potential for SSWRD. Retention and utilization of flood water for supplementary irrigation may also enhance agricultural production particularly in areas with relatively high altitude. However, it must be noted that water levels in these water resources must be maintained to a certain point to preserve the existing ecosystem and fisheries resources.

Surface Water Resources in the Study Area

District	Total Number		Without Beel		No. of Beel*	Beel Area (ha)
	Upazila	Union	Upazila	Union		
Jamalpur	7	69	6	33	62	879
Kishoreganj	13	110	12	50	160	1,158
Mymensingh	12	146	10	60	154	2,361
Netrakona	10	85	9	46	117	725
Sherpur	5	52	5	33	98	1,304
Tangail	11	103	10	28	73	8,606
Total	58	565	52	250	664	15,033

Source: NWRD, WARPO

Notes: * because a beel locates in the several unions

2) Drainage

In areas classified as “highland” (inundation depth up to 0.3m), potential for drainage may be found in small depressions at limited extent. Medium highland and lowland with the inundation depth of 0.3 to 1.8 m is expected to have the highest potential for drainage improvement. Excavation/re-excavation of drainage channels will have significant impact on agricultural production. Moreover, areas classified in medium highland/lowland cover about 60% of the area. Effectiveness of drainage at lowland and very lowland will also be limited.

3) Groundwater

Though excessive utilization of groundwater for irrigation in the dry season may result in temporary declining of groundwater table, it is believed to recover to its normal levels during monsoon season. However, potential for groundwater utilization is yet ambiguous considering its potential danger of arsenic contamination.

(2) Socio-economic Conditions

There is conventional decision making system in the *shomaj* (village) level, and is functioning. If consensus for development activities could be developed at this level, it may have significant effect on the sustainability of SSWRD interventions. The presence of community based earth dam project with six villages working together indicate the possibility of similar activities for the Master Plan. The case of a previous irrigation project where 37 villages participated further supports the possibility.

Though the number of women participants in workshops were small, they were active in the workshop. This may indicate the presence of active women who can act as leaders of local women groups. Road embankments also has the potential to work as flood embankments, in premise that water resource facilities are appropriately installed.

(3) Agriculture, Livestock and Fisheries Development Potential

Land and Soils: Seasonal floods bring water and sedimentation to agricultural fields. Sandy soils are useful for root and tuber crops. Char lands are free from soil born diseases, and have abundant water. Besides rice, tall and high-soil moisture resistant crops such as sugarcane and maize and fodder can be grown efficiently. Inundation induces anaerobic conditions in soils and is useful for protection of upland crops from soil-born diseases.

Agricultural Production: There is high potential for the improvement in agricultural production. Varietal improvements for high value crops, and high-water philic plants. Installation of rural industrial complex in some way will increase needs of agricultural products and enhances low-cost production. Off-seasons crops can be sold with higher price. Water management and breeding will enable off-seasons crop cultivation

Livestock Production: Aqua-animals are promising for export, although raising them requires specific techniques. Forests have high potentials for grazing and pasturing of animals. Integration of forest-livestock is useful for extending pasturing areas.

Post-harvest processing and marketing: In Bangladesh, farm mechanization has not yet been developed. Most of the farm activities are done by manually from land preparation to food processing. However, technology of informal sector is rather well developed as observed in manufacturing of power threshers. Economic development will cause diversification of food consumption in Bangladesh. At the same time, export of rice will be targeted.

Extension for agricultural development: At present, training is conducted as an independent course of farming. However, integrated training courses in other areas are important such as crop diversification and diversified farming. To enhance bargaining power of agricultural products and to increase cash income, farmers shall be oriented to specialized farming.

Fishery Production:

Hilly area: Generally not suitable for fish culture. If water remains in water bodies (0.5m depth, 6 months), it may be possible to introduce low cost seasonal fish culture.

Terrace and Floodplain: Generally suitable for fish culture. If water remains in water bodies (1m depth, 6-10 months), low cost subsistence/income generating fish culture may be possible.

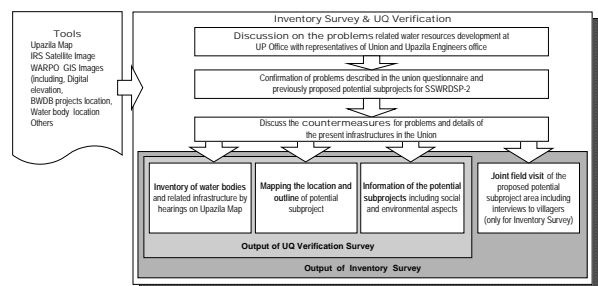
Deeply Flooded Area: Generally not suitable for fish culture. If pond/ditch etc. can be defended from flood, it may be possible to introduce low cost seasonal fish culture.

Chars/Haors: Not suitable for fish culture. Fishing/low cost seasonal fish culture may be possible

5.2 Identification of Potential Subprojects

(1) Methodology

Identification of potential SSWRD subproject conducted by the inventory and union questionnaire verification surveys. Both surveys conducted firstly, discussion and clarification of the answer of union questionnaires on the water related problems in the Union among UP chairman and members, representative of villagers and staff of Upazila



engineer's office at Union office. Then the locations, necessary countermeasures for the problems faced by people in the Union were confirmed.

(2) Inventory Survey

Through the inventory survey, a total of 258 potential subprojects were preliminarily identified in the field. These were further examined together with those identified through the Union Questionnaire Verification Survey for their consideration in the list of prioritized potential subprojects.

(3) Union Questionnaire Verification

Through the union questionnaire verification survey, a total of 419 potential subprojects were preliminarily identified in the field. These were further examined together with those identified in the Inventory Survey for their consideration in the list of prioritized potential subprojects.

(4) Identified Potential Subprojects

In preparation of the list of potential subprojects for SSWRD in the Study Area, the results of field surveys were carefully examined and necessary modification were made. Accordingly, the Study Team identified 694 ungrouped potential subprojects in the Study Area. The identified subprojects were further reviewed on the basis of the comments received in the consultation meetings with UDCC, DSSWRCC and IMCC. The hydrological features and contents of the identified subprojects were also examined to verify its adequacy as a single subproject. Consequently, a total of 593 potential subprojects were verified.

Verified Potential Subprojects by type

District	FM	DI	CAD	WC	FM& DI	FM & WC	DI& WC	FM, WC& DI	Total	Total before verification
Jamalpur	20	6	0	1	10	0	14	13	64	85
Kishoreganj	16	7	0	24	9	4	38	25	123	141
Mymensingh	13	26	1	6	20	3	42	20	130	159
Netrakona	19	18	1	8	20	13	24	9	112	124
Sherpur	9	12	0	7	1	1	14	0	44	55
Tangail	14	32	0	11	20	3	25	15	120	130
Study Area Total	91	101	2	57	80	23	157	82	593	694
% within total	15.3	17.0	0.3	9.6	13.5	3.9	26.5	13.8	100.0	-

5.3 Prioritization of Potential SSWRD Subprojects

(1) Necessity of Prioritization

In order to effectively utilize limited inputs, development activities of the Master Plan should be implemented at the right place for the right purposes, contributing at the maximum extent to its overall goals. Prioritization of subprojects should be done with necessary criteria to select the most important interventions. Before prioritization, the verified subprojects which were obviously unqualified for SSWRDSP were screened out, and then the qualified potential subprojects were scored and categorized into four categories (A-D) depending on their scores and maturity in planning.

(2) Method of Prioritization

Among prioritization, the verified potential subprojects were pre-screened to exclude sub-

projects that clearly do not fit into the SSWRD scheme. For this process, the gross area and location of the verified subprojects were applied, where medium and large-scale subprojects as well as small-scale subprojects lying in areas protected for the purpose of environmental conservation were excluded.

After pre-screening, the qualified subprojects were scored by applying a method for multi-criteria analysis. The criteria and weight of the scores were carefully examined based on available information, and each qualified subproject was scored accordingly.

(3) Qualification of Potential Subprojects

Two fundamental criteria from the selection criteria of SSWRDSP-2 were applied for qualification (pre- screening) of the verified potential subprojects, while the remaining selection-criteria were considered later on for the prioritization of qualified subprojects. The criteria applied were: Gross Subproject Area and Overlapping with protected areas

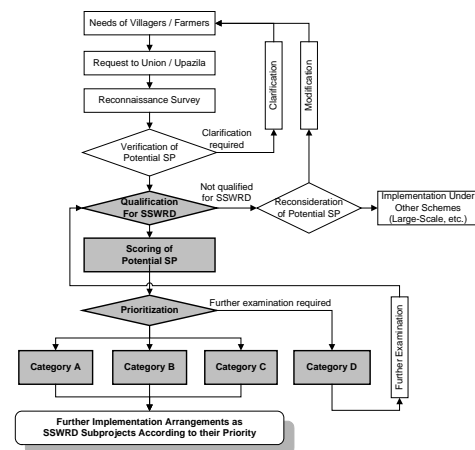
(4) Prioritization of Qualified Potential Subprojects

After qualification, the potential subprojects were prioritized and categorized into four categories (A, B, C and D) according to their priority. This was done by two approaches. One is to score the qualified subprojects by using a multi-criteria analysis method, and selecting those with higher priority based on a set of criteria. The other is to screen out and lower the priority of potential subprojects that are qualified but yet require additional information to confirm if they satisfy certain criteria for SSWRDSP-2. The potential subprojects selected in the latter process was categorized into category D, while the remaining were categorized in to A, B, and C.

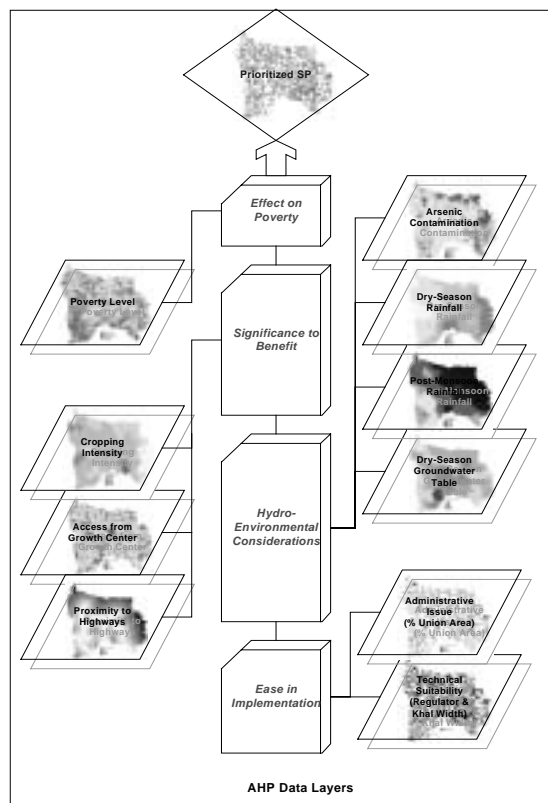
Scoring of subprojects was conducted by applying *Analytical Hierarchy Process* (AHP) method, which is a tool for decision making with various parameters (multi-criteria analysis).

Relative importance of items/decision factor called “natural states” regarded for categorization of SPs was considered and weights for scoring of these items were examined. The main procedure consists of four steps.

- 1) Examining weight of importance of each category
- 2) Examining weight of importance of each item in the same category
- 3) Scoring of individual items in consideration of each state
- 4) Integration of individual scores and weight to prioritize potential subprojects



Flow of Prioritization



The criteria used for prioritization were:

- 1) Effect on poverty reduction by the Subproject
- 2) Significance of Benefit
- 3) Hydrological and Environmental Considerations
- 4) Easiness in Implementation of the Subproject and O&M by Local Beneficiaries in the sub-project Area.

These criteria were further divided into 10 items and each subproject was examined in the light of the criteria.

(5) Prioritized Potential Subprojects

Prioritizations of the scored subprojects were done upazila-wise in regard of the capacity of the Upazila Engineer office in implementation. One subproject with the highest score was selected in each upazila for implementation under the short-term activities of the Master Plan. Such subprojects were categorized as Priority A. Furthermore, some 30% were selected from the remaining 292 subprojects for categorization in Priority B. This counted up to 99 subprojects, varying from 8 to 25 in each district. Finally, the remaining 193 subprojects were categorized into Priority C, which will be implemented under the long-term activities of the Master Plan. The prioritized subprojects have been checked upazila-wise and then district-wise so that implementations of the prioritized subprojects become distributed among the upazilas and districts. The location of these sub-projects are shown in Figure S-1

Prioritized Verified Potential Subprojects by Type

		FM	DI	CAD	WC	FMDI	FMWC	DIWC	FMDI&WC	Total
Category A	Jamalpur	5	0	0	0	1	0	0	1	7
	Kishoreganj	3	2	0	1	2	0	3	2	13
	Mymensingh	1	4	0	1	3	0	2	1	12
	Netrakona	2	5	0	1	0	0	1	1	10
	Sherpur	1	1	0	0	0	1	2	0	5
	Tangail	3	1	0	1	0	1	3	2	11
	Sub Total	15	13	0	4	6	2	11	7	58
Category B	Jamalpur	3	2	0	1	1	0	3	1	11
	Kishoreganj	1	0	0	7	0	0	8	3	19
	Mymensingh	3	7	0	2	3	0	7	3	25
	Netrakona	2	1	0	2	8	2	2	0	17
	Sherpur	3	2	0	2	1	0	0	0	8
	Tangail	1	9	0	1	2	0	4	2	19
	Sub Total	13	21	0	15	15	2	24	9	99
Category C	Jamalpur	6	2	0	0	3	0	3	7	21
	Kishoreganj	1	3	0	7	3	1	11	8	34
	Mymensingh	2	12	0	1	6	1	18	5	45
	Netrakona	6	12	0	0	7	8	5	1	39
	Sherpur	3	8	0	1	0	0	6	0	18
	Tangail	3	15	0	2	5	0	8	3	36
	Sub Total	21	52	0	11	24	10	51	24	193
Category D	Jamalpur	5	0	0	0	4	0	4	1	14
	Kishoreganj	9	0	0	8	3	3	10	11	44
	Mymensingh	4	0	1	1	4	0	4	3	17
	Netrakona	7	0	1	3	3	2	12	3	31
	Sherpur	1	0	0	3	0	0	0	0	4
	Tangail	6	3	0	7	11	2	2	5	36
	Sub Total	32	3	2	22	25	7	32	23	146

5.4 Sustainable Water Management

(1) Participatory Water Management

The National Water Policy (NWPo) directs that "stakeholder involvement should be an integral part of water resources management at all stages of the project cycle". Ministry of Water Resource (MOWR) issued "Guideline for People's Participation in the Water Development Projects" and "Guideline of Participatory Water Management".

Under the SSWRDSP-1 and 2, Water Management Association (WMA) is established under the legal framework of the Cooperative Societies Act 2001 and Cooperative Societies Rules framed there under. The main function of WMAs are to act as the representatives of local stakeholders in subproject design and decision making, and to contribute to the sustainability of the subproject by bearing recurrent maintenance activities including re-excavation work for maintaining design performance of the subprojects. They also function as the recipient body for technical support from government agencies. Moreover, some WMAs provide services to the members in form such as loans for new economic activities.

(2) Issues for Water Resources Management

Considering the finding on the SSWRDSP-1 subproject areas, followings will be pointed out for the sustainable water resources management.

- For sustainable water resources management in each subproject after completion of the project, more accurate water balance study in the project area will be essential at the feasibility level analysis.
- Additionally, basic O&M procedures for appropriate usage of water related facilities should be plainly explained in the feasibility level analysis for the future formulation of O&M plan by the WMA.
- In the O&M stage, the WMA should operate the water related facilities according to the O&M plan formulated in advance. If the water resources situation is not the same as planned, the WMA should modify the O&M plan and submit it to the Assistant Engineer of LGED located at each district office.
- The Modified O&M plan is to be confirmed by the Assistant Engineer together with the Agriculture, Fishery and Socio-Economist as technically feasible / socially viable.
- In case that the subproject is adjacent to other subproject(s) or a large-scale project by BWDB, the LGED Assistant Engineer and other Engineers had to discuss about the modified plan regarding the technical and social aspects with the Engineers concerned to other subproject(s) by LGED or a large-scale project by BWDB.
- The WMA O&M committee members are to pay attention on the water utilization from the Beel.

Furthermore, the following conditions should be applied.

- To exempt poor landless farmers, especially female-headed households, from cash contribution to join WMA.
- To introduce progressive cash contribution system based on gram level decision.
- To charge operation and maintenance fee solely on landowners' accounts.
- To include community-based water resources development projects into WMAs under SSWRDSP-2 even if they are not selected as subprojects.
- To make the relation between WMA and UP clear, For example, the advisory roll of UP shall be promoted

CHAPTER 6

MASTER PLAN ON

SMALL SCALE WATER RESOURCES DEVELOPMENT

6.1 Basic Concept of Small Scale Water Resources Development Plan

(1) Objectives

The National Water Policy (NWPo) has been formulated to provide direction to all agencies working with the water sector, and institutions that relate to the water sector, for achievement of specified objectives. Under this policy, the sector agencies of Government and local bodies will prepare sub-regional and local water-management plans and approved Government project appraisal guidelines. In regard of the above, the Master Plan of District Water Resources Development has been started by LGED including the Study covering 6 districts in Greater Mymensingh as one of the pioneers. The overall goal of the Study is to secure safe and sustainable water resources management and to increase farmers' income. The Master Plan is prepared comprising of strategies, prioritized subproject list, priority programs, and the scope for the follow-on investment project which include effective use of surface water.

(2) Basic Concepts of the Small Scale Water Resources Development

Integrated Rural Development: Improvement plan of agriculture, livestock, and fisheries including extension credit, system, post harvesting, marketing, etc., shall be conducted in the subprojects. Also due consideration shall be made to avoid / minimize the negative impact on environment and society.

Water Resources Development complying with NWPo and NWMP: The Master Plan prepared through this Study should be positioned under the NWPo and NWMP, and must be in line with the contents of the policy.

Flood-Management in Small Scale Water Resources Development: Human life shall be protected from all the conceivable floods. In reality, complete flood-proof conditions cannot be realized, and flood-management would be improved only in steps both in areal extent and increase level of protection.

Participatory Development Process: At all stages of the subproject, local stakeholders shall be involved or participated in order to formulate the ownership of the subproject.

Income Generation for Weak through the Project Implementation: Specific measures shall be taken to ensure the poor, marginal/small farmers and destitute women benefit from the subprojects.

Institutional Strengthening: Small scale water resources development is implemented in the rural area, and Union and Upazila level officials shall act as the enabler. But considering the present conditions, they need capacity building for implementation.

6.2 Strategy of Small Scale Water Resources Development Plan

(1) Target Year and Phasing of the Implementation

The target year of these plans, the target year of the Master Plan shall be the year of 2015.

And the target year of the Master Plan is set in the following three stages;

- Short Term: by 2007 to complete the feasibility study and start implementation of high priority subprojects
- Mid Term: by 2010 to implement high and medium priority subprojects
- Long Term: by 2015 to complete the permissive subprojects

(2) Strategy of Small Scale Water Resources Development Plan

Basically the implementation of Master Plan will follow the on the line of SSWRDSP-2 after modification of its procedures.

Upazilas in the Study Area is categorized into five (5) zones; 1) highland, 2) medium highland, 3) Medium lowland, 4) lowland, and 5) very lowland. Strategies for the small scale water resources development of each zone shall be set as follows:

Highland: The Madhupur Tract area is a typical area of the highland zone. Strategy of SSWRD shall be based on water retentions of the monsoon flood water and rainfall for irrigation during the dry season. The development potential of the pond at the depression of the hill shall be examined.

Medium highland: The medium highland spreads outside of the highland zone in the old Brahmaputra flood plain. Strategy of the SSWRD of the zone shall be based on flood management to reduce damage of *aman* at the beginning of flood season and to drain submerged water for the early re-trans planting *aman* paddy.

Medium lowland: The medium lowland spread outside of the lowland and the young Brahmaputra and Jamuna rivers. The strategy of SSWRD shall be based on flood management to delay the submergence of grown *aman*, and drainage after flooding. Embankment height will be reasonably set.

Lowland: The lowland with inundation depth between 180 and 300 cm spread outside of the Haor area. Because of the inundation depth, flood management in this zone is rather difficult without major river flood management, and strategy of SSWRD shall be concentrated mainly on drainage after flood season.

Very lowland: The very lowland zone is the *Haor* area of the old Meghna estuarine flood plain. The strategy of the small scale water resources development shall be mainly concentrated to the drainage acceleration before *boro* cultivation and flood management of early flood.

Char Land Haor Area: In this Study, char area will be mostly concentrated or prioritized in the stable char area in Jamalpur district as same as adopted by the FPP. Development of haor area should emphasize; converting the use of ground water to surface water, management of water resources in regard of environment, partial FM with submergible embankments, and local development of hill irrigation.

Paurshavas: In this Master Plan Study, paurshavas areas are excluded from the Study Area.

(3) Strategies of Relevant Sectors Development for the SSWRDP

As the nature of SSWRD other sector activities can not involve in the project like those in integrated rural development. It is considered that beneficiary sector activities will be implemented by the other financial resources. However, beneficiary sector development shall be implemented together with small scale water resources development in order to achieve the targets of the Master Plan.

6.3 Basic Concepts of SSWRD Subproject Plan

(1) Type of Small Scale Water Resources Subproject

The Identified potential subproject of the Study will be implemented under SSWRDSP-2 or expected SSWRDSP-3. Therefore, four types of SSWRDSP-2 will be applied in this SSWRDP subprojects. These are: 1) Flood Management (FM); Drainage Improvement (DI); Water Conservation (WC) and; Command Area Development (CAD).

(2) Sustainable Water Resources Management

WMA shall be formulated by beneficiaries for the sustainable subproject implementation and management under the legal framework Cooperative Association Act (2001) and “Guidelines for People’s Participation” and “Guidelines for Participatory Water Management”. The main function of WMAs are to act as the representatives of local stakeholders in subproject design and decision making, conflict settlement among stakeholders, and to contribute to the sustainability of the subproject.

6.4 Agriculture, Fishery and Livestock Development

The following approach for the development shall be considered:

(1) Agriculture Development

- Improve human nutrition by diversified farming
- Focus on profitable farming through higher productivity
- Upgrade of general agricultural technology–Technical packages other than water management will not be obstacle to agricultural production
- Collaborate with other agricultural projects
- Develop Value Added Agriculture
- Develop community-based activities to fulfill basic regional needs for the rural human security
- Develop wide-area based water management: e.g., multiple function of paddy fields
- Human Resources Development

(2) Fishery Development

- Encouragement of integrated fish culture
- Introduction of tilapia culture
- Introduction of freshwater prawn culture
- Introduction of freshwater ornamental fish culture
- Conservation of indigenous/natural fish in Beel, Khal, River and Haor
- Propagation of indigenous/natural fish by fish culture

(3) Livestock Development

- Stability of feed supply
- Improvement of animal health
- Processing/ slaughtering of animals

(4) Suggestions to Future Development in Agriculture and Livestock

- Rice terrace cultivation in Haor Area

- Rural industrial complex
- Development of livestock vaccination system in rural areas.
- Efficient irrigation technology in highland area.
- Small scale farm mechanization
- Field Training for quality seed production and processing for farmers own use.
- Development of recycling in farming system
- Integrated forestry-livestock farming
- Development of market information system for fish and fresh vegetables
- Human resources development

6.5 Priority Programs

In order to implement the SSWRD Project smoothly and assure the expected effects, the priority programs will be conducted in parallel with the SSWRD subproject implementation.

(1) Collaboration and Coordination among Stakeholders

Collaboration works with relevant government agencies are strongly expected to the implementation of SSWRD Project. National, district and Upazila level government agencies coordination committees should be maintained to achieve multiplication effects of the Project.

(2) Strengthening of Local Government Engineering Department

Improvement of office equipment and facilities support more smooth implementation of daily works of the Project at District and Upazila Level. This includes transportation vehicles, computer and peripherals/software, photocopy machines, etc.

(3) Strengthening the Local Government Level Technical Offices

There are not enough water resources development planners/engineers in LGED, especially at district and upazila level. Technical training program shall be considered to strengthen the capacity of local government officials of LGED for planning and implementation of SSWRD.

(4) Water Management Associations

In order to maintain the sustainability of SSWRDP sub-projects, capacity building of WMA members is indispensable. In parallel with training of WMA members, National Level Water Management Federation will be formulated to exchange experiences and information among individual WMAs.

(5) GIS and IT

At present, the GIS coordination system between WARPO and LGED is deferent. Standardization is required for exchanging information of GIS. Inventory of water bodies and existing projects under the NWRD is no completed yet. It needs to formulate nation wide inventory survey of water resources among stakeholders under the coordination of WARPO.

6.6 SSWRDP Implementation Plan – Action Plan -

(1) Project Implementation

The Project aims to achieve the sustainable agriculture and improve the farmers' living conditions through increased agricultural production and resources mobilization in the Project Area. The Project consists of two major components; 1) SSWRD Subprojects and 2) Priory programs. Considering the similarity of interventions, implementation arrangement of

SSWRDSP-2 will be applied for the Project with improvement, if appropriate. The Project is basically assumed to be implemented by the Bangladesh Government budget with external financial support. The LGED will be the executing agency of the Project.

(2) Executing Agencies

The project management office (PMO) will be established at LGED headquarters. The major functions of the PMO are: i) coordination of agencies concerned, ii) preparation of overall implementation plan, annual project work plans and budget, iii) review and approve subproject appraisals, iv) review and approve designs, v) supervise LGED district offices in preparing tender documents, evaluating bids, and awarding contracts, vi) maintain financial accounts, vii) prepare periodic reports on implementation progress and viii) monitor project progress and evaluate environmental impact. PMO will procure the consultants to support the PMO on the technical aspects and institutional strengthening.

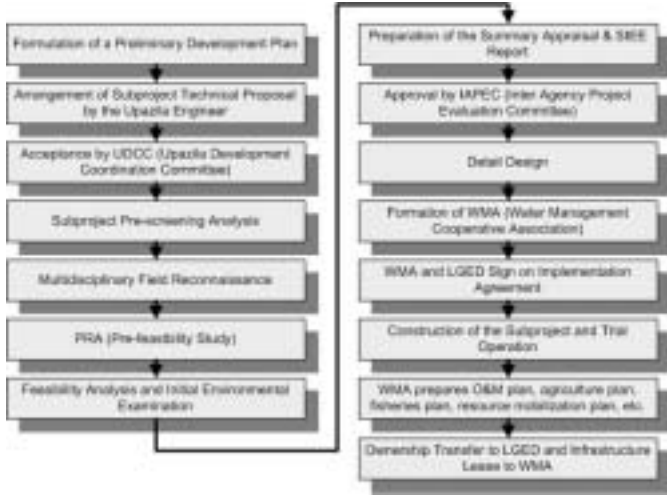
Under close guidance and supervision of the PMO, LGED district offices will be responsible for the day-to-day implementation at the subproject level with assistance from the upazila offices. The LGED district Executive Engineer will act as Subproject Manager and 1) prepare individual subproject implementation with stakeholder participation, 2) coordinate with other agencies and organizations, 3) support organization of WMAs, 4) carry out field surveys, 5) supervise construction activities and make payments to contractors, and 6) monitor and report subproject development to the PMO.

At National Level, Inter-ministerial Coordination Committee (IMCC) shall coordinate the agencies for smooth implementation of the Project. District-level Small-scale Water Resources Development Committees (DSSWRDCS) will meet when required to coordinate the activities of the district level Government agencies. MOLGRDC will issue an order requiring the Upazalial Development Coordination Committee (UDCC), composed of the union chairpersons and upazila-level officials, to put the review of subproject progress on the agenda of all its regular meetings. LGED district offices will maintain close coordination with BWDB through the Inter-Agency Project Evaluation Committee to ensure that proposed subprojects do not conflict with planned or existing BWDB projects.

(3) Implementation Plan

Identification and appraisal process for an individual sub-project on SSWRDSP-2 set by the LGED are as indicated in the diagram.

The high priority subprojects, after prioritization, are not equally distributed to each district and upazila. Some Upazila concentrate many high priority subprojects and only few high priority subprojects in some upazila. If subproject selected to implement from higher priority, some upazila has no subproject and some upazila concentrate more than 3 subprojects. To avoid these cases, SPs will be selected based on higher prioritized subprojects in the upazila.



Selection of subprojects in each phase, are set as follows:

Short term (2 years): select to start a subproject highest in each upazila (total 58 subprojects)

Medium term (3 years): select around 40 % of remaining higher priority subproject in each upazila

Long term (5/4 years): select around 60 % of remaining higher priority subproject in each upazila

Civil works of subproject will be contracted with local contractors under local competitive bidding (LCB) under the standard LGED procurement procedures. Small scale earthwork contracts with labour contracting associations (LCSs).

After completion of the subproject construction, Joint walk is conducted by Upazila Engineer and Assistant Engineer SSWRDSP for one year. Then the subproject, after necessary rectification, is handed over to WMA. WMA will be responsible for the O&M of the water resources infra- structure developed in the subproject. LGED will provide technical support for such activities. The expences of O&M are raised from contribution of the benefi- ciaries and through various income generating activities undertaken by the WMA. Implementation schedule of the whole Project component are indicated in the chart.

Phase Year	Short Term		Medium Term			Long Term				Total	
	2006	2007	2008	2009	2010	2011	2012	2013	2014		2015
Small Scale Water Resources Development (No. of Subproject)											
Jamalpur	3	4	3	4	4	5	6	5	5		39
Kishoreganj	6	7	6	6	7	8	9	9	8		66
Mymensingh	6	6	8	8	9	12	11	11	11		82
Netrokona	5	5	5	6	6	10	10	10	9		66
Sherpur	2	3	2	3	3	4	5	5	4		31
Tangail	5	6	6	6	7	9	9	9	9		66
Study Area Total	27	31	30	33	36	48	50	49	46	0	350
Monitoring & Evaluation by PMO											
Engineering Services											
Priority Programs											
Capacity Building of Upazila Engineers Office											
Training of WMA Management Board Members											
GIS Database system improvement											
Collaboration works on the Stakeholders											

(4) Project Costs

The costs for implementing the Master Plan consists largely of: 1) Preparatory works for implementation, 2) Construction of physical infrastructure, 3) Institutional strengthening, 4) Monitoring and quality control and 5) Overall project management.

Summary of Project cost

Unit: 1,000 USD

	Preparatory works		Construction of physical infrastructure	Institutional Strengthening			Monitoring and quality control			Project Management	total
	Further arrangements for Implementation	Institutional arrangements of local stakeholders		Agricultural training / extension	fisheries training (including measures for mitigation)	Capacity Building of LGED	Env. monitoring	monitoring and evaluation	system operation		
civil works	0.0	0.0	54,961.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54,961.2
land acquisition and contribution	0.0	0.0	2,388.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,388.3
material	0.0	0.0	0.0	1,005.0	0.0	0.0	840.0	0.0	0.0	0.0	1,890.0
vehicles and equipment purchase	0.0	216.8	0.0	96.8	96.8	0.0	60.0	0.0	98.8	60.0	629.3
surveys and investigation	525.0	0.0	525.0	0.0	0.0	100.0	10.0	0.0	0.0	0.0	1,160.0
training	0.0	2,100.0	0.0	1,005.0	2,841.8	1,800.0	35.0	0.0	0.0	0.0	7,826.8
Management information system (GIS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0	0.0	200.0
consulting services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	216.0	0.0	772.8	7,944.8
supervision and implementation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6,000.0	800.0	6,800.0
External staff (NGO, etc.)	840.0	1,680.0	0.0	700.0	700.0	0.0	0.0	0.0	0.0	0.0	3,920.0
Vehicles and equipment O&M	0.0	396.8	0.0	120.6	120.6	0.0	60.5	0.0	120.6	0.0	819.0
subtotal	1,365.0	4,393.7	57,874.5	3,017.4	3,759.2	1,900.0	1,005.5	416.0	6,219.4	8,588.8	88,539.4

6.7 Project Justification

(1) Economic and Financial Evaluation

1) Economic and financial evaluation of SSWRDSP-2

The SSWRDSP-2, which is a preceding case of SSWRD in Bangladesh, aims to implement 300 SPs for SSWRD. The project is estimated to cover some 195,000 ha and benefit over 280,000 farm households. Economic and financial analysis for SSWRDSP-2 is done based on the results of SSWRDSP-1, which was the first phase of the project. According to the analysis, farm financial returns are expected to range from Tk. 4,400 to Tk. 6,100 per ha, a 25 to 56 %. The overall project EIRR was 19 % when costs of the participatory water resource development component (including social mobilization, subproject selection, project management, monitoring, and post-construction agricultural and fisheries programs) are included. If the costs of the institutional strengthening component are also included, the EIRR was 17 %.

2) Economic Evaluation of the Master Plan

The Master Plan prepared in this Study aims to implement SPs for SSWRD such as those implemented under SSWRDSP-1 and 2 with rational planning. Therefore, the expected benefits derived by implementation of the Master Plan will be reflecting those of the said projects. Implementation of the SPs indicated in the Master Plan is expected to cover some 191,109 ha benefiting about 391,000 households. Also in regard of the scale of the activities, it is expected that the Master Plan can be justified as well as SSWRDSP-2. The EIRR for the 335 verified potential SPs calculated with the conditions and parameter mentioned in the above table was 18%. Furthermore, three alternative cases were examined. These are: 1) increase in project cost be 10%, 2) decrease in benefit by 10% and 3) combined case of 1) and 2) The EIRR in these three cases were 17%, 16% and 15% respectively.

(2) Environmental and Social Consideration

1) Categorization and its Reason

The Master Plan, has been categorized as Category B in reference to the JICA Guidelines for Environmental and Social Consideration (JICA, 2004) through discussions held between LGED and JICA Monitoring Team (19th – 26th July 2004). In regard of the findings of the Phase I and II Studies support that the Master Plan should remain as in Category B.

2) Negative impacts and measures for mitigation

In the Phase I of the Master Plan Study, scoping of possible negative impact to environmental and social factors in the Study Area were done, based on examination of existing materials and discussion with stakeholders. The negative key impacts of the identified at this stage were as follows.

Key Impacts Identified in Phase I Study

Key Impacts	Measures for Mitigation
Involuntary Resettlement	- Consensus building among landowners / users on land acquisition / reclamation - Incorporating presence of consensus into official procedures for project appraisal
Local economy such as employment and livelihood, etc.	- Consideration for fish-friendly structures in feasibility study - Promotion of aquaculture as activity of WMA (FSC) with priority to stakeholders conventionally practicing substantial capture fisheries - Securing access of all stakeholders (including non-WMA members) to fisheries activities (release public water bodies to local residents) - Fishery training to WMA members
Water Usage or Water Rights and Rights of Common	- Training of WMA members on methods of social development for Consensus building on water distribution for SPs aiming at WC in WMAs
Hydrological Situation	- Avoid SPs which may obstruct the conventional drainage system of the area at planning stage - Operation of regulator should be done with consensus with stakeholders outside of the SP area
Flora, Fauna and Biodiversity	- Avoid selection of SPs located in / adjacent to Madhupur National Park - Feed back the results of Bio-diversity monitoring which is to be carried out in the haor areas under SSWRDSP-2
Water Pollution	- Training for proper fertilizer / pesticide management to WMA members - Monitoring of water quality for selected SPs
Soil Contamination	- Training for proper fertilizer / pesticide management to WMA members, including promotion of organic fertilizers - Monitoring of water quality for selected SPs
Waste	- Examination of sediments and excessive earth that will occur from the SPs at the stage of detailed design and calculation of recyclable material - Inclusion of plan for waste management in detailed design of the SPs

(3) Overall Evaluation

The SSWRDSP-2 which is a preceding case of SSWRD which is currently being carried out by LGED is evaluated to be financially acceptable to the local beneficiaries and also economically viable with the overall EIRR of 17%. The Master Plan formulated in the Study, in regard of the similarity of project contents and its meaning in rational planning of SSWRD interventions, is expected to bare benefit similar to the said project. Also, the EIRR of the 335 verified potential SPs indicate a rate of 24%. Furthermore, sensitivity analysis with increased cost and decreased benefit and showed EIRR of 22-20%. For impact on environmental and social factors, negative impact is expected to be within an acceptable extent with necessary measures for mitigation. Implementation of the Master Plan is expected to bring favorable results to the economy of farm households in the Study Area, contributing to alleviation of poverty. In regard of the above examinations, the Mater Plan is considered economically viable and socially and environmentally sound, and should be implemented as soon as possible.

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

7.1 Conclusions

Small Scale Water Resources Development Sector Project (SSWRDSP-1) started in 1996 and successfully completed in 2002. Now the phase 2 of SSWRDSP (SSWRDSP-2) is under processing. These SSWRDSPs are designed by participatory approach to the water resources development, covering from the project formulation up to the O&M stages. The Study is understood as an expansion of the SSWRDSPs.

SSWRDSP-2 owes the implementation of the water resources development from subproject appraisal up to construction within 2 years. In order to conduct the construction of water resources development smoothly within the limited period, master plan formulation was expected.

The Master Plan Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh aims to contribute to poverty reduction by realizing effective and efficient development and management of surface water resources. Through implementation of the Master Plan, an environment where surface water can be effectively used for production purpose will be created. This includes not only conservation of surface water for direct utilization, but also an environment where agriculture, fisheries and livestock produce can be produced up to their potentials, not being hampered by floods and inundation. This environment will facilitate economic activities and lead to improved income of the local villagers.

The Study was designed to apply participatory planning as same as SSWTDSP-2. Many large-scale projects failed the sustainability at the insufficient performance of O&M stage. In order to achieve the sustainability of the project, it was recognized stakeholders' participation from the project formulation stage was indispensable.

Identified and qualified SSWRD subprojects cover the 11% of the Study Area, which estimated 400,000 households and 1.8 million populations as beneficiaries. They are benefited through the water resources development such as flood management, drainage improvement, water retentions and irrigation improvement. As proved by SSWRDSPs, the Project will contribute the poverty reduction through increase of agricultural products. Also the beneficiaries will be empowered through the implementation of people-centered project.

On the other hand, the Master Plan will contribute the NWMP on the several activities as shown in Table S-1. Therefore it is strongly recommended to implement the master plan of small-scale water resources development shall be implemented as soon as possible in collaboration with relevant government agencies, NGO and other stakeholders.

For the expected benefit of the Master Plan, the findings of the External Evaluation on SSWRDSP-1, conducted by ADB, IFAD, GoN and GoB can be referred to. Cropping intensity has significantly increased from an average of 176 % to 237 %. Average yield of crops have also increased for Aman (63%), Boro (31%), and Aus (21%) and other crops (wheat, onion). Flood number of landowners claiming flood problems in the subproject areas decreased from 74% to 9%. For 30 subprojects studied in the above evaluation, 424,000 man-days of employment is estimated to be newly created.

7.2 Recommendations

(1) Small Scale Water Resources Development (SSWRD)

Participation of stakeholders for the Development

NWPO declared the necessity of the participatory water management. It encourages the stakeholders and private sector for the water management. Through the field survey in phase I of the Study, the Study Team uncovered the communication gap between upazila – union and Union-shimaju. In case of the large-scale flood management subproject, many stakeholders did not know the subproject and what subproject started the construction without any notice

or explanation to local peoples. In this case, the Study Team confirmed, through discussions with all stakeholders, that they could solve conflicts among stakeholders. Also the Study Team confirmed that Upazila engineers can facilitate meetings and discussions among stakeholders with providing venues, which can formulate the consensus and find out the countermeasures by participants themselves.

Consensus Formulation and Submission of Proposal for the Subproject

After discussing with villagers in the field, the surveyor/enumerator of water resources engineers identified subprojects. Identified subprojects were also confirmed with UDCC consultation meetings. Even though, because of the limited time, surveyor/enumerator could not share time for formulating consensus in the field. The Study Team requested participants of UDCC consultation meetings that Upazila Engineer /UP chairperson arrange the venue to explain the subproject components and discuss among beneficiaries for formulation of consensus as soon as possible. Then After that subproject proposal could be prepared under the assistance of Upazila Engineers and officials. Upazila engineers are expected to follow up the UDCC consultation meeting results on this matter.

Coordination of Large and Small Scale Subprojects

The Study dealt with small-scale water resources development only. Sometimes, it became difficult to formulate the small-scale water resources subprojects, even through there were some needs to develop, because of the plan of large-scale project was no clear. Hence large-scale water resource development plan also shall be studied by BWDB based on the old study during the FAP. In the case of the study, LGED Upazila Engineer can support them.

Application of Survey and Planning Method to Formulate Plans of Other Districts.

The Study was expected as the pilot study for further extension of small-scale water resources master planning within short period and with minimum input. Besides that counterparts of LGED are expected to apply the approach and methodology of the Study to other district by themselves.

In the Study, PCM workshops of problem identification, PRA, Union Questionnaire survey, inventory survey, union questionnaire verification survey and farm household interview survey were applied as the tool of the Study. The results of the field survey were explained and discussed at UDCC, DSSWRDC and National workshops. There were some surveys such as union questionnaire, whose information on the replying paper sometimes misunderstands the truth in the field. Those questionnaires were prepared and distributed to UP Chairperson by dispatched Upazila Engineer. Those results were scheduled to analyze answers at office in Dhaka. So it was one of lessons obtained that simple correspondence with documentation sometimes causes misunderstandings. To secure the collection of accurate information, direct communication with local people is indispensable. Especially Bangladesh has insufficient topographic information; therefore, direct confirmation in the field is the most important measures especially water related development. For identifying potential subproject area, collation of the results of union questionnaire survey with field verification will be the best method for the smooth implementation of field survey.

Formulation of Demonstration Area for Rural Development.

Small-scale water resources development improves the infrastructure for the agriculture and fisheries in the field. Without improvement of economic activities in the subproject area, improvement of infrastructure will be meaningless. In order to increase the economic value,

DAE, DoF and DOL are requested to concentrate the technical support in the subproject area and to generate the success story of rural development in the regions.

(2) Agriculture, Fisheries and Livestock

Characteristics of Agriculture Development Plan

The objectives of the proposed agriculture development plan in the SSWRDP are to carry out the sustainable farming, which can be realized by following factors.

- a) Rational nutrition-linked agriculture developing pro-protein farming system and food system as like integrated rice-fish cultivation and or rice-livestock/poultry combination, to diversify farming and to enhance synergetic effects on sound farm production.
- b) Improvement and stabilization of farmers' economy.
- c) Improvement of living standard, especially under coexistence and mutual prosperity of the weaker and the stronger in rural society.
- d) Enough and timely supply of farm materials and enough supply of farm machinery
- e) Strengthening of farming basis of farmers themselves by commencing cooperative works as the first step to approach for establishing cooperative in future, which will have an advantage of joint selling of farmers' products and added values of products by processing to prevent beating down the prices by wholesalers.

The plan was made under consideration of these factors.

To Strengthen Agricultural Extension System

Farmers have integrated farming practices such as rice-livestock, rice-fish-poultry. Integrated training covering several fields in one course is needed.

Farmers target agricultural diversification, high profitable crops (Potato, wheat, chili, etc.), as integrated farming. Extension system needs to cover the diversified practices by introducing integrated training system.

In order to upgrade Block Supervisors' (BS) capability in agricultural technology, interchange of research and extension is important. It is appropriate to reorganize the extension system.

To Enhance Capacity Building

Establish rural (Upazila level) vocational school (Agricultural high school) to develop agriculture, nutrition and health, rural industry and marketing, targeting to innovate the current BS system, develop integrated training, and formulate rural middle technologist class for production of branded products.

Strengthening Agricultural Technical Extension System are required for;

- Senior extension officers who have experience in research and bridge the both activity.
- Specialized extension workers: Cropping, soil, machinery, poultry, livestock, fisheries, marketing, family management and forestry

Upgrading capacity building of Union staff is indispensable to develop local government's capability to formulate and to conduct project efficiently. Several aspects required urgently are as follows:

- Planning capacity
- Documentation ability
- Project watching

To Develop Farmers' Organization

Farmers are apt to practice independently and not in a position to organize cooperative works. However, when farmers try to reduce production costs and to sell their products at profitable price, they have to organize cooperatives to take advantages of joint work. It is recommended to organize marketing cooperatives at first with a view to commence activities close to cash generating.

Agribusiness

Even though agribusiness related facilities are generally obsolete from technical and economic point of views, they need to be renovated in terms of energy saving and quality-improvement of products, because the products of agribusiness are usually sold to international market and owes the task of international exchange.

Light industry products and foods are promising commodities for export from Bangladesh. Marketing commodities from rural areas to large markets generate the first step of cash flow. To stabilize the flow export of these commodities are necessary. Bangladesh has advantages in exporting agricultural products, especially winter crops. Further studies are required.

(3) Environmental and Social Considerations

Apart from the necessary environmental and social considerations indicated in the Master Plan, many of the potential subprojects are expected to go through environmental clearance as indicated in the Environmental Conservation Rules, 1997. Since there is no way that SSWRD subprojects will have absolutely no negative impact (needless to say of positive impact), detailed examination should be done at the time of detailed design in a scientifically attested manner and in conformance with the legislations of Bangladesh.

Table S-1 Contribution of the Master Plan to the Activities indicated in the NWMP

MIS Ref	Programme Name	Lead Agency	Contribution	Remarks
ID 001	Local Government Needs Assessment for Water Management	LGD	Partial	Needs for institutional setup and human resources development for planning and implementation of SSWRD subprojects by LGED in effective coordination with relevant government agencies at local level, UP chairpersons and members, and local stakeholders will be indicated in the Master Plan. This basic ideas indicated in the Master Plan could be effectively utilized for water resources management by LGIs.
ID 005	Local Government Capacity Building for Water Management	LGIs	Major	The Master Plan will enhance the capacity of Upazila level govt. officers including UE and UNO, UP chairmen and members, other local representatives and stakeholders in participatory planning and development of SSWRD interventions. This process is sure to contribute to the goals of the programme when LGIs will be officially initiated
AW 005	Improved Water Management at Local Government Level	LGED	Major	Government officers at district and upazila level have been and will be actively involved in the planning and implementation of activities indicated in the Master Plan. This process is sure to contribute to the goals of the programme when LGIs will be officially initiated
AW 006	Improved Water Management at Community Level	LGED	Major	One of the major issues that the Master Plan considers is water management with the incentive of local stakeholders. Activities of the Master Plan will directly contribute to the goals of the programme by realizing water management through WMAs
AW 007	Rationalization of Existing FCD Infrastructure	BWDB	Indirect	Though the programme targets FCD exceeding 1,000 ha, rationalization of small scale FCD infrastructure which will be done under the Master Plan will supplement the programme in achieving it's goals
EA 001	National Pollution Control Plan	Mol	Indirect	Possible indirect contribution through training for appropriate use of agro-chemicals and raising awareness to obtain wide stakeholder participation
EA 003	National Water Quality Monitoring	DOE	Indirect	Water quality data obtained through monitoring activities under environmental and social consideration may be utilized for this purpose
EA 004	National Fisheries Master Plan	DoFish	Indirect	Coordination may be made in order to practice fishery related activities under WMA (fish culture, training, etc.) collaboratively with the contents of the National Fisheries Master Plan
EA 007	Improved Water Management in the Haor Basins of the North East Region	HWDB	Indirect	In subprojects with designated water bodies, WMA can contribute through considering the requirements indicated by the programme in water resources management activities.
EA 008	Environmentally Critical Areas and Integrated Wetland Management	DoFish	Indirect	In subprojects with designated water bodies, WMA can contribute through considering the requirements indicated by the programme in water resources management activities.
DM 006	Supplementary Irrigation and Drought Proofing of Rural Water Supply	DAE	Indirect	Though the programme aims at installation of HTWs, WC components of the subprojects proposed in the Master Plan will support it's goal through mitigating the risk of drought risk at some extent
ID 003	FCD and FCD / I Management Rationalization	BWDB	Indirect	The practice of O & M by the local beneficiaries to be carried out under the Master Plan may be referred to for increasing the efficiency of the programme
EE 002	Field Testing of Participatory Management Model	BWDB	Partial	The system and institutional set up for SSWRD developed through SSWRDSP and the Master Plan can be one of the effective schemes to achieve participatory management of SSWRD interventions
EE 013	Alternative Financing Methods for Water Management	WARPO	Partial	O&M budget of infrastructure proposed in the Master Plan will be born by local stakeholders. This will contribute to the goals of the programme.
TR 002	Rural Arsenic Mitigation	DPHE	Indirect	Some WC subprojects may be partially utilized for domestic use provided that necessary treatment is done
TR 007	Large and Small Town Flood Protection	BWDB	Partial	Certain areas of the towns selected in the programme, particularly in the rural areas may benefit from FM components of the subprojects indicated in the Master Plan

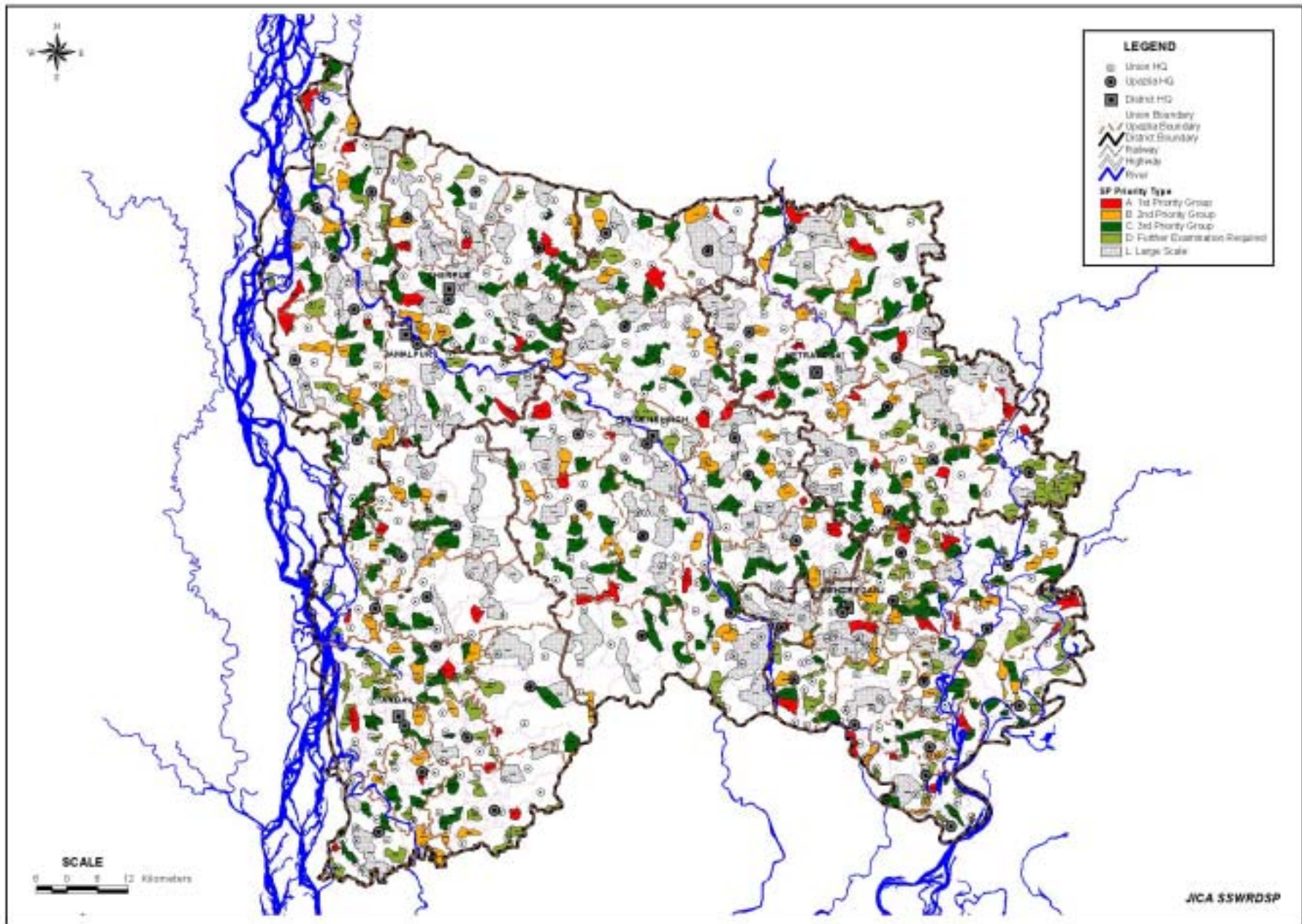


Figure S-1 Location of Prioritized Potential Subprojects

THE MASTER PLAN STUDY ON SMALL SCALE WATER RESOURCES DEVELOPMENT FOR
POVERTY ALLEVIATION THROUGH EFFECTIVE USE OF SURFACE WATER
IN GREATER MYMENSINGH OF BANGLADESH

FINAL REPORT (MAIN REPORT)

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Abbreviations

ADB	Asian Development Bank
ADP	Annual Development Program
AEO	Agricultural Extension Officer
AEZ	Agro-ecological Zone
AI	Appreciative Inquiry
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BCM	Billion cubic meters
BHN	Basic Human Needs
BMD	Bangladesh Meteorological Department
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRII	Bangladesh Rice Research Institute
BS	Block Supervisor
BWDB	Bangladesh Water Development Board
CAD	Command Area Development
CARE	Co-operative for American Relief Everywhere (NGO)
CPI	Consumer Price Index
CIDA	Canadian International Development Agency
CNRS	Center for Natural Resources Studies
DAE	Department of Agricultural Extension
DANIDA	Danish International Development Agency
DFID	Department for International Development of UK
DG	Director General
DHI	Danish Hydraulic Institute
DI	Drainage Improvement
DIWC	Drainage Improvement and Water Conservation
DMB	Disaster Management Bureau
DOC	Department of Cooperatives
DOE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DTW	Deep Tubewell
ECA	Environmental Conservation Act
ECNEC	Executive Committee of the National Economic Council
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EU	European Union
FAO	Food and Agriculture Organization of the UN
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FD	Forestry Department
FFWC	Flood Forecasting and Warning Center
FFYP	Fifth Five Year Plan
FM	Flood Management
FMDI	Flood Management and Drainage Improvement
FPP	Flood Proofing Project of CARE
GBM	The Ganges, Brahmaputra and Meghna Rivers

GDP	Gross Domestic Product
GIS	Geographical Information System
GOB	Government of the People's Republic of Bangladesh
GTZ	<i>Deutsche Gesellschaft für Technische Zusammenarbeit</i>
HQ	Headquarter
HTW	Hand Tubewell
HYV	High Yield Variety
IDA	International Development Association
IEE	Initial Environmental Examination
IFAD	International Fund for Agricultural Development
IMCC	Inter-ministerial Coordination Committee set under the TAPP
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
KSS	Water User Group (<i>Krissok Somobya Samity</i>)
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
LGI	Local Government Institutions
LLP	Low Lift Pump
M&E	Monitoring and Evaluation
MCM	Million cubic meters
MIS	Management Information System
MLGRD&C	Ministry of Local Government, Rural Development and Co-operatives
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forest
MoF	Ministry of Finance
MoF	Ministry of Food
MoFL	Ministry of Fisheries and Livestock
MoI	Ministry of Industry
MoL	Ministry of Land
MoWR	Ministry of Water Resources
NEC	National Economic Council
NEMAP	National Environmental Management Action Plan
NEP	National Environmental Policy
NGO	Non-Governmental Organization
NPV	Net Present Value
NWMP	National Water Management Plan
NWPo	National Water Policy
NWRD	National Water Resources Database
O&M	Operation and Maintenance
PC	Planning Commission
PCM	Project Cycle Management
PLA	Participatory Learning and Action
PMO	Project Management Office
PRA	Participatory Rural Appraisal
PRRA	Participatory Rapid Rural Appraisal
PWD	Public Works Datum
RDA	Rural Development Academy, Bogra
RDP	Rural Development Program
RIDP	Rural Infrastructure Development Project
RRA	Rapid Rural Appraisal
SAARC	South Asian Association of Regional Cooperation
SCF	Standard Conversion Factor
SIDA	Swedish International Development Cooperation Agency

SP	Subproject
SSWRDSP	Small-Scale Water Resources Development Sector Project
STW	Shallow Tubewell
SWOT	Strength, Weak, Opportunity and Thrust
SWR	Shadow Wage Rate
TAPP	Technical Assistance Project Progorma
TIP	Thana Irrigation Program
TK.	Taka, US\$ 1.00=Tk 57.4 as of October 2004
TTDC	Thana Training and Development Center
UAO	Upazila Agriculture Officer
UB	Union Board
UCC	Union Coordination Committee
UCCA	Upazila Central Cooperative Associations
UDCC	Upazila Development Coordination Committee
UNDP	United Nations Development Program
UNICEF	United Nations International Children's Emergency Fund
UP	Union <i>Parishad</i> (Council)
UE	Upazila Engineer
USAID	United Sates Agency of International Development
WARPO	Water Resources Planning Organization
WB	World Bank or International Bank for Reconstruction and Development
WC	Water Conservation
WFP	World Food Program
WMA(WMCA)	Water Management (Cooperative) Association

Bangla Terms

<i>Zila</i>	District
<i>Upazila (Thana)</i>	Sub-district
<i>Union</i>	Sub-Upazila - Local Government territory comprised of a number of villages
<i>Pourashavas</i>	Municipalities
<i>Mauza</i>	Sub-Union – land revenue territory often covering one village but may also cover more than one village
<i>Gram</i>	Village - smallest Local Government territory
<i>Para</i>	Sub-village - area or territory consisting of a group of homesteads
<i>Bari</i>	Homestead or Rural Habitation Unit – may include one or a few family households
<i>Aman</i>	Main monsoon rice crop
<i>Aus</i>	Late dry season/early monsoon rice crop
<i>Boro</i>	Rabi season rice crop
<i>Baor</i>	Oxbow Lake – crescent shaped lake formed from the cut off part of sharp bends of rivers
<i>Beel</i>	Bowl shaped natural depression - usually non-cultivable seasonal or perennial public water body
<i>Char</i>	Land newly formed in the river by accretion of alluvial materials
<i>Haor</i>	Extensive natural depression between river levees deeply flooded in monsoon, occurring in the North East Region of the country
<i>Khal</i>	Channel or Canal
<i>Kharif</i>	Summer and monsoon cropping season
<i>Rabi</i>	Winter cropping season

1 Bigha = 0.331 acre = 0.136 ha
1 Decimal = 0.01 acre = 0.00405 ha
1 Katha = 0.0165 acre = 0.000669 ha

1 Maund = 37.32 kg

CHAPTER 1

INTRODUCTION

1.1 Background

The provisions of the National Water Policy (NWPo) of 1999 states that the local government and relevant agencies are responsible for planning and execution of water management based on the National Water Management Plan (NWMP) approved by the National Water Resources Development Council (NWRDC) on 31st March 2004, and in regard to the regional features of local water resources.

The Government of Bangladesh (hereinafter referred to as “GOB”), with the support from ADB, IFAD and the Government of the Netherlands, has carried out the Small Scale Water Resources Development Sector Project (SSWRDSP-1) aiming at the rehabilitation and improvement of small-scale water resource management systems. The project was carried out from 1995 covering 37 districts of the western part of Bangladesh. Succeeding the same concept, the second phase of this project (SSWRDSP-2), covering 56 districts throughout the country has been implemented in 2003 with the planned period of 7 years. However, from lessons learned from SSWRDSP-1, the preparation of district level small scale water resources development plans (SSWRDPs) are recognized to have significant importance for further implementation of SSWRDSP.

Under such circumstances, the GOB requested the Government of Japan (hereinafter referred to as “GOJ”) for technical assistance regarding the preparation of district level plans for small scale water resources development (SSWRD), which will be the positioned as the basic development plans at district levels. In response to the GOB’s request, the GOJ dispatched a Preparatory Study Team from February to March, 2004, and signed the Scope of Work (S/W) for *the Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh of Bangladesh* (hereafter referred as “the Study”) on February 25, 2004.

Based on the Scope of W/Study, the JICA Study Team, carried out the Study in Bangladesh from July 18, 2004 to July 23, 2005.

1.2 Objectives and Scope of the Study

1.2.1 Objectives

The overall goal of the Study is to secure safe and sustainable water resources management and to increase farmers’ income, and objectives of the Study are;

- 1) to formulate Plan for SSWRD in Greater Mymensingh comprising program of priority programs, and the scope for the follow-on investment projects which include effective use of surface water, and
- 2) to enhance and strengthen the capacity of the counterpart in preparation of the SSWRD Plan

The district SSWRD master plan in the Greater Mymensingh is a part of the district water resources development plan which will be compiled by WARPO together with large scale water resources development plan to be formulated by BWDB, under the NWMP.

1.2.2 Scope of the Study

The Study is conducted in the following 2 phases:

- Phase I: Field Survey in wet season, Identification of problems on SSWRD in the Study Area (July 2004 ~ November 2004)
- Phase II: Field survey and Formulation of Small Scale Water Resources Development Plans (January 2005 – July 2005)

The Study will consist of the following study items.

1) Data Collection and Analysis

- (a) Collect and review the existing data and information on physical, socioeconomical and institutional settings, including hydrology, water availability and quality, land use, population, poverty and other human development indices, income, gender issues and occupational patterns; and collate the same with project objectives and outputs.
- (b) Assess the performance and issues of the economic activities of the Sub-districts (Upazila), including agriculture, fishery, forestry, and other natural resources, roads and road transport, water supply and sanitation.
- (c) Collect information on the ongoing and proposed interventions in the Upazila in water and other relevant sectors

2) Inventory Survey and Participatory Rural Appraisal (PRA)

- (a) Carry out the inventory survey of existing infrastructure related to water resources, along with their status and location maps
- (b) Select potential areas for SSWRD
- (c) Undertake PRA at representative Unions and Upazilas that includes the potential area and assess the following: i) development status, needs and priorities; ii) water-related problems, their causes and proposed solutions; iii) stakeholders' views on the ongoing and proposed initiatives; and iv) stakeholders' willingness to contribute to the construction, operation and maintenance (O&M).

3) Preparation of Master Plan for SSWRD with the Target Year of 2015

- (a) Strategies and priority programs which could include flood management, irrigation and drainage, agriculture and fishery extension, rural water supply, arsenic mitigation, and institutional strengthening.
- (b) Preparing guidelines for project assessment
- (c) Preparing prioritized list of sub-projects
- (d) Preparing Action Plans

4) Technical transfer to counterpart personnel

- (a) On-the-job training in the process of preparing the Master Plan
- (b) Conduct workshops

1.3 The Study Area

The Study Area, as indicated in the location map, covers the six districts of the Greater Mymensingh area (Mymensingh, Tangail, Sherpur, Jamalpur, Netrakona and Kishoreganj). The Study Area is located in the north-central part of the country bordered by the Meghna River and Sunamganj District in the east, Greater Dhaka District containing Dhaka City in the south, the Jamuna River in the west, and the Indian state of Meghalaya in the north. The old Brahmaputra River runs through the Area flowing from the northwest to the southeast. In the southern part of the Study Area, the Madhupur terrace with an elevation of about 15 m lies in the 3 m-lowlands. The Study Area occupies 11.3 % of the country with a land area of 16,672 km², and has a population of 12.6 % (15.5 million people) of the total population (BBS, 2001). The local administration in the Study Area comprises of 6 Districts, 58 Upazilas (sub-districts) and 562 Unions.

1.4 Counterparts of the Study

As stated in S/W, the GOB counterpart institution is Integrated Water Resources Management Units (IWRMU) of Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development and Cooperatives (MLGRD&C).

The counterparts of the Study are consisting of the staff of LGED headquarters at the central government level and Executive Engineers and Upazila Engineers of LGED at the local government level in the Study Area as shown in Attachment B.

1.5 Surveys and Workshops conducted in the Study

The Study designed as participatory plan formulation with several workshops and meetings, and several surveys at each level of the administration. They are summarized as follows:

Stages	Workshops/Surveys	IMCCC	National	District	Upazila	Union	Community
Phase I: Problem Identification	W/S on the Inception Report and PCM Problem Analysis						
	Socio-economic Interview Survey						
	Farm Household Interview Survey						
	Union Questionnaire Survey(UQS)						
	Workshops on Phase I Survey Results						
	W/S on Interim Report						
Phase II: Development Potential and Master Plan Formulation	W/S on Planned Field Survey & Questionnaire Survey to Upazila Engineers						
	Participatory Workshops (PRA)						
	Inventory Survey						
	UQS Verification Survey						
	CM of UDCC/DSSWRDC on Master Plan Concepts and verification of Proposed Subproject						
	Explanation on Master Plan Concepts and verified of Potential Subproject						
	W/S Draft Master Plan Explanation and Discussion						

Notes: W/S= Workshop(s), UQS= Union Questionnaire Survey, PRA= Participatory Rural Appraisal, CM= Consultation Meeting(s), UDCC= Upazila Development Coordination Committee(s), DSSWRDC= District Small Scale Water Resources Development Committee, IMCC= Inter-ministerial Coordination Committee

1.6 The Report

After the Phase I Field Survey, the Interim report was prepared including the field survey results during the monsoon season, preliminary analysis of the identified problems, constraints and potential of development in the Study Area together with the basic concept of SSWRD plan. Based on the discussion on the Interim Report at several workshops, the phase II Survey during the dry season conducted including the detailed field survey such as Inventory and Union Questionnaire Verification Survey and PRA in the Study Area. These field survey results and development plan studied were discussed at UDCCs at Upazila level, DSSWRDC at District level, Central workshop and IMCC involving the relevant government agencies at each level.

Based on the field fining with analysis and discussion results with stakeholders, the Study Team formulated the master Plan of SSWRD in Greater Mymensingh and summarized as the Final Report.

CHAPTER 2

BACKGROUND

2.1 General

The People's Republic of Bangladesh (hereinafter referred as the "Bangladesh"), covering a land area of 56,997 miles² (147,570 km²), is located between 20°34' N and 26°38' N latitude, and between 88°01' E and 92°41' E longitude; and shares its boundary with India in North, West, and most of the East and with Myanmar on some parts of the East and the Bay of Bengal at the South. The country, which itself is the largest delta on earth, has a population of 123.2 million people (Statistical yearbook of Bangladesh 2001, BBS, 2003) with an annual growth rate of 1.48% (1991-2001) and with a high population density of 834/km².

2.2 Natural Conditions

2.2.1 Physiography

Physiography of Bangladesh is shown in Fig. 2.2.1. In total, there are 31 physiographical classes including urban, water and unclassified class. In Bangladesh, the highest area (13.14%) is covered by the Northern and Eastern Hills. The Ganges Tidal Floodplain (10.95%) and the High Ganges River Floodplain (9.52%) constitutes a large portion of the area. In the Study Area, which is about 11.3% of the country area, the Old Brahmaputra Floodplain (4.46%) and the Young Brahmaputra and Jamuna Floodplain (2.87%) constitutes more than half of the Study Area. Madhupur Tract lying inside the Study area (1.35%) constitutes almost half of the total Madhupur tract area (3.02%) in the country.

2.2.2 Climate

(1) General

Bangladesh has a subtropical monsoon climate characterized by wide seasonal variations in rainfall, moderately warm temperatures, and high humidity. Regional climatic differences in this flat country are minor. In general, maximum summer temperatures range between 32 °C and 38 °C and April is the warmest month in most parts of the country. January is the coldest month, when the average temperature for most of the country is about 10 °C. Winds are mostly from the north and northwest in the winter, blowing gently at 1 to 3 km/hr in the northern and central areas and 3 to 6 km/hr near the coast. From March to May, violent thunderstorms, called "*northwesters*" by local English speakers, produce winds of up to 60 km/hr. During the intense storms of the early summer and late monsoon season, southerly winds of more than 160 km/hr cause waves to crest as high as 6 m in the Bay of Bengal, which brings disastrous flooding to coastal areas.

(2) Climate Seasons

Climate plays a main role in determining temporal distributions of rainfall, evapotranspiration, surface and ground waters. In Bangladesh, the water year is defined as beginning on April 1

and ending on March 31 and is divided into four distinct seasons:

Seasons	Period
Pre-monsoon season	April to May
Monsoon/wet/rainy season	June through September
Post-monsoon season	October and November
Dry season	December through March

(3) Rainfall

Mean annual rainfall ranges from about 1,200 mm in the west to almost 6,000 mm in the northeast. The average annual rainfall in the Himalayas and in the Meghalaya hills to the north of Bangladesh reaches about 10,000 mm.

Average annual rainfall of the country is about 2,360 mm (1960-1997 data). The rainfall over the whole country considering two seasons (wet from May to October and dry from November to April) is shown as follows:

Rainfall by Hydrological Regions (1960-1997)

Unit: mm

Season	Hydrological Region							Average
	NW	NC	NE	SW	SC	SE	EH	
Wet	1,393	1,445	2,297	1,299	1,821	1,683	1,934	1,856
Dry	346	511	897	366	486	588	511	504
Annual	1,739	1,956	3,194	1,665	2,307	2,271	2,445	2,360

The table indicates that northwest and southwest regions receive less rainfall compared to other regions. Also, almost 80% of annual total rainfall occurs during the wet season.

2.2.3 Water Resources and Floods

(1) River System

Bangladesh is the biggest delta in the world, formed by 3 mighty rivers: the Ganges (catchment 907,000 km²), the Brahmaputra (catchment 583,000 km²) and the Meghna (64,000 km²). Of the total area of the 3 catchments (1.55 million km²), only 8% is in Bangladesh, 62% in India, 18% in China, 8% in Nepal and 4% in Bhutan.



(2) Hydrological Regions

In accordance with National Water Policy (NWP), WARPO has delineated eight hydrological regions covering the entire country, based on appropriate natural features for planning the development of water resources. Fig. 2.2.2 shows the WARPO defined hydrological regions which are: Northwest (NW), North Central (NC), Northeast (NE), Southeast (SE), South Central (SC), Southwest (SW), Eastern Hills (EH), plus the active floodplains and charlands of the Main Rivers and Estuaries (RE). Within each hydrological region there are significant sub-regions, defined by parameters such as agro-climatic zone, landform, river salinity and degree of urbanization.

(3) Water Resources

1) Water resources estimation

The natural surface water resources in Bangladesh are mainly obtainable from the country's dense network of river system, which include a combination of upstream inflows and runoff generated from rainfall within the country. Almost 70% of these surface water resources concentrate in the monsoon season. Preliminary estimates at the inception phase of the NWMP indicated as follows:

- Cross-border flows: 1,010 BCM¹⁾
- Generated from local rainfall (2,300 mm): 340 BCM
- Evaporation losses 190 BCM
- Available for use or flows into the sea 1,160 BCM

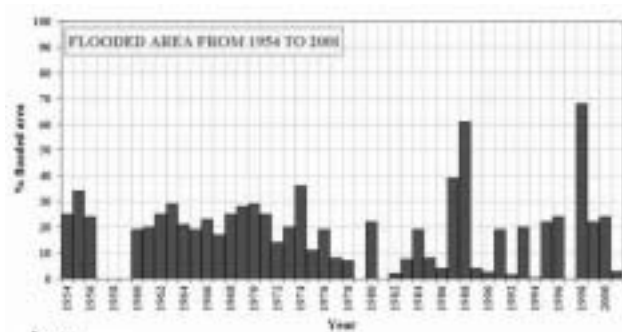
MPO estimated and suggested that the available recharge of groundwater was 21 BCM in 1991. After the estimate, several studies and analysis were conducted²⁾. They acknowledge that more information on groundwater is required to make reliable assessment. Some of the area already observed the declination of groundwater table caused by excess extraction for irrigation, domestic and industrial water supply. Particular attention also needs to be given to the issue of arsenic contamination of groundwater.

2) Water use

MPO projected a water demand for all purposes for the year 2018 at 24.37 BCM during the critical dry month of March. On the other hand, the FAOSTAT 2000 estimated the water use at 79.4 BCM in 2000, of which the irrigation water covering 3.7 million ha consumes 96.16 % followed by domestic water use at 3.19 % and industrial water use at 0.65 %.

(4) Floods

The floods of the years 1955, 1974, 1987, 1988, and 1998 were catastrophic. Peak discharges in 1988 were of the order of 98,600 m³/s in the Bhramaputra, 19,800 m³/s in the upper Meghna and around 160,000 m³/s in the lower Meghna. The historical flooded area (1954-2001) is shown in the figure.



Historical Flooded Area

For the latest flood of 2004, according to the “Interim Report (August 14, 2004) of Rapid Assessment of Flood 2004”³⁾, it covered an area of about 20.72 % of Bangladesh's total land area till August 4, 2004 which is about a-third of flood 1998 inundated area of 67.76 % of Bangladesh total land area.

60% of the area of Bangladesh is at an elevation of less than 6 m above MSL. The average river gradient in the delta is only about 6 cm /km or 1/16,667.

¹⁾ BCM: billion cubic meters

²⁾ 19.6 BCM by BWDB/UNDP (1982), 36.6 BCM by BWDB/FAO (1983), 14.8 BCM by M.A. Karim (1984) and 25.7 BCM by MPO (1987)

³⁾ by the Centre for Policy Dialogue (CPD) under the program of Independent Review of Bangladesh's Development (IRBD), _

The four major types of floods are; 1) River or monsoon flood of major rivers, 2) Flash flood in the eastern and northern rivers, 3) Tidal flood, and 4) Rainfed local flood. The floods usually start with flash floods in the northern and eastern hilly streams during pre-monsoon months of April and May followed by the onset of monsoon in June. The Meghna and the Jamuna normally reach their flood peaks in July and August and the Ganges in August and September. Severe flooding occurs when both the Jamuna and the Ganges are in flood stage concurrently.

(5) Droughts

Agricultural drought is a common phenomenon in areas, particularly in the north-western regions of Bangladesh where water supply for irrigation in post monsoon and dry season falls short. Fig. 2.2.3 shows areas affected by drought. The main causes of drought are limited rainfall, high temperature associated with low humidity and withdrawal of water in the upstream. Droughts affect water supplies and plant growth leading to loss of production, food shortages and starvation. In comparison with floods and especially cyclones, droughts are slow to manifest themselves and are relatively more pervasive.

(6) Groundwater

1) Groundwater

Groundwater is abundant in Bangladesh and the aquifers are highly productive. The sediments are predominantly non-inundated and easy to drill by hand, at least to shallow levels. Water tables vary across the country but are typically shallow at around 1-10 m below the ground surface. These factors have made groundwater an attractive and easily accessible resource and have led to a rapid proliferation in the use of groundwater over the last few decades. Today, 97% of the population relies on groundwater for potable supplies and groundwater is also an important source for irrigation and industry. Groundwater levels across Bangladesh become depressed during the dry season, but the aquifers replenish during the monsoon.

BADC initiated development of groundwater in the 1960s to enable seasonal irrigation of cereals. Study of the hydrogeology and groundwater resources of Bangladesh was begun in the 1970s by BWDB under the guidance of UNDP. UNICEF, recognizing that large quantities of groundwater existed at shallow depth, advocated the installation of large numbers of hand-drilled boreholes equipped with suction pumps. Some 6-11 millions hand-pumped tubewells are estimated to have been installed to date. At present, the extensive abstraction of groundwater for irrigation and domestic water supply is being questioned because of its extensive contamination with arsenic.

Considerable uncertainty surrounds the exact number of the various types of wells present in Bangladesh, but estimates are: HTW of 6-11 millions, STW of 0.5 million and DTW of 55,000. Data shows that high-density usage of STWs and DTWs could lower water levels in various parts of Bangladesh sufficiently to affect operation of HTWs during late dry season. Tara pumps are being installed in such areas where late dry-season water levels lie at 6m or more below ground level.

2) Arsenic contamination

Arsenic contamination of groundwater was first detected in Bangladesh in 1993 by the DPHE

in Chapai Nawabganj in the far west of Bangladesh in a region adjacent to an area of West Bengal which had been found to be extensively contaminated in 1988. Extensive contamination in Bangladesh was confirmed in 1995 when additional surveys detected contamination of shallow tubewells across much of southern and central Bangladesh. At the same time, cases of chronic arsenicosis were being recognized by health professionals. Since 1995, data pointing to the extensive contamination of Bangladesh groundwater have been collected by a large number of organizations. Fig. 2.2.4 shows the arsenic contamination area in Bangladesh analyzed by the DFID assisted study.

It is now generally agreed that the arsenic contamination of groundwater in Bangladesh is of natural origin, deriving from the geological strata underlying Bangladesh. The groundwater arsenic problem in Bangladesh arises because of an unfortunate combination of three factors:

- A source of arsenic (arsenic is present in the aquifer sediments),
- Mobilization (arsenic is released from the sediments to the groundwater) and
- Transport (arsenic is flushed away in the natural groundwater circulation).

The Bangladesh Standard for arsenic in drinking water is 0.05 mg/l (or 50 µg/l or 0.05 ppm or 50 ppb). This standard was based on World Health Organization (WHO) advice at the time when the regulations were drafted. In 1993, WHO lowered their guideline value for arsenic to 0.01 mg/l (or 10 µg/l or 0.01 ppm or 10 ppb).

2.3 Socio-economic Conditions

2.3.1 Social Conditions

(1) People and Population

People in Bangladesh mostly share a common culture named as *Bengali Culture*, which have a tradition of about two thousand years or so. Bangladeshis are from different stream of religions; such as Muslims (88.3%), Hindus (10.5%), Buddhists (0.6%), Christians (0.3%); and the rests are the Indigenous religions practiced by different indigenous people (*1.2 million*), such as *Chakma, Marma, Shantal, Garo* etc.

As shown in the table, Bangladesh has a population of 123.2 million people¹⁾ with an annual growth rate of 1.48% [1991-2001]; and with a highest density of 834 heads/km².

Most of the people live in the rural areas (*94.3 million / 76.6%*). The male-female ratio is 104:100. The life expectancy at birth is estimated at 68.8 (*Year: 2000*).

Population Growth

Population Census Year	Enumerated Population	Average Annual Growth Rate
1901	28,927,786	
1911	31,555,056	0.87%
1921	33,254,096	0.53%
1931	35,604,170	0.69%
1941	41,997,297	1.67%
1951	44,165,740	0.50%
1961	55,222,663	2.26%
1974	76,398,000	2.53%
1981	89,912,000	2.35%
1991	111,455,185	2.17%
2001*	123,151,246	1.48%

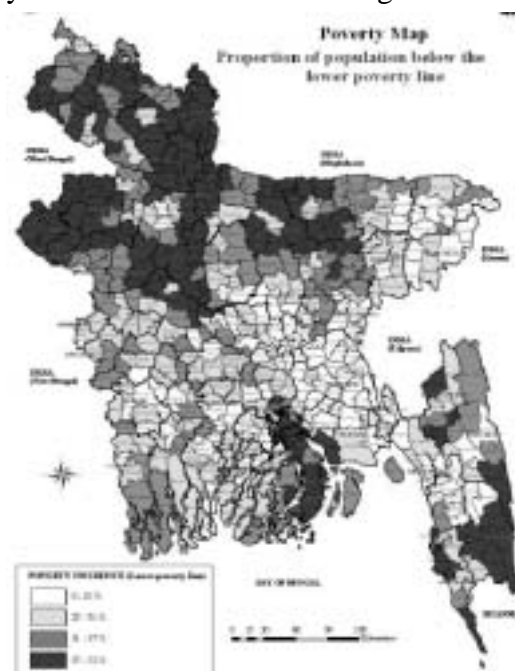
Source: Statistics Yearbook Bangladesh 2001
Table 2.07, BBS. *Population of 2001 from
Population Census 2001 Preliminary report, BBS

¹⁾ Population Census 2001 Preliminary Report BBS

(2) Social Development

1) General

Bangladesh has achieved substantial progress in mass literacy, public health, reduction of population growth and self employment support for rural poor. Primary education is compulsory and female education is free through the first eight years. The strong commitment to primary education and to gender equity means that three out of four girls now enter primary education. In the area of health, over 80% of the country's children are immunized against the six `killer` diseases. Infant mortality has decreased significantly. There has been a sharp decline in the fertility rate. The increased participation of women in poverty alleviation programmes as well as in Bangladesh's ready-made garments sector, which provides jobs for more than 1 million women, has helped to create an awareness of women's issues at all levels. An unparalleled concentration of innovative and committed NGOs has brought about a micro-credit revolution and guided countless indigent women and landless households into income generating activities. The safety net programmes initiated by the government in improving the condition of the poorest to a level of survival are proving effective.



2) Poverty

Since its independence in 1971, Bangladesh has reduced poverty, as measured by head count index, from more than 70% in the early 1970's to 50% in 2000. And 90 % of poor live in the rural areas.

Source	Area	1983/84	1985/86	1988/80	1991/92	1995/96	2000*
World Bank	National	58.5	51.7	57.1	58.8	53.1	49.8
	Rural Area	59.6	53.1	59.2	61.2	56.7	53.1
	Urban Area	50.5	42.9	43.9	44.9	35.0	36.6
Gini Coefficient*	National	0.360	0.379	0.379	0.388	0.432	0.417
	Rural Area	0.350	0.360	0.368	0.364	0.384	0.366
	Urban Area	0.370	0.370	0.381	0.398	0.444	0.452

Source: World Bank, and * Household Expenditure Survey, 2000, BBS

As shown in the Poverty Map of "Local Estimation of Poverty and Malnutrition in Bangladesh 2004", BBS/WFP, a large portion of poor people live in upazilas in northern central to west, which is a part of the Study Area.

3) Gender

Bangladesh, like other developing countries of the world has the vision to accelerate growth, alleviate poverty, take advantage of new opportunities and meet the challenges for the future. Bangladesh is also fully committed to ensure equality for all citizens and to eliminate all forms of discrimination against women and girls. As a reflection of this commitment, Bangladesh has made sustained and comprehensive efforts to address the special needs and interests of women and girls as well as bringing them into the mainstream of national

development.

Women are in a relatively disadvantaged position in terms of fulfillment of basic needs, such as food security, education, health, shelter and human rights. the GOB placed more emphasis on ensuring women's advancement in various socio-economic aspects and declared "the National Women

Development Policies" in 1997. Though the Ministry of Women and Children Affairs is considered as the leading agency for women's development, other line agencies and serving Ministries are also playing important role in implementing sector specific women's development plan and programs.

Government of Bangladesh fully committed for achieving gender equity and equality to accelerate progress and the government has approved the national policy for advancement, which emphasizes the mainstreaming of women issues at national, local and family levels. The following strategies have been identified to achieve the objectives of the policy:

- Strengthening/introducing institutional measures at national, district, upazila and grassroots levels.
- Strengthening national machinery.
- Building stronger collaborative ties with NGOs and broader level of society.
- Commissioning research on gender issues.
- Developing gender disaggregated database and information system.
- Building capacity at all levels to develop and implement programs and projects for facilitating gender mainstreaming.
- Taking up advocacy and lobbying at all levels to raise awareness about gender concerns and mass mobilization.
- National and international networking.
- Financial arrangement etc.

Future strategic plans and actions for women's advancement will be formulated and implemented on the basis of experience and lessons learned from the best practices.

Despite the efforts of Government of Bangladesh, NGOs, and people, there are several issues related to gender and development which need to be given attention to:

- Micro credit by the Grameen Bank and NGOs has contributed a lot to raise the position in the family, the social status and also dignity of women; yet, social constraints and violence against women remain.
- Nine union *parishad* members from nine constituencies in the union are elected, three woman union *parishad* members from each of three constituencies. More poor women have chances to participate local politics this way, however, they also might be parts of

Gender Development

Items	1980	1990	1995	2000
Life expectancy at birth (years) Male	49	55	58	61
Life expectancy at birth (years) Female	48	55	59	62
Adult illiteracy rate (% of people aged 15+) Male	60	55.7	53.2	50.6
Adult illiteracy rate (% of people aged 15+) Female	82.8	76.3	73.1	69.8
Total labor force (millions)	40	51	59	69
Female labor force (% of total)	42	42	42	42
Unemployment Total (% of total labor force)		1.9	2.5	3.3
Unemployment Female (% of female labor force)		1.9	2.3	3.3
Youth illiteracy Rate (% of people aged 15-24) Male	55.3	49.3	46.4	43.3
Youth illiteracy Rate (% of people aged 15-24) Female	74.1	66.8	63.7	60.3
Total fertility rate (births per woman)	6.1	4.1	3.4	3.1
Contraceptive prevalence (% of women aged 15-49)		31	45	54
Births attended by skilled health staff (% of total)			10	12

Note: Data in italics refer to the most recent data available within the two years of the year indicated
Source: World Bank Gender Statistics

the politics of influence peddling. Also this system might discourage women to become regular union *parishad* members.

- Despite many credit systems and promotion of income generating activities for women, nation-wide extension of activities and sharing of information among women are still not enough.

(3) Unemployment

Employment is a major issue in the economy of Bangladesh. Wage is very low as there is more than excess supply of labor in the agricultural sector; and also due to the rural-urban migration many people in the urban area is getting very low wages; even though many of them are working in industries with the minimum wages. There are about 1.8 million people reported to be underemployed (Male: 1.1 million & Female: 0.7 million).

Condition of Unemployment	Share
Do not work	28.40%
Looking for work	1.8%
Household work	32.4%
Agriculture work	19.2%
Industry	1.30%
Water/ Gas/ Electricity	0.10%
Construction	0.90%
Transport	1.50%
Business	5.50%
Services (self employed)	0.80%
Others	8.10%

In broad sectors, about 20.0 million people (51.3% of total labor force) are employed in agricultural sector, and about 19.0 million (48.7% of total labor force) people are employed in non-agricultural sector.

(4) Social Development Plan

1) Interim Poverty Reduction Strategy Paper (I-PRSP)

The GOB formulated “National Strategy for Economic Growth, Poverty Reduction and Social Development (NSEGPRSD)” as an I-PRSP in March 2003, which seeks to reduce by half the incidence of income poverty by 2015 (millennium Development Goals). I-PRSP is composed of four main policy piers; i) macroeconomic stability, ii) improving governance, iii) investing in human development, and iv) social protection for reducing vulnerabilities and improving income generating opportunities. The I-PRSP long-term social targets to be achieved by the year 2015 are as follows:

- Remove the ‘ugly faces’ of poverty by eradicating hunger, chronic food insecurity, and extreme destitution
- Reduce the number of people living below the poverty line by 50%
- Attain universal primary education for girls and boys of primary school age
- Eliminate gender disparity in primary and secondary education
- Reduce infant and under five mortality rates by 65%, and eliminate gender disparity in child mortality
- Reduce the proportion of malnourished children under five by 50% and eliminate gender disparity in child malnutrition
- Reduce maternal mortality rate by 75%
- Ensure access of reproductive health services to all
- Reduce sustainability, if not eliminate totally, social violence against the poor and the disadvantage groups, especially violence against women and children, and
- Ensure disaster management and prevent environmental degradation for overcoming the persistence of deprivation.

2) Poverty Reduction Strategy Paper (PRSP)

Following the I-PRSP, the Government drafted the full PRSP in December 2004, titled “Unlocking the Potential”. It is expected to be approved by the Parliament after review by

donor agencies/nations.

It proposed seven-point agenda; 1) employment, 2) nutrition, 3) maternal health, 4) sanitation and safe water, 5) quality education, 6) criminal justice, and 7) local governance. Interim macro-economical frameworks during 2004 to 2007, is summarized in Table 2.3.1.

2.3.2 Economic Conditions

(1) National Development Plan

After the independence of Bangladesh in 1971, the GOB started the 1st Five Year Plan in 1973. With some interruptions, the 5th Five Year Development plan completed the term in 2002. Achievements of previous Five Year Development Plans are shown as follows:

Five Year Development Plan (FYDP)	Period	GDP Growth Rate (%)	
		Planned	Actual
1 st FYDP	1973-1978	5.5	4.00
2 Years Plan	1978-1980	5.6	3.50
2 nd FYDP	1980-1985	5.4	3.80
3 rd FYDP	1986-1990	5.4	3.80
4 th FYDP	1990-1995	5.00	4.15
5 th FYDP	1997-2002	7.00	

After completing the 5th Five Year Development Plan in 2002, the Interim Poverty Reduction Strategy Plan (I-PRSP), titled “A National Strategy for Economic Growth, Poverty Reduction and Social Development 2003”, is the only development strategy document of the GOB at the reporting period. I-PRSP will be replaced by PRSP after its approval of the parliament. Also previous Local Consultative Group (LCG) or Bangladesh Development Forum, annually held with donors and GOB, will be changed to the new Bangladesh PRSP Forum.

(2) Recent Economic Development

Bangladesh has marked considerable progress since its independence in 1971 despite its dire initial conditions. From a mainly feudal agrarian base, the economy of Bangladesh has undergone a rapid structural transformation towards manufacturing and services. The contribution of the agriculture sector to GDP has dwindled from 50 % in 1972-73 to around 20 % in 1999-2000. The agricultural sector is, however, still the main employment provider. The staple crop is rice, with paddy fields accounting for nearly 70% of all agricultural land. GDP by industrial sectors are shown in Table 2.3.2.

(3) Foreign Trade

As shown in table, foreign trade balance is constantly negative in Bangladesh. These deficits of balance are mostly covered by transfer by Bangladesh nationals abroad.

Industrial production growth has averaged more than 6% over the last 5 years. The export sector has been the engine of industrial growth, with ready-made garments leading the way, having grown at an average of 30% over the last 5 years. Primary products constitute less than 10 % of the country’s exports; the bulk of exports are manufactured/processed products, ready-made garments and knit wears in particular.

Balance of Trade

Unit: Tkl. 10 million

Year	Export	Import	Balance
1986/87	3,368.2	6,849.6	-3,481.4
1987/88	4,116.1	9,158.8	-5,042.7
1988/89	4,268.6	9,507.5	-5,238.9
1989/90	5,141.5	11,330.5	-6,189.0
1990/91	6,027.2	11,187.7	-5,160.5
1991/92	7,419.8	13,275.6	-5,855.8
1992/93	8,821.5	13,819.8	-4,998.3
1993/94	9,873.9	13,754.0	-3,880.1
1994/95	13,692.0	21,856.4	-8,164.4
1995/96	14,452.1	25,464.6	-11,012.5
1996/97	17,155.4	29,018.7	-11,863.3
1997/98	22,940.8	31,891.6	-8,950.8
1998/99	24,561.9	34,101.7	-9,539.8
1999/00	24,741.5	37,202.2	-12,460.7
2000/01	30,647.6	43,694.9	-13,047.3

Source: Foreign Trade Section, BBS

(4) Government Budgets, and Foreign Economic Assistance and External Debt

As shown in Table 2.3.3, more than 30 % of the total government expenditure is covered by foreign economic assistance every year. External debts are accumulated at US\$ 14.7 billion at the end of June 2001. Among the creditors, IBRD shares 43.1%, followed by ADB at 27.2%, Japan 19.5% and others.

2.3.3 Agriculture, Fisheries and Livestock

(1) Agriculture

1) General

Agriculture plays a key role in the overall economic performance of the country, not only by contributing to about 25% of the national GDP, but also by providing employment to 63% of the labor force. Besides, exports of primary agriculture products constituted 10.4% of total exports of the country in 1997-98. For nearly two decades since the early 1970s, agricultural growth in Bangladesh has been predominantly led by food grains, mostly rice. Although acceleration of rice production resulted in an increase in per capita availability, there has been concern about the sustainability of rice-led agricultural growth. There is a need to devise a strategy that can deal with the new challenges and opportunities to make agriculture more flexible, diversified and efficient.

The Ministry of Agriculture (MOA) is the prime organization of the agricultural administrative structure of the country. In the MOA, the Department of Agricultural Extension (DAE) is responsible for the extension of agricultural technology and Human Resources Development (HRD) through training activities. DAE has regional offices in each upazila, where there are specialists for each related field such as agriculture officers, fisheries officers and livestock officers. A total of 20-30 Block Supervisors (BS) work under each agricultural officer. Each Union is separated into 2-3 blocks, and each block has 1 BS who is engaged in technical assistance to farmers. BSs are the only government functionary who has constant and direct connection with farmers

2) Agriculture and rural development in draft-PRSP

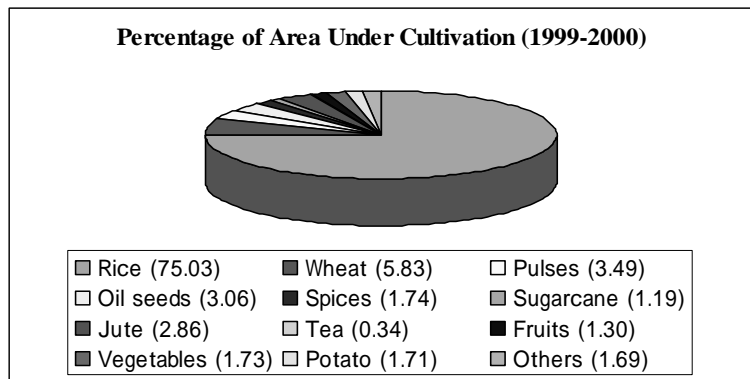
Agriculture and the rural economy are recognized as the key driver of the government's pro-poor growth strategy. The overall policy of the Government is therefore to create an enabling environment and play a supportive role so that agricultural production can move from a predominantly subsistence level to a more diversified commercial pursuit. While rice production will be supported for ensuring food security at the national and household level, high value vegetables, fruits and other horticultural crops will also be promoted through a crop diversification program. The Government is committed to ensuring input supplies, credit deliveries, technological support and marketing services. Along with the government's pro-poor program, the private sector and NGOs will be supported, so that they can play more a proactive roles in transforming agriculture and the rural economy. As an agricultural growth towards poverty reduction, the following strategic goals are proposed (ref. Table 2.3.4):

- Increase productivity and profitability in crop sector
- Ensuring food security through increasing production for food crops
- Encouraging production of cash crops

- Accelerating production of high value crops for domestic and export market
- Improvement of land resource base
- Strengthening agricultural research
- Strengthening agriculture extension service
- Expansion of irrigation with emphasis on efficient management of water resources
- Promoting quality seed development
- Improvement of agricultural marketing
- Promoting agro-processing and agribusiness development
- Promoting investment in agriculture
- Mainstreaming women in agriculture sector

3) Function of the Agriculture Sector

From a view to considering demand-led agricultural development, it is convenient to categorize agricultural functions into three major steps: 1) Supply of sufficient food, 2) increase of cash generating for farmers and 3) improvement of rural society. In the first step the increase of rice production is the principal target. The production of rice has been increasing, and the per-capita supply is now maintained at 155 kg/year. The rice supply has almost achieved a state of self-sufficiency, and the per-capita calorie intake also reached 2,372 calories. The majority of rural areas in Bangladesh has finished the first step, and is presently entering into the second stage. However, protein intake is only 46.8 g/day, and its supply is not sufficient. Farmers are suffering from low cash income.



Ref : Yearbook of Agricultural Statistics of Bangladesh, 2000

4) Agricultural production

Three-fourth of the cultivated area is cropped with rice followed by other crops such as wheat, pulses, oilseeds etc. The area, yield and production of crops from 2000-2001 to 2002-2003 are shown in Table 2.3.5. The rice yield of boro is higher than that of aus and aman, mainly because of irrigation and use of high yielding varieties (HYVs). Although Bangladesh is one of the largest rice producers in the World, the average rice yield is relatively low at the level of 2.34 ton/ha (2002-03). However, an average yield of 3.18 ton/ha was attained by HYVs in boro season (2002-03).

5) Food Grains Production, Requirement and Self Sufficiency

The production and requirement of food grains are shown in Table 2.3.6. By comparing food grain requirement and net total requirement, it can be seen that food self-sufficiency has been achieved in the late 1990s. By projecting population and production, it is estimated that the self-sufficiency trend can be continued until 2020.

6) Cash income from agricultural production

Although food supply has been improved, it is reported that cash income of farmers is still low. Therefore, poverty alleviation is one of the main priority subjects of rural development.

Higher profitable farming systems and their necessary requirements will be the major targets after the achievement of self-sufficiency.

7) Land use and landholdings

Land use in Bangladesh during 1974 to 2001 is shown in the following table. Land under 'not available for cultivation' has increased from 19% in 1974 to 23% in 2001. It is presumed that most of this land was used for non-agricultural purposes such as urban development and construction of various infrastructure facilities. The cultivated area has reduced from 59% to 54% during the period of 1974 to 2001.

Nature of Land Use	Area in '000 ha			Percentage of total		
	1974	1990	2001	1974	1990	2001
Cultivated Crop Land	8,489	8,827	8,081	59%	58%	54%
Currently Fallow	627	288	399	4%	2%	3%
Cultivable Idle Land	272	267	321	2%	2%	2%
Forests	2,229	1,858	2,627	16%	12%	18%
Not available for cultivation	2,661	3,934	3,410	19%	26%	23%

Source: Bangladesh Bureau of Statistics (BBS)

Basic information on the land holdings in Bangladesh is shown in Table 2.3.7. The percentage of small farm holdings with areas of less than 1 ha occupied 79.9% of the total holdings (1996), while medium (1-3 ha) and large holdings (>3 ha) were 17.6% and 2.5%, respectively.

Of the total land area of 14.85 million ha, cultivable area is estimated to be 8.48 million ha (2001-02), which covers about 57% of Bangladesh. The net area sown was 8.08 million ha (2001-02), leaving about 400,000 ha area as fallow land. However the total cropped area was about 14.3 million ha with an average cropping intensity of 177% owing to double / triple cropping in some areas. In 2001-02, it is estimated that 2.87 million ha is single cropped; while 4.13 million ha are double cropped and 1.02 million ha are triple cropped.

8) Export and import

Agriculture export constitutes a prime component of the total exports of the country. The major agriculture exports are jute, tea and vegetables, which contributed up to Tk. 4,774.6 million, Tk. 895.9 million, and Tk. 766.6 million respectively in 2002-2003.

The major imported agriculture commodities are edible oil, oil seed, pulses, onion, ginger and sugar. The amount spent on import is generally much higher than that of the export of agricultural commodities.

9) Value-added of agriculture sector and different crops

Gross value added of agriculture sector at constant (1995-96) price is shown in Table 2.3.8. Agriculture, horticulture and fishing increased to about 130% in 2001-2002 in comparison with 1995-96, which implies that the farmers are receiving better values in the past 5 years. The distribution of weights of value-added of different crops at constant prices is shown in Table 2.3.8. The value added of *boro* rice was about 159%, while that of spices and potato were 198% and 179% respectively. This implies that a better value is also added to the production of rice, spices and potato in comparison with the situation of 1995-96.

(2) Agriculture Extension Services

Extension activities cover all the areas of agricultural and rural development. The activities are positioned at a strategic area to take entire views of the past experiences, current activities and future development. Agricultural technology, especially rice production technology, is well developed to use limited farming areas. However, after the self-sufficiency of rice a new farming system is required to be established. Priority in the future development is focused to 1) Stabilization of food supply to vulnerable groups, 2) alleviation of malnutrition and 3) profitable farming. To meet the new demands of agriculture, the extension of new technology is urgently required; not only in production but also in marketing and processing. The Department of Agricultural Extension (DAE) under the MOA formulated “The DAE Strategic Plan 2002-2006” to implement the New Agricultural Extension Policy (NAEP) (1996).

For the development of extension work, the extension service draws its strength from research findings as well as from farmer’s innovation. Strengthening of these three way linkages among research, extension and farmers community is of vital importance for rural and agricultural development. In the DAE Strategic Plan 2002-2006, five specific objectives have been selected. The items cover all the areas required to develop agriculture and the rural area. The major points are as follows:

- Increase agricultural productivity
- Provide pro-poor services
- Develop DAE as an effective institution for providing services of appropriate quality and quantity
- Develop performance measurement

(3) Agribusiness and Marketing

1) Agribusiness

Development of marketing systems is crucially important to cope up with poverty alleviation. Several measures should be carried out to improve marketing capacity such as development of transportation, market information services and improvement of market infrastructure in all areas of agriculture.

The functions of rural markets include obtaining of daily goods, exchange of agricultural products to cash, wholesale function to large cities such as Dhaka, collection and distribution to large scale users such as rice mills, livestock farmers, etc.

The I-PRSP indicates gives top priority to agri-business and agro-processing as a thrust sector to promote value addition to grain crops, livestock, fish and horticultural crops. Agribusiness has relations with various fields in agriculture and is composed of a wide range of activities: Rice milling, production of small tools for fieldwork, transportation, aquaculture, feed production, etc. Agribusiness is one of the indispensable factors for the development of agricultural productivity. It is increasingly important in the Bangladesh farming system. Functions of agribusiness on agricultural development are as follows:

- a) Enhance agricultural production through technical support
- b) Strengthen marketing / consumption through processing and transportation
- c) Enlarge employment in rural areas

- d) Develop and support mechanization / modernization
- e) Develop food safety
- f) Develop environment-friendly production and processing.

2) Agricultural Marketing

Rural markets shoulder various important functions such as exchange of agricultural products and supply of daily goods. In the view of increasing cash income and rural development, collection of agricultural produce for marketing to major cities is also important. At the current situation in which rice production has achieved self-sufficiency, development of marketing is an urgent matter for agricultural diversification and income generation. The Draft PRSP proposes as future priorities; 1) development of transport system and market place, 2) development of modern marketing information system and 3) promotion of supply chain for high value crops.

(4) Fisheries

1) Natural environment and fisheries resources

Bangladesh, a country of delta plains of 147,570 km², is dominated by the Ganges–Padma, Brahmaputra-Jamuna and Meghna rivers and their tributaries. It is estimated that the country has about 700 rivers, streams and canals that total some 24,000 km in length and covering about 7% of country's total surface area. Inland water bodies of the country cover an area of 4,415,657 ha of which 91.20% comprise open water body and 8.80% closed water body. The major inland open water areas are floodplains, river and tributaries, beels and haors. The inland closed water areas comprise of ponds, Oxbow lakes and shrimp farms.

Along with potential inland water resources, the country is also rich in the diversity of various fresh water fish species. About 260 species of finfish live in the inland open waters, most of the large and medium size fishes, hilsa, carps and catfishes undertake long migration in rives of breeding. Endemic carp species of Bangladesh can be sub-divided into two sub- groups, 1) major carps (eg. catla, rohu, mrigal, calbus), 2) minor carps (eg. bata, nandin, gonia, etc.)¹⁾. The other fish species including exotic and indigenous are rui, silver carp, grass carp, tilapia, magur and shol etc.

2) Production and consumption

Between the two broad categories of fisheries environment in Bangladesh, namely, inland and marine, the former is dominant in terms of its contribution to total national fish production. Inland water fisheries are further divided into two types. One is inland openwater and the other is inland close water. Fish production in 2002-2003 is 1,998,197 metric tons (MT) with the inland openwater fisheries providing 709,333 MT (35.5%), the marine fisheries providing 431,908 MT (21.6%) and inland closewater fisheries providing 856,956 MT (42.9%). While available statistics place limits on the ability to analyze fisheries trends, there has been a decline in production of inland capture fisheries, river & estuary, beels and Laptai Lake.

The estimated per capita fish consumption from 1991 to 2000 is shown in the following table.

¹⁾ Role of aquatic ecosystems in the food and livelihood security in the Gangetic basin Bangladeshs, M.G.Hussain, BFRI

Comparison of Annual Total Catch of 2002-2003 with those of 2001-2002

Sector of Fisheries	Water Area (ha)	Annual Total Catch (M.T.)		Increase (B)-(A)	Percent Increase
		2001-02(A)	2002-03(B)		
A. Inland Fisheries					
(a) Capture					
1. River & Estuaries	1,031,563	143,592	137,848	-5,744	-4.00
2. Sundarbans	-	12,345	13,884	1,539	12.47
3. Beel	114,161	76,101	75,460	-641	-0.84
4. Kaptai Lake	68,800	7,247	7,025	-222	-3.06
5. Flood Land	2,832,792	449,150	475,116	25,966	5.78
Capture Total	4,047,316	688,435	709,333	20,898	3.04
(b) Culture					
1. Pond & Ditch	290,500	685,107	752,054	66,947	9.77
3. Baor	5,488	3,892	4,098	206	5.29
4. Coastal Shrimp & Fish Farm	141,353	97,605	100,804	3,199	3.28
Culture Total	437,341	786,604	856,956	70,352	8.94
Inland Total	4,484,657	1,475,039	1,566,289	91,250	6.19
B. Marine Fisheries					
(a) Industrial Fisheries (Trawl)		25,165	27,954	2,789	11.08
(b) Artisanal Fisheries		390,255	403,954	13,699	3.51
Marine Total		415,420	431,908	16,488	3.97
Country Total		1,890,459	1,998,197	107,738	5.70

Source: Fisheries statistical year book of Bangladesh 2002-2003, DoF

Mymensingh Aquaculture Extension component Impact Evaluation Study (January 2004)

The fish consumption survey report (BBS), indicates that the overall per capita fish consumption increased from 12.6 kg to 14.03 kg (+10%) over the period of 1991 - 2000. However, from 1995 to 2000, consumption declined from 15.98kg to 14.03kg (-14%). This decrease in consumptions is a clear indication of a substantial decline in the inland capture fisheries. Most fish consumed in Bangladesh is freshwater fish (80% in 2000).

Fish Consumption Trends (kg/year)

	1991-92	1995-96	2000*
Freshwater	11.16	12.67	11.13
Sea water	0.84	1.08	0.95
Dry Fish	0.43	0.43	0.38
Other fish	0.17	1.80	1.58
Total	12.60	15.98	14.04

* from the 2000 BBS preliminary report- only total fish is available. Other categories are estimated as the same proportion in 1995.

3) Socio-economic factors

Capture fisheries and aquaculture have been playing a very significant role in the overall economy of Bangladesh, as a source of employment generation, foreign exchange earning and improving environmental condition and for human nutrition from animal protein. 63% of the demand for animal protein in the country is still met by fish as available and cheap sources of protein¹⁾.

According to 2000-2001 statistics, the sector contributes about 5.30% of GDP which is about 21% of the value of agricultural production. In addition, there are about 12 million people whose livelihood depends indirectly on fisheries as subsistence fisher, part time fishing labor, aquaculture operator, fisheries trade and business etc. The sector contributes 5.77% to the country's total export earnings (2000-2001) and ranks third in the list of export commodities. The annual growth rate of fish export since 1991 ranges between 6 and 8 % supporting its immense potential which needs comprehensive and concerted efforts to harness the maximum potential¹⁾.

¹⁾ Fisheries and Livestock sub-sector, three year rolling plan 2002-2005.

¹⁾ The medium term plan for economic and social development 2003/04- 2005/06, Fisheries sub-sector

4) Fisheries development plan

In the draft PRSP, the overall strategy of fishery sector development envisage 1) intensification of aquaculture by species and ecosystems, 2) addition of export-oriented species, 3) product diversification and value addition, and 4) development of appropriate marketing infrastructure. Strategic goals of fisheries sub-sector are; 1) increasing productivity in inland aquaculture, 2) increasing productivity in inland capture fishery, 3) raising income of the poor fishermen, 4) promoting rice cum fish culture, and 5) strengthening fisheries research and extension (Table 2.3.4).

5) Flooding, water control and fish habitat

Large numbers of Flood Control and Drainage (FCD) and Flood Control Drainage and Irrigation (FCDI) projects and unplanned flood protection embankments were implemented under water resource development programs since 1960, within and around major rivers and floodplains areas. This has adversely affected the aquatic ecosystem and habitats of fish population by obstructing their migratory route, and lead to the decline of natural recruitment of fish in those rivers and floodplains. On the other hand, a large number of non-migratory, resident fish spawners have mostly lost their breeding grounds for natural seed production. Land reclamation by drainage works has greatly reduced the areas of permanent water bodies and especially within FCDI projects; many perennial beels have become seasonal. As a result, many fin fish and prawn species of rivers, floodplains and estuaries have become threatened and endangered. Moreover, the overall livelihood of the people surrounding these water bodies have severely been affected at the same time, owing to the reduction of open water areas and declining the catch. (Source: M.G.Hussain, Role of aquatic ecosystem in the food and livelihood security in the Gangetic basin Bangladesh, BFRI).

6) Role of Women in Aquaculture and Fisheries

The 1991 census estimated that 48.3% of the total population is women, of which about 90% live in the rural environment. The involvement of women in different aquaculture activities is increasing. Many donor aided projects have preconditions to involve 30-50% female in the aquaculture related activities. The NGO's fisheries program included female in various activities to increase their income through training and motivation rising and also involved the common property resource management. Through this program, the women are being empowered and are able to participate in decision-making and address problems and establish their rights²⁾.

7) Marketing

The availability of fish in the markets depends not only on the fish catch, but also on the efficient marketing and distribution of the catch. Poor physical facilities in the fish marketing centers and inadequate marketing channels hinder the development of fish marketing and distribution in the county restricting the profit and income of producers and fishers. Fish markets and marketing are generally conducted by fish traders, either individually or as groups, or by fish Traders Associations / Fishermen's co-operatives societies. Almost of these fish markets are ill managed, unhygienic and unscientific. No standard practice of handling,

²⁾ Source: Profile of key aquaculture technologies and fisheries practices, Md. Nasir Uddin Ahmed, DG, DOF, Md. Mokammel Hossain, PSO, DOF, et al.

washing, cleaning, icing or grading of fish is followed. Limited attention is being paid on post-harvest handling, leading to major reduction in price and product quality. Most fish markets managed by fish traders in cities, district towns and rural areas have no modern infrastructure facilities; not even with roofs. In villages, fish is directly placed on the soil and in bamboo baskets and sold by auction, before being transported to cities/towns for retailing. City markets built by the municipal corporations/municipalities offer better facilities but are not managed according to any standards. The MoLGRD&C is now constructing small fish markets in the rural areas of Bangladesh through the LGED¹⁾.

(5) Livestock and Poultry

1) Livestock and poultry development policy

The Government is already in the process of preparing a comprehensive livestock policy with the support of FAO. According to the draft PRSP, the proposed livestock development policy will emphasize the following items:

- i) enhancement of the knowledge base of small holders on animal husbandry, nutrition and disease control through a community participation approach
- ii) provision of technological support with respect to disease control, genetic stock development, and supply of quality feeds, vaccines and medicines
- iii) training and education on livestock and poultry development
- iv) provision of adequate technical, financial, infrastructure and marketing support for large, commercial farms as well as small-scale home-based farms
- v) strengthening and broadening of livestock extension and veterinary services, integrating community-based participation at the local level
- vi) promotion of a private sector-led supply chain i.e. contract growing of poultry and dairy products involving small rural producers
- vii) introduction of livestock insurance program
- viii) enhancing budgetary support for livestock research and extension with necessary institutional strengthening of DLS

2) Administrative structure

The Ministry of Livestock and Fisheries (MOLF) is the prime organization of the livestock administrative structure of the country. The Department of Livestock Services, under MOLF, is responsible for the development of livestock farming and marketing. MOLF has regional offices in each upazila, where specialists for livestock farming are stationed: such as Livestock Officer and veterinary surgeon. Block Supervisors of DAE do not cover the services of livestock farming. Veterinary Field Assistants (VFA) assist livestock services at the field level.

Private workers are involved in technical support to livestock farmers. They work under the technical instruction of Livestock Officers and other government officials. Their work covers rearing and vaccination to animals. About 1 week of training is usually provided to private workers and distressed women are usually engaged in the services. Vaccines are obtained from Livestock Officers at a fixed price. Service fees are paid by farmers.

¹⁾ Profile of key aquaculture technologies and fisheries practices, Md. Nasir Uddin Ahmed, DG, DOF, Md. Mokammel Hossain, PSO, DOF, et al.

3) Production and consumption in livestock areas

The livestock farming in Bangladesh was not attached with high priority in the past. The average populations of cattle and buffaloes have not largely changed, but the number of small ruminants, fowls and ducks are increasing. Livestock farming plays various roles in the rural areas.

Group-Wise Population of Livestock and Poultry in million head

Animals	1995-96	1996-97	1997-98	2004*	Trend
Cattle	23.20	23.32	23.40	22.5	Constant
Buffaloes	0.80	0.81	0.82	Na	Decrease
Goats	33.02	33.31	33.30	35.5	Increase
Sheep	1.07	1.08	1.11	Na	Decrease
Fowls	127.50	130.20	138.20	162.4	Increase
Ducks	12.65	12.70	13.00	17.7	Increase

Source: Department of Livestock, MoLF. * 2004: Interview to M L F

It shares about 6.5% of GDP, and about 20% of the population of Bangladesh earn their livelihood through work associated with raising cattle and poultry. Animal shares 95% in agricultural labor (plowing, etc.) and 50% in transportation (DLS, 2004). Livestock resources also play an important role in the sustenance of landless and small farmers.

Comparison of Productivity by Local or Indigenous Varieties with Improved Varieties

Animals	Products	Local varieties	High productive varieties	Ratio
Milking cow	Milk production per year (Kg)	221	4,920 (Denmark)	4
			5,377 (USA)	4
Cow for meat	Meat production (Kg)	50	224 (Denmark)	22
			271 (USA)	18
Hen	Egg laying per year	40-50	250-300 (Exotic breed)	16
Goat	Meat production (Kg)	10	11 (World average)	90

Source: Department of Livestock, MOLF. (2004)

Some of the main issues related to livestock farming are as follows:

- Vaccines are provided by upazila livestock officers, while veterinary services are provided by veterinary surgeons, vaccination field assistants and private service staff. However, the actual services are not well managed due to lack of budget and technical staff. Vaccination is almost fully supplied to poultry, but it is still in sort for cattle and ducks.
- Pasturelands are not abundantly available. Recent water shortages and development of agricultural machinery have caused unfavorable conditions for water buffaloes.
- Animal breeding has been developing in Bangladesh. However, climatic and topographic conditions are not suitable to domestic animals except for aqua-animals. Poor genetic quality of the livestock species is a major cause of acute shortage of milk, meat and eggs.

4) Effects on human nutrition

As well as fish, livestock is an important animal protein source. Livestock combined with fisheries sector shares about 80% protein intake. Out of the protein intake per capita per day (46.8g), majority is from vegetable 40.7g, and protein from animal products is as low as 6.0g. The breakdown is followed by: fish-3.0g, milk-1.2g, meat-1.2g, egg-0.3g, others-0.3g.

Production, Demand and Deficit of Animal Products

Products	Production <Million>	Need per capita	Demand <Million>	Deficit <Million>	Sufficiency Rate <%>
	(a)		(b)	(a/b : %)	
Milk	1.62 ton	120 g/day	11.04 ton	9.42 ton	15
Meat	0.62 ton	240 g/day	6.40 ton	5.78 ton	10
Eggs	3,252	180 / year	22,680	19,428	14

Source: Department of Livestock, MOLF.

5) Socio-economic factors

Share of the livestock in income source is estimated to be about 5-10%. The share is still low now. Livestock farming should be developed in the future as an important income source of farmers. As the national economy improves, the consumption of livestock will also be increased. Livestock can be a demand-driven product and there are several high feed efficiency animals such as goats and poultry. In addition, livestock farming can play an important role in recycling of agricultural by-products in the rural areas. There are various promising aqua-animals to be developed such as ducks, water-buffalos, geese and reptiles. Livestock farming can play an important role in recycling of agricultural by-products in the rural areas to conserve environments and establish low-cost farming system by integrating with agriculture farming. For this purpose, development and extension of new technology are urgently required.

2.4 Institutions

2.4.1 Government Institutions

A Parliamentary form of government governs the People's Republic of Bangladesh. There are 41 ministries and 15 divisions, where chief-executive-officer is designated as Secretary who belongs to the Bangladesh Civil Service.

2.4.2 Local Government Institutions

The country is divided into 6 administrative Divisions (*Dhaka, Chitagong, Rajshahee, Khulna, Barisal, Sylhet*), where the chief government executive is *Divisional Commissioner*. There are several districts under these divisions, and there are several Upazilas, under each district. Union *Parishad* (UP: Union Council) and Municipalities (*Pouroshova*), including City Corporations, are the local government organizations of rural and urban area, respectively.

Number of Administrative Units

Administration Level	Number	Avg. population 2001. [in '000'] (Enumerated)
Division	6	21,541.2
Zila (District)	64	2,019.5
Upazila	507	254.9
Union	4,484	28.8
Mouza	59,990	2.2
Municipalities	223	
City Corporations	4	

Source: Statistical Yearbook of Bangladesh 2002 (2004, BBS)

2.4.3 Donor Agencies and NGOs

(1) Foreign Aids

External assistance is considered as a critical item for the economic development of Bangladesh, in order to bridge the gap between savings and investments. Up to 30 June 2001, a total of US\$ 46,072.1 million of external assistance was committed. Of the total amount, 13.6% was food aid, 23.4% was commodity aid and 63.0% was project aid.

The total foreign aid disbursement as of 30 June 2001 is US\$ 37,713.5 million, of which 47.7% is grant and 52.3% loan. The purpose wise breakdown is: 16.0% food aid, 28.0% as commodity aid and 56.0% as project aid. Over the years, the total aid package of the country has changed. The share of grant is gradually declining. Bilateral aid, which was 73.9 % of the total aid during 1971/76, has decreased to 50.9 % in 2000/01. Multilateral aid, on the other

hand, has grown from 26.1 percent to 49.1 % over the same period. The decreasing volume of grant has resulted in a larger proportion of loan in the total aid package. The share of grant, which was 89.0 % in 1971/73, has declined to 53.2 % in 1979/80, 51.2 % in 1994/95 and 36.8 % in 2000/01. Furthermore, the flow of food aid showed a sharp declining trend from 47.9 % in 1971/72 to 3.7 % in 2000/01, while commodity aid has similarly fallen from 50.8 % to 13.4 %.

Among bilateral donors, Japan tops the list in terms of cumulative disbursement, followed by USA and Canada. International Development Association (IDA), is the largest amongst the multilateral development institutions followed by the Asian Development Bank.

(2) NGOs

GO-NGO efforts have brought some positive changes in peoples living conditions. These changes, notably are, credit access, sanitation, yield in agriculture, improvement in informal sector, awareness on various social aspects (*basic rights, governance, education, health & nutrition etc.*). Today, there are about 1,500 NGOs (registered to NGO Bureau, GoB) working in Bangladesh. Though most of the NGO activities are micro-credit biased, the trend is shifting towards income generation, education, health & nutrition, HUGO, environment etc. Currently, decentralization of development is a major issue. Consensus building in the society is getting more and more complex as different interest groups are being more active in different parts of the country. The country has potential manpower for prospective income generating activities; the young part of the society is promising to bring about a positive change in the society. In the rural area, development of irrigation command area has significant impact in the economy of Bangladesh.

2.5 Water Resources Development

2.5.1 Historical Background of Water Resources Development

From the establishment of the East Pakistan Water and Power Development Authority (EPWAPDA) in 1959, many development studies and projects were conducted in Bangladesh. The most important study/reports/documents/activities which have guided the government policy on the water resources sector are as shown in Table 2.5.1.

2.5.2 National Water Policy (NWPo)

In order to ensure continued progress towards fulfilling the national goals of economic development, poverty alleviation, food security, public health and safety, decent standard of living for the people and protection of the natural environment, the Government declares the NWPo which guides management of the country's water resources by all the 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. Under the NWPo (1999), the Government addresses 16 issues and corresponding policies for the management of water resources and protection of the environment in a comprehensive, integrated and equitable manner. The 16 issues and the concerned policies are outlined as shown in Table 2.5.2.

The NWPo also addresses the government's policy towards the institutional and legal frameworks of the country. The National Water Resources Council (NWRC) will coordinate all water resources management activities in the country. The Executive Committee of the National Water Resources Council (ECNWRC) will provide directives on all matters relating to the planning, management, and coordination of water resources across all sectors, as may be required by the NWRC. WARPO (Water Resources Planning Organization) will be the exclusive government institution for macro-level water resource planning. It will also serve as the Executive Secretariat of the ECNWRC. The government enacts a National Water Code revising and consolidating the laws governing ownership, development, appropriation, utilisation, conservation, and protection of water resources.

2.5.3 National Water Management Plan (NWMP)

The Bangladesh Government approved National Water Management Plan (NWMP) on 31 Mar 2004. The plan incorporates 84 programs covering the country's hydrological regions and provides proper guidelines in utilizing the water resources. It will be implemented in three phases: 5-year first phase, 5-year second phase and 15-year third / long-term phase. The plan will be monitored by the Water Resources Planning Organization (WARPO). The plan will be reviewed after every five years and can be amended, if necessary.

(1) NWMP Framework

The National Water Policy (NWPo), along with the Development Strategies constitute the main policy and strategic framework for the NWMP. Besides these, a wide range of policies for various sectors has direct or indirect bearing on the water sector. These include: 1) National Environment Policy (1992), 2) National Forestry Policy (1994), 3) National Energy Policy (1996), 4) National Fisheries Policy (1998), 5) National Policy for Safe Water Supply and Sanitation (1998), 6) National Agricultural Policy (1999) and 7) Industrial Policy (1999).

All these policies and the Development Strategies together provide an extensive framework for management of water resources. However, policy for land use planning was not approved during the NWMP preparation.

The NWMP provides a framework where all concerned in the development, management and use of water resources and water services are to plan and implement their activities in a coordinated and integrated manner. The programs are presented in 8 sub-sectoral clusters, where each cluster comprises of a number of individual programs, with the total of 84 sub-sectoral programs identified. Among the 8 clusters, 2 address the structural constraints which are: 1) Institutional Development (ID) and 2) Enabling Environment (EE). The remaining 6 clusters address capital needs and opportunities which are: 1) Main Rivers (MR), 2) Towns and Rural Areas (TR), 3) Major Cities (MC), 4) Disaster Management (DM), 5) Agriculture and Water Management (AW) and 6) Environment and Aquatic Resources (EA).

The sub-sectoral programs under the clusters can be summarized in the following categories:

- *Cross-Cutting Programs*: Programs relating to the actions necessary to evolve and strengthen the institutional framework and to create an enabling environment conducive to efficient and effective management of the sector.

- *National-Level Programs*: Programs mainly relating to long-term strategic security of water supplies to Bangladesh, pollution control, restoration of flood-plain and river fisheries, and other environmental management issues.
- *Regional Programs*¹⁾: 1) *Generic Programs*: These are generic in nature and applicable to all or most regions (eg rural water supplies and arsenic mitigation), 2) *Specific Programs*: These are specific to one or two regions only (eg cyclone protection).

The programs have been scheduled in a manner to improve the investment flows. Priority has been given to institutional development, enabling environment, water supply and sanitation, rationalization of FCD&I management and key elements of the natural environment programs. Table 2.5.3 summarizes programs within the NC and NE regions and for which local units (LGD, LGED and LGIs) have responsibility as either leading or supporting agency. In total, 20 programs are identified.

The NWMP is a rolling 25-year plan which is to be implemented in three phases: 1) Short-Term (Firm Plan, 2000-05), 2) Medium-Term (Indicative Plan, 2006-10), and 3) Long-Term (Perspective Plan, 2011-25). The programs are to be implemented by the line agencies and others as designated. Each organization is responsible for planning and implementing its own activities and projects within the NWMP framework. Implementation of the plan will be monitored regularly and the plan will be updated in every five years.

(3) Funding the National Water Management Plan

The overall capital cost of the NWMP has been estimated to be a little over one trillion Taka or US\$ 20 billion. It is intended that these costs will be funded by a combination of traditional government allocations from Gross Domestic Product (GDP), beneficiaries and small-scale private sectors. Other sources will include larger private sector instruments, public bond issues and water and environment funds, but will be highly dependent on the emergence of the enabling environment.

Inadequate provision for recurring is recognized as a major constraint on sustainable water sector management. The plan will facilitate increased cost recovery based on user pays principles and transferred responsibilities for scheme operation and maintenance. Furthermore, although the recurring costs will build up to considerable amounts by the end of the plan's lifetime, the greater part of them will comprise of service fees that can be sanctioned. In due course, and based on consultation and sensitization over a suitably protracted period, other recurring costs will gradually become the responsibility of users; leaving government with a small residue of recurring costs that it should rightly cover.

2.5.4 Water Resources Development in PRSP-D

Following the Interim Poverty Reduction Strategy Paper (I-PRSP), the Draft PRSP (PRSP-D) was prepared in December 2004. After approval, the PRSP-D will be the medium term

¹⁾ It is to be noted that WARPO has delineated eight hydrological regions of the country, based on appropriate natural features, for planning the development of water resources which are: Northwest (NW), North Central (NC), Northeast (NE), Southeast (SE), South Central (SC), Southwest (SW), Eastern Hills (EH), the active floodplains and charlands of the Main Rivers and Estuaries (RE).

micro-economic framework of the Government. Implementation of the NWPo (1999) and NWMP (2004) is the basic strategy for water resources development and management in PRSP-D. Eight strategic goals and their key targets are indicated in the following:

Strategic Goal	Key targets
1. Expand utilization of Surface Water.	<ul style="list-style-type: none"> • Creation of additional irrigation facilities • Supply of safe water for domestic use.
2. Rationalize utilization of ground water.	Ensuring: <ul style="list-style-type: none"> - Supply of safe water for domestic use - Regulate Industrial & agricultural use - Ensure conjunctive use of water.
3. Protect flood, improve drainage and reduce vulnerability.	<ul style="list-style-type: none"> • Protection of lives and properties. • Rehabilitation of 123 polders for protection of 1.28 million ha land from tidal flood and salinity intrusion.
4. Enhance access of the poor to water and common properties resources.	<ul style="list-style-type: none"> • Creation of Income Generating Activities (IGA) for the poor through water resources management program. • Protection of 0.28 million hectares from
5. Augment surface water utilization (retention) in rivers, creeks and khals.	<ul style="list-style-type: none"> • Re-excavation of rivers, canals, derelict ponds and rainwater harvest.
6. Protect wetland/ Sundarban, saline water intrusion and promote accretion of land from the sea.	<ul style="list-style-type: none"> • Environmental protection, habitation for the poor people on the raised platforms and in the char areas.
7. Make Institutional Development of water sector agencies.	<ul style="list-style-type: none"> • Development of knowledge and capability for design of future water resources management plans & monitoring.
8. Control Erosion of major rivers and protect large and small towns	<ul style="list-style-type: none"> • Save property worth Tk. 50000/- million • Generate employment for 470 million person day annually for construction works.

2.5.5 Small Scale Water Resources Development Sector Project (SSWRDSP-1)

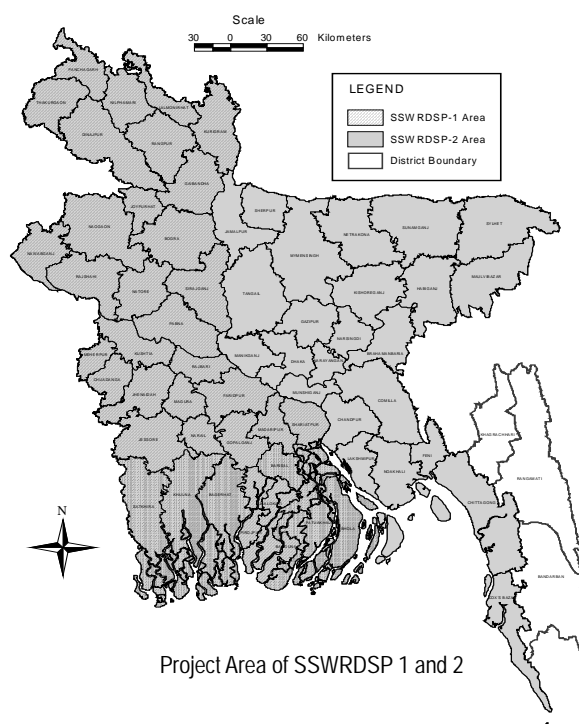
(1) Background

Water is the foundation for many livelihood activities of the rural poor, and effective water resource management is fundamental to address pervasive rural poverty problems while promoting economic growth in Bangladesh. Based on the Government's main instrument to have the strategy implemented, the first SSWRDSP was launched in April 1996 to enhance rural income by developing community-based water management. This has been proved to be an effective means to reduce rural poverty.

(2) Outline of the Project

1) Objectives and project area

The project aims at sustainable growth of agricultural production and income for about



140,000 farm families in western Bangladesh. This will be realized through the establishment of about 300 small-scale water resources development schemes. According to its final report, some 280 subprojects were completed in the project, covering 165,000 ha of cultivated land and benefiting 192,600 farm households.

2) Implementation period and executing agency

The Project was implemented from April 1996 and completed in December 2002. The Local Government Engineering Department (LGED) was the executing agency collaborating with other government agencies and NGOs.

3) Financial arrangement

The Project was implemented with funds from several stakeholders. In addition, project beneficiaries also contributed US\$ 3.5 million.

Financial Sources	Finance amount	Share
Asian Development Bank (ADB)	US\$ 28.3 million	52.9 %
International Fund for Agriculture Development (IFAD)	US\$ 8.8 million	16.4 %
Government of the Netherlands	US\$ 6.8 million	12.7 %
Government of the Peoples Republic of Bangladesh (GOB)	US\$ 8.9 million	16.7 %
Total	US\$ 53.5 million	100.0 %

(3) Achievement of the Project

Major achievements of the 1st SSWRDSP are as follows:

- Total number of benefited districts = 37
- Total number of completed sub-projects = 280
- Total benefited cultivated land = 164,700 ha
- Total benefited farm families = 142,300
- WMCA membership = 119,400 persons with 24% female

Temporary employment of about 8.38 million person-days was generated from the works of 21 million m³ of earthwork embankment (945 km) and re- excavation of canals (1,162 km).

2.5.6 Small Scale Water Resources Development Sector Project Phase 2 (SSWRDSP-2)

(1) Background

After the successful completion of the SSWRDSP-1, the GOB requested the implementation of its second phase, expanding the project area to the entire country, excluding three hill tract districts. The request was agreed by ADB and the Government of Netherlands.

(2) Outline of the Project

1) Objectives

The Project aims to improve the development of the water resources sector through participatory rehabilitation and management of small-scale (1,000 ha or less of benefited area) water resources infrastructure and support by sector-wide policy and institutional reforms.

2) Project area

The Project will implement 300 more subprojects in 61 districts of the country. The Project will not be implemented in the 3 districts of the Chittagong Hill Tracts, considering the different physical, institutional, and socio-cultural conditions.

3) Implementation period

The loan for this Project has become effective on 9 November 2001. Period of utilization of the Loan is until 31 December 2009. The estimated project completion date will be 30 June 2009.

4) Executing agency

Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development and Cooperatives is implementing the Project.

5) Financial plan

Asian Development Bank (ADB) decided to provide a loan equivalent to \$34.0 million from its Special Funds resources to finance about 44 % of the total cost of the Project. The loan will finance foreign exchange costs estimated at \$7.6 million (48 % of the total foreign exchange cost) and \$26.4 million of the local currency cost. The GON also decided that it would provide grant fund up to \$24.3 million (to cover \$8.3 million of the foreign exchange cost and \$19.8 million of the local currency cost) for NGO services, civil works, consulting services and training, etc. The GOB decided to provide local currency cost estimated at \$17.3 million equivalent (22 % of total cost) for incremental project staff, taxes and duties, and land acquisition / compensation. In addition, the beneficiaries are expected to contribute approximately \$2.4 million equivalent in the form of O&M costs incurred during project implementation.

2.5.7 Rubber Dam Project

(1) Rubber Dam Project

Following the construction of two rubber dams construction in Cox's Bazar in 1995 as the pilot basis, rubber dam projects have been implemented by LGED. Up to now, nine rubber dams were installed and four dam are currently under construction. According to the Rubber Dam Project Office, winter crop area and production increased at 68% and 70%, respectively due to irrigation enabled by the installation of rubber dams.

(2) Prospect of Rubber Dams in Bangladesh

There is large potential for exploitation of surface water from small and medium rivers of Bangladesh for irrigation. Rubber dams would be feasible water retention and conservation structures for such rivers in premise that its effect to up/down stream can be mitigated.

(3) Collaboration with Department of Agricultural Extension (DAE)

Planning of rubber dams were done in collaboration with DAE to estimate and evaluate the effectiveness of implementation and benefit.

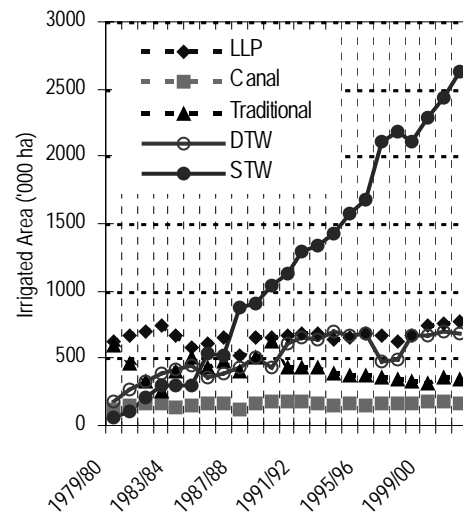
2.5.8 Surface and Groundwater Irrigation Development

(1) Irrigated Area

Significant development of irrigated agriculture started with the introduction of the green revolution in later 1960's using low lift pumps where surface water available. In the 1970's, minor irrigation by deep tube wells has been initiated under the BADC.

(2) Surface Water Irrigation

According to the Ministry of Agriculture, surface water irrigation covers 1,267,000 ha, while low lift irrigation covers 768,000 ha (2001/02). It is found that application of surface water supply measures has been hardly changed during these 20 years. However, application of LLP and canal system has slightly incremented. On the other hand, traditional methods have gradually reduced. Surface water irrigation area is regarded to have not changed due to its limitation of water source availability.



Irrigated Area in Bangladesh by Means

(3) Groundwater Irrigation

The area under groundwater irrigation has significantly increased since 1987/88, particularly for the area irrigated by Shallow Tube Well (STW), which covers more than 57% (2,632,000 ha) of the total irrigated area in 2001/02. Irrigation area by STW is continuously increasing. On the other hand, the increment of irrigation area by DTW has stopped from the year 1991/92.

2.6 Environmental Policies and Institutions

2.6.1 Environmental Policies and Legal Framework

(1) Environmental Policies

The environmental policies and legal framework in Bangladesh has shown large progress since the 1990s. In 1992, the National Environmental Policy was adapted, in view of maintaining ecological balance with overall progress of the country, protection of the country against natural disasters, prevention of activities related to pollution and degradation of environment, and ensuring environmentally sound development, guaranteeing sustainable, long term and environmentally agreeable utilization of national resources.

The Environmental Conservation Act (1995) has designated the Director General of the Department of Environment (DoE) to undertake all activities for conservation and enhancing the quality of environment and control, abatement and mitigation of pollution. The Act also states the procedures for environmental clearance, where all industry and projects are obligated to this procedure before actual implementation.

The procedure for environmental clearance is more specifically stated in the following Environmental Conservation Rules (1997). The rules obligate industries and projects to environmental consideration through procedures for preparing Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) reports and Environmental Management Plan (EMP), according to their categorization as indicated in schedule-1.

Furthermore, the Environmental Court Act was enforced in 2000, with declaring the establishment of environmental courts in each government division. The environmental court has jurisdiction over violations of environmental laws, and is competent to impose penalty to repeated or serious offence against the environment. This is expected to enforce environmental conservation in the country.

(2) Forest Policies

After a series of commercial oriented forest policies, the current forest policy was introduced in 1994 and represents the first shift towards recognition of the importance of people's participation in forestry. Sustainable development, poverty alleviation, local people's participation in forest protection, and governmental support for forestry development from a broader sector of society are some of the important policy commitments of the new people-oriented forestry initiative in Bangladesh.

(3) Other Relevant Regulations

Other relevant regulations may include the followings:

Regulations	Description
Agricultural and Sanitary Improvement Act, 1920	enacted to consolidate and amend the law relating to the construction of drainage and other works in certain areas.
Agricultural Pests Ordinance, 1962	promulgated to prevent the spread of agricultural pests in Bangladesh
Agricultural Pesticides Ordinance, 1971	aimed to regulate the import, manufacture, sale, distribution and use of pesticides.
Protection and Conservation of Fish Act, 1950	adopted to provide for the conservation of fish resources. Under this law the government may for a specified period prohibit the catching, carrying, transporting, offering or exposing or possession for sale or barter of fishes below the prescribed size of any prescribed species
Bangladesh Wild Life (Preservation) Order, 1973	deals with game and protected animals. While game animals can be hunted, killed, or captured only subject to the terms and conditions of permits, issued by the relevant authority, protected animals cannot be hunted, killed or captured except for protecting life, crops or livestock.
Smoke Nuisances Act, 1905	prohibit specific activities related to smoke emission within any specified area
The Brick Burning (Control) Act, 1989	requires license from the district commissioner for brick burning.

2.6.2 Environmental Organizations and Their Roles

(1) Department of Environment

The Department of Environment was established in 1997 under the Environmental Pollution Control Ordinance, 1997, and is responsible for the implementation of the Environmental Conservation Act, 1995. The department is currently organized into two main functional areas "Administration, Planning and Development" and "Technical", with 4 Units under Administration, Planning and Development and 5 under Technical. In addition there are six

Divisional Offices that carry out enforcement activities including overall management of the environment supported by laboratory analysis.

(2) Environmental Clearance

Under the Environmental Conservation Act, the provision for environmental clearance is given. The procedures for environmental clearance, as defined in the Environmental Conservation Rules-1997, refer to Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) in well known terms. Development activities are divided into four categories and necessary procedures are provided accordingly. The activities to be indicated in the Master Plan prepared in the Study are likely to be categorized in Red Category where IEE or EIA is required for environmental clearance.

(3) Protected Areas

The Study Area embraces the Modhpur National Park known for its deciduous forest. The area is located in the eastern part of Tangail with the area of 8,436 ha. Management of National Parks, along with other protected areas done by the Department of Forest. However, the enforcement of protection is not sufficient due to limits in capacity.

2.6.3 Environmental and Social Consideration Required by JICA

(1) Guidelines for Environmental and Social Considerations

Japan's Official Development Assistance (ODA) Charter states that, in formulating and implementing assistance policies, Japan will take steps to assure fairness. This should be achieved by giving considerations to the conditions of the socially vulnerable and the gap between the rich and the poor as well as the gap among various regions in developing countries. Furthermore, great attention will be paid with respect to factors such as environmental and social impacts on developing countries when implementing ODA. In this regard, the Japan International Cooperation Agency (JICA) has prepared the Guidelines for Environmental and Social Considerations (the Guidelines), which was enforced in April 2004.

Within the Guidelines, JICA makes clear requirements that the recipient governments must meet and that are mindful of environmental and social considerations in the guidelines, and JICA provides the recipient governments with support to facilitate the achievement of these requirements by implementing cooperation projects. JICA will examine the undertakings of the recipient government and will submit proposals to MOFA regarding selection of cooperation projects from a viewpoint of environmental and social considerations, so that the Government of Japan can make an appropriate decision regarding project selection.

(2) Application of JICA Guidelines to the Study

The JICA Guidelines indicate different procedures according the type of study and its categorization. In regard that this Study is a Master Plan Study, and has been defined category B in the discussions for the Minutes of Meeting for The Master Plan Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water agreed and signed upon between LGED and JICA on 26th July 2004.

Table 2.3.1 Mid-term Micro-economic Framework of Draft PRSP

Triangle	Strategic Blocks/Supporting Strategies		Contents of Strategy	
Economic Growth	Accelerating Growth for Pro-Poor	Employment	Assets of poor, Education, labour productivity, working environment, labour market	
		Investment & Saving	Increase investment and saving ratio	
		Macroeconomic Stability	Macro-economic stabilization financing and banking policies for investment promotion	
		Promotion of Trade	Countermeasure for MFA(Multinational Fiber Arrangement) cancellation, export diversification and trade liberalization	
		Facilitating Fair & competitive business	Legal improvement, renovation of banking sector, privatization, direct investment, development of private enterprise,	
		Promotion of employment	Increase employment ratio, support for entrepreneur, vocational training and emigrant workers	
	Critical Sectors for Pro-poor economic growth	Agriculture/rural development		Diversification of production, increase productivity, value-adding
				Development of fishery, livestock and forestry
				Technical extension, marketing & processing, rural non-farm activities
				Food security
				Micro-credit
		Water resources development and management	Implementation of NWPo and NWMP	
		Small & medium size enterprises		
		Informal sector		
		Infrastructure development	Electricity (rural & urban), gas, new energy, and communication transportation	
		ICT (information communication technology)	Expansion to rural area, high-tech park	
	Effective Safety nets		Integration of various programs, comprehensive policy and expansion of coverage	
	Social Development	Human Development	Education	Qualified education, Non formal education (NFE) and increase literacy rate
			Health	Maternal health, female health, infectious disease, improvement of governance through the Health, Nutrition & Population Sector Program (HNPSP).
	Governance	Social inclusion & Empowerment		Support female, children, tribal people, disable and other disadvantage group
Promoting good governance		Capacity building, promotion local governance, tackling corruption, criminal justice reform		
Service Delivery		Public-private partnership		
Environment	Caring for the environment & Sustainable development		Conservation of nature, combating pollution	

Table 2.3.2 GDP at Constant Price (1995/96=100) by Sectors

	unit: million Taka								
	1993/94	1993/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
1 Agriculture and Forestry	324,200	317,932	324,382	342,458	348,080	359,368	384,251	405,514	417,847
2 Fishing	74,551	79,613	85,500	91,997	100,257	110,240	120,019	114,582	116,978
3 Mining & quarrying	14,119	15,482	16,691	17,286	18,281	18,522	20,277	22,254	23,860
4 Industry	209,554	231,517	246,351	258,795	280,908	289,882	303,679	323,976	340,176
5 Electricity, gas and water supply	21,628	22,772	24,009	24,473	24,965	26,463	28,258	30,349	32,680
6 Construction	92,525	101,372	109,993	119,500	130,833	142,503	154,590	167,959	181,228
7 Wholesale and retail trade	182,433	196,948	206,076	217,374	230,382	245,377	263,282	280,212	295,988
8 Hotel and Restaurant	8,876	9,318	9,782	10,269	10,936	11,664	12,473	13,346	14,214
9 Transport, storage and communication	131,241	137,739	144,831	152,798	161,490	171,019	181,422	195,798	207,605
10 Financial intermeditation	22,838	24,001	25,171	26,465	27,860	29,365	30,980	32,697	34,404
11 Real estate, renting and business services	141,159	146,065	151,036	156,385	162,328	168,528	174,990	180,959	187,147
12 Public Administration and defence	36,911	38,561	40,165	42,375	44,874	47,432	50,262	53,216	56,950
13 Education	30,831	32,214	33,042	34,618	37,422	40,304	43,424	46,511	50,012
14 Health & social services	34,436	35,431	36,388	37,807	39,542	41,361	43,346	45,480	47,748
15 Community social & personal services	136,345	139,073	142,943	146,929	151,117	155,575	160,332	165,378	170,729
16 GDP at constant producers price	1,461,647	1,528,038	1,596,360	1,679,529	1,769,275	1,857,603	1,971,585	2,078,231	2,177,566
17 import duty	54,492	61,724	66,880	73,318	75,202	76,687	77,689	79,121	83,324
18 GDP at constant market price	1,516,139	1,589,762	1,663,240	1,752,847	1,844,477	1,934,290	2,049,274	2,157,352	2,260,890
19 net primary income from abroad	47,372	48,482	49,536	56,707	59,867	66,203	75,098	80,880	84,447
20 GNI at constant market price	1,563,511	1,638,244	1,712,776	1,809,554	1,904,344	2,000,493	2,124,372	2,238,232	2,345,337
population (in million)	117.7	119.9	122.1	124.3	126.5	128.1	129.8	129.2	131.2
Per capita GDP	12,881	13,259	13,622	14,102	14,581	15,100	15,788	16,698	17,232
Per capita GNI	13,284	13,663	14,028	14,558	15,054	15,617	16,367	17,324	17,876

Source: Statistical Yearbook of Bangladesh 2001, BBS

Table 2.3.3 Consolidated Receipts and Expenditure of the Government of Bangladesh

	Unit: Tk. million						
Items	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
Revenue Receipts	151,380	172,705	188,987	204,668	213,450	241,730	284,560
tax	121,241	142,614	153,900	161,671	170,957	194,900	220,230
non-tax	30,139	30,091	35,087	42,997	42,493	46,830	64,330
Development Receipts	81,120	80,440	81,470	119,630	145,890	178,220	175,260
Project	46,780	50,107	51,390	59,250	69,430	76,060	85,030
Food & Commodities	22,380	16,030	14,170	28,285	18,890	13,160	17,190
Internal Resources	11,960	14,303	15,910	32,095	57,570	89,000	73,040
Total Receipts	232,500	253,145	270,457	324,298	359,340	419,950	459,820
Revenue Expenditure (gross)	120,833	123,729	138,450	168,783	185,820	206,619	220,379
Wages & Salaries	41,834	43,255	49,747	53,671	59,327	60,973	66,782
Commodities & Services	24,017	26,917	19,819	29,023	32,533	37,095	42,872
Transfer	45,809	44,016	60,251	78,091	85,118	99,337	101,219
Other Services	9,173	9,541	8,633	7,998	8,842	9,214	9,506
Development Expenditure	99,957	110,410	110,370	125,090	79,659	161,508	136,000
Agriculture, Flood Control, Water Resources and Rural Development	20,365	25,719	29,355	27,530	36,760	36,828	27,031
Industry	1,763	1,762	593	980	2,560	5,410	2,397
Transport & Communication	27,008	24,519	20,175	26,360	32,000	37,566	32,868
Other Services	50,821	58,410	60,247	70,220	8,339	81,704	73,704
Total Expenditure	220,790	234,139	248,820	293,873	265,479	368,127	356,379
Balance	11,710	19,006	21,637	30,425	93,861	51,823	103,441
Real Public Expenditure (deflated)	220,990	227,123	238,478	258,737	294,347	313,220	296,365
Share of Foreign revenue at real expenditure	31.3%	29.1%	27.5%	33.8%	30.0%	28.5%	34.5%

Resource: Statistic Yearbook Bangladesh 2001 Table 9.01, BBS

Table 2.3.4 Policy Matrix of Agriculture Sector Growth in Draft-PRSP

	Strategic Goal	Key targets/Activities
Agriculture	Increase productivity and profitability in crop sector	<ul style="list-style-type: none"> • Narrow yield gap • Increase rice production to 29 million tons by 2006 • Increase production of other field crops including horticultural and plantation crops
	Ensuring food security through increasing production for food crops	<ul style="list-style-type: none"> • Increase production of rice, wheat, maize, potatoes, pulses, oil-seeds, fruits and vegetables • Improve nutrition intake of the poor through promotion of crop diversification
	Encouraging production of cash crops	<ul style="list-style-type: none"> • Increase production of jute, cotton, sugar cane, tea, and plantation crops
	Accelerating production of high value crops for domestic and export market	<ul style="list-style-type: none"> • Increase production of vegetables, fruits and flowers • Increase production of medicinal ornamental and aromatic plants
	Improvement of land resource base	<ul style="list-style-type: none"> • Protect crop land from non-agricultural uses • Improve soil fertility through increasing organic content from 1% to 5%
	Strengthening agricultural research	<ul style="list-style-type: none"> • Development improved crop technologies for quick dissemination • Increase bio-technology research for crops
	Strengthening agriculture extension service	<ul style="list-style-type: none"> • Give pro-poor focus on extension service • Cover all categories of farmers, landless households and women in the extension service • Raise income of the rural households
	Expansion of irrigation with emphasis on efficient management of water resources	<ul style="list-style-type: none"> • Increase irrigation coverage, especially to less developed area • Increase use of surface water for irrigation • Improve on-farm water management • Increase profit margins from rice irrigation
	Promoting quality seed development	<ul style="list-style-type: none"> • Increase availability of quality seeds for rice and non-rice crops • Expedite private sector participation in seed development
	Improvement of agricultural marketing	<ul style="list-style-type: none"> • Reduce producer-consumer price spread • Reduce marketing costs of various crops
	Promoting agro-processing and agribusiness development	<ul style="list-style-type: none"> • Increase opportunities for value addition to crops • Strengthen linkage among farmers, traders, processors and business service provider
Promoting investment in agriculture	<ul style="list-style-type: none"> • Making provision for appropriate financial support to farmers to ensure level playing fields for them 	
Mainstreaming women in agriculture sector	<ul style="list-style-type: none"> • Increase and improve women's participation in crop agriculture 	
Livestock & Poultry	Increasing productivity in livestock sector	<ul style="list-style-type: none"> • Increase production of livestock products, i.e. meat, milk and egg • Increase income of the livestock and poultry
	Promoting poultry sector development	<ul style="list-style-type: none"> • Raise poultry production • Raise income of the poor
	Promoting milk and meat production	<ul style="list-style-type: none"> • Increase milk production • Develop milk and meat processing facilities
	Strengthening livestock research and extension	<ul style="list-style-type: none"> • Boost up production of livestock products • Develop new breeds • Develop improved animal husbandry practices and veterinary services
Fisheries	Increasing productivity in inland aquaculture	<ul style="list-style-type: none"> • Increase fish from pond poly-culture • Cover 90% of ponds for fish culture
	Increasing productivity in inland capture fishery	<ul style="list-style-type: none"> • Increase output from semi-closed and closed water bodies • Reclaim and improve fish habitats and sanctuaries
	Raising income of the poor fishers	<ul style="list-style-type: none"> • Increase income from cage, pen, seed and fry production
	Promoting rice cum fish culture	<ul style="list-style-type: none"> • Introduce fish production in rice land concurrently and alternately
	Strengthening fisheries research and extension	<ul style="list-style-type: none"> • Accelerate fish production

Source: Draft-PRSP, Annexure 2 Policy Matrix

Table 2.3.5 Area, Yield and Production of Major Crops, 2000/01 to 2002/03

Crops	2000-01			2001-02			2002-03		
	Area	Per ha	Production	Area	Per ha	Production	Area	Per Acre	Production
	'000 ha	Tons	'000 Tons	'000 ha	Tons	'000 Tons	'000 ha	Tons	'000 Tons
Rice									
Aus	1,325.9	1.45	1,916.0	1,242.2	1.46	1,808.0	1,244.1	1.49	1,850.7
Aman	4,942.5	1.97	11,249.0	4,916.2	1.90	10,726.0	4,986.3	1.96	10,275.6
Boro	3,763.2	3.17	11,920.0	3,771.8	3.12	11,766.0	3,844.8	3.18	12,222.2
Total Rice	10,801.6	2.32	25,085.0	10,661.5	2.28	24,300.0	10,771.0	2.34	25,189.9
Wheat	772.9	2.16	1,673.0	641.8	2.17	1,606.0	706.5	2.13	1,507.0
Pulses	468.4	0.80	377.0	447.7	0.79	355.0	448.3	0.77	344.6
Oil seeds	424.7	0.93	394.0	429.7	0.91	392.0	399.3	0.98	368.8
Condiments & Spices	252.7	1.60	397.0	252.2	1.70	418.0	253.3	1.70	425.0
Sugarcane	168.8	39.94	6,742.0	162.7	39.97	6,502.0	176.0	40.22	6,838.0
Jute	448.2	10.10	4,526.0	456.5	10.37	4,733.0	437.0	10.10	4,408.0
		(bales)	(bales)		(bales)	(bales)		(bales)	(bales)
Tea	48.6	1.07	52.0	48.6	1.07	52.0	-	1.12	56.5
Tobacco	30.0	1.23	37.0	30.4	1.25	38.0	-	1.20	37.0
Banana	42.9	14.13	606.0	44.9	14.56	654.0	45.3	14.34	650.0
Mango	50.6	3.72	188.0	50.6	3.70	187.0	50.8	4.78	243.0
Pineapple	14.2	10.73	152.0	14.2	10.81	153.0	14.2	10.86	154.0
Jackfruit	26.7	10.04	268.0	27.1	10.14	275.0	27.0	10.20	275.5
Total Fruits	166.4	6.00	1,405.9	169.6	6.00	1,467.0	176.7	5.90	1,546.9
Potato	288.3	12.40	3,573.0	275.7	12.10	3,340.0	282.1	13.20	3,718.0
Total Vegetables	234.8	6.30	1,472.0	243.7	6.60	1,599.0	263.9	6.10	1,604.7

Source: Bangladesh Bureau of Statistics (BBS)
Department of Agricultural Extension (DAE) and Ministry of Food (MOF)

Table 2.3.6 Food grain Production and Requirement 1971/72 to 2020

Year	Mid-Year Population (million)	Food grain Requirement	Production				Net Total Production	Import/Donation (Rice + Wheat)
			Rice	Wheat	Maize	Total		
1971-72	72.60	12,019.73	9,774.00	113.00	2.20	9,889.20	8,744.03	
1975-76	79.90	13,228.33	12,560.00	215.00	2.00	12,777.00	11,297.42	1,493.00
1980-81	89.91	14,885.60	13,883.00	1,092.00	1.00	14,976.00	13,241.78	1,076.00
1985-86	100.30	16,605.78	15,041.00	1,060.00	3.00	16,104.00	14,239.16	1,200.00
1990-91	111.00	18,377.28	17,785.00	1,004.00	3.00	18,792.00	16,615.89	1,577.00
1995-96	122.10	20,215.01	17,687.00	1,369.00	32.00	19,088.00	16,877.61	2,427.00
1996-97	124.30	20,579.24	18,880.00	1,454.00	40.70	20,374.70	18,015.31	967.00
1997-98	126.50	20,943.48	18,861.71	1,802.80	65.30	20,729.81	18,329.30	1,951.00
1998-99	128.10	21,208.37	19,904.58	1,908.40	84.50	21,897.48	19,361.75	5,491.00
1999-00	129.80	21,489.83	23,067.00	1,840.00	120.70	25,027.70	22,129.49	2,104.00
2000-01	131.50	21,771.28	25,085.00	1,673.00	149.20	26,907.20	23,791.35	1,554.00
2001-02	133.45	22,094.13	24,300.00	1,606.00	172.40	26,078.40	23,058.52	1,799.00
2002-03	135.00	22,350.75	25,189.85	1,507.00	117.30	26,814.15	23,709.07	3,221.00
2003-04	136.20	22,549.42	26,796.00	1,248.00	300.00	28,344.00	25,061.76	2,784.00
Project Population, Foodgrain Requirement and Production from 2005 to 2020								
2005	139.10	23,029.55	27,067.00	1,500.00	300.00	28,867.00	25,524.20	
2010	148.10	24,519.60	29,150.00	1,600.00	450.00	31,200.00	27,587.04	
2015	156.70	25,943.42	31,550.00	1,600.00	550.00	33,700.00	29,797.54	
2020	166.90	27,632.14	32,800.00	1,600.00	600.00	35,000.00	30,947.00	

Source: Bangladesh Bureau of Statistics (BBS), Department of Agricultural Extension (DAE) and Ministry of Food (MOF)

- Notes:
- Foodgrain Requirement is calculated @ 16 Ounce (453.66 gm) per day per head from 1971-72 to 2020
 - Net Total Production is calculated by deducting 11.58% of total Production for seed, feed & wastage as per study on 'Seed, Feed and Post Harvest losses' Ministry of Food (MOF)
 - Population as per Bangladesh Bureau of Statistics (BBS) estimation
 - Projected Production of Rice, Wheat, Maize as per DAE estimation
 - Figures for 2003-04 is estimated

Table 2.3.7 Basic Information on the Land Holding in Bangladesh

Items	1983-84	1996	Items	1983-84	1996
Number of Holdings			Fertilizer		
Number of Holdings	13,817,646	17,828,187	Holdings reporting use of fertilizer	6,176,100	9,782,685
Number of non farm households	3,772,347	6,029,945	Net area treated with fertilizer		13,798,879
Number of total farm holdings	10,045,299	11,798,242	% of farms reporting use of fertilizer	61.9	82.9
% of total holdings	72.70	66.18	% of area under fertilzier	-	77.6
% of small farm holdings (0.05-2.49 acres)	70.34	79.87			
% of medium farm holdings 2.50-7.49 acres	24.72	17.61	Bovine Animal		
% of large farm holdings (7.50 acres & above)	4.94	2.52	Total number of bovine animal	22,062,257	22,294,904
% of holdings owning no land (landless)	8.67	10.18	Bovine Animal per holding	1.60	1.25
% of male headed holdings		96.52	Per capita bovine animal	0.26	0.18
% of female headed holdings		3.48			
Operated Area			Sheep-goat		
Operated area of all holdings	23,019,885	20,484,561	Number of sheep-goat	14,225,768	14,609,783
Operated area per holding	1.67	1.15	Number of sheep-goat per holding	1.03	0.82
Per capita operated area	0.27	0.17	Per capita sheep-goat	0.17	0.12
Operated area of farm holdings	22,678,464	19,957,144			
Operated area per farm holding	2.26	1.69	Poultry		
Homestead area	965,986	1,318,415	Number of poultry	73,713,161	126,667,861
Homestead area per holding	0.07	0.07	Number of poultry per holding	5.33	7.10
Homestead area per non farm household	0.04	0.05	Per capita poultry	0.91	1.04
Homestead area per farm holding	0.08	0.09			
Cultivated Area			Cottage industry		
Cultivated Area	20,157,564	17,771,339	Holding reporting cottage industry	932,381	464,353
Cultivated area per farm	2.00	1.50	% of total holdings	6.7	2.6
Per capita cultivated area	0.25	0.14			
Net temporary cropped area	19,055,299	16,450,528	Agricultural labour		
Net temporary cropped area per farm	1.94	1.39	Number of agricultural labour holding	5,495,300	6,401,453
			% of total holdings	39.8	35.9
Crop area of farm holdings (in '000 acres)			Number of agricultural labour non-farm household	62.97	56.07
Gross cropped area	32,544	28,616	Number of agricultural labour farm holdings	3,119,749	3,020,356
Area under Aus	7,684	4,149	% of farm holdings	31.06	25.60
% of gross cropped area	23.6	14.5			
Area under Aman	11,964	10,548			
% of gross cropped area	36.8	36.9			
Area under Boro	3,138	6,137			
% of gross cropped area	9.6	21.4			
Irrigation					
Holdings reporting irrigation	4,426,941	7,570,302			
Irrigated area	4,003,719	8,586,222			
% of holdings reporting irrigation	32.0	42.5			
% of farms reporting irrigation	43.3	64.2			
% of irrigated area to cultivated area	19.9	48.3			

Ref : Census of Agriculture, Bangladesh Bureau of Statistics, 1996

Table 2.3.8 Gross Value of Agriculture Sector at Constant (1995/96) Price

Items	Mill. Taka						
	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
<Value>							
Crops and horticulture	239,925	255,376	258,098	266,136	287,688	305,481	314,147
Animal farming	53,621	55,003	56,456	57,975	59,566	61,241	63,005
Forest & related services	30,836	32,079	33,526	35,257	36,997	38,792	40,695
Fishing	85,500	91,997	100,257	110,240	120,019	114,582	116,978
Total agriculture	409,882	434,455	448,337	469,608	504,270	520,096	534,825
<Share in %>							
Total agri. as % of GDP	24.64	25.87	25.34	25.26	25.58	25.03	24.58
<Share in total agriculture>							
Crops and horticulture	58.5	58.8	57.6	56.7	57.1	58.7	58.7
Animal farming	13.1	12.7	12.6	12.3	11.8	11.8	11.8
Forest & related service:	7.5	7.4	7.5	7.5	7.3	7.5	7.6
Fishing	20.9	21.2	22.4	23.5	23.8	22.0	21.9
Total agriculture	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<Increase rate>							
Crops and horticulture	100.0	106.4	107.6	110.9	119.9	127.3	130.9
Animal farming	100.0	102.6	105.3	108.1	111.1	114.2	117.5
Forest & related service:	100.0	104.0	108.7	114.3	120.0	125.8	132.0
Fishing	100.0	107.6	117.3	128.9	140.4	134.0	136.8
Total agriculture	100.0	106.0	109.4	114.6	123.0	126.9	130.5
Total agri. as % of GDP	100.0	105.0	102.8	102.5	103.8	101.6	99.7

Source: Statistical Yearbook of Bangladesh (2001)

Table 2.3.9 Distribution of Weights of Value-added of Different Crops at Constant Prices

Items	Mill. Taka					
	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
<Value>						
Cereals	165,709	178,315	178,445	181,370	203,324	219,342
Aus	17,039	18,912	19,040	16,458	16,882	18,565
Aman	90,709	99,289	92,192	60,224	102,087	111,275
Boro	50,641	52,340	57,521	74,428	74,463	80,506
Total paddy	158,389	170,541	168,753	151,110	193,432	210,346
Jute	7,891	9,425	11,312	8,693	7,617	8,793
Fruits	10,578	10,621	10,651	10,008	10,035	10,442
Oilseeds	5,800	5,899	5,977	6,995	7,030	5,554
Pulses	7,871	7,893	7,770	7,598	7,611	6,663
Spices	5,568	5,613	5,615	11,018	11,093	11,051
Sugarcane	7,600	7,977	7,840	7,409	7,366	7,186
Vegetables	20,384	20,848	21,636	24,277	25,186	26,309
Potatoes	6,702	6,776	7,035	10,311	10,951	12,005
Total w/ others	239,925	255,376	258,098	266,136	287,688	305,481
<Share in total crops>						
Cereals	69.1	69.8	69.1	68.1	70.7	71.8
Aus	7.1	7.4	7.4	6.2	5.9	6.1
Aman	37.8	38.9	35.7	22.6	35.5	36.4
Boro	21.1	20.5	22.3	28.0	25.9	26.4
Total paddy	66.0	66.8	65.4	56.8	67.2	68.9
Jute	3.3	3.7	4.4	3.3	2.6	2.9
Fruits	4.4	4.2	4.1	3.8	3.5	3.4
Oilseeds	2.4	2.3	2.3	2.6	2.4	1.8
Pulses	3.3	3.1	3.0	2.9	2.6	2.2
Spices	2.3	2.2	2.2	4.1	3.9	3.6
Sugarcane	3.2	3.1	3.0	2.8	2.6	2.4
Vegetables	8.5	8.2	8.4	9.1	8.8	8.6
Potatoes	2.8	2.7	2.7	3.9	3.8	3.9
Total w/ others	100.0	100.0	100.0	100.0	100.0	100.0
<Increase rate>						
Cereals	100.0	107.6	107.7	109.5	122.7	132.4
Aus	100.0	111.0	111.7	96.6	99.1	109.0
Aman	100.0	109.5	101.6	66.4	112.5	122.7
Boro	100.0	103.4	113.6	147.0	147.0	159.0
Total paddy	100.0	107.7	106.5	95.4	122.1	132.8
Jute	100.0	119.4	143.4	110.2	96.5	111.4
Fruits	100.0	100.4	100.7	94.6	94.9	98.7
Oilseeds	100.0	101.7	103.1	120.6	121.2	95.8
Pulses	100.0	100.3	98.7	96.5	96.7	84.7
Spices	100.0	100.8	100.8	197.9	199.2	198.5
Sugarcane	100.0	105.0	103.2	97.5	96.9	94.6
Vegetables	100.0	102.3	106.1	119.1	123.6	129.1
Potatoes	100.0	101.1	105.0	153.8	163.4	179.1
Total w/ others	100.0	106.4	107.6	110.9	119.9	127.3

Source: Statistical Yearbook of Bangladesh (2001)

Table 2.5.1 Most Important Study Reports on Water Resources Development

Sr	Name of Study/Project	Contents
1	Water and Power Development in East Pakistan Report of United Nations Technical Assistance Mission, 1957 (Krug Mission Report)	The report was a product of a study on flood control and water management in East Pakistan after the disastrous floods of 1954, 1955 and 1956 that drew world attention. The most significant recommendation of the report was to create a new government corporation with comprehensive responsibilities and authorities to deal with all water and power development problems. Following the recommendation, East Pakistan Water and Power Development Authority (EPWAPDA) was created in 1959
2	East Pakistan Water and Power Development Authority Master Plan with the assistance of the International Engineering Company of USA (IECO), 1964	The Master Plan was designed to meet the agricultural demand of water through large-scale public sector development and water management in both dry season (irrigation) and wet season (flooding). The Master Plan identified 63 water development projects and grouped them according to geographic locations. Major outcomes of the plan were the initiation of the process of national level water sector planning and the eventual implementation of large-scale Flood Control Drainage (FCD) and Flood Control, Drainage & Irrigation (FCDI) projects including the protection of most coastal zones against tidal flooding.
3	Review of EPWAPDA 1964 Master Plan, International Bank for Reconstruction and Development (IBRD) 1966	Even though, the report indicated that the EPWAPDA 1964 Master Plan was based on insufficient data and was over ambitious, the report agreed with the general principles of regarding the importance of flood control, drainage and irrigation. The report, however, expressed reservations on the suggested strategy and specific proposals of the plan. The IBRD review of 1964 Master Plan played an important role in taking decision by many donor agencies for not to finance large, complex and long gestation schemes.
4	Joint Govt. of Bangladesh-World Bank Mission, 1970	The mission recommended that a new Master Plan (National Water Plan – NWP) was needed for assessment of availability and demands of each sector of water use.
5	Land and Water Resources Sector Study, Bangladesh IBRD, 1972	The Study emphasized the need for quick results from water development efforts to achieve food grain self-sufficiency. It attached high priority to small and medium sized, simple, low cost, labor intensive projects. Such schemes would involve low embankments and gravity drainage. It also proposed low lift pump irrigation and tubewell irrigation. The government, however, did not accept the study as a whole but its water development strategy was greatly influenced by its findings and recommendations.
6	Formation of the National Water Council and Master Plan Organization (MPO), 1983	NWC was constituted in February 1983 to guide and oversee the national water resources planning activities. The MPO was created at the same time and entrusted with the task of preparation of the NWP.
7	National Water Plan Phase-I MPO, 1986	In its first phase, the NWP identified 15 modes of development for the water sector with analysis in four major categories such as: (i) FCD (flood control, and gravity drainage); (ii) irrigation (major and minor irrigation); (iii) FCDI (flood control, drainage and irrigation); and (iv) additional modes. The investment priorities set by NWP included: (a) minor irrigation schemes such as low lift pump (LLP), shallow tubewells (STWs); (b) major irrigation schemes (FCDI); (c) deep tubewells (DTW); and (d) flood control and drainage scheme (FCD).
8	National Water Plan Phase-II MPO, 1991	It was updated NWP-I with a detailed investment program and a list of projects. The 20-year (1991-2010) public investment program gave more emphasis to FCD. Although the government did not formally either accept or reject the NWP reports, the NWP had in its two phases: (a) made important contributions to the knowledge; and (b) understanding of the water resources of Bangladesh. The NWP data provided the basis for subsequent water sector planning.
9	The Flood Action Plan FPCO, 1989-95	After the disastrous floods of 1987 and 1988, the attention of the government of Bangladesh, as well as its development partners (16 donor countries) was once again focused to floods in the country, especially in its urban areas. The Flood Plan Co-ordination Organization (FPCO) was created in 1989 and it undertook 11 main and 15 supporting studies (26 in total) including 2 pilot projects on FCD and river bank protection under a common umbrella known as the Flood Action Plan (FAP). Noteworthy among the features of FAP were: (a) the attention to urban FCD and non-structural flood proofing, though agriculture remained the main focus of regional plans; and (b) emphasis on social and environmental impact, effect on fisheries, and people's participation in flood control and water management.
10	Formation of Water Resources Planning Organization (WARPO) 1992	In June 1992, MPO was renamed as WARPO. The National Water Policy (NWP), published in January 1999, establishes a clear role for WARPO as an apex planning body in the water sector. WARPO will also act as a secretariat to the Executive Committee to the National Water Resources Council who oversees all water resources management activities in the country.
11	The Bangladesh Water and Flood Management Strategy, FPCO, 1995	The BWFMS report was a follow-up to FAP and became the working policy document for the water sector that presented a framework for the development and implementation of specific programs in water sector. It was approved by the government in 1995. It recommended a 5-year program involving: (a) preparation of a National Water Policy; (b) preparation of a National Water Management Plan; (c) strengthening of water sector organizations responsible for planning, construction, operation and maintenance; and (d) implementation of a portfolio of high priority projects.
12	Preparation of National Water Management Plan (NWMP) and a National Water Resources Database (NWRD) WARPO	From 1990 to 1995 when FAP studies were being undertaken, WARPO remained a more or less dormant organization. But after the adoption of the Water and Flood Management Strategy, the government decided to abolish FPCO and merge it with WARPO in January 1996 giving it a new lease of life and the responsibility of preparing a new NWMP and a NWRD. WARPO embarked on the preparation of the NWMP in March 1998 and completed the draft NWMP in March 2001. Finally, the Bangladesh Government on 31 Mar 2004 approved the 25-year NWMP which will be centrally monitored by WARPO.

Table 2.5.2 Outline of National Water Policy (NWPo) (1/2)

Issues	Description
<i>River Basin Management</i>	The government will work with co-riparian countries to establish a system for exchange of information and data on relevant aspects of hydrology, morphology, water pollution, ecology, changing watershed characteristics, cyclone, drought, flood warning, etc., and to help each other understand the current and emerging problems in the management of the shared water sources.
<i>Planning and Management of Water Resources</i>	<ul style="list-style-type: none"> • WARPO will prepare, and periodically update, a NWMP addressing the overall resource management issues in each region and the whole of Bangladesh. • Sector agencies of the government and local bodies will prepare and implement sub-regional and local water-management plans in conformance with the NWMP and approved government project appraisal guidelines. The Executive Committee of the National Water Resources Council (ECNWRC) will resolve any interagency conflict in this regard. • BWDB will implement all major surface water development projects and other FCDI projects with command area above 1,000 ha. The Local Government will implement FCDI projects having a command area of 1,000 ha or less after identification and appraisal through an interagency Project Appraisal Committee. Any interagency dispute will be resolved by means prescribed by the government
<i>Water Rights and Allocation</i>	<ul style="list-style-type: none"> • The ownership of water does not in an individual but in the state • In general, the priority for allocating water during critical periods in the water shortage zones will be in the following order: domestic and municipal uses, non-consumptive uses (e.g. navigation, fisheries and wild-life), sustenance of the river regime, and other consumptive and non-consumptive uses such as irrigation, industry, environment, salinity management, and recreation. The above order of priority could however be changed on specific socio-economic criteria of an area by local bodies through local consensus. • The government may empower the local government or any local body it deems fit, to exercise its right to allocate water in scarcity zones during periods of severe drought, and it will monitor the water regime and enforcement of the regulations through specifically designed mechanisms.
<i>Public and Private Involvement</i>	<ul style="list-style-type: none"> • The management of public water schemes, barring municipal schemes, with command area up to 5,000 ha will be gradually made over to local and community organizations and their O&M will be financed through local resources. • Public water schemes, barring municipal schemes, with command area of over 5,000 ha will be gradually placed under private management, through leasing, concession, or management contract under open competitive bidding procedures, or jointly managed by the project implementing agency along with local government and community organizations. • Ownership of FCD and FCDI projects with command area of 1,000 ha or less will gradually be transferred to the local governments, beginning with the ones that are being satisfactorily managed and operated by the beneficiary/ community organizations.
<i>Public Water Investment</i>	<ul style="list-style-type: none"> • Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment (GPA), the Guidelines for People’s Participation (GPP), the Guidelines for Environmental Impact Assessment (EIA), and all other instructions that may be issued from time to time by the government. • Interests of low-income water users, and that of women, are adequately protected in water resource management.
<i>Water Supply and Sanitation</i>	<ul style="list-style-type: none"> • Preserve natural depressions and water bodies in major urban areas for recharge of underground aquifers and rainwater management. • Mandate local governments to create awareness among the people in checking water pollution and wastage.
<i>Water and Agriculture</i>	<ul style="list-style-type: none"> • Improve efficiency of resource utilization through conjunctive use of all forms of surface water and groundwater for irrigation and urban water supply. • Strengthen crop diversification programs for efficient water utilization.

Table 2.5.2 Outline of National Water Policy (NWPO) (2/2)

Issues	Description
<i>Water and Industry</i>	Standards of effluent disposal into common watercourses will be set by WARPO in consultation with DOE
<i>Water and Fisheries and Wildlife</i>	<ul style="list-style-type: none"> • Water bodies like baors, haors, beels, roadside borrow pits, etc. will, as far as possible, be reserved for fish production and development. Perennial links of these water bodies with the rivers will also be properly maintained. • Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding.
<i>Water and Navigation</i>	<ul style="list-style-type: none"> • Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken. • Minimum stream-flows in designated rivers and streams will be maintained for navigation after diversion of water for drinking and municipal purposes.
<i>Water for Hydropower and Recreation</i>	Recreational activities at or around water bodies will be allowed provided it is not damaging to the environment.
<i>Water for the Environment</i>	<ul style="list-style-type: none"> • Give full consideration to environmental protection, restoration and enhancement measures consistent with the National Environmental Management Action Plan (NEMAP) and the NWMP. • Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time. • Protect against degradation and resuscitate natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes.
<i>Water for Preservation of Haors, Baors, and Beels</i>	<ul style="list-style-type: none"> • Haors that naturally dry up during the winter will be developed for dry season agriculture. • Take up integrated projects in those water bodies for increasing fish production.
<i>Economic and Financial Management</i>	<ul style="list-style-type: none"> • Water charges realized from beneficiaries for O&M in a project would be retained locally for the provision of services within that project. • Effective beneficiary participation and commitment to pay for O&M will be realized at the project identification and planning stages by respective public agencies.
<i>Research and Information Management</i>	Develop a central database and management information system (MIS) consolidating information from various data collection and research agencies on the existing hydrological systems, supply and use of national water resources, water quality, and the eco-system.
<i>Stakeholder Participation</i>	<ul style="list-style-type: none"> • The "Guidelines for People's Participation (GPP) in Water Development Projects" be adhered to as part of project planning by all institutions and agencies involved in public sector management of water resources. • Guidelines for formation of water user groups (WUG) and similar community organizations will be formulated. • Generally 25 percent of the earthwork of any public water project will be offered to specific target groups or beneficiaries. • New projects proposed by a community or local institution will be considered for implementation on a priority basis only when the beneficiaries have mobilized a certain percentage of the total cost as their contribution to the project.

Table 2.5.3 Programs in the NC and NE Areas under LGL, LGED and LGIs

Cluster / Su-Sector	Program			Region	Location	Responsible Agency		Program Phase	Starting Year	Duration (years)
	Code	ID	Title			Leading	Supporting			
Institutional Development	ID	001	Local Government Needs Assessment for Water Management	All	Nationwide	LGD	None	Short Term	2002	2
		002	Independent Regulatory Body for Water Supply and Sanitation Service Sector	All	Nationwide	LGD	MoFinance, New agencies	Short Term, Medium Term	2003	7
		005	Local Government Capacity Building for Water Management	All	Nationwide	LGIs	None	Short Term, Medium Term, Long Term	2003	25
Enabling Environment	EE	002	Field Testing of Participatory Management Models	All	Nationwide	BWDB	LGED, LGIs, CBOs	Short Term, Medium Term	2003	5
Main Rivers	MR	006	Regional River Management and Improvement	All	Nationwide, in regional phases	BWDB	LGIs	Short Term, Medium Term, Long Term	2002	25
		008	North East and South East Regional Surface Water Distribution Networks	NE, SE	NE & SE Regions	BWDB	LGED	Medium Term, Long Term	2016	5
		009	North Central and North West Regional Surface Water Distribution Networks	NW, NC	NW & NC Regions	BWDB	LGED	Long Term	2021	12
Towns and Rural Areas	TR	004	Rural Water Supply and Distribution Systems	All	Rural Areas Nationwide	DPHE	LGIs, DPHE, CBOs	Short Term, Medium Term, Long Term	2001	25
		005	Large and Small Town Sanitation and Sewerage Systems	All	Nationwide	Paurashavas	LGIs, LGED, DPHE, CBOs	Short Term, Medium Term, Long Term	2002	25
		006	Rural Sanitation	All	Rural Areas Nationwide	DPHE	CBOs, Private sector, LGIs	Short Term, Medium Term, Long Term		
		008	Large and Small Town Stormwater Drainage	All	Nationwide	Paurashavas	LGIs	Short Term, Medium Term, Long Term	2003	25
Disaster Management	DM	003	Flood Proofing in the Charlands and Haor Basin	NW, NE, RE	NW, NE, & RE Regions	NGOs	LGED	Short Term, Medium Term, Long Term	2003	10
	DM	004	National, Regional and Key Feeder Roads - Flood Proofing	NW, NC, NE, SE, SC, SW	Regions NW, NC, NE, SE, SC, SW	RHD	LGED	Short Term, Medium Term, Long Term	2001	25
Agriculture and Water Management	AW	002	Improved Performance of Existing Public Surface Water Irrigation Schemes	All	Nationwide	BWDB	BMDA, CBOs, LGIs, NGOs, Private Sector	Short Term, Medium Term, Long Term	2004	20
		003	New Public Surface Water Irrigation Schemes	All	Nationwide	BWDB	LGED	Medium Term, Long Term	2005	15
		005	Improved Water Management at Local Government Level	All	Nationwide	LGED	None	Short Term, Medium Term, Long Term	2001	24
		006	Improved Water Management at Community Level	All	Nationwide	LGED	LGIs, DAE	Short Term, Medium Term, Long Term	2001	24
		007	Rationalisation of Existing FCD Infrastructure	All	Nationwide	BWDB	LGED	Medium Term, Long Term	2007	20
Environment and Aquatic Resources	EA	006	Unspecified Regional Programmes	All	Nationwide	WARPO	DoE, DoFish, DoForest, BWDB, LGED, RHD	Medium Term, Long Term	2005	15
		008	Environmentally Critical Areas and Integrated Wetland Management	All	Nationwide	DoE	WARPO, LGIs	Short Term, Medium Term, Long Term	2003	23

Source: National Water Management Plan, WARPO, December 2001

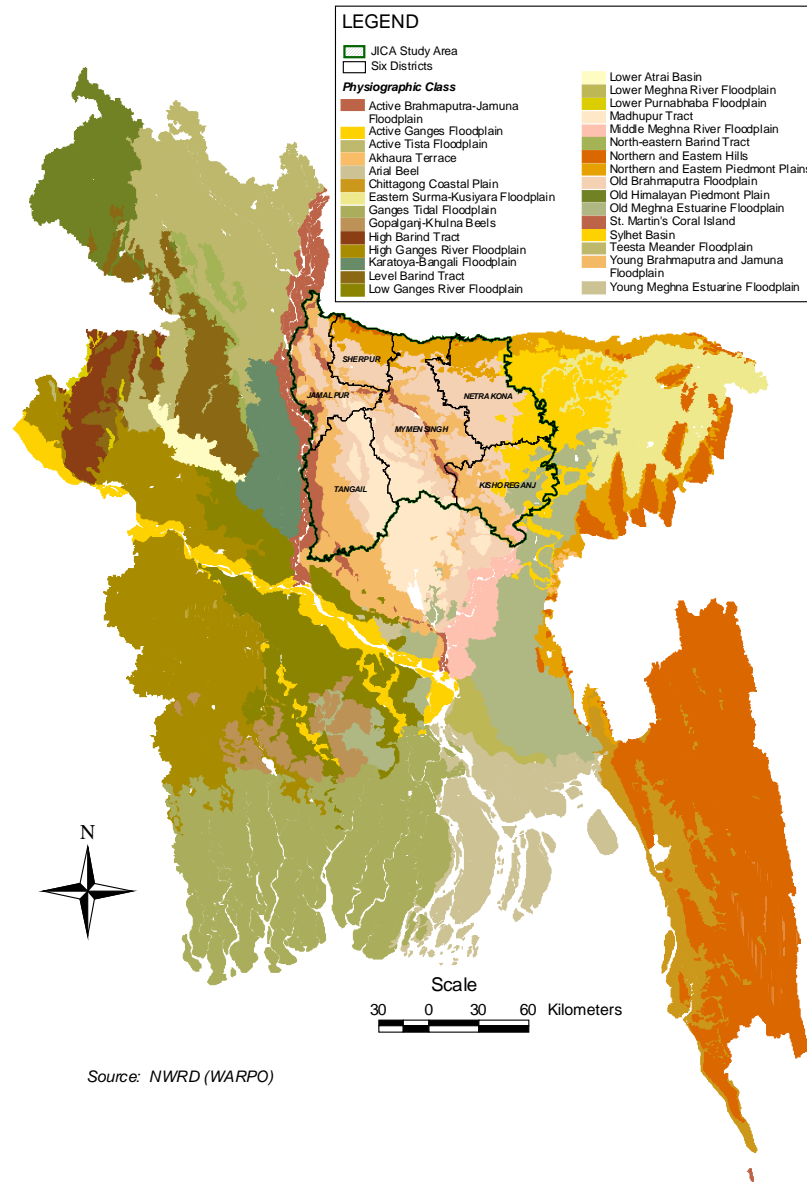


Fig. 2.2.1 Physiography of Bangladesh

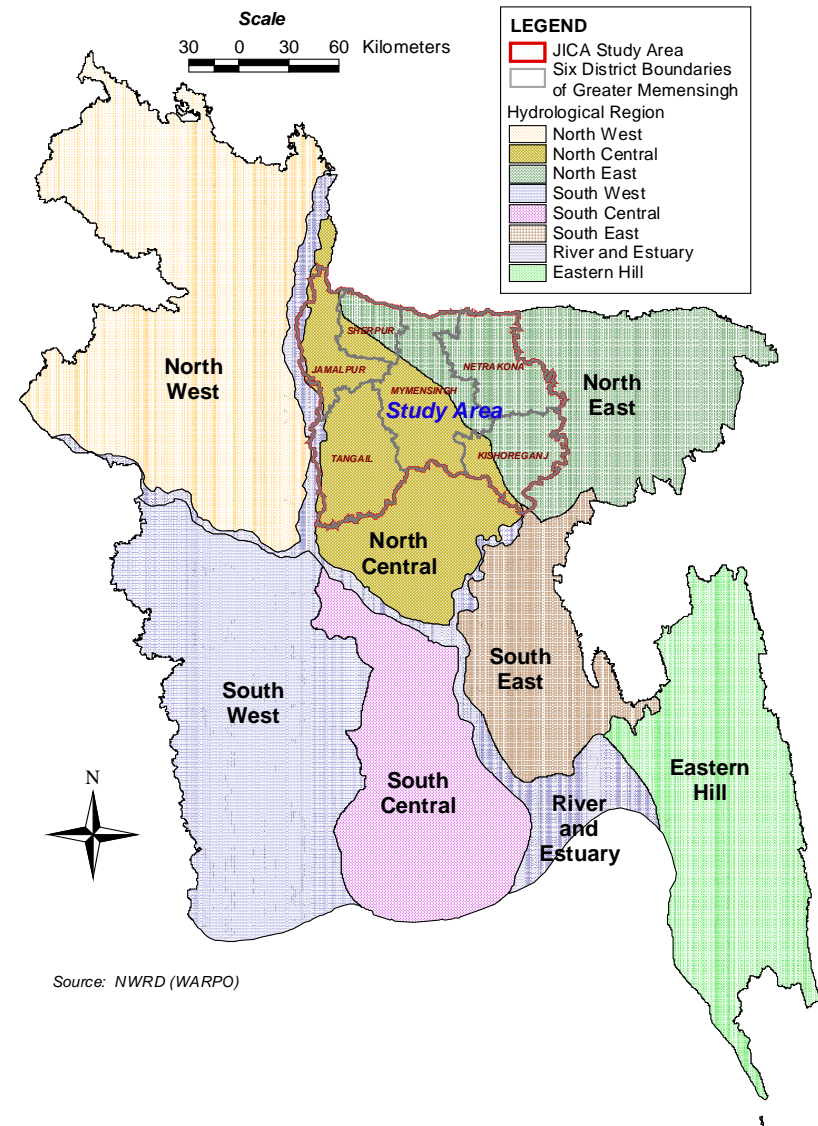


Fig. 2.2.2 Hydrological Regions of Bangladesh

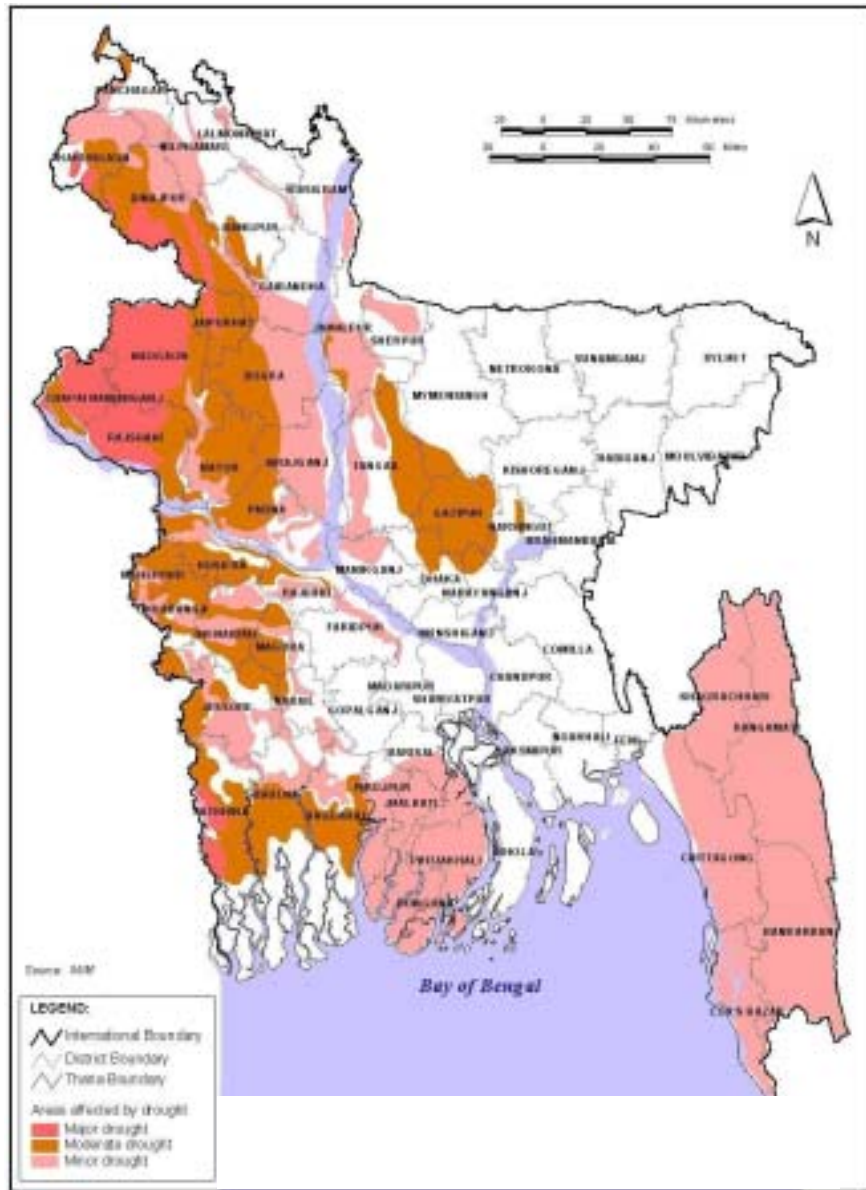


Fig. 2.2.3 Areas Affected by Drought

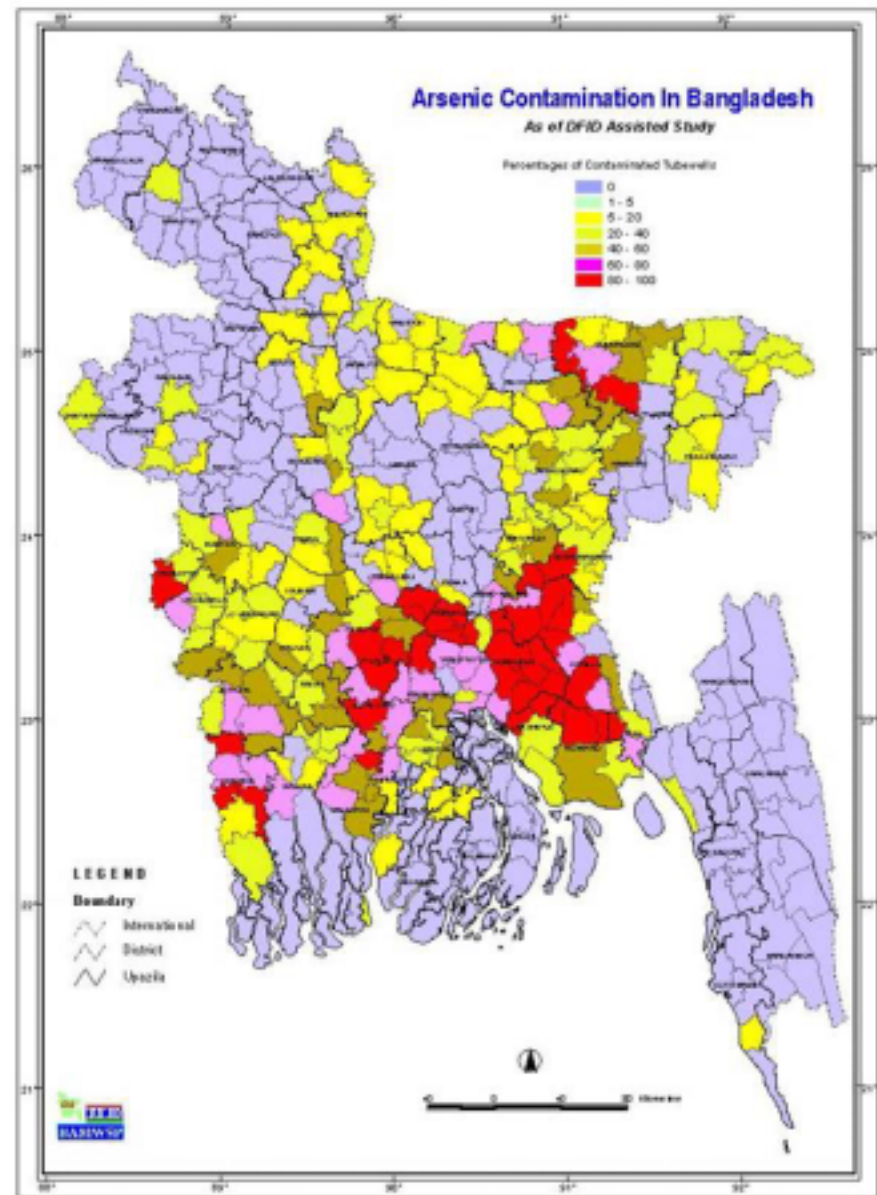


Fig. 2.2.4 Arsenic Contamination in Bangladesh

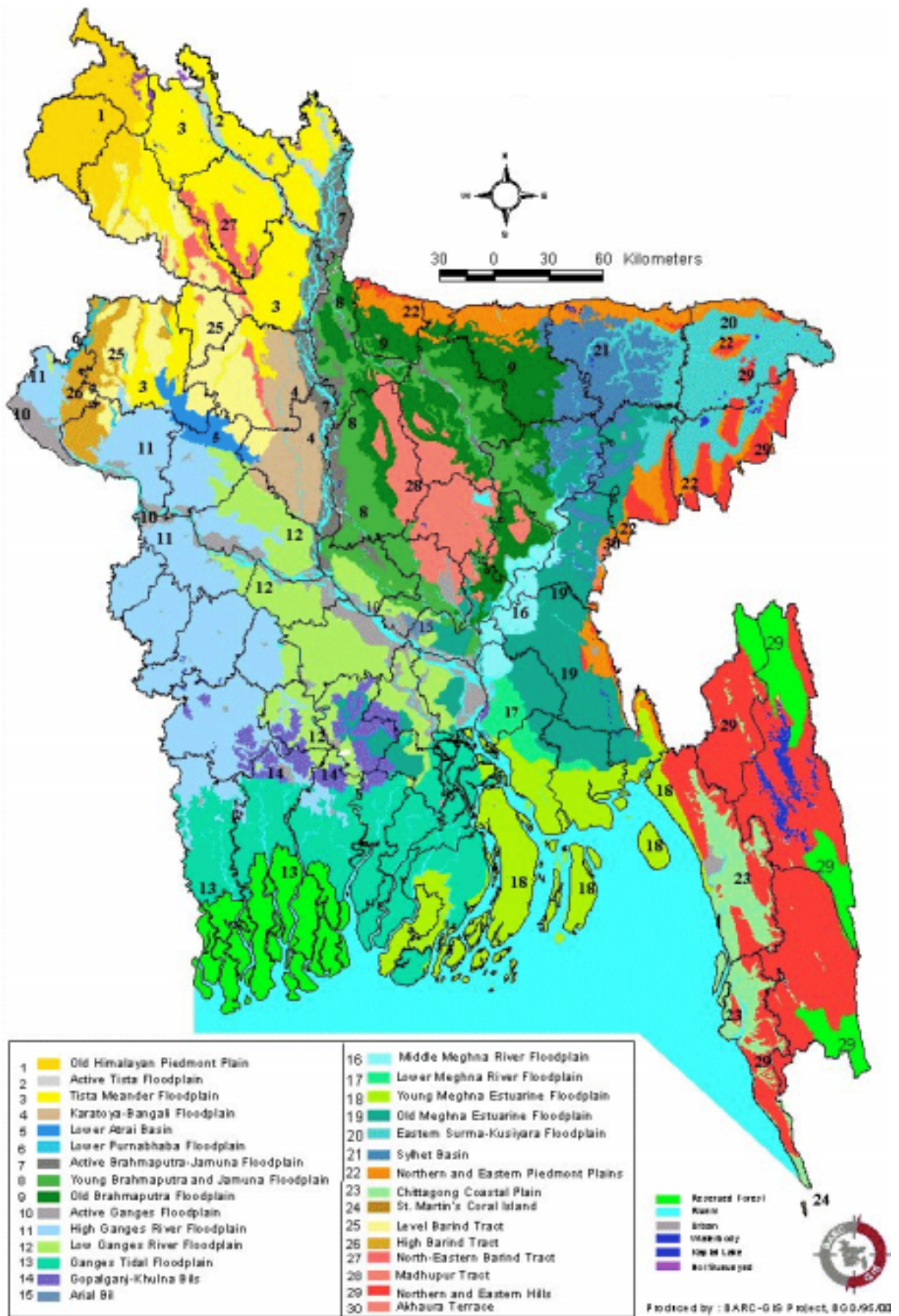


Fig. 2.3.1 Agroecological Zone in Bangladesh