BANGLADESH WATER DEVELOPMENT BOARD
LOCAL GOVERNMENT ENGINEERING DEPARTMENT

PREPARATORY SURVEY
ON
UPPER MEGHNA RIVER BASIN WATERSHED MANAGEMENT IMPROVEMENT PROJECT
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

FINAL REPORT

VOLUME-I MAIN REPORT

FEBRUARY 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

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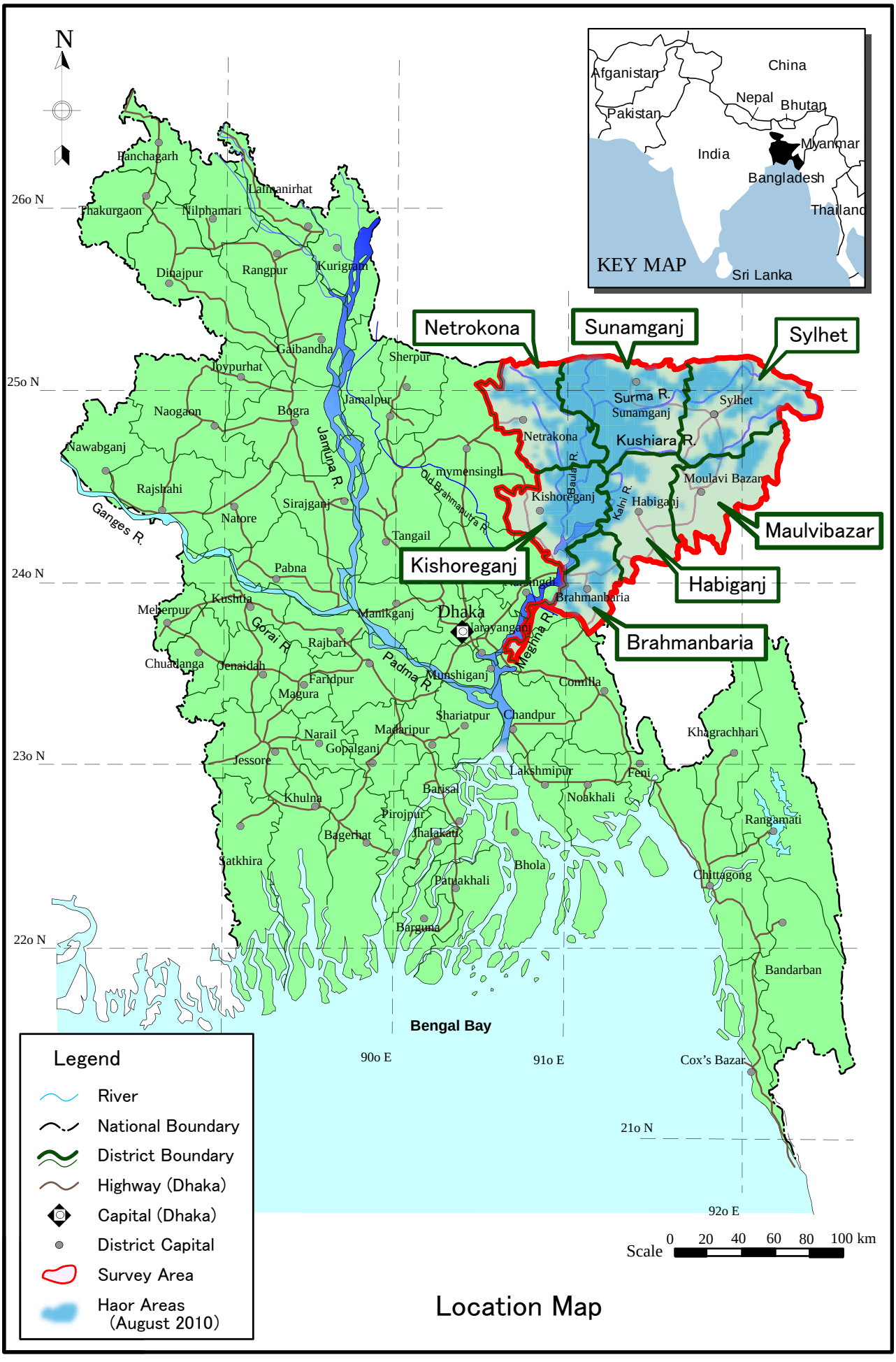
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KEY MAP
Afganistan
China
Pakistan
Nepal
Bhutan
India
Myanmar
Bangladesh
Thailand
Sri Lanka
Netrokona
Sunamganj
Sylhet
Maulvibazar
Habiganj
Brahmanbaria
Kishoreganj
Panchagarh
Thakurgaon
Lalmanirhat
Nilphamari
Dinajpur
Rangpur
Kurigram
Gaibandha
Joypurhat
Sherpur
Jamalpur
Naogaon
Bogra
Nawabganj
Rajshahi
Jamuna R.
Sirajganj
Natore
Ganges R.
Pabna
Kushtia
Meherpur
Gorai R.
Rajbari
Chuadanga
Jenaidah
Faridpur
Magura
Padma R.
Manikganj
Dhaka
Narayanganj
Munshiganj
Tangail
Old Brahmaputra R.
mymensingh
Netrakona
Surma R.
Sunamganj
Sylhet
Kushiara R.
Baulai R.
Kishoreganj
Kahi R.
Habiganj
Moulavi Bazar
Meghna R.
Brahmanbaria
Comilla
Shariatpur
Chandpur
Madaripur
Narail
Gopalganj
Jessore
Khulna
Satkhira
Bagerhat
Pirojpur
Barisal
Jhalakati
Patuakhali
Barguna
Bhola
Lakshmipur
Noakhali
Feni
Khagrachhari
Rangamati
Chittagong
Bandarban
Cox's Bazar
Bengal Bay
26o N
25o N
24o N
23o N
22o N
21o N
90o E
91o E
92o E
Legend
River
National Boundary
District Boundary
Highway (Dhaka)
Capital (Dhaka)
District Capital
Survey Area
Haor Areas (August 2010)
Scale
0 20 40 60 80 100 km
Location Map

EXECUTIVE SUMMARY

1. Introduction

1.1 Background of the Survey

1. The discharges from the upstream reaches of the Upper Meghna River basin elevate the surface of stagnant water in the depressed areas. During the month of June, it merges the water in depressions to form a huge natural pond called the haor. Most of the haor area is under water until the end of October. The area of the haor extends to 8,500-8,600 km^2 in August, almost every year. The water level starts to subside in October until December when the area had dried up except for the river channels and depressed areas.

2. The haor area administratively belongs to seven districts, namely, Sunamganj, Sylhet, Habiganji, Maulvibazar, Netrokona, Kishoreganji, and Brahmanbaria. More than 50% of households are engaged in agriculture sector in the haor area according to the Labour Force Survey conducted in 2010. The main agricultural crop produced is boro rice which significantly shared 13.5% of the national foodgrain production in 2010/2011. Farmers start to plant boro rice in December and harvest in April when the water level of the haor is lowest. In April, however, floods triggered by heavy pre-monsoon rains called flash floods tend to submerge the paddy, depriving farmers of their only source of income. Poverty due to flash floods in the Upper Meghna River basin has been one of the most serious issues of the Government of Bangladesh (GOB).

1.2 Policy, Strategy, and Development Plans, and Projects of the Government

3. In order to cope with the issues, the government formulated various policies, strategies, and plans. Those referred to in this survey are as follows:

- Flood Action Plan (FAP) 6 Phase II (1994-1997)
- National Water Policy (NWP) (1999)
- National Water Management Plan (NWMP 2004)
- Sixth Five-Year Plan FY2011-FY2015 (SFYP 2011)
- Five-Year Strategic Plan of BWDB (2010)
- Master Plan of Haor Area (2012)

1.3 Related Existing Projects Referred to for Project Formulation

4. The GOB has implemented several interventions in line with the formulated policies. This survey has selected some of the projects to be referred to in the formulation of the project. The selected projects are as follows:

- Northern Bangladesh Integrated Development Project (NOBIDEP);
- Haor Infrastructure and Livelihood Improvement Project (HILIP);
- Sunamganj Community-based Resource Management Project (SCBRMP); and
- Southwest Area Integrated Water Resources Planning and Management Project.

1.4 Rationale of the Survey

5. The Japan International Cooperation Agency (JICA) has conducted surveys and studies to extend its cooperation to Bangladesh. JICA established the necessity to focus its cooperation to Bangladesh on the Meghna River basin because of the seriousness of the damages caused by flash floods and the significant poverty conditions in the area as indicated in the policies of GOB as mentioned above. JICA duly commenced the Data Collection Survey on Water Resources Management in Haor Area of Bangladesh to review the projects proposed in the master plan based on technical and economic aspects and to propose priority projects in 2012. Accordingly, JICA and the Bangladesh Water Development Board (BWDB) agreed to conduct this Preparatory Survey on the Upper Meghna River Basin Watershed Management Improvement Project that comprises three components, i.e., flood control and livelihood enhancement through rural infrastructure development and promotions of agricultural and fisheries in the area. JICA entrusted the JICA Survey Team with the survey works and commenced it in May 2013.

6. During the course of the study, both JICA and the government realized that implementation of measures to mitigate flood damage and to enhance livelihood as one effort is crucial in improving the living standards in the haor area because people in the area are suffering from the so-called vicious cycle of poverty and vulnerability to disaster. Eventually, both sides decided to implement the project vesting the same priority to livelihood enhancement and flood control. JICA dispatched a mission to Bangladesh to discuss the implementing arrangement of the project with BWDB and Local Government Engineering Department (LGED). The minutes of discussions signed by JICA, BWDB, and LGED on 24 July 2013 defined the arrangement.

1.5 Objectives of the Survey

7. The objectives of the preparatory survey is to identify the target components of the project, namely, Component 1: Mitigation of the damages caused by flash floods, Component 2: Development of rural infrastructure, and Component 3: Livelihood enhancement through promotion of agriculture and fishery. The survey will propose an institutional arrangement for the implementation, operation and maintenance of the project as well. To study the environmental and social considerations is another important objective of the preparatory survey for its smooth implementation. Furthermore, to estimate the cost and benefit of the project is another crucial task of the preparation together with the evaluation of the viability of the proposed project for budgetary arrangement.

1.6 Survey Area

8. The target area of the project is the haor area, which is about 8,500 km^2. However, the survey covers all the seven districts. The total area of the seven districts is about 20,000 km^2. The target area shares about 42% of the survey area. The survey area is illustrated and shown in the location map provided in the opening page of this report together with the target area. Table 1 presents the areas and population of each district and the haor areas therein.

Table 1 Areas and Population of the District and Haor Areas Therein

District	District Area (km^2)	Haor Area (km^2)	District Population (in millions)
Sunamganj	3,747	2,685	2.47
Sylhet	3,452	1,899	3.43
Habiganj	2,636	1,095	2.09
Maulvibazar	2,799	476	1.92
Netrokona	2,794	793	2.23
Kishoreganj	2,688	1,399	2.91
Brahmanbaria	1,881	296	2.84
Total	19,999	8,585	17.89

Source: Basis of the district area and population is the Community Report, BBS, 2012
Basis of the haor area is the Master Plan of Haor Area, 2012, BHWDB

2. Project Area

2.1 Socioeconomic Features

9. Households of 3,489,000 or a population of 17,800,000 occupied the seven districts in 2011. The estimated area is 20,000 km^2 and the mean population density was 890 persons/km^2. The population in the survey area shares 12.4% of the national population. The details on household and population are given in Table 2.

Table 2 Household and Population (2001 and 2011)

Area	**Household** (in thousands)		**Population** (in millions)	
	2001	**2011**	**2001**	**2011**
National	25,491	32,173	124	144
Survey Area				
Brahmanbaria	429	539	2.4	2.8
Kishoreganj	535	627	2.6	2.9
Netrakona	410	479	2.0	2.2
Habiganj	322	393	1.8	2.1
Maulvibazar	293	361	1.6	1.9
Sunamganj	350	440	2.0	2.5
Sylhet	*424*	*596*	*2.5*	*3.4*
Total	**2,763**	**3,489**	**14.9**	**17.8**

Source: Household and Population 2001, Community Report 2012, BBS

10. The share of household income source by division is summarized in Table 3.

Table 3 Main Income Source of Household by Divisions (Percentage)

Name of Division	**Total House-holds**	**1) Agriculture**			**2) Non-agriculture**			**3) Service**	**4) Other**
		Self-Employed	**Day Laborer**	**Total**	**Self-Employed**	**Day Laborer**	**Total**		
Barishal	2,022	26.7%	13.1%	39.8%	16.1v	19.3%	35.4%	12.4%	12.4%
Chittagong	5,786	17.4%	13.5%	30.9%	15.1%	13.8%	28.8%	22.4%	17.9%
Dhaka	10,707	19.7%	13.8%	33.6%	19.2%	14.2%	33.4%	21.0%	12.0%
Khulna	4,030	26.9%	22.3%	49.2%	18.7%	14.0%	32.7%	11.0%	7.1%
Rajshahi	4,860	28.8%	24.3%	53.1%	17.1%	13.0%	30.1%	7.8%	9.0%
Rangpur	4,068	26.9%	28.9%	55.8%	19.0%	13.6%	32.6%	6.9%	4.7%
Sylhet	*1,862*	*27.5%*	*25.0%*	*52.5%*	*8.9%*	*17.3%*	*26.3%*	*9.3%*	*11.9%*
Bangladesh	**33,335**	**23.2%**	**18.8%**	**42.0%**	**17.3%**	**14.3%**	**31.7%**	**15.2%**	**11.1%**

Source: Report on Labor Force Survey 2010, Bangladesh Bureau of Statistics 2011

The table indicates that 53% of the households in Sylhet Division, which represent the haor area, are engaged in the agriculture sector. Agriculture is the most important source of income of the residents.

11. Agriculture in the haor area is important to the national economy as well. The following table indicates that food grain production in Sylhet Division shares 13.5% of the national production.

Table 4 Food Grain Production in Haor Area

Name of District	Cultivated Land		Food Grain Production*	
	1'000 ha	Percent of Bangladesh	1'000 t	Percent of Bangladesh
Brahmanbaria	119	1.5%	582	1.7%
Kishoreganj	356[1]	4.5%[1)]	786	2.4%
Netrokona			864	2.6%
Habiganj	608[2]	7.8%[2)]	786	2.3%
Moulvibazar			435	1.3%
Sunamganj			488	1.4%
Sylhet			592	1.8%
Total	1,083	13.8%	4,547	13.5%
Bangladesh	**7,841**		**33,767**	

Note: 1): Kishoreganj and Netrokona districts are combined.
2): Sylhet, Habiganj, Moulvibazar, and Sunamganj districts are combined.

Source: Agriculture Census 2008 and Yearbook of Agricultural Statistics of Bangladesh 2010 and 2011.

12. The fish production in the haor area is summarized in Table 5. The combined production composes 13.2% of the total fish production in Bangladesh. Compared with other areas, fish production in beels and floodplains have the higher shares in the haor area.

Table 5 Fish Production in Haor Area (2009-2010)

Name of District	Production (t)					
	River	Beel	Floodplain	Pond	Others[(a)]	Total
Brahmanbaria	1,291	287	16,003	18,533	396	36,510
Kishoreganj	1,229	6,205	33,034	14,545	65	55,078
Netrokona	316	5,140	35,042	19,249	231	59,978
Habiganj	137	1,832	5,867	10,006	23	17,865
Moulvibazar	599	1,832	15,815	14,611	361	33,218
Sunamganj	532	12,895	39,182	19,043	471	72,123
Sylhet	452	3,239	25,788	9,368	251	39,098
Total	**4,556**	**31,430**	**170,731**	**105,355**	**1,798**	**313,870**
% of Bangladesh	**3.2**	**39.7**	**21.8**	**9.2**	**0.8**	**13.2**
Bangladesh	**141,148**	**79,209**	**781,807**	**1,140,484**	**239,268**	**2,381,916**

Source: Yearbook of Agricultural Statistics of Bangladesh, 2011.

13. The share of people living below the poverty lines in each division is summarized in the following Table 6. The share of Sylhet Division under the lower poverty line (LPL) is higher compared with the national level.

Table 6 Population Rate Living below Poverty Lines per Division

Division	LPL (Lower Poverty Line)			UPL (Upper Poverty Line)		
	Total	Rural	Urban	Total	Rural	Urban
Barisal	26.7%	27.3%	24.2%	39.4%	39.2%	39.9%
Chittagong	13.1%	16.2%	4.0%	26.2%	31.0%	11.8%
Dhaka	15.6%	23.5%	3.8%	30.5%	38.8%	18.0%
Khulna	15.4%	15.2%	16.4%	32.1%	31.0%	35.8%
Rajshahi	21.6%	22.7%	15.6%	35.7%	36.6%	30.7%
Sylhet	***20.7%***	***23.5%***	***5.5%***	***28.1%***	***30.0%***	***29.0%***
National	**17.6%**	**21.1%**	**7.7%**	**31.5%**	**35.2%**	**21.3%**

Source: HIES 2010

14. The household survey conducted presents the balance of income and expenditure as follows:

Table 7 Average Annual Income and Expenditure of Household Survey

(BDT/year)

District	No. of Household Member	No. of Earners	No. of Samples	Average Income			Average Expenditure
				Total	Dry Season	Rainy Season	
Sunamganj	5.96	1.62	71	135,533	107,226	28,306	143,559
Habiganj	6.14	1.66	70	205,465	119,055	86,410	191,636
Netrokona	6.07	1.53	72	163,787	*81,808	*81,979	169,014
Kishoreganj	5.77	1.85	107	149,291	101,487	47,804	140,736
Brahmanbaria	5.49	2.03	35	170,664	115,908	54,756	179,699
Total	**5.91**	**1.72**	**355**	**162,663**	**103,529**	**59,134**	**160,914**

Note: * In Netrokona, income during dry season and rainy season are similar. Higher income from business/trade (18% of total income) and agriculture during the rainy season (27% of total income) are considered as main reasons that make them different among others.
Source: Household Survey of the JICA Survey Team, July 2013

It should be noted that the estimated small balance is due to the nonavailability of electricity and water supply.

15. The household survey indicates that flash floods have brought serious damages to the economy in the survey area. Table 8 below presents the damages.

Table 8 Economic Losses on Products and Assets by Flash Floods

Year	Loss of Production (Average per Affected Household)						Loss of Assets*		
	Boro Rice		Other Crops		Fish Production				
	No. of Samples	Avg. Loss on Production	No. of Samples	Avg. Loss on Production	No. of Samples	Avg. loss on Production	No. of Samples	Total Loss (BDT)	Average Loss (BDT)
2004	**284**	**75%**	57	79%	13	79%	**133**	**3,118,000**	**23,444**
2008	62	66%	1	90%			1	2,500	2,500
2010	**210**	**53%**	37	52%	9	31%	**71**	**995,000**	**14,014**
2013	84	39%	1	50%	1	23%	46	1,099,000	23,891

Note: * Asset loss value was asked from affected farmers through open-ended question.
Source: Household Survey of the JICA Survey Team, July 2013

2.2 Overview of the Physical Conditions

16. The substantial rivers that have formed the floodplains are the Surma-Kushyara River, the old Brhamaputra River, and the old Meghna River. The watershed area of the Surma-Kushyara River shares more than 50% of the total survey area of 20,000 km^2 extending from northeast to northwest of the area. The approximate share of the floodplains formed by

the old Brahmaputra and Meghna rivers are almost the same at 15% of the total survey area. These floodplains are flat and low-lying with elevations from 2 to 5 m BSD. Piedmont plains from two sides of the triangular survey area on its northern side (northern piedmont) and northeast to south side (eastern piedmont). The plain comprises alluvial fans. Several hills emerge in the piedmont plain in the Eastern Piedmont. The total share of the piedmont plains is approximately 20%. Sand and silt are substantial materials of the floodplains and piedmont hills. Meanwhile, the hills are formed with consolidated and unconsolidated sandstones, siltstones, and shale of various rocks of Tertiary age.

17. There is a huge depressed area in the downstream reach of the Surma-Kushiyara River which is almost the centre of the survey area. The depression is attributed to the subsidence caused by plate tectonics in the area. A geomorphologic study estimated an annual subsidence rate of 20 mm/year. Flood basins within this large subsidence form deeply inundated haors such as Tangua, Shanir, Matian, Karcher, and Kalner. The haors are divided by natural dikes of channels and are very poorly drained. Flood water in this area does not drain which keeps it wet throughout the year.

18. The sub-tropical monsoon characterizes the climate of the northeast region of Bangladesh. The southwest monsoon brings wet air mass to the region from the Indian Ocean through the Bay of Bengal with a predominant northeastern direction from the middle of May to October. The air mass meets the steep and high hills located at the states of Assam, Meghalaia, and Tripura in India. The orographic effects of the hills bring the world's heaviest rainfall in the southern slopes of the hills and the piedmont plains, which extend to the northeast region of Bangladesh. The flood plain itself is under the influence of these orographic effects as well. The Meghna River drains the substantial discharges thereof.

19. The Master Plan of Haor Areas prepared by the Bangladesh Haor and Wetland Development Board (BHWDB) in 2012 estimated the average annual rainfall for the districts in the survey area since 1961 as presented in Table 9:

Table 9 Estimated Decadal Mean Annual Rainfall Depth (in mm)

District	Station	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010
Sunamganj	Sunamganj	5,242	5,183	6,224	6,387	5,371
Sylhet	Sylhet	3,899	4,259	4,644	4,001	4,157
Netrokona	Netrokona	2,647	2,969	2,906	3,311	3,003
Habiganj	Habiganj	2,255	2,682	2,561	2,521	2,426
Kishoreganj	Kishoreganj	2,086	2,339	2,387	2,404	1,921
	Itna	2,509	2,590	2,526	2,309	2,383
Brahmanbaria	Brahmanbaria	1,629	2,179	2,201	2,099	2,013

Source: Master Plan of Haor Area

The figures in the above table enunciate the spatial trend of the orographic effects from north to south. The figures imply the increasing trend of rainfall depth for a long period of time as well.

20. The master plan estimated the seasonal distributions of rainfall depth based on the recorded data from 1961 to 2010. Table 10 indicates the distribution for each districts:

Table 10 Mean Seasonal Distribution of Rainfall Depth from 1961 to 2010 (in mm)

District	Station	Pre-monsoon Season	Monsoon Season	Post-monsoon Season	Dry Season
Sunamganj	Sunamganj	1,006	4,543	302	188
Sylhet	Sylhet	951	2,845	262	221
Netrokona	Netrokona	624	2,209	261	90
Maulvibazar	Maulvibazar	681	1,530	185	135
Habiganj	Habiganj	653	1,532	239	124
Kishoreganj	Kishoreganj	494	1,563	209	93
Brahmanbaria	Brahmanbaria	570	1,274	200	110

Source: Master Plan of Haor Area

The rainfall depth during the monsoon season is reasonably high. However, it should be noted that the rainfall depth in the pre-monsoon period is very high taking into account a period of one month only. High discharge caused by intensive rainfall is concentrated in the survey area where the regulating capacity is low since the water level is at its lowest. The inflow brings an abrupt rise in water level in the survey area as flash floods submerge the vast low lying cultivated lands.

2.3 Necessity of the Project

21. The survey developed equations that express the relationship among three variables, i.e., the magnitude of the damages caused by a natural disaster, economic situation or the balance of income and expenditure of the people, and the capacity of a society to prevent disasters. The equations enunciated that (1) disaster preparedness is proportional to the balance of income and expenditure and (2) disaster mitigation works are effective to enhance the income of residents with a certain time lag.

22. In this consequence the survey concluded that (1) the survey area is suffering from a vicious cycle of poverty and disaster as presented by the data in Tables 7 and 8, (2) interventions to mitigate disaster and to improve livelihood could be effective to get away from the spiral if they are implemented simultaneously in the repetitive disaster-prone areas like the haor area, and (3) interventions should be substantial to secure durability for a certain period against repetitive disasters. In this manner, the mechanism of disaster prevention and poverty mitigation expressed in the developed equations attested the necessity of the project.

3. Flood Management Facility

3.1 Objectives of Component 1

23. The objectives of Component 1 are (1) to protect boro rice, the only source of income of the majority, from flash floods during the pre-monsoon season, (2) to secure the safety of the lands currently protected by full embankments from haor water, and (3) to provide facilities to manage landside water to a desirable state through the operation of a regulator or drainage. The main interventions of Component 1 are the following:

- Construction of new submergible embankments;
- Rehabilitation of the existing full or submergible embankments;

- Refurbishment of regulating facilities; and
- Re-excavation of drainage canals.

3.2 Selection of Subprojects

24. The preceding data collection survey adopted 12 embankment rehabilitation projects proposed in the Master Plan of Haor Areas in the survey area for the candidates in the rehabilitation of embankment works. The Data Collection Survey added three rehabilitation projects taking into account its economic advantages. This survey adopted 15 embankment rehabilitation projects as the subprojects for Component 1 in line with the selection conducted by the Data Collection Survey.

25. The Master Plan of Haor Areas proposed 26 new construction projects in the survey area. In the Data Collection Survey, two out of the proposed 26 were evaluated as unnecessary to provide embankment because the ground elevations of the said projects are high enough as compared with the selection criteria of water level with a return period of ten years. The said survey further excluded the two projects because the hydraulic analysis revealed the high possibility that the embankments of the two projects would significantly elevate the water level in the upstream reaches. The raised water level would increase the flooding risks of other haors which are protected by the existing embankments. Subsequently, the survey adopted 22 new embankment projects to be constructed. The survey further prioritized the adopted 37 projects for rehabilitation and construction mainly through preliminary economic evaluation.

26. This preparatory survey reviewed the selection procedures conducted in the Data Collection Survey to confirm the validity to adopt these 37 projects as candidate subprojects of this survey. This survey further assessed the environmental and social impacts of the selected projects. The assessment concluded that no significant impact is foreseeable. Eventually, 15 rehabilitation projects and 14 new construction projects were selected as subprojects of Component 1 taking into account the available budget for the implementation. Table 11 presents the principal features of the selected subprojects.

Table 11 Principal Features of the Selected Subprojects for Component 1

No.	Subproject Name	Location	Principal Features of Major Structures
i) Rehabilitation of existing haor projects			
r-1	Dampara Water Management Scheme	Upazila : Purbodhola District: Netrakona	Resectioning of embankment = 200 m (Full), 460 m (Submergible) Replacement of regulator gates = 15 nos. Re-excavation of canal = 12 km (Kalihor Khal) Pipe cleaning = 3 locations Sluice gate (0.6 m x 0.6 m) = 23 nos.
r-2	Kangsa River Scheme	Upazila: Sadar, Purbodhola District: Netrakona	Resectioning of embankment = 40 m (Full) Replacement of regulator gates = 16 nos. Maintenance equipment = 1 no.
r-3	Singer Beel Scheme	Upazila : Barhatta District: Netrakona	Resectioning of embankment = 100 m (Full),125 m (Submergible) Replacement of regulator = 1 no. Re-excavation of canal = 2 km (1 km + 1 km) Pipe cleaning = 2 locations

No.	Subproject Name	Location	Principal Features of Major Structures
r-4	Baraikhali Khal Scheme	Upazila: Nandail, Hosenpur Kishoreganj Sadar District: Mymensingh, Nandail, Kishoreganj	Resectioning of embankment = 10 m (Full) Re-excavation of canal = 24.5 km Replacement of regulator gates = 6 nos. Flap gate (0.5 m x 0.5 m) = 2 nos. Pipe cleaning=2 locations Maintenance equipment = 1 no.
r-5	Alalia-Bahadia Scheme	Upazila: Katiadi, Pakundia District: Kishoreganj	Replacement of regulator gates = 2 nos. Re-excavation of canal = 8 km (5 km + 3 km)
r-6	Modkhola Bhairagirchar Subproject Scheme	Upazila: Pakundia, Katiadi District: Kishoreganj	Resectioning of embankment = 500 m (Full)
r-7	Ganakkhalli Sub-scheme	Upazila: Kuliarchar District: Kishoreganj	Replacement of regulator gates = 3 nos. Maintenance equipment = 1 no.
r-8	Kairdhala Ratna Scheme	Upazila: Ajmiriganj, Baniachong District: Habiganj	Resectioning of embankment = 60 m (Submergible) Replacement of regulator gates = 9 nos. Maintenance equipment = 1 no.
r-9	Bahira River Scheme	Upazila: Ajmiriganj, Baniachong District: Habiganj	Resectioning of embankment = 6,000 m (Submergible) Installation of regulators = 2 nos. Re-excavation of canal = 20 km Maintenance equipment = 1 no.
r-10	Aralia Khal Scheme	Upazila: Baniachong District: Habiganj	Replacement of regulator gates = 4 nos. Re-excavation of canal = 2.4 km Maintenance equipment = 1 no.
r-11	Chandal Beel Scheme	Upazila: Bancharampur District: Brammanbaria	Resectioning of embankment = 100 m (Full) Reinstallation of regulator = 1 no. Re-excavation of canal = 1.5 km Maintenance equipment = 1 no.
r-12	Satdona Beel Scheme	Upazila: Bancharampur District: Brammanbaria	Reinstallation of regulator = 2 nos. Maintenance equipment = 1 no.
r-13	Gangajuri FCD Subproject	Upazila; Bahubol, Baniachong and Sadar District Habiganj	Embankment = 600 m (Full) Replacement of regulator gates = 20 Re-excavation of canal = 4.5 km
r-14	Kaliajuri Polder #02 Scheme	Upazila; Kaliajuri District Netrakona	Embankment = 810 m (Submergible) Replacement of regulator gates = 19 nos.
r-15	Kaliakjuri Polder #04 Scheme	Upazila; Kaliajuri District Netrakona	Embankment = 630 m (Submergible) Replacement of regulator gates = 3 nos.

No.	Subproject Name	Location	Principal Features of Major Structures
ii) Development of new haor projects			
n-1	Boro Haor Project (Nikli)	Upazila: Karimganj, Katiadi, Kishoreganj Sadar, Nikli District: Kishorganj	Embankment = 9.6 km Re-excavation of canal = 10 km 9-vent regulators = 2 nos. 3-vent regulator = 1 no. (including vent number of flushing gate)
n-2	Naogaon Haor Project	Upazila: Itna, Karimganj, Mithamain, Nikli District: Kishorganj	Embankment = 34.1 km Re-excavation of canal = 20 km 9-vent regulators = 2 nos. 8-vent regulator = 1 no. 4-vent regulator = 1 no. (including vent number of flushing gate)
n-3	Jaliar Haor Project	Upazila: Chhatak District: Sunamganj	Embankment = 6.8 km Re-excavation of canal = 8 km 2-vent regulator = 1 no. 2-vent regulator = 1 no.
n-4	Dharmapasha Rui Beel Project	Upazila: Dharmapasha, Kalmakanda, Barhatta, Mohanganj District: Sunamganj & Netrokona	Embankment = 57.1 km Re-excavation of canal = 5 km 9-vent regulators = 3 nos. 8-vent regulators = 2 nos. 6-vent regulator = 1 no. 3-vent regulator = 1 no.
n-5	Chandpur Haor Project	Upazila: Katiadi, Nikli District: Kishorganj	Embankment = 2.1 km Re-excavation of canal = 5 km 4-vent regulator = 1 no. 1-vent regulator = 1 no. (including vent number of flushing gate)
n-6	Suniar Haor Project	Upazila: Tarail District: Kishorganj & Netrokona	Embankment = 16.2 km Re-excavation of canal = 25 km 4-vent regulator = 1 no. 1-vent regulator = 1 no. (including vent number of flushing gate)
n-7	Badla Haor Project	Upazila: Itna, Karimganj, Tarail Dstrict: Kishoreganj	Embankment = 10.8 km Re-excavation of canal = 2 km 2-vent regulators = 2 nos.
n-8	Nunnir Haor Project	Upazila: Bajitpur, Kariadi, Nikli District: Kishorganj	Embankment = 25.5 km Re-excavation of canal = 20 km 5-vent regulator = 1 no. 2-vent regulator = 2 nos. (including vent number of flushing gate)
n-9	Dakhshiner Haor Project	Upazila: Ajmirganj, Itna, Mithamain District: Kishorganj	Embankment = 18.3 km Re-excavation of canal = 10 km 6-vent regulator = 1 no. 3-vent regulator = 1 no.
n-10	Chatal Haor Project	Upazila: Tarail, Itna, Madan District: Kishorganj	Embankment = 5.7 km Re-excavation of canal = 11 km 1-vent regulator = 2 nos.
n-11	Ganesh Haor Project	Upazila: Madan, Atpara District: Netrokona	Embankment = 22.5 km Re-excavation of canal = 3 km 3-vent regulator = 1 no. 2-vent regulator = 1 no.

No.	Subproject Name	Location	Principal Features of Major Structures
n-12	Dhakua Haor Project	Upazila: Dakshin, Sunamganj, Jamalganj, Sunamganj Sadar District: Sunamganj	Embankment = 36.5 km Re-excavation of canal = 30 km 5-vent regulator = 1 no. 3-vent regulator = 1 no. 1-vent regulator = 1 no.
n-13	Mokhar Haor Project	Upazila: Habiganj Sadar, Baniachanpur, Ajmirganj District: Habiganj	Embankment = 68.8 km Re-excavation of canal = 110 km 5-vent regulator = 1 no. 4-vent regulators = 2 nos. 3-vent regulators = 2 nos.
n-14	Noapara Haor Project	Upazila: Austagram, Karimganj, Nikli District: Kishorganj	Embankment = 28.3 km Re-excavation of canal = 7 km 3-vent regulator = 1 no. 2-vent regulator = 1 no. 1-vent regulator = 1 no.

Source: JICA Survey Team

3.3 Facility Planning

27. In line with the Data Collection Survey, this survey adopted the design water levels for the submergible embankment as the water level with a 10-year return period in the pre-monsoon season. Meanwhile, the adopted water level for full embankment is one with a 20-year return period. The freeboards considered in the design of the crest elevations are 0.3 m for submergible embankment and 0.9 m for full embankment.

28. In general, this survey adopted the Standard Design Manual by BWDB Design Circle in designing the embankments with some modifications to adapt to the conditions of the haor area which submerges most of the structures for more than six months. The designed values are summarized in Table 12 below.

Table 12 Design of Embankment

Item		Submergible Embankment	Full Flood Embankment
Design Water Level		10-year water level in the pre-monsoon season	20-year water level in the monsoon season
Crest Width		4.3 m	4.3 m
Slope Gradient	Landside	1:3.0	1:2.0
	Riverside	1:3.0	1:3.0
Free Board		0.3 m	0.9 m
Slope Protection		Turfing	Turfing
Pavement		Brick chips (20% of total length)*	
Degree of Compaction		95%	95%

Note: * It is desirable to provide pavement for the entire stretch of embankment in order to avoid its deterioration; however, BWDB was limited only to pave 20% of the total length of embankment due to budget limitation. The stretch of pavement should be extended as long as possible in the detailed design stage or transportation on the embankment should be restricted to avoid damage from wheel trucks.

Source: JICA Survey Team

29. Flow capacities of regulators in the new projects were determined in line with the stipulations of the Standard Design Manual of BWDB that the capacity of the regulators should be sufficient to secure the maximum head difference across the regulator to be within 0.3 m with a 10-year return period when the embankment is overtopped. The sites where the regulators are to be provided were defined referring to the drainage channels in the digital elevation model (DEM) provided by BWDB.

4. Rural Infrastructure

4.1 Policies on Rural Development

30. This project adopted rural infrastructure development in its second component as an important intervention to improve the livelihood in line with the policy, strategy, and plan of GOB. The main policies referred to are as follows:

- Strategy for Rural Development Projects (1984);
- Bangladesh Rural Infrastructure Strategy (1996);
- Rural Roads Master Plan (2005); and
- Rural Road and Bridge Maintenance Policy (2013).

4.2 Target Rural Infrastructure

31. The development targets of the project were selected among the various rural infrastructures in light of the following conditions;

- Contribution to livelihood enhancement through promotion of agriculture and fisheries.
- Having synergistic effects with the flood management component.

Eventually, rural road, market facility (hat), and ship landing facility (ghat) were selected as the targets of development. Rural road comprises the upazila roads, union roads, and village roads. Market facility comprises the growth center market and rural market.

4.3 Data Collection, Interview Surveys, and Identified Issues

32. In order to identify the necessity of interventions, the survey conducted data collection and interview surveys regarding the present conditions of the target infrastructures. The identified main issues of the target infrastructures are as follows:

Rural road	:	Pavement of the road surface is required. The widths of some roads are insufficient as compared with the standards.
Hat	:	Provided numbers are not sufficient.
Ghat	:	Provided numbers are not sufficient.

4.4 Selection of the Candidates

33. The LGED had prepared their own priority lists for the development of rural roads in the five districts. The district offices examined the relevance of the roads in the list in light of the 29 subprojects of Component 1 to select candidate roads, hats, and ghats to be developed by this project as subprojects. LGED prepared the proposed list of candidates for the projects with the selected candidates. The total length of rural road candidates is 1,109 km (proposed list) comprising upazila roads of 225 km, union roads of 377 km, and village roads of 507 km. The total number of candidate hats and ghats are 136 and 105, respectively.

34. The survey narrowed the candidates to be accommodated in the project by applying the screening criteria. The criteria used to screened out the candidates for road development are as follows: 1) new development, 2) no synergistic effect is expected, 3) presently sufficing the requirements of the standards, 4) proposed by other projects, 5) ineffective in reducing flash flood damage, and 6) requires resettlement of more than 15 people. In case of road development, the maximum number of subprojects that could be handled by an upazila is assumed to be three subprojects.

35. The criteria screened out the candidates for market (hat) and landing facility subprojects (ghat) if a candidate has no synergistic effects with Component 1 or whether the required resettlement affects more than 15 people.

36. The screening resulted in the total length of selected rural roads of 514 km, of which 126 km are upazila roads, 209 km are union roads, and 179 km are village roads. The total number of hats is 22, growth center markets 4, and rural markets 18, while the total number of the survived candidate subprojects of landing facilities (ghat) is 21. Table 13 below summarized the selected candidates:

Table 13 Final Candidate Lists

District	Ranking												Selection			
	Rural Road															
	Upazila		Union		Village		Total				Remarks		Hat			Ghat
	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Total*		Bridge	Culvert	GCM	RM	Total	
									(Nos.)	(km)	(m)	(m)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
Kishoregnj	33.57	12.90	36.80	69.39	8.33	9.84	78.70	92.13	28	170.83	0	0	1	8	9	10
Netorkona	8.48	2.24	19.06	28.42	10.00	19.19	37.54	49.85	21	87.39	610	110	0	3	3	3
Sunamganj	33.23	9.65	18.39	8.05	35.67	9.29	87.29	26.99	28	114.28	510	470	1	1	2	5
Habiganj	7.02	19.06	5.73	23.42	36.25	45.27	49.00	87.75	36	136.75	280	570	2	6	8	3
Brahmanbaria	0.00	0.00	0.00	0.00	1.50	3.00	1.50	3.00	2	4.50	0	0	0	0	0	0
Total	82.30	43.85	79.98	129.28	91.75	86.59	254.03	259.72	115	513.75	1,400	1,150	4	18	22	21

Total*: including Bridge and Culvert

Source: Prepared by the JICA Survey Team

4.5 Subproject Selection

37. The survey vested priority to the candidates which were screened through the process discussed in previous paragraphs 32 and 33. The number of beneficiaries is the index for priority in the case of rural roads. Meanwhile, the ranking of hats and ghats were not prepared because the number of selected candidates is narrowed enough and all the candidates are evaluated as subprojects to be taken up for implementation.

38. The GOB duly prepared budgets for the implementation of the selected hats and ghats. In this consequence the budget shared by the yen loan for rural infrastructure development was fully allocated to the development of roads. The candidate roads were selected as subprojects for Component 2 until the implementation costs thereof reach the limit of the budget. The list of the subprojects for Component 2 are summarized in Table 14 as follows:

Table 14 Summary of Subproject Lists

District	Ranking												Selection			
	Rural Road															
	Upazila		Union		Village		Total*				Bridge	Culvert	Hat			Ghat
	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	(Nos.)	(km)	(m)	(m)	GCM (Nos.)	RM (Nos.)	Total (Nos.)	(Nos.)
Total	79.645	41.485	55.755	101.615	79.770	55.610	215.170	198.710	84	413.880	760	860	4	18	22	21

Total*: not including Bridge and Culvert

Source: Prepared by the JICA Survey Team

4.6 Basic Design

39. The existing road alignment is observed to design rural roads improvement. LGED has provided the design standards for rural roads on the basis of the stipulations of the Technical Viability Study of Block Road, Community-based Resource Management Project Final Report (April 2011, BRTC and BUET). The standards provide various design values for each road class. Most of the existing roads require improvements because the dimensions thereof do not satisfy the standards. The substantial improvements are road width, pavement width, and section of pavement. Table 15 presents the difference in pavement rates between the existing roads and standards as example:

Table 15 Rates of Road Pavement

Class	Type	Existing	design
Uazila Road	Submerged	37%	100%
	Non-submerged		
Union Road	Submerged	24%	100%
	Non-submerged		
Villgae Road	Submerged	15%	100%
	Non-submerged		
Average		24%	100%

Source: Prepared by the JICA Survey Team (based on the proposed list by LGED)

5. Agricultural Promotion

5.1 Present Condition of Agriculture Sector

40. The estimated rate of farm household in the survey area is 1.7 million or 55% in 2008 according to the Census of Agriculture 2008. The operated area is 1.2 million ha in 2008 and the average operated area is 0.72 ha per farm household. An association of floodplain soil is dominant in the survey area according to the general soil map.

41. Agricultural land use of 1.5 million ha dominates the survey area occupying about 78% in 2012. Settlement of 0.3 million ha followed the agricultural land. Other land uses are water body and forest. Table 16 presents the general cropping seasons in the survey area:

Table 16 General Cropping Seasons in the Survey Area

Cropping Season	Period	Corresponding Rice Cropping Season
Kharif I	March to June	Aus rice season (April.–July.)
Kharif II	July to October	Aman rice season (March/April-October/November)[1/]
Rabi	November to February	Boro rice season (December/January–April/May)

Note: [1/]: Cropping season in medium lowland

The cropping intensity in the survey area is estimated at 125% in 2010. The total rice production in the survey area is estimated at about 2.7 million t. Boro rice shares about 87%. The boro rice of 3.9 t/ha is the largest yield among the rice produced in the haor area with an estimated net return of 31,000 BDT/ha or 40% of the total yield.

42. The number of farmer or rural community-based organizations (CBOs) formed for agricultural purposes are rather limited, and the activities of most of such organizations are also limited in the haor areas. The inventory survey conducted on farm machinery identified the shortage in power tiller and power threshers, in particular in the survey area. Enhancement of these matters will contribute to improve the livelihood of the majority of residents.

43. The District Agriculture Office (DAO) manages the field level agricultural extension works through the Sub-Assistant Agriculture Officers (SAAOs) stationed in each union. The number of union where SAAOs are stationed is 918 out of the total 1,187 in the five districts related to this survey. The vacancy of 23% should be improved to enhance the livelihood of the people.

5.2 Agricultural Issues in the Survey Area

44. The Master Plan of Haor Areas (2012) identified problems in agriculture through the participatory planning approach. This survey compiled the data provided by the master plan to identify the specific issues related to agricultural development in the survey area. The identified issues are (1) crop damages due to flood, (2) poor drainage, (3) poor irrigation systems, (4) rainfed agriculture, (5) rice monoculture, (6) farming operations, (7) shortage of farm machinery, (8) production losses in harvest and post-harvest operations, (9) lack of agricultural facilities, (10) marketing issues, (11) inadequate extension services, (12) inadequacy of research program, (13) inadequate farm input supply, (14) weakly organized water management organizations (WMO), (15) limited accessibility to farm credit, and (16) limited landholding size, landless households, and poor female headed households.

5.3 Proposed Subprojects of Component 3-1 (Agricultural Promotion and Livelihood Improvement)

45. In order to improve the livelihood and cope with the issues discussed in Section 5.2, this survey proposed agricultural promotion programs as subprojects in the 29 subproject areas of Component 1. The proposed programs comprises the Agricultural Promotion Support Subproject (APSS) and Small-scale Income Generation Subproject (SIGS) as follows:

Table 17 Proposed Programs of APSS and SIGS (Component 3)

Activities	Conceived Program	Primary Target Group
APSS	1. Field Program	Small farm households
	2. Farmer Training Program	Small farm households
	3. Field Staff Empowerment Program	Field staff of project & line agencies
	4. Farm Machinery & Facility Support,	Small (& medium) farm households
	5. Technology Development Program	-
SIGS	1. Floating Bed Vegetable Culture Scheme	Marginal farm households, agriculture labour households & poor female headed households
	2. Small-scale Vegetable Production Support Scheme	
	3. Fruit Production Support Scheme	
	4. Micro Poultry Raising Scheme,	
	5. Small-scale Mushroom Culture Scheme	

Source: Prepared by the JICA Survey Team

46. The programs will be implemented in the area of the 29 subprojects of Component 1 for a period of five years from 2017/2018 to 2021/2022. The total volume of the programs contemplated on are as follows:

Table 18 Contemplated Volumes of the Programs

Activities	Program	Volume
APASS	1 Field program	895
	2 Farmers training program	553
	3 Field staff empowerment program	50
	4 Farm machinery and facility support	95
	5 Technology development program	2 (on rice and on non rice)
SIGS	1 Floating bed vegetable culture scheme	50
	2 Small-scale vegetable production support scheme	60
	3 Fruits production support scheme	50
	4 Micro-poultry raising scheme	50
	5 Small-scale mushroom culture scheme	40

Source: Prepared by the JICA Survey Team

6. Fisheries Development Promotion

6.1 Present Condition of Fisheries Sector

47. Fisheries have played a significant role in the economy of Bangladesh wherein more than two million people are directly or indirectly dependent. Fish provides about 60% of the national protein, 6% of export earnings, and 5% of the gross domestic product (GDP). The per capita availability of fish is estimated to be 10.0 kg to 12 kg. During the monsoon season, about 90% of the survey area or 1.77 million ha, is inundated and about 48% of the flooded areas are in the floodplain at an average depth of about 5 m with huge fisheries resources.

48. The estimated fish habitat area in the survey area comprising the open water bodies (for capture fishery) and closed water bodies (for culture) is nearly 1.0 million ha, where capture fishery habitats contribute about 96% and the rest (4%) is shared by culture habitat.

49. There are about 87 fish landing centers distributed over the study area. In this respect, the identified problems are poor infrastructure facilities, lack of proper monitoring system and sanitation, inadequate drainage system, and dirty and unhygienic environment. There are around 326 ice plants in haor region that are mostly situated near the landing centers, retail

markets, and wholesale markets. Further, there are three government-owned fish hatcheries and 37 privately-owned hatcheries in the study area. Private nurseries and fish farming communities are dependent on the hatchlings (spawns) from these two sources for the commonly cultivated six species, namely, rui (*Labeo rohita*), catla (*Catla catla*), marigal (*Cirrhinus mrigala*), silver carp (*Hypothalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*), and common carp (*Cyprinus carpio*). Several institutions provide fisheries support services, and the main ones are the Department of Fisheries (DoF), District Fisheries Office (DFO), Upazila Fisheries Office (UFO), and Bangladesh Fisheries Research Institute (BFRI). Fisheries academies and NGOs also play substantial roles in the development of the fisheries sector.

50. Bangladesh has enacted several fisheries acts and rules pertaining to research, development, protection, conservation, and management of its resources in both marine and inland waters. Several policies are also in place to develop inland open water fisheries resources to alleviate poverty and improve the socioeconomic conditions as well to facilitate leasing of water bodies for community-based fisheries management. Bangladesh had successive five-year plans and programs since 1976 to develop its marine and inland fisheries with an overall aim to increase fish production, nutrition from fish, employment, and fisheries export. The Master Plan of Haor Area (2012) presents the fisheries development plan formulated by comprehensive approach to water resources management. The current and ongoing plan, the 6th Fisheries Plan, was formulated in line with the master plan.

6.2 Issues of Fisheries in the Survey Area

51. This survey reviewed the master plan and identified main issues in the survey area as listed below.

- Indiscriminate fishing of brood stocks (spawners);
- Destruction of breeding grounds by blocking the migration routes through erection of embankments and unplanned roads;
- Reduction of water areas due to flood control and irrigation structures;
- Indiscriminate use of agrochemicals and pesticides; and
- Leasing policies of water bodies for fisheries.

6.3 Proposed Subprojects of Component 3-2 (Fisheries Promotion and Livelihood Improvement)

52. The Haor Master Plan (HMP-2012) proposed the priority projects to develop fisheries in the haor area. The proposed 22 projects include development of fish sanctuary, habitat restoration, nursery (beel) development, community net pen development, human resource development, enhancement of landing facilities, and fish processing.

53. This survey proposes fisheries promotion programs in the project areas defined by the 29 subprojects of Component 1 as subprojects of Component 3 reviewing the priority projects proposed by the master plan. There are five proposed programs as listed in Table 19 below.

Table 19 Subprojects for Fisheries Promotion (Component 3) and Target Beneficiaries

Program/Activity	Primary Target Group and Beneficiaries
A. Community-based Fishery Resource Management (CFRM)	
1. Resource Mapping and Identification of Resources	
2. Development of the Beels System	Fishers/farmers living around the beels will be organized to BUGs
Beel operation/sanctuary/nursery management	
B. Floodplain Aquaculture Activities	HHs, fishermen, farmers will be encouraged to form groups, preferably those landless. Women will be given preference. Participants must be willing and interested to learn through training, exchange visits, and technical assistance provided by the project. Participants must also have some experience in certain activities.
Income Generating Activities (Pilots)	
Fish net pen culture	
Fish cage culture	
Backyard fish pond culture	
Seasonal aquaculture (Daudkandi model)	
Dry fish and fermentation	
C. Fisheries Support Services	
Fisheries Extension Strengthening	DFOs and UFOs (in the project areas)
D. Trainings/Workshops/Seminars	
1. Training of Project Staff/Officers	Project field staff (PMO and PIU)
2. Training of Beneficiaries	
Fish net pen culture	All participants (groups) in the above income generating activities and BUGs.
Fish cage culture	
Backyard fish pond culture	
Daudkandi model aquaculture	
Capacity building BUGs	
Fish drying and fermentation	
3. Consultation Meetings with GOs and NGOs	Government officials and NGOs, etc.
4. Workshops (on need-based subjects)	Government officials, research organizations (agricultural universities, fisheries research institutions, NGOs, etc.
5. Seminars on Findings, New Ideas, and Results	
E. Exchange Visits for Experience Sharing	Representatives of above groups
F. Monitoring, Legal Support, and Studies	
1. Third Party M&E/Knowledge Management	
2. BUGs Auditing	All BUGs
3. Legal Support	BUGs having legal issues

Source: Prepared by the JICA Survey Team, 2013

The proposed programs will be initiated in 2015 and the implementation will be continued until the end of 2020 as the project. The last BUG auditing and legal support will be completed in 2021.

7. Project Implementation and O&M Arrangements

7.1 Implementing Agencies of the Project

54. As mentioned in Subsection 1.4 (6), the project will be implemented by BWDB and LGED. The implementation arrangement had defined the responsibilities in line with the mandates of both agencies. BWDB is responsible for the implementation of Component 1, flood mitigation, and agricultural promotion subcomponent of Component 3-1, while LGED will be the implementing agency for Component 2, rural infrastructure development, and fisheries promotion subcomponent of Component 3-2.

7.2 Current Organizational Structures of BWDB

55. The BWDB is a board under the Ministry of Water Resources. The chief executive of BWDB is the director general. The overall authority for board management is vested with the director general and there are five additional director generals (ADGs) under him. The whole country is divided into eight BWDB zones. The zones are headed by eight chief engineers. Each zone is then divided into two to three circles. Each circle is headed by one superintending engineer. Further, each circle is subdivided into three to four divisions and each division is headed by the executive engineer. There are eight zones, 33 circles, 86 divisions, and around 200 subdivisions. The overall manpower, as of June 2013, is 6,061 officers including both personnel coming from the headquarters and field offices while the total number of sanctioned posts is 8,935.

56. The substantial tasks of BWDB is dividedly mandated to six offices, namely, the Office of the Director General, Office of the Additional Director General (ADG)-Administration, Office of the ADG-Finance, Office of the ADG-Planning, Office of the ADG-Eastern Region, and Office of the ADG-Western Region. The Office of ADG-Planning is responsible for planning and design works of this project whereas the offices of ADG-Eastern Region and Western Region are responsible for the implementation and land expropriation. In addition the Director Program is responsible for the preparation of financial proposals to be submitted to the Ministry of Finance and Planning Commission. Environmental matters are generally handled by the project management office (PMO) headed by the project director since there is no particular unit in charge.

57. The project directors are mainly responsible for project implementation at the headquarters level, while the executive engineers of division offices are mainly responsible at the field level. The project director is designated at the beginning of the project.

7.3 Current Organizational Structures of LGED

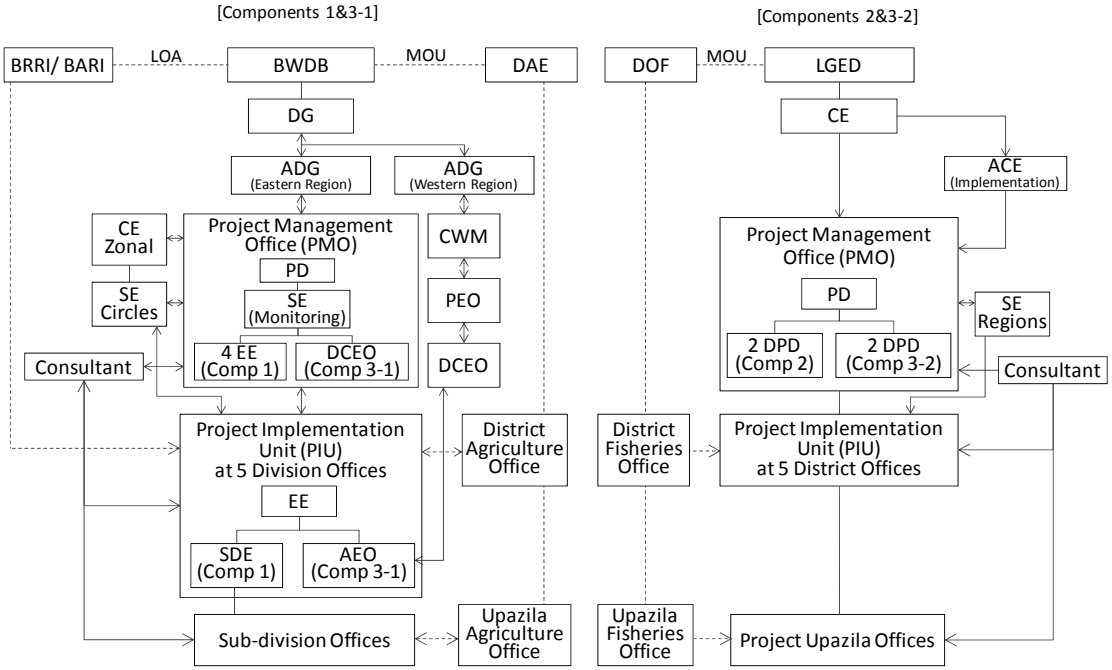
58. The LGED is a department under the Ministry of Local Government, Rural Development and Cooperative. LGED is a highly decentralized organization where 98% of its total manpower works are at the district and upazila (subdistrict) levels. LGED consists of headquarters and three-layer local offices. The chief engineer is responsible for the management of the department. The local offices are set up as three-layer hierarchies: regional, district, and upazila. Bangladesh is divided into 14 regions, each with an office headed by a superintending engineer. District offices are deployed, one in each of the 64 districts, for basic functions that include planning and implementation of LGED projects, related financial management, and supervision of the activities of upazila offices in the district. Each district office is headed by an executive engineer and has 21 or 22 staff. The 485 upazila offices are distributed throughout the country. Their basic function is the planning and implementation of LGED works and related financial management at their level. Each upazila office is headed by an upazila engineer with approximately 19 support staff. The total manpower under permanent payroll is 11,068 both at the headquarters and field levels. The additional maximum manpower of 226 is proposed to strengthen the department.

59. Under the chief engineer, there are six additional chief engineers (ACE), namely, i) maintenance and asset management, ii) planning and design, iii) urban management, iv) integrated water resources management, v) primary educational infrastructure management, and vi) implementation. The ACEs' tasks are divided among 13 superintending engineers and their tasks are further subdivided by 44 executive engineers.

60. The project directors are mainly responsible for project implementation at the headquarters level; meanwhile, executive engineers of district offices are mainly responsible at the field level.

7.4 Project Implementation Arrangements

61. The existing BWDB division offices in Netrokona, Kishoreganj, Habiganj, Brahmanbaria, and Sunamganj are to become PIUs of BWDB and the number of office staff will be increased for the project. The LGED will establish PIUs within the existing LGED district offices in Netrokona, Kishoreganj, Habiganj, Brahmanbaria, and Sunamganj. The LGED project upazila offices will be created within the existing LGED upazila offices. In this manner, both BWDB and LGED will establish one PMO each in their head offices and five PIUs each in their division offices. The district agriculture office will corroborate with the PIUs of BWDB, whereas, the district fisheries office will corroborate with the PIUs of LGED. A consultant team will be employed by each PMO to assist the implementing agencies. An organizational chart will be developed as presented in Figure 1.



Notes: DG=Director General, ADG=Additional Director General, CE=Chief Engineer, ACE=Additional Chief Engineer, SE=Superintending Engineer, CWM=Chief Water Management, PEO=Principal Extension Officer, DCEO=Deputy Chief Extension Officer, PD=Project Director, DPD=Deputy Project Director, EE=Executive Engineer, SDE=Sub-divisional Engineer, AEO=Assistant Extension Officer

Source: JICA Survey Team

Figure 1 Project Organizational Chart

62. The steering committee will be established for the project to oversee the overall project progress and effective coordination among various stakeholders. The steering committee will be headed by the Secretary of the Ministry of Water Resources (MoWR). The committee will comprise members of the Local Government Division of the Ministry of Local Government, Rural Development and Cooperatives (LGD of MLGRD&C), BWDB, LGED, BHWDB, Department of Agriculture Extension (DAE), DoF, Economic Relations Division of the Ministry of Finance (ERD of MOF), Ministry of Environment and Forests (MOEF), and Ministry of Land (MOL) (when necessary), and JICA as an observer. The roles of the steering committee will be as follows: i) to ensure smooth inter-ministry/agency coordination, and ii) to oversee project implementation and progress, and guide to resolve implementation problems and issues that require higher level interventions. The steering committee meeting will be held every six months and whenever necessary.

63. The coordination meeting will be held every three months headed by ADG (Eastern Region) of BWDB with the attendance of BWDB (project director, superintending engineer, executive engineers, and deputy chief extension officers), LGED (project director, deputy project directors, and executive engineers), DAE, and DOF to discuss the progress of Components 1, 2, and 3 and coordinate the interlinked activities.

64. The progress review meeting of BWDB will be held monthly headed by the project director with the attendance of superintending engineer, executive engineers, deputy chief extension officers, and DAE to discuss the progress of Components 1 and 3-1 (agriculture) and issues to be addressed. However, participation of executive engineers in the PIUs and staff of district agricultural offices will be quarterly. The progress review meeting of LGED will be held monthly headed by the project director with the attendance of deputy project directors, executive engineers, and DOF to discuss progress of Components 2 and 3-2 (fisheries) and issues to be addressed.

65. In addition to the abovementioned meetings, BWDB and LGED will attend the district coordination meeting at the district level. The meeting is the existing one held monthly and chaired by the deputy commissioner to discuss the activities of ongoing projects in the district. The meeting will coordinate with the stakeholders after the project completion.

66. The PMO of BWDB will be responsible for the overall management of Components 1 and 3-1 (agriculture) in order to achieve the outputs efficiently. The PMO will perform the following tasks and responsibilities for the implementation of the project:

a) Plan the overall implementation of Components 1 and 3-1,
b) Procure and manage the consultants,
c) Conduct detailed designs with the Design Circle,
d) Verify tender documents for construction,
e) Monitor land acquisition,
f) Supervise the overall implementation of Components 1 and 3-1 and monitor their progress,
g) Coordinate Components 1 and 3-1,
h) Provide guidance to PIUs,

i) Certify the consultants' and contractors' bills,
j) Ensure compliance with environmental and social considerations,
k) Report to the relevant organizations and
l) Prepare MOUs with DAE and supervise the activities.

67. The PIUs of BWDB will be responsible for implementing Components 1 and 3-1. The units will perform the following tasks and responsibilities for the implementation of the project:

a) Prepare implementation plans for the concerned subprojects of Components 1 and 3-1,
b) Carry out surveys and investigations,
c) Prepare the tender documents for the project including cost estimates, and manage tender process (evaluation of the tenders will be carried out by the tender evaluation committees formed for respective contracts),
d) Carry out land acquisition,
e) Guide the subdivision and section offices,
f) Supervise and check the construction of concerned subprojects in conformity with the specified checking procedures,
g) Manage the activities of DAE,
h) Check contractors' bills, and
i) Prepare monthly progress reports.

68. The PMO of LGED will be responsible for the overall management of Components 2 and 3-2 in order to achieve the outputs efficiently. The PMO will perform the following tasks and responsibilities for the implementation of the project:

a) Plan the overall implementation for Components 2 and 3-2,
b) Procure and manage the consultants,
c) Conduct detailed designs,
d) Monitor land acquisition,
e) Supervise the activities and monitor the progress,
f) Coordinate Components 2 and 3-2,
g) Provide guidance to the PIUs,
h) Certify the consultants' and contractors' bills,
i) Ensure compliance with environmental and social considerations,
j) Report to the relevant organizations, and
k) Prepare MOU with DOF.

69. The PIUs of LGED will be responsible for implementing Components 2 and 3-2. The PIUs will perform the following tasks and responsibilities for the implementation of the project:

a) Prepare the subproject and scheme implementation plans,
b) Carry out surveys and investigations,
c) Prepare the tender documents, call tenders, award and sign the contracts (evaluation of tenders will be carried out by tender evaluation committees, and approval of the evaluation will be made by the officials specified in the government rules),
d) Review the designs,
e) Carry out land acquisition,
f) Supervise the construction of rural infrastructures and implementation of fishery activities,
g) Check contractors' bills, and
h) Prepare progress reports.

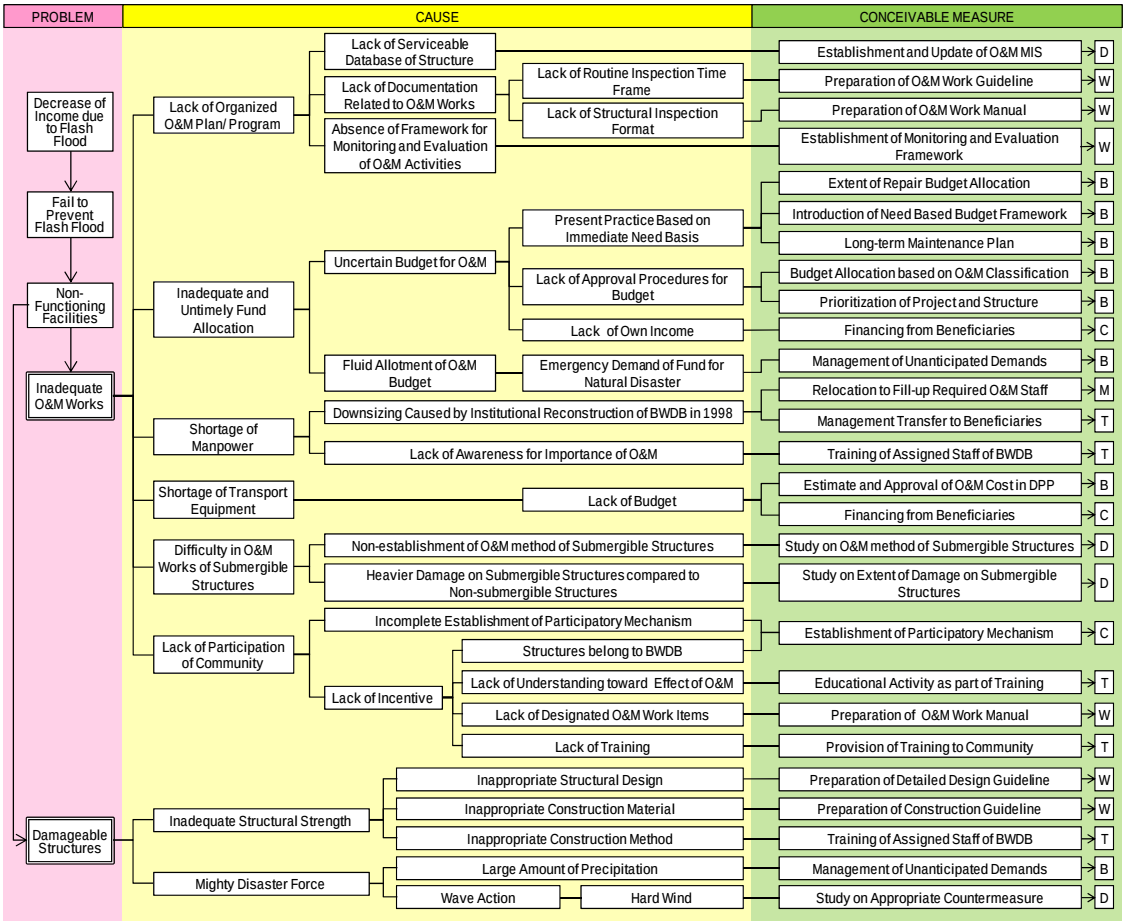
7.5 O&M Arrangements for BWDB

70. The BWDB has formulated the "Policy on O&M of Permanent Structures of BWDB". It was prepared by the director of O&M, BWDB and approved by the MoWR in October 2010. The policy stipulates the following: 1) Extent of allocation expenditure for repair, 2) Classification of O&M works, 3) Need-based budget framework, 4) Prioritization of project and infrastructure, 5) Standard O&M work description, 6) Establishment of O&M management information system (O&M MIS), 7) National-based priority, 8) Distribution of expenses for O&M works based on classification, 9) Long-term maintenance plan, 10) Procedures to prepare and finalize annual work plan, 11) General policy to be followed in allocation distribution, 12) Local beneficiaries involvement and local resources use, 13) Management of unanticipated demands, and 14) Monitoring and evaluation framework.

71. The inter-agency task force prepared the Guidelines for Participatory Water Management (GPWM) which was duly approved by the government in November 2000. The guideline stipulated the formulation of WMO for the participation of the community and specified the responsibilities of WMO.

72. Through data collection on the existing facilities, O&M works, and interviews with relevant units of BWDB and communities in the haor areas, the identified problems/issues are the following: 1) Lack of clear policy and organized structure, 2) Inadequate and untimely fund allocation, 3) Shortage of manpower, 4) Shortage of transporting equipment, 5) Damageable structures, 6) Difficulties in O&M works of submergible structures, and 7) Lack of community participation.

73. In order to formulate an effective O&M plan for the project, the survey examined the O&M by applying the fault tree analysis. The developed fault tree analysis is presented in Figure 2.



Note: The letters written under the column conceivable measure such D, W, B, C, M and T are explained in Chapter 7.
Source: JICA Survey Team

Figure 2 Fault Tree Analysis for O&M of BWDB Flood Management Structures

74. On the basis of conceivable measures that appeared in the fault tree, the O&M plan for Component 1 was formulated. The proposed plans are mainly; 1) Participatory approach, 2) Preparation of O&M guideline, 3) Introduction of preventive maintenance, 4) Development of operation manual, and 5) Update of the database.

75. The estimated necessary additional manpower to realize the planned O&M is summarized in Table 20.

Table 20 Summary of Manpower to be Added for O&M Works in BWDB

(Unit: in person)

Name of Office	Netrokona			Kishoreganj			Habiganj			Brahmanbaria			Sunamganj		
	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro
Division Office	1 DO			1 DO			1 DO			1 DO			1 DO		
	21	7	23	15	6	23	20	7	23	9	1	15	20	4	23
Sub-division Office	2 SDOs			2+ new1 SDOs			2 SDOs			1 SDO			2 SDOs		
	23	6	53	20	8	65	21	7	44	6	0	10	19	8	33
Section Office	5 SOs			5+ new3 SOs			6 SOs			3 SOs			6 SOs		
	20	10	20	20	9	32	20	9	20	9	0	9	24	10	24
Directorate of O&M	Set up: 24, Existing: 14, Proposed: 24														

Note: Set = Set up, Exi = Existing, Pro = Proposed,
DO = Division Office, SDO = Sub-division Office, SO = Section Office
Source: JICA Survey Team based on discussion with BWDB

The estimated annual O&M cost is BDT 67 million. Meanwhile the estimated training cost is BDT 8 million, gate replacement cost is BDT 31 million, and the geotechnical inspection cost is BDT 6 million/10 years.

7.6 O&M Arrangements for LGED

76. The LGED has formulated the Rural Road and Bridge Maintenance Policy. It was prepared by the Road Maintenance and Road Safety Unit (RMRSU) and approved by the Minister of LGRD&C in January 2013. The main provisions thereof are: 1) Maintenance needs assessment, 2) Road and bridge maintenance standard, 3) Environmental considerations, 4) Implementation management, 5) Stakeholders' participation, 6) Gender equity and involvement, 7) Financial mobilization, and 8) Institutional policy.

77. The LGED prepared the annual maintenance plan and estimate of the costs for the upazila, union, and village roads on the basis of annual maintenance needs assessment, district-wise weightage calculation of fund allocation, and finalization of the annual maintenance plan. Actual maintenance has been conducted in line with the plan.

78. Regarding O&M of growth centers and rural markets (hats), the upazila parishads are responsible for the annual leasing of all markets within their jurisdiction, and some percentages (15% to 25%) of the lease value shall be allocated for the maintenance of the markets. In addition to that amount, 10% of the annual lease value from all markets shall be deposited to the Upazila Development Fund for maintenance and development of the markets within the upazila. The boat landing facilities (ghats) are, in many cases, constructed adjacent to the growth centers or rural markets. The O&M of such ghats then falls under the responsibility of the market lessee and market management committee (MMC). Other ghats may be leased on the same basis as stipulated for leasing the markets.

79. This survey judged that no special alteration is necessary to the ongoing maintenance works so far except for the village road maintenance to be conducted by the local government institutions (LGIs). The following measures should be taken to ensure the sustainable maintenance by LGI such as upazila and union parishads:

1) Assignment of technical staff in LGI to work exclusively for road maintenance,
2) Allocation of budget for road maintenance in LGI to be subsidized from the national budget and/or allocated by using part of the maintenance budget provided as 10% of the project costs of various projects as per the maintenance policy, and
3) Ongoing technical guidance by LGED upazila offices should be continued.

80. The LGED has a central training unit (CTU) in the headquarters and 14 decentralized regional training centers (RTCs) in regions set under revenue budget.

The LGED training program includes on-the-job training. Subjects of the on-the-job training include the following: i) construction procedure for base and subbase course, ii) bituminous carpeting, and iii) protection works by concrete and sand bags. Participants of the trainings are upazila engineers, sub-assistant engineers, work assistants, contractors, and the labour contracting societies (LCS) people.

It is recommended that the present training system be maintained. Furthermore, certain trainings to LCS people on construction and maintenance activities of the village roads will be necessary according to LGED. The features of the LCS training program are shown in Table 21.

Table 21 LCS Training Program

Item	Description
Subject of Training	Methods of construction and maintenance of village roads (by using implementation manuals for LCS prepared by LGED)
Trainee	LCS members, a total of 12,150 persons (= 135 km long village roads x 3 groups/km x 30 members/group)
Trainer	Upazila engineers or others having similar capability, (the training will be undertaken by project upazila offices under the instructions of the district project coordinator of PIU.)
Number of Training	Two trainings per LCS group to be undertaken before and after construction
Training Cost	Estimated cost of BDT10,000,000 with the approximate unit cost of BDT 25,000 per LCS group

Source: JICA Survey Team based on the results of discussion with LGED

8. Environmental Consideration

8.1 Legal and Policy Framework related to Environmental Assessment in the Country

81. The Bangladesh Environmental Conservation Act, 1995 (amended in 2010) provides the principal law on environmental protection in Bangladesh. An environmental clearance certificate (ECC) is required for any project implementation. Under the act, environmental assessment process is prescribed by the Environmental Conservation Rules (ECR, 1997) and its amendment. There are no significant gaps between the legislations related to environmental assessment in Bangladesh (provided in ECR, 1997 and others) and the JICA Environmental and Social Consideration Guidelines 2010, in terms of the objectives of the environmental impact assessment (EIA).

82. The preliminary environmental survey categorized the project as Category B under JICA category because there are no environmentally critical areas located in the project site and no significant adverse impact is anticipated.

8.2 Environmental Screening of Subprojects (Categorization)

83. The proposed subprojects are tentatively classified into four categories provided in ECR 1997. The embankment rehabilitation works of Component 1 are basically not associated with additional land acquisition and will not cause large impact in the area, as a design policy. Most of the road projects are comparatively small in scale. The official confirmation to the Department of Environment (DoE) is recommended after the JICA preparatory survey.

Table 22 Number of Red Category Subprojects in Each Component

Component	Number of Red Category Subprojects	Number of Orange B Category Subprojects	Number of Orange A Category Subprojects	Number of Green Category Subprojects	Number of Unidentified Subprojects
Component 1	25	0	0	0	4
Component 2	0	22	0	0	7
Component 3	0	0	0	0	29

Note: The subprojects proposed in the end of August 2013 were categorized tentatively in line with ECR, 1997 and all projects and subprojects are subject to the categorization by DoE. Projects which are not listed in ECR, 1997 were tentatively categorized as "unidentified". Numbers in the table shows the number of haors.

Source: JICA Survey Team

8.3 Overall IEE Study

84. Natural environment, ecological parameter, environmental pollution, and social impact are the key issues to be assessed in the overall IEE study. The issues were further broken down to 29 items for Component 1 and 21 items for Component 2. The results of the examination turned to be 23 B ratings and six C ratings for Component 1 and 16 B ratings and five C ratings for Component 2. The results enunciated that the environmental impacts of the project are not serious and could be mitigated with appropriate measures.

8.4 Preliminary EIA Study

85. Based on the results of the IEE study, the preliminary EIA was conducted in the two representative project sites, namely, Boro Haor in Kishoreganj District and Ganesh Haor in Netrokona District. Natural environment, ecological parameter, environmental pollution, and social impact are the key issues to be assessed in the preliminary EIA study. The issues were further broken down to 19 items for Component 1 and 10 items for Component 2. All the ratings of the assessment turned to be B rating for both Components 1 and 2. The results enunciated that the environmental impacts of the project are not serious and could be mitigated with appropriate measures.

9. Social Considerations

9.1 Legal Framework for Resettlement/Compensation

86. The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance II (1982) and its subsequent amendments in 1989, 1993, and 1994. The 1982 ordinance requires that compensation be paid for the following: (i) land and assets permanently acquired (including houses, trees, and standing crops) and (ii) any other impacts caused by such acquisition. The MOL is the legal authority for land acquisition.

9.2 Prepared Resettlement and Compensation Framework (RCF)

87. The project has three main components. The RCF identified the land acquisition as summarized in Table 23.

Table 23 Scope of Land Acquisition

Component	Estimated Land Acquisition*	Estimated Resettlement
Component 1: Flood Management		Nil Layout is proposed not to cause any resettlement. In the detailed design stage, further adjustment is recommended so that no resettlement takes place.
Rehabilitation of existing flood control facilities	Nil	
Construction of new submerged embankment	4,048,385 m^2	
Construction of new regulators	Nil (all constructions are expected to be within existing canals)	
Re-excavation of canals	Nil (all constructions are expected to be within existing canals)	
Subtotal, Component 1	*4,048,385*	*Nil*
Component 2: Rural Infrastructures		
Rehabilitation and upgrading of rural roads	506,733 m^2	139
Rural hats	44,352 m^2	67
Rural ghats	252 m^2	34
Subtotal, Component 2	*551,337 m2*	*240*
Component 3-1 Agricultural Development	Nil	
Component 3-2 Fisheries Development	Nil	
TOTAL	**4,599,722 m^2**	**240****

Note: * = Based on respective project design as outlined in previous chapters. Design of facilities and their actual locations are not yet finalized, thus, land acquisition values are only preliminary.
** = Indicative value only, estimated by LGED

88. The RCF further provides the following issues: 1) Eligibility and entitlement, 2) Socioeconomic surveys of RAPs, 3) Consultation and disclosure, 4) Grievance redress mechanism, 5) Implementation arrangements, 6) Budget and financial planning, 7) Implementation schedule, and 8) Supervision, monitoring and evaluation.

9.3 Principal Features of Abbreviated Resettlement Plan (ARP)

89. Under this survey, two ARPs have been prepared, one each for two executing agencies, namely, BWDB and LGED. These will serve as examples for future RAP preparation by the executing agencies. These ARPs have been prepared following the proposed preliminary RCF as explained in Section 9.2. Two representative subprojects are selected for the preparation of ARP. These are Ganesh Haor and Baro Haor that spread over Atpara and Madan Thana of Netrokona District and Katiadi, Nikli, Karimganj and Sadar Upazila of Kishoreganj District, respectively.

90. The items discussed in the ARP are as follows:1) Scope of land acquisition activity, 2) Census for asset inventory and assessment of losses, 3) Socioeconomic survey of PAPs, 4) Market survey for land price and valuation of other assets, 5) Government rate for land price, 6) Stakeholders meeting, and 7) Cost and budget.

10. Economic and Financial Analyses

10.1 Economic Benefit

91. The benefit accrued by the project of BWDB is the damage reduction on boro rice to be induced by flood protection. The annual benefit through damage reduction was estimated for each subproject.

92. The benefit of LGED is the reduction of vehicle operating costs (VOCs) to be induced through road pavement, spoilage reduction of perishable products accrued by rural markets,

improvement of landing facilities, and increase in income of fishermen by the project activities.

10.2 Results of the Economic Analysis

93. In order to calculate the economic internal rate of return (EIRR), benefit/cost ratio (B/C), and economic net present value (ENPV), the annual flow of cost and benefit is predicted. The EIRR of the project is computed at 15.6%, whereas the estimated B/C and ENPV with a discount rate of 12% resulted to 1.26 and BDT 2,065 million, respectively. The results indicated the project's high economic viability.

Table 24 Results of the Economic Analysis of the Project

Project	EIRR	B/C	ENPV
BWDB part	16.1%	1.29	BDT 1,153 million
LGED part	15.2%	1.23	BDT 1,011 million
Whole Project	**15.6%**	**1.26**	**BDT 2,164 million**

Source: JICA Survey Team

94. The project sensitivity with respect to the changes in benefit and cost is evaluated to analyze the sustainability of the project. Three alternative cases, i.e., (i) 10% increase in cost, (ii) 10% decrease in benefit, and (iii) combined 10% increase in cost and 10% decrease in benefit (worst case), were assumed. The EIRR and B/C are 12.5% and 1.03 under the worst case. The EIRR value is higher than the criteria (EIRR=12%) even under the worst case, therefore, the project is justified to be economically feasible.

Table 25 Results of the Sensitivity Analysis

	EIRR	B/C	ENPV
Base Case	15.6%	1.26	BDT 2,169 million
a) Capital cost of the project: +10%	14.0%	1.14	BDT 1,327 million
b) Benefit -10% point	13.9%	1.13	BDT 1,111 million
c) a) + b)	12.4%	1.03	BDT 273 million

Source: JICA Survey Team

10.3 Evaluation Indicators of the Project

95. The ex-post evaluation could be conducted after two years of the project completion. The proposed evaluation indicators are set as follows:

1) BWDB

- Decrease in frequency and area of inundation inside the subproject areas. (Effect Indicator)
- Accruing the difference of the water levels between riverside and landside. (Operation Indicator)
- Increase in yield of boro rice and crop diversification. (Effect Indicator)
- Increase in household income and asset (Effect Indicator).

2) LGED

- Increase in traffic volume per vehicle mode (car, motorcycle, CNG, rickshaw, walking, etc.). (Operation Indicator)
- Decrease in travel time (Operation Indicator)
- Increase in sales, handling, and business in markets per upazila. (Effect Indicator)
- Increase in household income and assets. (Effect Indicator)
- Increase in fish catch. (Effect of Indicator)
- Improvement in biodiversity. (Effect Indicator)

BANGLADESH WATER DEVELOPMENT BOARD
LOCAL GOVERNMENT ENGINEERING DEPARTMENT

PREPARATORY SURVEY
ON
UPPER MEGHNA RIVER BASIN
WATERSHED MANAGEMENT IMPROVEMENT PROJECT
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

FINAL REPORT
VOLUME-I MAIN REPORT

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List of Abbreviations and Acronyms

AA	:	Animal Attendant
AADT	:	Annual Average Daily Traffic
AAEO	:	Assistant Agriculture Extension Officer
AC	:	Assistant Chief
ACE	:	Additional Chief Engineer
ADB	:	Asian Development Bank
ADG	:	Additional Director General
ADLO	:	Additional District Livestock Officer
ADP	:	Annual Development Program
AE	:	Assistant Engineer
AEO	:	Agriculture Extension Officer
AE	:	Assistant Engineer
AIDS	:	Acquired Immune Deficiency Syndrome
AIGA	:	Alternate Income Generating Activity
ALOC	:	Activities for the Landless Organized with Consciousness
AO	:	Accounts Officer
AP	:	Affected Person
APSS	:	Agriculture Promotion Support Sub-project
ARP	:	Abbreviated Resettlement Plan
ASA	:	Caritas Bangladesh; Association for Social Advancement
AWP	:	Annual Work Plan
B.C	:	Bituminous Carpetting
BADC	:	Bangladesh Agriculture Development Corporation
BARC	:	Bangladesh Agricultural Research Council
BARI	:	Bangladesh Agriculture Research Institute
BBS	:	Bangladesh Bureau of Statistics
B/C	:	Benefit Cost Ratio
BD	:	Bangladesh
BFDC	:	Bangladesh Fisheries Development Corporation
BFRI	:	Bangladesh Fisheries Research Institute
BHWDB	:	Bangladesh Haor and Wetland Development Board
BKB	:	Bangladesh Krishi Bank
BLRI	:	Bangladesh Livestock Research Institute
BMC	:	Beel Management Committee
BMD	:	Bangladesh Meteorological Department
BPC	:	Bangladesh Planning Commission
BRAC	:	Bangladesh Rural Advancement Committee
BRDB	:	Bangladesh Rural Development Board
BRRI	:	Bangladesh Rice Research Institute
BRTA	:	Bangladesh Road Transport Authority
BRTC	:	Bureau of Research Testing and Consultation
BSD	:	Bangladesh Standard Datum
BSD	:	Bangladesh Statistic Department
BUET	:	Bangladesh University of Engineering & Technology

BUG	:	Beel Users Group
BWDB	:	Bangladesh Water Development Board
C/S	:	Construction Supervision
CARE	:	Cooperative for Assistance & Relief Everywhere
CBN	:	Cost of Basic Needs
CBO	:	Community Based Organization
CBRMP	:	Community Based Resource Management Project
CC	:	Community Clinic
CCDB	:	Christian Commission for Development in Bangladesh
CCL	:	Cash Compensation under Law
CDSP	:	Char Development and Settlement Project
CE	:	Chief Engineer
CEGIS	:	Center for Environmental and Geographic Information Services
CFRM	:	Community Fishery Resource Management
CIC	:	Community Infrastructure Coordinator
CIG	:	Common Interest Group
CNG	:	Compressed Natural Gas
COD	:	Cut-Off Date
CPR	:	Common Properties Resources
CPS	:	Crop Specialist
CPTU	:	Central Procurement Technical Unit
CPUA	:	Catch Per Unit Area
CRP	:	Common Resource Properties
CRM	:	Community Resource Management
CS	:	Certified Seed
CTU	:	Central Training Unit
CUL	:	Compensation Under Law
CVD	:	Commercial Vehicle per Day
CWM	:	Chief Water Management
D/D	:	Detail Design
DAE	:	Department of Agriculture Extension
DANIDA	:	Danish International Development Agency
DAO	:	District Agriculture Office
DAWP	:	District Annual Work Plan
DC	:	Deputy Commissioner
DC	:	Deputy Chief
DC	:	Deputy Commissioner
DCEO	:	Deputy Chief Extension Offices
DICT	:	Dutch Cone Test
DEID	:	Department For International Development
DEM	:	Digital Elevation Model
DFO	:	District Fisheries Office
DFO	:	District Fisheries Officer
DFS	:	Directorate Field Services
DG	:	Director General
DLO	:	District Livestock Office

DLS	:	Department of Livestock Services
DO	:	Division Office
DOA	:	Department of Agriculture
DOE	:	Department of Environment
DOF	:	Department of Fisheries
DPD	:	Deputy Project Director
DPP	:	Development Project Proforma
DPP	:	Development Project Proposal
DPP	:	Developing Project Profile
DSC	:	Design Supervision Consultant
DTO	:	District Training Officer
DTW	:	Deep Tube Well
EA	:	Executing Agency
EC	:	Executive Committee
ECA	:	Environment Conservation Act
ECA	:	Ecologically Critical Area
ECC	:	Environmental Clearance Certificate
ECNEC	:	Executive Committee of National Economic Council
ECR	:	Environmental Conservation Rule
EE	:	Executive Engineer
EMoP	:	Environmental Monitoring Plan
ERD	:	Economic Relations Division
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Ratio of Return
EMA	:	External Monitoring Agency
EME	:	Effect Monitoring and Evaluation
EMP	:	Environmental Management Plan
ENPV	:	Economic Net Present Value
EO	:	Extension Overseas
ESC	:	Engineering Services Consultant
ETP	:	Effluent Treatment Plant
F&A	:	Finance and Accounting
F/S	:	Feasibility Study
FA	:	Field Assistant
FAP	:	Flood Action Plan
FC	:	Foreign Currency
FCD	:	Flood Control and Drainage
FCD/I	:	Flood Control, Drainage and Irrigation
FCDI	:	Flood Control, Drainage and Irrigation
FDAP	:	Fisheries Development Area Plan
FFS	:	Farmer Field School
FFW	:	Food For Works
FGD	:	Focus Groups Discussion
FIVDB	:	Friends in Village Development, Bangladesh
FLID	:	Fisheries and Livestock Information Department
FTA	:	Fault Tree Analysis

FWC	:	Family Welfare Center
FWMA	:	Federation of Water Management Association
FWUA	:	Federation of Water Users Association
FY	:	Fiscal Year
GCM	:	Growth Center Market
GDP	:	Gross Domestic Product
GIS	:	Geographic Information System
GK	:	Ganges-Kobadak
GO	:	Governmental Organization
GOB	:	Government of Bangladesh
GPWM	:	Guidelines for Participatory Water Management
GRC	:	Grievance Redress Committee
GTZ	:	German Technical Cooperation Agency
HACCP	:	Hazard Analysis and Critical Control Point
HED	:	Health Engineering Department
HH	:	Household
HIES	:	Household Income and Expenditure Survey
HILIP	:	Haor Infrastructure and Livelihood Improvement Project
HISAL	:	Haor Initiatives for Sustainable Alternative Livelihood
HIV	:	Human Immunodeficiency Virus
HMP	:	Haor Master Plan
HP	:	High Priority
HQ	:	Headquarters
HS	:	Highly Significance
HYV	:	High Yielding Variety
IA	:	Implementing Agency
IAPP	:	Integrated Agricultural Productivity Project
ICM	:	Integrated Crop Management
ICMG	:	Integrated Crop Management Group
ICUN	:	International Union for Conservation of Nature
ID	:	Identity Card
IEE	:	Initial Environmental Examination
IFAD	:	International Fund for Agricultural Development
IGA	:	Income Generation Activity
ILRP	:	Income and Livelihood Restoration Program
IMC	:	Implementation Monitoring Committee
IMR	:	Infant Mortality Rate
IMSC	:	Inter-Ministerial Steering Committee
IPM	:	Integrated Pest Management
IPMG	:	Integrated Pest Management Group
IRI	:	International Roughness Index
IWM	:	Institute of Water Modelling
IWMP	:	Integrated Water Management Plan
IWRM	:	Integrated Water Resources Management
IWT	:	Inland Water Transport
JDCF	:	Japan Debt Cancellation Fund

JICA	:	Japan International Cooperation Agency
JMC	:	Joint Management Committee
JVS	:	Joint Verification Survey
JVT	:	Joint Verification Team
KKRM	:	Kalni-Kushiyara River Management
KSS	:	Krishok Sarnabaya Samity
L	:	lowland
L&R	:	Land and Revenue
L/A	:	Loan Agreement
LA&R	:	Land Acquisition and Resettlement
LAP	:	Land Acquisition Plan
LC	:	Local Currency
LCB	:	Local Competitive Bidding
LCS	:	Labor Contracting Societies
LEAF	:	Local Extension Agents for Fisheries
LGD	:	Local Government Division
LGEB	:	Local Government Engineering Bureau
LGED	:	Local Government Engineering Department
LGI	:	Local Government Institution
LGSP	:	Local Governance Support project
LGRD	:	Local Government, Rural Development
LGRD&C	:	Local Government, Rural Development and Cooperative
LH	:	Lease Holder
LLP	:	Low Lift Pump
LMS	:	Land Market Survey
LOA	:	Letter of Agreement
LPL	:	Lower Poverty Line
M&E	:	Monitoring and Evaluation
M/M	:	Man/Month
MC	:	Management Committee
MDGs	:	Millennium Development Goals
MH	:	Medium Highland
MICS	:	Multiple Indicator Cluster Survey
MIS	:	Management Information System
ML	:	Medium Lowland
MLGRD&C	:	Ministry of Local Government, Rural Development and Cooperative
MM	:	Man/Month
MMC	:	Market Management Committee
MMT	:	Mobile Maintenance Team
MOA	:	Ministry of Agriculture
MOE	:	Ministry of Education
MOF	:	Ministry of Finance
MOEF	:	Ministry of Environment and Forests
MOFL	:	Ministry of Fisheries and Livestock
MOL	:	Ministry of Land
MOU	:	Memorandum of Understanding

MOWR	:	Ministry of Water Resources
MP	:	Master Plan
MP	:	Medium Priority
MVC	:	Multipurpose Village Center
NARS	:	National Agricultural Research System
NATP	:	National Agricultural Technology Project
NCA	:	Net Cultivated Areas
NCB	:	National Competitive Bidding
NEP	:	National Fisheries Policy
NERM	:	North East Region Model
NGO	:	Non-Governmental Organization
NOBIDEP	:	Northern Bangladesh Integrated Development Project
NOC	:	No Objection Certificate
NSAPR II	:	National Strategy for Accelerated Poverty Reduction II
NWMP	:	National Water Management Plan
NWP	:	National Water Policy
O&M	:	Operation and Maintenance
OAWP	:	Overall Annual Work Plan
ODA	:	Official Development Assistance
OFRD	:	On-farm Research Division
OP	:	Operational Procedure
OWP	:	Overall Work Plan
PAP	:	Project Affect Person
PC	:	Planning Commission
PD	:	Project Director
PEC	:	Project Evaluation Committee
PEO	:	Principal Extension Officer
PIU	:	Project Implementation Unit
PMO	:	Project Management Office
PMU	:	Project Monitoring Unit
POPI	:	People's Oriented Program Implementation
PPR	:	Public Procurement Regulation
PQ	:	Pre-Qualification
PRA	:	Participatory Research Activities
PSM	:	Participatory Scheme Management
PSO	:	Principal Scientific Officer
PSSWRSP	:	Participatory Small Scale Water Resources Sector Project
PUO	:	Project Upazila Office
PVAT	:	Property Valuation Advisory Team
PWD	:	Public Works Datum
PWD	:	Public Work Department
QCBS	:	Quality and Cost Based Selection
RAC	:	Resettlement Advisory Committee
RADP	:	Revised Annual Development Program
RAO	:	Regional Agriculture Office
RAP	:	Resettlement Action Plan

RCC	:	Reinforced Cement Concrete
RCF	:	Resettlement and Compensation Framework
RD	:	Rural Dispensary
RDP	:	Rural Development Project
RDRS	:	Rangpur Dinajpur Rural Service
REA	:	RAP Executing Agency
REB	:	Rural Electrification Board
RF	:	Resettlement Framework
RHD	:	Roads and Highways Department
RIIP	:	Rural Infrastructure Improvement Project
RM	:	Rural Market
RMRSU	:	Road Maintenance and Road Safety Unit
RO	:	Research Officer
ROW	:	Right of Way
RSDMS	:	Road and Structure Database Management System
RTC	:	Regional Training Centers
RTIP	:	Rural Transport Improvement Project
RU	:	Resettlement Unit
RV	:	Replacement Value
SAAO	:	Sub-assistant Agricultural Officer
SAE	:	Sub-assistant Engineer
SAIWRPM	:	Southwest Area Integrated Water Resources Planning and Management
SAP	:	South Asia Partnership- Bangladesh
SAPPO	:	Sub-assistant Plant Protection Officer
SCA	:	Seed Certification Agency
SCBRMP	:	Sunamganj Community Based Resource Management Project
SDE	:	Sub-divisional Engineer
SDO	:	Sub-division Office
SCF	:	Standard Conversion Factor
SE	:	Superintending Engineer
SFYP	:	Sixth Five Year Plan
SIA	:	Social Impact Assessment
SIGS	:	Small-scale Income Generation Sub-project
SO	:	Section Officer
SO	:	Section Office
SOB	:	Survey of Bangladesh
SR	:	Spoilage Reduction
SRDI	:	Soil Resources Development Institute
SSWRDP	:	Small Scale Water Resources Development Project
SSWRDS	:	Small Scale Water Resources Development and Support
STW	:	Shallow Tube Well
SU Samity	:	Samaj Unnoyan Samity
SW	:	Shallow Well
SW	:	Southwest
SWAIWRP&MP	:	Southwest Area Integrated Water Resources Planning and Management Project
TARD	:	Technical Assistance for Rural Development

TCCA	:	Thana Central Cooperative Association
TOR	:	Terms of Reference
TSD	:	Training and Staff Development
UCS	:	User's Cost Saving
U5MR	:	Under-5 Child Mortality Rate
UAO	:	Upazila Agriculture Offices
UAWP	:	Upazila Annual Work Plan
UCCA	:	Upazila Central Cooperative Association
UE	:	Upazila Engineer
UFO	:	Upazila Fisheries Office
UHC	:	Upazila Health Complex
ULAO	:	Upazila Livestock Assistant Office
ULO	:	Upazila Livestock Office
UMMC	:	Upazila Market Management Committee
UNESCAP	:	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	:	United Nations International Children's Emergency Fund
UNO	:	Upazila Nirbahi Officer
UNR	:	Union Road
UP	:	Union Parishad
UPL	:	Upper Poverty Line
UZR	:	Upazila Road
VAT	:	Value Added Tax
VC	:	Veterninary Compounder
VFA	:	Veterinary Field Assistant
VGD	:	Vulnerable Group Development
VGF	:	Vulnerable Group Feeding
VHP	:	Very High Priority
VHS	:	Very Highly Significance
VL	:	Very Lowland
VLR	:	Village Road
VOC	:	Vehicle Operating Cost
VOSD	:	Voluntary Organization for Social development
VR	:	Village Road
VS	:	Veterninary Surgeon
WARPO	:	Water Resources Planning Organization
WB	:	World Bank
WM	:	Water Management
WMA	:	Water Management Association
WMC	:	Water Management Committee
WMCA	:	Water Management Cooperative Association
WMF	:	Water Management Federation
WMG	:	Water Management Group
WMIP	:	Water Management Improvement Project
WMO	:	Water Management Organization
WP	:	Works Program
WPW	:	Works Program Wing

WUA	:	Water Users Association
WUC	:	Water Users Committee
WUG	:	Water Users Group
XEN	:	Executive Engineer

Abbreviations of Measures

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

Area

ha	=	hectare
m^2	=	square meter
km^2	=	square kilometer

Volume

1, lit	=	liter
m^3	=	cubic meter
m^3/s, cms	=	cubic meter per second
MCM	=	million cubic meter
m^3/d, cmd	=	cubic meter per day

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
t	=	ton
MT	=	metric ton

Time

sec	=	second
hr	=	hour
d	=	day
yr	=	year

Energy

kcal	=	Kilocalorie
kW	=	kilowatt
MW	=	megawatt
kWh	=	kilowatt-hour
GWh	=	gigawatt-hour

Money

BDT	=	Bangladesh Taka
JPY	=	Japanese Yen
USD	=	U.S. Dollar

Direction

N	=	North
E	=	East
S	=	South
W	=	West
NE	=	North-East
NW	=	North-West
SE	=	South-East
SW	=	South-West

Others

%	=	percent
°	=	degree
'	=	minute
"	=	second
°C	=	degree Celsius
cap.	=	capital
LU	=	livestock unit
md	=	man-day
mil.	=	million
no.	=	number
pers.	=	person
mmho	=	micromho
ppm	=	parts per million
ppb	=	parts per billion
lpcd	=	litter per capita per day
Mw	=	moment magnitude scale

CHAPTER 1 INTRODUCTION

1.1 Background of the Survey

The Ganges River, the Brahmaputra River and the Meghna River drain into the land of the People's Republic of Bangladesh, which has an area of 147,570 km^2 and is located between 20°34'N - 26°38'N and 88°01'E - 92°41'E[1]. Geographically, a substantial part of the country belongs to a low-lying delta formed by the three international rivers. The elevation of more than 90% of Bangladesh is lower than 10 m above mean sea level. Rainfall in the river basins is concentrated in the period of the wet season between May and October when the southwest monsoon prevails and shares more than 80% of the annual rainfall. The northeastern part receives the most rainfall in the country. An area in the Meghna River basin in the northeastern part of the country receives an average annual rainfall of more than 5,000 mm. The flat river channels in the deltas are not able to accommodate the runoff in the wet season and spill out flood water from the riverbanks every year in Bangladesh. Floods submerge more than 20% of the land on an annual average.

The catchment area of the Meghna River basin is estimated at 82,000 km^2. Bangladesh occupies the downstream delta of 35,000 km^2 in the northeastern region of the country. The land is flat alluvial fan with an average elevation of 5 m. There are lots of depressed areas with elevations of less than 3 m. Piracy of the river basin and branching of the river channel are frequent therein.

The remaining mountainous area of 47,000 km^2 belongs to India on the north of Bangladesh. The Meghalaya Mountain Range having an elevation of more than 2,000 m lies in this 47,000 km^2 area extending from the east to west, thus blocking the southwest monsoon. Orographic effect of the mountain range is prominent. The world's maximum average annual rainfall depth of 12,000 mm is recorded at Cherrapunji which is located in the upstream reach of the Meghna River basin on the southern slope of the Meghalaya Mountain Range.

The Meghna River in Bangladesh drains the high inflow runoff from the mountainous upstream reach area, including the runoff from the alluvial fan until it meets the Ganges River. The water stage of the Ganges River is higher than 5 m at the confluence in the wet season although it fluctuates depending on the tide level of the Bengal Bay. This affects the conveyance capacity of the Meghna River as well. The high inflow runoff and the limited conveyance capacity of the river channel are the main causes of the frequent flooding in the Meghna River basin. The flooded water spreads into the depressed areas in the low-lying alluvial fan through the branched channels and forms so called "haors". The depression is formed most probably by the meandering river channel in the erodible alluvial fan. Water surface of a haor amalgamates the surface water of the neighboring haor when the water level is raised. In this manner, a huge lake appears in the fan area in July every year. The surface

[1] Rashid, 1991

area of the lake fluctuates depending on the season. According to the Haor Master Plan, the area affected by the extreme flood in August 2010 was estimated at 8,600 km^2.

The haor area stretches over seven districts, namely, Sunamganj, Sylhet, Habiganj, Maulvibazar, Netrokona, Kishoreganj and Brahmanbaria. A haor area of about 8,600 km^2 shares about 42.5% of the total area of the seven districts (20,000 km^2). The estimated population in the seven districts is 18 million or 12.5% of the national population in 2011 according to the Community Report prepared by the Bangladesh Bureau of Statistics (BBS) in 2012. Agriculture, especially paddy cultivation followed by fisheries, is the main economic activity in the area.

Farmers plant paddies, boro rice, in December when the haor is drained up. Accordingly, they are busy harvesting in the period from the end of April to the beginning of May during pre-monsoon period. Production in the haor region of about 5.3 million tons in 710,000 ha shares almost 16% of the national paddy production, although the cultivation therein is only once a year or a crop intensity of 100%.

From time to time, certain magnitudes of floods occur in the pre-monsoon, period bringing damage to the paddy to be harvested. Floods suddenly attacking cultivated land are called flash floods. The Master Plan of Haor Area formulated by the Bangladesh Haor and Wetland Development Board (BHWDB) in 2012 estimated the annual damage caused by flash floods at BDT 3,486 million. Flood control in the haor area has been one of the major concerns of the government.

People in the haor area have established residential sites in elevated mounds which are not submerged throughout the year. However, wave action of the huge lake causes erosion in the bank of mounds. Loss of land due to erosion is another serious problem for residents. Erosion control is another issue to be handled by the government.

The navigable lake is beneficial to the people because they can reach their destination by the shortest possible way. However, sediment siltation in the lake has hampered such navigation. Silting in the river channel impedes draining of water in the haor area and delays planting of paddies. The risk of flash flood damages becomes higher if harvesting is delayed due to delayed planting. Control of siltation together with drainage improvement in the haor area is therefore another major issue to be coped with.

1.2 Policy, Strategy and Development Plans of the Government

The Bangladesh government has declared policies and formulated plans to manage water resources in the country. Most of the policies and plans address the haor area with significant concern. The following gives a brief summary of such relevant policies and plans:

Flood Action Plan (FAP) 6 Phase II (1994-1997)

FAP 6 stressed that water resources management in the northeastern region of Bangladesh should be planned for socioeconomic development of the area. Therefore, FAP 6 proposed a comprehensive approach in water resources management addressing the concept of Integrated

Water Resources Management (IWRM). The proposed comprehensive approach envisaged the preservation of the environment. It focused on sustainable water resources management, particularly of the haor area. In this context, FAP 6 concluded that a scheme to develop large-scale irrigation or flood control is not appropriate in the haor area. It vested higher priority to intervention of flood management rather than of flood control.

National Water Policy (NWP) (1999)

The NWP provides directives for 17 water-related issues in the country. Water in the haor area is one of these issues. The NWP demands the preservation of water in the haor area in order to maintain the aquatic environment. Also, drainage in the area is stipulated in the policy. Drainage is another facet of water-related issues to maintain the aquatic environment.

National Water Management Plan (NWMP 2004)

The government approved the NWMP, which was formulated by the Ministry of Water Resources (MoWR) in 2001, as the framework for realization of the policies indicated in the NWP. The intended goal of the plan is to achieve harmonized socioeconomic development through integrated management of water resources. Enhancement of living standards, poverty reduction and disaster prevention are major issues considered in the plan. In this context, water management of the haor area is one of the important programs included in the plan. The plan proposed 25 programs related to the haor area, such as flood protection in the charlands and haor basin, national, regional and feeder road development, and new public surface water irrigation system.

Five-Year Strategic Plan of BWDB (2010)

The Bangladesh Water Development Board (BWDB) formulated a strategic five-year plan based on FAP 6, the NWP and the NWMP for the period of 2011-2015. The programs related to the Upper Meghna River basin are river improvement, erosion control, navigation, existing surface water utilization, new surface water irrigation scheme and flood control, and drainage improvement. The proposed projects include river bank protection in Sylhet District, Meghna River erosion control, erosion control for Chandpur irrigation, procurement of dredging equipment, Monu River irrigation, flood control and drainage improvement of upper Surma-Kushiyara River, flood control along the right bank of the Surma River, rehabilitation and development of 37 haors, rehabilitation and development of Hail Haor and water resources management project for Jagannnah-Dirai-Shalna.

Sixth Five-Year Plan FY2011-FY2015 (SFYP 2011)

In recognition of the long-term development challenges, the government adopted Vision 2021. Vision 2021 and the associated Perspective Plan 2010-2021 have set solid development targets for Bangladesh by the end of 2021. Implementation will be done through two medium-term development plans, with the first spanning FY2011-FY2015. This five-year plan is the sixth in a series of development plans in Bangladesh which started in 1973.

The primary task of the Sixth Five-Year Plan (SFYP) is to develop strategies, policies and institutions that allow Bangladesh to accelerate growth and reduce poverty for achieving the goals set in Vision 2021. The SFYP presents detailed sectoral strategies, plans and programs as well. Haor areas were identified throughout the document as areas in the country that are isolated from mainstream public services. Meanwhile, the SFYP states, as one of its policies and strategies for the crop sector, that in order to meet the demand for additional food of the increasing population, emphasis would be given to utilize idle haor areas.

Master Plan of Haor Area (2012)

The highlight of the development plan in the haor area is the Master Plan of Haor Area (2012) formulated by BHWDB. The master plan was duly approved by the government in 2012. The master plan covers comprehensive areas and comprises a main report supported by 18 appendixes related to relevant subjects. The report describes socioeconomic conditions of the haor area as well as natural conditions such as climatology and hydrology. The report summarizes the haor area's geomorphology and river morphology. The report presents the identified problems and issues in the haor areas. The master plan proposes various strategic interventions to alleviate the problems. The examples of interventions directly related to flood control and livelihood enhancement are as follows:

Water resources	:	Protection from pre-monsoon flash floods
		River dredging
		Village protection against wave action
Agriculture	:	Expansion of irrigation
		Automation of paddy transplanting
		Diversification of crops
Fisheries	:	Establishment of fish sanctuaries
		Floodplain aquaculture
		Renovation of fishponds
Livestock	:	Improvement of fodder
		Establishment of pilot breeding program
Transportation	:	Upgrading of rural roads
		Development of landing facilities
Social services	:	Construction of growth center
Industry	:	Development of small and cottage industries

These projects were identified based on the requirements of the local people. The total number of projects is 154.

1.3 Related Projects

In line with the policies mentioned above, the government has embarked to implement the projects in the country including in the haor area. Some of such projects are summarized below.

Northern Bangladesh Integrated Development Project (NOBIDEP)

1) Objectives

The project purpose is to expand access to rural and urban infrastructures and services, and improve urban governance in the northern region of Bangladesh. This will be achieved by improving and sustaining the following: 1) rural infrastructure such as upazila roads (UZRs) and union roads (UNRs), and trading facilities such as growth centers and rural markets; 2) urban infrastructure, service delivery and governance of target *pourashavas*; and 3) linkages between rural and urban areas. The Japan International Cooperation Agency (JICA) supported the project under a yen loan scheme.

2) Area

The project covers an area of 32,740 km^2 and has a population of 33 million people. The project area consists of 14 districts. Eight districts are located in Rangpur Division, and six districts are located in Dhaka Division. Netrokona and Kishoreganj in Dhaka Division overlap with this study area.

3) Main Beneficiaries

The main beneficiaries of the project include the following: 1) users of rural infrastructures to be improved in the project area; 2) urban residents of the target *pourashavas* who will use basic infrastructures and receive public services; and 3) destitute women who will participate in Labor Contracting Societies (LCS) that will carry out off-pavement routine maintenance and tree plantation and caretaking on the project road.

4) Period

The proposed project duration is six years, starting from July 2013, and to be completed in June 2019.

5) Components

The project consists of the following four components:

- Component 1 : Rural Infrastructure Development
- Component 2 : Urban Infrastructure and Governance Improvement
- Component 3 : Project Implementation Support
- Component 4 : Project Administration Support

In addition to the yen loan-supported project, technical assistance is considered for local governance improvement to complement and strengthen the yen loan project.

6) Implementing Agency: Local Government Engineering Department (LGED)

7) Development Partner: JICA (Yen loan scheme)

Haor Infrastructure and Livelihood Improvement Project (HILIP)

1) Objectives

The objectives of the project is to improve the living standards and reduce the vulnerability of the poor by promoting the following: 1) enhanced access to market, livelihood opportunities and social services; 2) enhanced village mobility, reduction in production losses and protection against extreme weather events; 3) enhanced access to fishery resources and conservation of biodiversity; 4) enhanced production, diversification and marketing of crop and livestock productions; and 5) efficient, cost-effective and equitable use of project resources by stakeholders.

2) Area

The target districts of the project are overlapping with that of this survey, namely, Netrokona, Kishoreganj, Sunamganj, Habiganj and Brahmanbaria.

3) Target People

The project will benefit mainly the following: 1) poor households living in the haor basin; (2) smallholder farming households with less than 2.5 acres of land; 3) small fishing households deriving a major share of their income from fishing; 4) women from poor households; and 5) small traders and market intermediaries in local markets.

4) Period

The project period is from January 2012 to June 2019.

5) Components

The project consists of the following components:

- Component 1 : Communication Infrastructure
- Component 2 : Community Infrastructure
- Component 3 : Community Resources Management
- Component 4 : Livelihood Protection
- Component 5 : Project Management

6) Implementing Agency: LGED

7) Development Partner: International Fund for Agricultural Development (IFAD)

Sunamganj Community Based Resource Management Project (SCBRMP)

1) Objectives

The main objectives of the project are as follows:

- Increase the asset and income by developing self-managing grassroots organizations to improve the access of beneficiaries to primary resources, employment and credit.
- Support the development of available national institutions to replicate the project approach in other areas of Bangladesh.

2) Target area is Sunamganj District.

3) Target People

The project will benefit 90,000 farmers and fisher households holding land below 2.5 acres.

4) Period

The total project period is from 2002-03 to 2013-14.

5) Components

The following are the five components of the project to meet the project objectives:

- Labor-intensive infrastructure development
- Fisheries development
- Crop and livestock production
- Microcredit
- Institutional support

6) Implementing Agency: LGED

7) Development Partner: IFAD

Southwest Area Integrated Water Resources Planning and Management Project

1) Objectives

The main objectives of the project are to enhance the livelihood of the rural population by improving the productivity and sustainability of the existing flood control, drainage, and irrigation (FCDI) scheme.

2) Target Area

The target area is the FCDI area of 100,000 ha in the districts of Rajbari, Magura, Faridpur, Jessor, Narail and Gopalganj including Narail and Chenchuri beels.

3) Target People: 800,000

4) Period

The project period is from October 2005 to December 2013.

5) Components

The major components are flood control, irrigation, agricultural promotion, freshwater fisheries promotion, institutional reform and community development.

6) Implementing Agency: BWDB

7) Development Partner: Asian Development Bank (ADB)

8) Remarks

Although the project was implemented in the area other than the haor areas, the project deserves special consideration since this is one of the BWDB's representative projects related to income generation activities.

1.4 Rationale of the Survey

In line with the goals of the government presented in the former subsections, JICA has conducted surveys and studies to extend its cooperation to Bangladesh. The Preparatory Study on Cooperation for Disaster Management Sector in 2009 and 2010 proposes JICA's cooperation with the country. Based on this study, JICA established the necessity to focus its cooperation to Bangladesh on the Meghna River basin because of the seriousness of flood damages and the significant poverty conditions in the area as well as conceivable flood effects to Dhaka, the capital of Bangladesh. In view of this, JICA has conducted a series of surveys focusing on the river basin such as the Preparatory Survey on Cooperation for the Meghna River Basin Management Master Plan in 2010 and 2011, and the Preparatory Survey on Cooperation Program for Disaster Management in Bangladesh in 2012. Following these surveys, JICA commenced the Data Collection Survey on Water Resources Management in Haor Area of Bangladesh to review the projects proposed in the master plan based on technical and economic aspects and to propose priority projects in 2012.

Accordingly, JICA and BWDB agreed to conduct the Preparatory Survey on the Upper Meghna River Basin Watershed Management Improvement Project that comprises three components, i.e., Component 1 (flood control), Component 2 (rural infrastructure development) and livelihood enhancement mainly through Component 3-1 (agricultural promotion) and Component 3-2 (fisheries promotion) in the area. JICA entrusted the JICA Survey Team with the survey works and commenced the survey in May 2013.

During the course of the study, both JICA and the government realized that the implementation of measures for flood disaster mitigation and livelihood enhancement as one effort is crucial in improving living standards in the haor area because people in the area are suffering from the so-called vicious cycle of poverty and vulnerability to disaster. Eventually, both sides decided to implement the project vesting the same priority to livelihood enhancement (Components 2 and 3) and flood control (Component 1). JICA dispatched a mission to Bangladesh to discuss the implementing arrangement of the project with BWDB and LGED. The minutes of discussions signed by JICA, BWDB and LGED on 24 July 2013 defined the arrangement.

1.5 Objectives of the Survey

Firstly, the survey reviewed the projects of the first component, i.e., flood control, proposed by the Data Collection Survey on Water Resources Management in Haor Area of Bangladesh. In addition, the survey identified the necessary rural infrastructure development in order to facilitate livelihood enhancement through synergetic effects with Components 1 and 3. The survey carried out basic design thereof. Another substantial objective of the survey is to identify and formulate a plan to develop possible agricultural and fishery promoting interventions that have synergetic effects with the above proposed projects in the livelihood enhancement of the residents. The survey is expected to cover issues necessary for the consideration of the application of Japanese yen loan, such as project purpose, outline, project

cost, schedule of implementation, construction method, implementing agency, operation and maintenance system, and environmental and social considerations.

1.6 Survey Area

The target area of the survey is the haor area which covers seven districts, namely, Sunamganj, Sylhet, Habiganj, Maulvibazar, Netrokona, Kishoreganj and Brahmanbaria. As discussed in Section 1.1 above, the haor area is a depressed wetland in the Upper Meghna River basin. According to the Master Plan of Haor Area, the estimated total target area is 8,600 km^2. The target area is shown in blue color in the location map provided in the opening page of this report.

On other hand, the survey covers all the seven districts. The total area of the seven districts is 20,000 km^2 according to the Master Plan of Haor Area. The target area shares about 42% of the survey area.

Table 1.6.1 presents the areas and population of each district and the haor areas therein.

Table 1.6.1 Areas and Population of District and Haor Areas Therein

District	District Area (km^2)	Haor Area (km^2)	District Population (million)
Sunamganj	3,747	2,685	2.47
Sylhet	3,452	1,899	3.43
Habiganj	2,636	1,095	2.09
Maulvibazar	2,799	476	1.92
Netrokona	2,794	793	2.23
Kishoreganj	2,688	1,399	2.91
Brahmanbaria	1,881	296	2.84
Total	19,999	8,585	17.89

Source: Basis of district area and population is the Community Report, BBS, 2012
Basis of haor area is the Master Plan of Haor Area, 2012, BHWDB

1.7 Final Report

The commencement of this preparatory survey was in May 2013. Since the commencement the survey team have collected and collated the relevant data and information in the site and in Japan. The team has conducted analyses to formulate the most appropriate plan for the project. The Inception Report was prepared and submitted in June 2013 to clarify the objective of the project and to confirm the approaches for the project preparation. The submissions of the Progress Report and Interim Report were July and October 2013 respectively. Both reports present the progress of the project preparation at the times of the submissions. The Draft Final Report was prepared and submitted on 17 December 2013. The Report presents the planned features of the project, implementation methods, cost to be incurred, benefit to be accrued. Environment and social considerations are crucial as for the smooth and effective implementation of the project and are discussed in the report as well. The Reports were presented and explained to the implementing agencies namely BWDB and LGED. Together with JICA both agencies have commented to the Reports and given suggestions to the survey team for the preparation of the Final Report.

This Final Report incorporates all the information, analyzed results, comments and suggestions furnished to the survey during the survey period and presents the features of the eventually formulated Project together with the required funds, budgets and the multi-objective viabilities of the project on the basis of economic, environmental and social evaluations. The report presents the necessary preparations for the implementation and maintenance of the project as well. The Report comprises 13 chapters as presented in Table of Contents.

Chapter 1 and 2 discuss the rationale, objective and background of the Project. The Project addresses flood damage and livelihood improvement at one effort. The necessity of the Project is discussed in the chapter 2.

The formulated features of the multi disciplinary project with 3 components are presented in the chapters of 3, 4, 5 and 6.

Chapter 7 discusses the implementation and OM of the project. Meanwhile chapter 8 briefs the construction methods of the proposed interventions.

The required environmental and social considerations are indicated in Chapter 9 and 10 respectively.

The costs for the implementation are summarized in chapter 11 including the cost for engineering services. Meanwhile the scope of works for the engineering services are the main subjects of the chapter 12.

Chapter 13 enumerates the benefit of the project and the economic viability of the project as the results of the evaluation.

The Final Report comprises two separate volumes. While the Volume I describes the main text, the Volume II presents the back data for better understanding as Appendixes.

CHAPTER 2 PROJECT AREA

2.1 Socioeconomic Features

In this sub-chapter, the socioeconomic conditions in Bangladesh and the Survey Area are evaluated referring to the latest census data and other public documents. The economic risk of flash floods and poverty condition, which the people in the Survey Area faces, is clarified in the latter part, referring to the implemented household survey within this study.

2.1.1 Population and Household

The Bangladesh Bureau of Statistics (BBS) has conducted series of census survey. According to the "Population and Housing Census 2011", the national household and population numbers are 32,173,000 and 142,319,000, respectively. Furthermore, the Population and Housing Census 2011 prepared by BBS presents the trends in population by divisions as shown in Table 2.1.1.

Table 2.1.1 National and Divisional Population

Division	Population (1,000 people)		
	1991	2001	2011
Barisal	7,463	8,174	8,147
Chittagong	20,523	24,290	28,079
Dhaka	32,666	39,045	46,729
Khulna	12,688	14,705	15,563
Rajshahi	14,212	16,355	18,329
Rangpur	11,998	13,847	15,665
Sylhet	***6,765***	***7,939***	***9,807***
National	**106,315**	**124,355**	**142,319**

Source: Population and Housing Census 2011, BBS

Sylhet Division, the core division of the survey area[1], accounted for 6.4% of the national population in 1991. This share increased to 6.9% in 2011. The estimated national population growth rates in ten-year periods 1991-2001 and 2001-2011 are 16.9% and 14.4%, respectively. Meanwhile, those for Sylhet Division are 17.4% and 23.5%, respectively. Due to the recent high growth rates in Sylhet Division, the development of infrastructure is necessary in this division in supplementing social services and infrastructure for additional demand.

Households of 3,489,000, or a population of 17,800,000, occupied the seven Districts in 2011. The estimated area is 20,000 km^2 and the mean population density was 890 persons/km^2. The population in the survey area shares 12.4% of the national population. The details on household and population are given in Table 2.1.2.

[1] Four districts out of seven districts of survey area is located in the Sylhet Division.

Table 2.1.2 Household and Population (2001 and 2011)

Area	**Household** (in thousands)		**Population** (in millions)	
	2001	**2011**	**2001**	**2011**
National	25,491	32,173	124	144
Survey Area				
Brahmanbaria	429	539	2.4	2.8
Kishoreganj	535	627	2.6	2.9
Netrakona	410	479	2.0	2.2
Habiganj	322	393	1.8	2.1
Maulvibazar	293	361	1.6	1.9
Sunamganj	350	440	2.0	2.5
Sylhet	*424*	*596*	*2.5*	*3.4*
Total	**2,763**	**3,489**	**14.9**	**17.8**

Source: Household and Population 2001, Community Report 2012, BBS

2.1.2 Economic Condition

The estimated GDP of Bangladesh is BDT 9.2 trillion in the fiscal year (FY) of 2011/2012 at current price. The amount is equivalent to BDT 4.1 trillion in FY2008/2009 constant prices. The share of the manufacturing sector is BDT 749 billion in FY2008/2009 constant prices or 18.3%, which is the highest, followed by the agricultural sector with BDT 593 billion or 14.5% of the total. The contribution of wholesale is BDT 562 billion or 13.9%, which is remarkably low as compared with those in other Asian countries at 20% to 30%.

Textile is the representative industry in the manufacturing sector and is mostly concentrated in large cities like Dhaka and Chittagong. Paddy is the substantial product of the agricultural sector. Table 2.1.3 indicates GDP trends of each sector in the national economy.

Table 2.1.3 GDPs and Contributions of Sectors in FY2008/2009 Constant Price

(unit: BDT million)

Sector	FY2008/2009		FY2009/2010		FY2010/2011		FY2011/2012		FY2012/2013*	
	price	**%**	**price**	**%**	**price**	**%**	**price**	**%**	**price**	**%**
Agriculture	***522***	***15.3***	***551***	***15.3***	***579***	***15.0***	***593***	***14.5***	***601***	***13.9***
Fisheries	***150***	***4.4***	***157***	***4.4***	***165***	***4.3***	***174***	***4.3***	***182***	***4.2***
Manufacture	588	17.3	626	17.4	685	17.8	749	18.3	819	18.9
Construction	299	8.8	317	8.8	338	8.8	364	8.9	393	9.1
Wholesale	473	13.9	501	13.9	532	13.8	562	13.7	589	13.6
Transportation	349	10.3	376	10.4	398	10.3	424	10.4	453	10.4
Real Estate	241	7.1	250	6.9	260	6.8	271	6.6	282	6.5
Community service	228	6.7	238	6.6	249	6.5	261	6.4	274	6.3
Others	552	16.2	592	16.4	645	16.7	693	16.9	743	17.1
Total	**3,402**	**-**	**3,608**	**-**	**3,851**	**-**	**4,091**	**-**	**4,337**	**-**

Note: *Provisional figures
Source: Compiled by the JICA Survey Team based on BBS data

The estimated annual growth rate of GDP is 6% except for FY2010/2011, where the growth was estimated to be high at 7% from its previous year. The shares of agriculture decrease from 15.3% in FY2008/2009 to 13.9% in FY2012/2013, as the increase rate of the sector is slower than the average of the whole sector.

2.1.3 Present Condition of Agriculture and Fisheries Sector

The main income source of households by division is summarized in Tables 2.1.4 (number) and 2.1.5 (share). As shown in Table 2.1.5, 53% of households in Sylhet Division are engaged in agriculture, where the self-employed and day labor employees comprise about 28% and 25% of the total households, respectively. The said rate of households engaged in agriculture is much higher than the national level at 42%. This indicates that the local economy highly depends on the agriculture sector.

Table 2.1.4 Main Income Source of Household by Division (by Number of Households)

Name of Division	Total Households	1) Agriculture			2) Non-agriculture			3) Service	4) Other
		Self Employed	Day Laborer	Total	Self Employed	Day Laborer	Total		
Barishal	2,022	540	264	804	326	390	716	251	251
Chittagong	5,786	1,004	783	1,787	871	796	1,667	1,297	1,035
Dhaka	10,707	2,113	1,482	3,595	2,051	1,523	3,574	2,248	1,290
Khulna	4,030	1,084	899	1,983	753	564	1,317	443	287
Rajshahi	4,860	1,399	1,183	2,582	832	630	1,462	380	436
Rangpur	4,068	1,094	1,174	2,268	773	554	1,327	281	192
Sylhet	*1,862*	*512*	*466*	*978*	*166*	*323*	*489*	*174*	*221*
Bangladesh	33,335	7,746	6,251	13,997	5,772	4,780	10,552	5,074	3,712

Source: Report on Labor Force Survey 2010, Bangladesh Bureau of Statistics

Table 2.1.5 Main Income Source of Household by Division (Percentage)

Name of Division	Total Households	1) Agriculture			2) Non-agriculture			3) Service	4) Other
		Self Employed	Day Laborer	Total	Self Employed	Day Laborer	Total		
Barishal	2,022	26.7%	13.1%	39.8%	16.1v	19.3%	35.4%	12.4%	12.4%
Chittagong	5,786	17.4%	13.5%	30.9%	15.1%	13.8%	28.8%	22.4%	17.9%
Dhaka	10,707	19.7%	13.8%	33.6%	19.2%	14.2%	33.4%	21.0%	12.0%
Khulna	4,030	26.9%	22.3%	49.2%	18.7%	14.0%	32.7%	11.0%	7.1%
Rajshahi	4,860	28.8%	24.3%	53.1%	17.1%	13.0%	30.1%	7.8%	9.0%
Rangpur	4,068	26.9%	28.9%	55.8%	19.0%	13.6%	32.6%	6.9%	4.7%
Sylhet	*1,862*	*27.5%*	*25.0%*	*52.5%*	*8.9%*	*17.3%*	*26.3%*	*9.3%*	*11.9%*
Bangladesh	**33,335**	**23.2%**	**18.8%**	**42.0%**	**17.3%**	**14.3%**	**31.7%**	**15.2%**	**11.1%**

Source: Report on Labor Force Survey, 2010, Bangladesh Bureau of Statistics

The amount of food grain production (rice, wheat, maize, millets, barley, and other cereal) by division is shown in Table 2.1.6. The production in Sylhet Division has a relatively low efficiency accounting for 6.8% of the food grain production in contrast to 7.8% of the net cultivated land in the country.

Even though the share of households working in the agriculture sector is higher, the overall production is lower than the other areas. It implies the lower income source of agriculture in the area under the severe natural condition.

Table 2.1.6 Foodgrain Production by Division

Name of Division	Cultivated Land		Foodgrain Production*		Population
	1,000 ha	Share	1,000 t	Share	Share
Barisal	771	9.8%	2,339	6.6%	5.7%
Chittagong	1,050	13.4%	4,728	13.3%	19.7%
Dhaka	1,926	24.6%	8,745	24.6%	32.8%
Khulna	832	10.6%	4,817	13.6%	10.9%
Rajshahi	1,521	19.4%	6,126	17.2%	12.9%
Rangpur	1,133	14.4%	6,354	17.9%	11.0%
Sylhet	*608*	*7.8%*	*2,426*	*6.8%*	*6.9%*
Bangaldesh	**7,841**	**100.0%**	**35,535**	**100.0%**	**100.0%**

Note: *Rice, wheat, maize, millets, barley, and other cereal.
Source: Yearbook of Agricultural Statistics of Bangladesh 2011. Bangladesh Bureau of Statistics. Statistics Division, Ministry of Planning

The foodgrain production in the haor area is summarized in Table 2.1.7. The haor area takes 13.5% of the total foodgrain production in contrast to 13.8% of the net cultivated land in Bangladesh.

Table 2.1.7 Foodgrain Production in Haor Area

Name of District	Cultivated land		Foodgrain Production*	
	1,000 ha	Percent of Bangladesh	1,000 t	Percent of Bangladesh
Brahmanbaria	119	1.5%	582	1.7%
Kishoreganj	356[1)]	4.5%[1)]	786	2.4%
Netrokona			864	2.6%
Habiganj	608[2)]	7.8%[2)]	786	2.3%
Moulvibazar			435	1.3%
Sunamganj			488	1.4%
Sylhet			592	1.8%
Total	1,083	13.8%	4,547	13.5%
Bangladesh	**7,841**		**33,767**	

Note 1): The values of Kishoreganj and Netrokona districts are combined.
2): The values of Sylhet, Habiganj, Moulvibazar, and Sunamganj districts are combined.
Source: Agriculture Census 2008 and Yearbook of Agricultural Statistics of Bangladesh 2010 and 2011.

Regarding fisheries, the annual fish production in Sylhet Division accounts for 6.8% of the national production, as shown in Table 2.1.8. The rate almost corresponds to the population share of Sylhet Division at 6.9%.

Table 2.1.8 Annual Fish Production (2009-2010)

Name of Division	Production (million t)					Total		
	River	Beel	Floodplain	Pond	Others[1)]	Production (million t)	Share	Population Share
Barishal	67,894	47	29,799	87,770	13,352	198,862	8.3%	5.7%
Chittagong	48,295	985	182,920	216,857	43,541	492,598	20.7%	19.7%
Dhaka	12,561	32,724	259,413	347,626	7,206	659,530	27.7%	32.0%
Khulna	4,364	4,671	58,138	127,611	167,331	362,115	15.2%	10.9%
Rajshahi	4,823	16,548	103,902	222,046	5,485	352,804	14.8%	12.9%
Rangpur	1,491	4,147	60,983	85,547	1,535	153,703	6.5%	11.0%
Sylhet	*1,720*	*20,114*	*86,652*	*53,027*	*791*	*162,304*	*6.8%*	*6.9%*
Bangladesh	**141,148**	**79,236**	**781,807**	**1,140,484**	**239,241**	**2,381,916**	**100.0%**	**100.0%**

Note: 1): Brackish water, lake, semi-closed culture, and shrimp/prawn farms.
Source: Yearbook of Agricultural Statistics of Bangladesh, 2011

The fish production in the Haor area is summarized in Table 2.1.9. The combined production composes 13.2% of the total fish production in Bangladesh. Compared with other areas, fish production in beels and floodplains have the higher shares in the Haor area.

Table 2.1.9 Fish Production in Haor Area (2009-2010)

Name of District	Production (t)					
	River	Beel	Floodplain	Pond	Others	Total
Brahmanbaria	1,291	287	16,003	18,533	396	36,510
Kishoreganj	1,229	6,205	33,034	14,545	65	55,078
Netrokona	316	5,140	35,042	19,249	231	59,978
Habiganj	137	1,832	5,867	10,006	23	17,865
Moulvibazar	599	1,832	15,815	14,611	361	33,218
Sunamganj	532	12,895	39,182	19,043	471	72,123
Sylhet	452	3,239	25,788	9,368	251	39,098
Total	**4,556**	**31,430**	**170,731**	**105,355**	**1,798**	**313,870**
% of Bangladesh	**3.2**	**39.7**	**21.8**	**9.2**	**0.8**	**13.2**
Bangladesh	**141,148**	**79,209**	**781,807**	**1,140,484**	**239,268**	**2,381,916**

Source: Yearbook of Agricultural Statistics of Bangladesh, 2011.

2.1.4 Infrastructure and Social Services

(1) Electricity

The Rural Electrification Board (REB) is responsible for the distribution of electricity in rural areas of Bangladesh. The electrification rate in the survey area shows a lower rate compared with national level at 55% in 2010. The lowest rate of access to electricity is 21.23% in Sunamganj District, followed by Netrakona (27.41%), and Kishoreganj (30.47%) Division, as shown in Table 2.1.10. There would still be a wide gap between the household demand and electricity supply in rural areas.

Table 2.1.10 Rate of Access to Electricity

Division	District	Household with Access to Electricity	
		in 2005	in 2010
Sylhet	Sunamganj	10.20%	21.23%
Sylhet	Habiganj	24.00%	35.03%
Dhaka	Netrakona	16.38%	27.41%
Dhaka	Kishoreganj	19.44%	30.47%
Chittagong	Brahmanbaria	33.71%	44.74%
Sylhet	Sylhet	35.17%	46.17%
Sylhet	Maulvibazar	25.88%	36.91%
	National	**44.23%**	**55.26%**

Source: M/P of Haor Area 2012, original source from Preliminary Report on HIES-2010, BBS

(2) Water Supply

Referring to the Multiple Indicator Cluster Survey (MICS) conducted in 2009, most of the households in the survey area are using either deep tube well or shallow tube well that extracts groundwater for drinking purposes. The percentage of using unimproved water source (such as

unprotected well, unprotected spring, surface water and other) is higher in Sylhet (16.4%), Maulvibazar (5.6%), and Sunamganj (5.4%) divisions, compared with the national level (4.0%), as shown in Table 2.1.11.

Table 2.1.11 Source of Drinking Water

Division	District	Water Supply	Deep Tube Well (>500 ft)	Shallow Tube Well (<500 ft)	Other Improved Source (Protected Well, etc.)	Unimproved Source (Unprotected Well, etc.)
Sylhet	Sunamganj	0.70%	28.20%	65.00%	0.80%	5.30%
Sylhet	Habiganj	1.20%	12.50%	83.20%	0.70%	2.40%
Dhaka	Netrakona	2.20%	8.50%	88.00%	0.20%	1.10%
Dhaka	Kishoreganj	0.60%	7.50%	91.20%	0.30%	0.40%
Chittagong	Brahmanbaria	0.60%	6.60%	91.00%	1.20%	0.60%
Sylhet	Sylhet	7.50%	14.00%	60.30%	1.80%	16.40%
Sylhet	Maulvibazar	3.10%	5.30%	80.50%	5.50%	5.60%
	National	**7.90%**	**16.10%**	**70.90%**	**1.10%**	**4.00%**

Source: Multiple Indicator Cluster Survey, 2009, UNICEF

(3) Sanitation

The types of sanitation facilities in the survey area are summarized in Table 2.1.12. Pit latrine has the dominant share in the area. By the definition of GOB, the hygiene facility rate shows the inferior condition in the Project area except for Habiganj and Brahmanbaria Districts. Further improvement in sanitation facility is necessary for achieving the clean livelihood condition.

Table 2.1.12 Types of Sanitation Facility

Division	District	Flush to Sewer or Septic Tank	Pit Latrine	Others (bucket latrine, no facility, etc.)	Hygienic Facility by GOB Definition*
Sylhet	Sunamganj	7.7%	81.7%	10.6%	30.3%
Sylhet	Habiganj	5.7%	74.4%	19.9%	53.4%
Dhaka	Netrakona	5.4%	72.6%	22.0%	24.4%
Dhaka	Kishoreganj	4.9%	75.3%	19.8%	13.8%
Chittagong	Brahmanbaria	13.4%	76.0%	10.6%	55.5%
Sylhet	Sylhet	27.0%	62.2%	10.8%	43.6%
Sylhet	Maulvibazar	15.4%	69.4%	15.2%	45.4%
	National	**17.3%**	**71.5%**	**11.2%**	**51.5%**

Note: * Hygienic facilities are those with ring-slab/tank and water seal, where the excreta and smell don't get out and insects can't get in to or out of the pit/tank.
Source: Multiple Indicator Cluster Survey, 2009, UNICEF

(4) Education

According to the BBS, the average literacy rate of the haor districts in 2005 is 38%, while the national level is at 54.8%. Among the districts in the survey area, Maulvibazar District has the highest literate population (42%) followed by Sylhet (41%) and Brahmanbaria (40%). The distribution of educational institutes in each district in 2010 is shown in Table 2.1.13.

Table 2.1.13 Literacy Rate in 2005 and Number of Educational Institutes in 2010

Division	District	Literacy Rate (2005)	Primary school	High school	College	Vocational school
Sylhet	Sunamganj	33%	1,447	149	27	2
Sylhet	Habiganj	37%	1,053	108	22	2
Dhaka	Netrakona	34%	1,166	186	30	6
Dhaka	Kishoreganj	37%	1,305	202	30	9
Chittagong	Brahmanbaria	40%	1,033	182	36	7
Sylhet	Sylhet	41%	1,350	256	60	3
Sylhet	Maulvibazar	42%	1,027	141	27	0
Total		**-**	**8,381**	**1,224**	**232**	**29**
National		**54.8%**	**-**	**-**	**-**	**-**

Source: MoE, 2010 and BBS, 2010

(5) Health

Health sector is one of the foremost focus in the national policies in ensuring national development.. However, burdened by inadequate poverty and infrastructure, the overall health status in the haor area continues to lag behind the national benchmark.

The Infant Mortality Rate (IMR) and Under-5 Child Mortality Rate (U5MR) indicate the probability of dying by exact age of one year and five years per 1,000 live births. Referring to MICS 2009, both figures in the survey area show higher figures except for Brahmanbaria District. The IMR and U5MR imply the inferior health condition in Sunamganj, Netrakona, and Kishorenganj districts, as their numbers are approximately 30-40% higher than the national average of 49 and 64 per 1,000 live births, respectively, as shown in Table 2.1.14.

Table 2.1.14 Infant Mortality Rate and Under-five Mortality Rate

(unit: number of deaths per 1,000 live births)

Division	District	IMR	U5MR
Sylhet	Sunamganj	68	94
Sylhet	Habiganj	50	65
Dhaka	Netrakona	66	91
Dhaka	Kishoreganj	67	92
Chittagong	Brahmanbaria	45	58
Sylhet	Sylhet	52	69
Sylhet	Maulvibazar	50	66
National Average		**49**	**64**

Source: Multiple Indicator Cluster Survey, 2009, UNICEF

The high IMR and U5MR are closely related to malnutrion. Referring to HILIP 2011 report, the average of under-five child malnutrition in haor districts is approximately 55%, which is again higher than the national rate of 41%, as shown in Table 2.1.15.

Table 2.1.15 Incidence of Child Malnutrition

Division	Underweight	Acute Malnutrition	Chronic Malnutrition
Haor Area	55.2%	17.8%	48%
Char Area	57%	18%	52%
National Average	**41.0%**	**17.4%**	**43.2%**

Source: HILIP 2011, original data from Bangladesh Demographic and Health Survey, 2007 and Mitra 2010 (Haor RiMS Survey)

Health services and facilities in the Haor area are available in five tiers: the district-level hospitals, the Upazila Health Complex (UHC) at upazila level, the Family Welfare Center (FWC), the Rural Dispensary (RD) at union level, and the Community Clinic (CC) at community level. The number of respective health facilities are shown in Table 2.1.16.

Table 2.1.16 Number of Health Facilities

Division	District	Health Complex	Family Welfare Center	Community Clinic
Sylhet	Sunamganj	9	27	164
Sylhet	Habiganj	7	43	171
Dhaka	Netrakona	9	60	196
Dhaka	Kishoreganj	12	70	233
Chittagong	Brahmanbaria	6	65	192
Sylhet	Sylhet	10	64	187
Sylhet	Maulvibazar	5	43	148
	Total	**58**	**372**	**1,291**

Source: HED, 2010

According to HED in 2010, the population per doctor in the haor area is 23,304, which is eight times higher than the national average of 2,785. The lowest coverage was observed in Habiganj District (44,000) followed by Sunamganj District (37,000). The number of population per nurse is 11,729 in the Haor area compared to the national level average of 5,782. This ratio is the highest in Kishoreganj District (15,920) followed by Maulvibazar (15,553) and Sunamganj (13,000) districts.

(6) Road transport

Haor areas remain underwater for 4-6 months during the pre-monsoon and monsoon seasons. The roads are submerged during this period making it impossible to travel from one place to another without using boats. The transportation networks of waterways and roadways have been developed over the years in keeping with the unique characteristics of haors.

The Bangladesh Roads and Highways Department (RHD) is responsible for constructing roads at the national, regional, and district levels. The rural roads consisting of upazila, union, and village roads are constructed by the Local Government Engineering Department (LGED). There are 11 upazilas out of the total 69 in the haor districts that are not connected with the RHD network. The road network length and density in the districts are shown Table 2.1.17. The table shows that Sunamganj District has the lowest number of roads in terms of density while Sylhet has the largest road coverage.

Insufficiency of road networks has hampered farmers in transporting their products to flood-free zones and facilities while the products have been damaged by floods. The poor road network has been one of the causes of poverty in the Haor area.

Table 2.1.17 Road Network Length and Density

(unit: km)

District	Roads under RHD					Roads under LGED			
	National	Regional	District	Upazila	Density (m/km^2)	Union	Village A[*1]	Village B[*1]	Density (m/km^2)
Sunamganj	-	94	173	264	73	1,067	2,607	1,429	1,463
Habiganj	238	151	205	611	225	849	1,957	1,022	1,683
Netrakona	-	147	452	809	218	969	2,504	906	1,890
Kishoreganj	4	146	441	692	216	975	1,915	1,788	1,967
Brahmanbaria	145	123	120	532	201	657	1,359	922	1,801
Sylhet	513	623	494	463	467	1,194	3,608	1,600	1,966
Maulvibazar	423	138	349	381	325	849	2,499	888	1,650
Total	**1,323**	**1,422**	**2,234**	**3,752**		**6,560**	**16,449**	**8,555**	

Note: *1 Villages "A" and "B" are not clearly explained in the draft Haor M/P.
Source: RHD, 2010; LGED, 2010; and Draft Haor M/P, 2011

(7) Inland navigation

Inland waterway is a major mode of transporting cargos and passengers in the haor area. There are 25 inland Water Transport (IWT) routes covering a length of 1,828.8 km of inland waterways, which remain navigable during the monsoon season (May to September). However, during the lean period (October to April), inland vessels cannot navigate along the waterways of about 1,000 km.

(8) Problems in access to infrastructures

The Boro haor in Kishoreganj District and Ganesh haor in Netrokona District are the selected haors in which a preliminary abbreviated resettlement and compensation plan was studied on the basis of the conducted socioeconomic survey. The survey furnishes its indicative information regarding the access to the infrastructures in the haor area as well.

People in many villages in the Boro haor like Shaharmul use boats for transportation during the monsoon season. Walking is the only option for them to access the infrastructures such as schools, hospitals, and markets during the dry season because the roads are badly deteriorated. The nearest market is Marichkhali located at a 5 km distance. The situation in the Ganesh haor is more or less the same. For instance, the people in Douj Village travel 5-6 km by foot to avail general health services in Atpara or Madan UHC during the dry season.

The submerged depths of two haors are 2-3 m in the monsoon season and the consequent accessibilities to infrastructures are supposed to be representative of the whole sub-projects.

2.1.5 Household Economy

In accordance to the Household Income and Expenditure Survey (HIES) in 2011, the trend of income and expenditure in Bangladesh is as shown in the Table 2.1.18.

The average income and expenditure of households has been gradually increasing in Bangladesh, which achieved BDT 11,479 per month and BDT 11,200 per month in 2011, respectively. The inequity of the economic conditions in the society is considerably high as the Gini Co-efficient becomes 0.458 and has not improved since 2000.

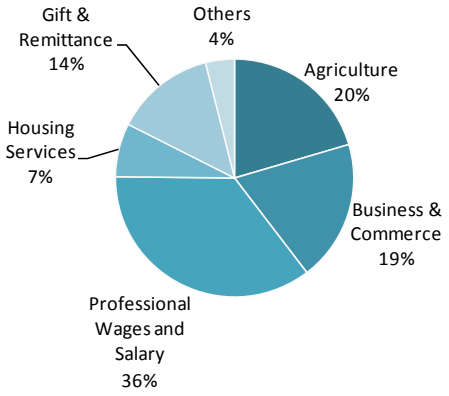
Table 2.1.18 Average Household Income and Expenditure and Respective Gini Co-efficient

Survey Year	Number of Household Members	Number of Earners	Monthly Household Income (TK)			Monthly Income per Capita (BDT)	Gini Coefficient	Monthly Expenditure (BDT)	Monthly Consumption Expenditure (BDT)
			National	Urban	Rural				
2010	4.50	1.31	11,479	16,475	9,648	2,553	0.458	11,200	11,003
2005	4.85	1.40	7,203	10,463	6,095	1,485	0.467	6,134	5,964
2000	5.18	1.45	5,842	9,878	4,816	1,128	0.451	4,881	4,537
1995-96	5.26	1.48	4,366	7,973	3,658	830	-	4,096	4,026

Note: There is a difference between the amount of income and consumption expenditure owing to the inconsistency of the answers collected from households.

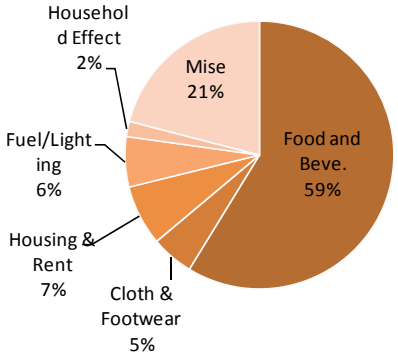
Source: HIES 2010

The share of income and expenditure categories is summarized in Figures 2.1.1 and 2.1.2, respectively. Agriculture is one of the main sources of income, which shares approximately 20% of the total income in Bangladesh. The "Gift & Remittance" from domestic and international workers also take a significant share at 14% of the total income.



Source: HIES 2010

Figure 2.1.1 Composition of Income Items



Source: HIES 2010

Figure 2.1.2 Composition of Expenditure Items

The average income and consumption expenditure of each division is indicated in Table 2.1.19. The income and consumption expenditure in Sylhet Division is approximately at the same level as the national average.

Table 2.1.19 Average Household Income/Expenditure per Division

(unit: BDT/month)

Division	Income	Consumption Expenditure
Barishal	9,158	9,826
Chittagong	14,092	14,360
Dhaka	13,226	11,643
Khulna	9,569	9,304
Rajshahi	9,342	9,254
Rangpur	8,359	8,298
Sylhet	*11,629*	*12,003*
National	**11,479**	**11,003**

Note: There is a difference between income and consumption expenditure owing to the inconsistency of the answers collected from households.

Source: HIES 2010

2.1.6 Poverty Condition

Since 1995, BSS has been using the Cost of Basic Needs (CBN) method as the standard method in estimating the incidence of poverty. The population rate living below two poverty lines, which are the Lower Poverty Line (LPL) and Upper Poverty Line (UPL), are generally used for the evaluation of poverty condition. Both poverty lines are calculated in each division as summing the "necessary food expenditure" and "non-food expenditure" of the lowest and lower income household based on the result of HIES in 2010.

The trend after 2000 clearly shows an improvement in the livelihood in Bangladesh reflected by the national economic growth and installment of other social services during the period, as shown in Table 2.1.20 and Figure 2.1.3. The improvement should be sustained through optimum development plans and sufficient social support.

Table 2.1.20 Historical Trend of Population Living under Poverty Lines

Years of HIES	Population Rate under UPL	Population Rate under LPL
2010	31.5%	17.6%
2005	40.0%	25.1%
2000	48.9%	34.3%
1995-96	50.1%	35.2%
1991-92	42.8%	41.1%

Source: HIES 2010

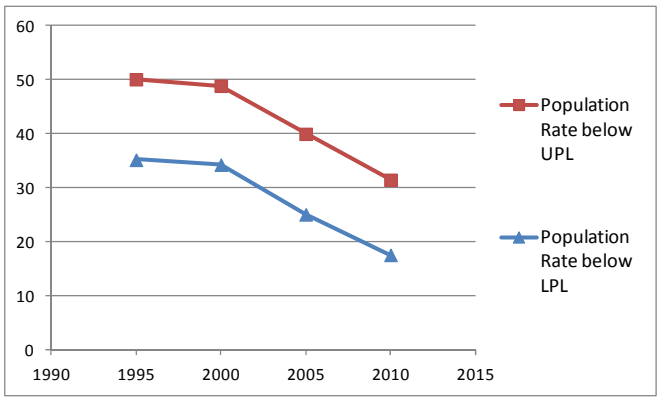


Figure 2.1.3 Historical Trend of Population Living under Poverty Lines

Furthermore, the inequity of economic condition based on the education level, employment sector, and living area (urban/rural) are still high as implied by Gini Co-efficient as shown earlier in the Table 2.1.18. The support to the lower income group, including the agriculture and fishery sectors, contributes in securing social stability and sustainable development.

The share of people living below the poverty lines in each division is summarized in Table 2.1.21. The share of Sylhet Division under LPL is higher compared with the national level, while its share under UPL is slightly lower than the national level.

Table 2.1.21 Population Rate Living below Poverty Lines per Division

Division	LPL (Lower Poverty Line)			UPL (Upper Poverty Line)		
	Total	Rural	Urban	Total	Rural	Urban
Barisal	26.7%	27.3%	24.2%	39.4%	39.2%	39.9%
Chittagong	13.1%	16.2%	4.0%	26.2%	31.0%	11.8%
Dhaka	15.6%	23.5%	3.8%	30.5%	38.8%	18.0%
Khulna	15.4%	15.2%	16.4%	32.1%	31.0%	35.8%
Rajshahi	21.6%	22.7%	15.6%	35.7%	36.6%	30.7%
Sylhet	***20.7%***	***23.5%***	***5.5%***	***28.1%***	***30.0%***	***29.0%***
National	**17.6%**	**21.1%**	**7.7%**	**31.5%**	**35.2%**	**21.3%**

Source: HIES 2010

The summary of population rates living below the poverty lines per employment sector of household head in Bangladesh is shown in Table 2.1.22. It indicates the dependency of the living condition on the employment sector. As for the LPL and UPL under the category of agriculture, forestry, and fisheries, which are the main sources of income in the survey area, the incidence rate of poverty is approximately 5% higher than the national average level.

Table 2.1.22 Rate of People Living Under Poverty Line per Employment Sector

Occupation of Head	LPL			UPL		
	Total	Rural	Urban	Total	Rural	Urban
Professional, Technical & related Works	10.6%	15.0%	4.3%	19.5%	24.8%	11.9%
Administrative & Management Works	0.5%	1.2%	0.0%	0.8%	1.8%	0.0%
Clerical related works & Govt. Executive	8.5%	15.5%	4.6%	17.7%	23.5%	14.5%
Sales Workers	10.3%	14.6%	4.7%	22.3%	27.1%	16.0%
Service Workers	26.1%	30.9%	16.6%	44.2%	49.1%	34.4%
Agriculture, Forestry & Fisheries	***22.2%***	***22.5%***	***16.7%***	***37.0%***	***36.8%***	***40.0%***
Production, Transport labours	21.5%	28.9%	10.7%	41.0%	47.9%	30.7%
Head not working	12.6%	15.7%	4.0%	24.2%	28.1%	13.6%
National	**17.6%**	**21.1%**	**7.7%**	**31.5%**	**35.2%**	**21.3%**

Source: HIES 2010

2.1.7 Detailed Socioeconomic Condition in the Survey Area

The precise socioeconomic information in the survey area is summarized in Table 2.1.23. The several reliable data were collected from public organizations as described in the upper column.

Table 2.1.23 Socioeconomic Condition in the Survey Area

Data Source	Project Area (JICA Survey Team)		Population and Housing Census 2011 - Community Reports 2012						MICS 2009				MoH -HEALTH BULLETIN 2012	
District / Upazila	Number of LGED Sub-projects selected	Number of BWDB Sub-projects selected (Table 3.3.1)	Population Total	Household Number	Average HH Size	Urbanization (%)	Literacy (%)	School Attendance (5 to 24 years) (%)	Infant mortality rate (IMR)	under-five mortality rate (U5MR)	% of pop. using improved source of drinking water	% of pop. using a hygiene facility	No. of health facilities	Total no. of bed
Netrokona	**18**	**12**	**2,229,642**	**479,146**	**4.64**	**11.09**	**39.4**	**49.4**	**66**	**91**	**99.0**	**24.4**	**309**	**593**
Atpara	**3**	**1**	**144,624**	**31,437**	**4.59**	**6.70**	**38.7**	**50.3**	**32**	**39**	**99.5**	**34.4**	-	-
Borhatta	**2**	**2**	**1,80,449**	**37,854**	**4.77**	**4.35**	**37.6**	**45.9**	**65**	**89**	**99.3**	**21.1**	-	-
Durgapur			2,24,873	50,596	4.43	11.84	39.5	48.0	41	52	96.3	10.3	-	-
Khaliajuri	**3**	**2**	**97,450**	**18,903**	**5.13**	**6.36**	**30.4**	**33.8**	**75**	**106**	**99.7**	**7.8**	-	-
Kalmakanda		**1**	**2,71,912**	**58,069**	**4.68**	**5.29**	**36.6**	**46.8**	**88**	**125**	**97.8**	**23.1**	-	-
Kendua			3,04,729	66,133	4.61	7.34	37.6	53.5	82	117	99.0	36.6	-	-
Madan		**2**	**1,54,479**	**31,751**	**4.87**	**12.18**	**30.4**	**43.7**	**111**	**163**	**98.1**	**16.3**	-	-
Mohonganj		**1**	**1,67,507**	**34,885**	**4.79**	**16.23**	**42.1**	**48.2**	**46**	**59**	**100.0**	**8.5**	-	-
Netrokona sadar		**1**	**3,72,785**	**81,435**	**4.54**	**24.66**	**46.0**	**53.2**	**46**	**60**	**100.0**	**26.0**	-	-
Purbadhala	**10**	**2**	**3,10,834**	**68,083**	**4.56**	**7.12**	**42.8**	**53.9**	**63**	**85**	**100.0**	**35.5**	-	-
Kishoreganj	**47**	**30**	**2,911,907**	**627,322**	**4.62**	**16.79**	**40.9**	**52.8**	**67**	**92**	**99.7**	**13.8**	**440**	**1,266**
Astagram	**3**	**1**	**1,52,523**	**31,129**	**4.89**	**11.41**	**32.0**	**42.1**	**63**	**85**	**100.0**	**1.1**	-	-
Bajitpur	**1**	**1**	**2,48,730**	**53,345**	**4.67**	**14.03**	**41.2**	**52.0**	**70**	**97**	**100.0**	**16.7**	-	-
Bhairab			2,98,309	58,940	5.01	39.89	42.7	54.4	72	100	99.8	8.6	-	-
Hossainpur	**5**		**1,83,884**	**41,376**	**4.44**	**12.57**	**41.8**	**56.6**	**45**	**58**	**100.0**	**12.5**	-	-
Itna	**6**	**4**	**1,64,127**	**34,637**	**4.78**	**13.81**	**27.7**	**43.1**	**76**	**107**	**100.0**	**17.0**	-	-
Karimganj	**1**	**4**	**2,87,807**	**62,774**	**4.58**	**9.33**	**38.6**	**54.8**	**63**	**86**	**100.0**	**32.3**	-	-
Katiadi	**1**	**5**	**3,14,529**	**69,801**	**4.50**	**12.95**	**40.6**	**52.4**	**83**	**118**	**99.5**	**5.7**	-	-
Kishoreganj Sadar	**17**	**2**	**4,14,208**	**89,863**	**4.54**	**25.06**	**48.9**	**57.1**	**80**	**114**	**99.8**	**18.3**	-	-
Kuliarchar	**2**	**1**	**1,82,236**	**39,166**	**4.62**	**17.44**	**44.6**	**53.6**	**88**	**126**	**100.0**	**5.2**	-	-
Mithamain	**3**	**2**	**1,22,026**	**23,850**	**5.12**	**10.33**	**30.9**	**43.8**	**66**	**90**	**99.5**	**5.9**	-	-
Nikli	**2**	**5**	**1,33,729**	**30,450**	**4.38**	**14.15**	**28.9**	**48.4**	**63**	**85**	**100.0**	**1.9**	-	-
Pakundia	**4**	**2**	**2,50,060**	**57,399**	**4.34**	**11.44**	**51.8**	**58.5**	**49**	**64**	**98.2**	**23.4**	-	-
Tarail	**2**	**3**	**1,59,739**	**34,592**	**4.62**	**5.43**	**35.7**	**52.3**	**34**	**42**	**100.0**	**10.9**	-	-
Habiganj	**35**	**12**	**2,089,001**	**393,302**	**5.30**	**11.73**	**40.5**	**46.0**	**50**	**65**	**97.6**	**53.4**	**262**	**327**
Ajmiriganj	**14**	**4**	**1,14,265**	**21,293**	**5.39**	**13.04**	**37.1**	**39.8**	**80**	**114**	**95.2**	**17.2**	-	-
Bahubal	**6**	**1**	**1,97,997**	**37,334**	**5.28**	**2.04**	**39.8**	**44.2**	**36**	**45**	**98.5**	**62.4**	-	-
Baniachanj	**10**	**5**	**3,32,530**	**59,433**	**5.59**	**8.57**	**34.7**	**41.4**	**36**	**44**	**98.5**	**41.6**	-	-
Chunarughat			3,02,110	61,132	4.94	6.50	40.8	47.6	51	67	93.5	57.7	-	-
Habiganj Sadar	**5**	**2**	**3,29,093**	**62,281**	**5.26**	**32.42**	**50.7**	**51.2**	**55**	**73**	**100.0**	**63.8**	-	-
Lakhai			1,48,811	27,759	5.36	11.58	33.7	43.2	38	47	99.6	19.9	-	-
Madhabpur			3,19,016	62,300	5.12	7.65	39.8	48.3	55	73	99.5	59.4	-	-
Nabiganj			3,45,179	61,770	5.58	8.55	41.0	46.0	43	54	95.7	72.0	-	-
Brahmanbaria	**0**	**2**	**2,840,498**	**538,937**	**5.25**	**15.79**	**45.3**	**50.8**	**45**	**58**	**99.4**	**55.5**	**454**	**494**
Akhaura			1,45,215	27,831	5.21	24.97	52.7	53.8	57	76	99.9	70.3	-	-
Ashuganj			1,80,654	33,552	5.37	20.34	51.2	52.2	65	89	99.8	70.3	-	-
Bancharampur		**2**	**2,98,430**	**59,699**	**4.99**	**6.24**	**38.5**	**48.8**	**61**	**82**	**98.9**	**56.1**	-	-
Brahmanbaria Sadar			5,21,994	95,802	5.4	37.13	53.4	53.0	35	43	99.7	57.2	-	-
Bijoynagar			2,57,247	48,617	5.28	2.96	42.1	48.2	-	-	-	-	-	-
Kashba			3,19,221	60,919	5.23	12.66	50.7	56.6	59	80	99.8	65.4	-	-
Nabinagar			4,93,518	94,871	5.19	10.77	43.6	51.9	36	44	99.3	46.4	-	-
Nasirnagar			3,09,011	59,024	5.23	4.83	34.9	44.5	45	58	99.4	42.6	-	-
Sarail			3,15,208	58,622	5.36	14.89	40.9	46.9	49	64	98.9	53.7	-	-
Sunamganj	**27**	**5**	**2,467,968**	**440,332**	**5.58**	**10.38**	**35.0**	**44.5**	**68**	**94**	**94.8**	**30.3**	**317**	**554**
Bishwamvarpur			1,56,381	29,336	5.33	2.02	34.6	46.8	47	61	85.9	37.6	-	-
Chhatak		**1**	**3,97,642**	**66,724**	**5.93**	**12.74**	**38.6**	**47.7**	**52**	**68**	**93.0**	**45.0**	-	-
Dakshin Sunamganj	**5**	**1**	**1,83,881**	**32,033**	**5.74**	**2.82**	**32.3**	**43.8**	**71**	**98**	**95.7**	**47.9**	-	-
Derai	**7**		**2,43,690**	**45,040**	**5.40**	**14.85**	**37.1**	**41.2**	**59**	**79**	**94.2**	**6.9**	-	-
Dharmapasha	**3**	**1**	**2,23,202**	**43,918**	**5.08**	**5.29**	**29.2**	**38.9**	**72**	**100**	**99.8**	**11.3**	-	-
Dowarabazar			2,28,460	42,693	5.35	6.48	30.4	47.2	72	100	94.2	35.7	-	-
Jagannathpur			2,59,490	42,866	6.05	15.68	39.9	47.3	79	111	93.0	41.5	-	-
Jamalganj	**2**	**1**	**1,67,260**	**29,935**	**5.57**	**6.06**	**32.5**	**40.3**	**80**	**114**	**99.5**	**6.3**	-	-
Sullah	**1**		**1,13,743**	**20,299**	**5.60**	**3.44**	**34.3**	**36.0**	**90**	**130**	**94.9**	**0.5**	-	-
Sunamganj Sadar	**9**	**1**	**2,79,019**	**49,557**	**5.57**	**25.13**	**38.8**	**48.8**	**79**	**111**	**97.4**	**58.2**	-	-
Tahirpur			2,15,200	37,931	5.59	4.39	30.4	40.9	71	98	97.7	3.6	-	-
Sylhet	0	0	34,34,188	5,96,081	5.74	21.94	51.2	50.6	52	69	83.6	43.6	351	1,399
Balaganj			3,20,227	54,246	5.88	2.44	50.2	50.4	45	57	88.5	13.1	-	-
Beani Bazar			2,53,616	42,119	6.01	16.57	59.7	54.5	63	85	99.1	67.0	-	-
Bishwanath			2,32,573	37,993	6.11	9.05	46.9	49.5	35	43	98.9	65.5	-	-
Companiganj			1,74,029	28,756	6.06	10.36	28.8	40.4	75	105	89.5	18.0	-	-
Dakshin Surma			2,53,388	43,004	5.88	6.73	56.0	52.9	46	59	95.3	56.2	-	-
Fenchuganj Upazila			1,04,741	18,859	5.55	20.85	50.5	51.8	54	72	98.5	45.5	-	-
Golapganj			3,16,149	50,465	6.23	11.85	57.0	54.0	47	61	98.6	50.7	-	-
Gowainghat			2,87,512	47,992	6.00	2.11	32.7	44.5	57	76	68.2	24.7	-	-
Jaintapur			1,61,744	27,719	5.84	4.88	41.2	48.5	75	105	72.8	22.8	-	-
Kanaighat			2,63,969	46,147	5.72	10.26	43.5	50.3	77	109	38.9	29.9	-	-
Sylhet Sadar			8,29,103	1,58,233	5.16	63.49	61.3	51.6	26	31	89.4	44.9	-	-
Zakiganj			2,37,137	40,548	5.82	8.77	49.4	54.4	79	110	51.2	25.0	-	-
Maulvibazar	0	0	1,919,062	361,177	5.30	10.84	51.1	50.0	50	66	94.5	45.4	238	699
Barlekha			2,57,620	44,192	5.83	10.35	52.4	52.7	73	102	96.2	25.0	-	-
Kamalganj			2,59,130	51,895	4.99	11.65	48.6	50.3	34	41	92.1	45.8	-	-
Kulaura			3,60,195	66,465	5.41	7.63	51.9	51.5	57	76	98.8	47.7	-	-
Maulvibazar Sadar			3,42,468	62,881	5.41	16.51	54.9	49.5	42	53	92.8	54.4	-	-
Rajnagar			2,32,666	43,070	5.40	6.07	48.6	49.1	30	36	97.0	67.8	-	-
Sreemangal			3,18,025	65,165	4.86	12.50	48.3	45.9	69	94	89.9	30.8	-	-
Juri			1,48,958	27,509	5.42	8.92	52.3	51.5	48	62	92.6	36.4	-	-
National					**4.44**	**23.30**	**51.8**	**52.7**	**49**	**64**	**97.8**	**51.5**	**3,549**	**95,103**

Note: * The number of LGED sub-projects includes rural road, hat, and ghat projects. * The number of BWDB sub-projects indicates the number of sub-projects that will be implemented in each upazila. The total number does not match with the number of sub-projects selected because one sub-project area covers multiple upazilas.

Source: Population and Housing Census 2011, MICS 2009, and MoH (Health Bulletin 2012)

The columns shaded in gray indicate an inferior condition of each upazila compared with the national average level in terms of literacy, school attendance rate, IMR, U5MR, population using improved drinking water, and people with hygiene facility. The gray-shaded cells in the table above imply the inferior socioeconomic conditions in the survey area.

The Project Area determined in Chapter 3 and 4 is labeled in the left columns of the above table. The selected Project Area and the inferior livelihood condition area overlap. Hence, the impact of the Project is expected to be higher for the development of local society.

2.1.8 Household Survey

(1) Survey Design

The household survey was conducted on 355 samples in order to clarify the actual social and economic conditions of beneficiaries in the survey area. The outline of the survey plan is as follows:

Target farmers:	Farmers in the project areas
Sampling method:	Farmers are randomly selected by enumerator in the eight preliminary chosen upazilas
Supervisor:	Bangladesh socioeconomic expert
Number of surveyors:	10 enumerator (1–2 enumerators/upazila)
Questionnaire:	Semi-structure Household Survey Questionnaire (Attached in Appendix 2.1)

There were 355 samples that were randomly selected in the eight upazilas, which were selected among the proposed sub-project sites for flood control (Component 1) and considering the accessibility of enumerators and project size. To avoid bias, the sample farmers were chosen as instructed by local leaders.

Table 2.1.24 Target Projects and Upazilas for Household Survey

District	Upazila	Related Project/Haor	Project Area (ha)	Project Type	Sample Numbers
Sunamganj	1. Dharmapasha	Dharmapasha Rui Beel	18,972	New project	71
Kishoreganj	2. Nikli	Boro Haor (Nikli)	9,147	New project	35
	3. Mithamaine	Charigram Project	7,829	New project	35
	4. Austagram	Boro Haor (Austagram)	11,013	New project	37
Netrokona	5. Purbadhala	Kangsa River Scheme	11,337	Rehabilitation	37
Habiganj	6. Ajmiriganj	Kairdhala Ratna	11,900	Rehabilitation	70
Brahmanbaria	7. Bancharampur	Satdona Beel Scheme	5,030	Rehabilitation	35
Netrokona	8. Khaliajuri	Dhanu River	-	River dredging	35
				Total	355

Source: JICA Survey Team

(2) Characteristics of Surveyed Household

Education Level

The educational attainment of the surveyed household members aged over 18 years are summarized in Table 2.1.25. The illiterate rate is 44%, and the rate of members who has been educated in secondary school and higher composes only 10.0%.

Table 2.1.25 Educational Attainment of Household Members

Education Level	Sex				All	
	Male		Female			
	Number	Share (%)	Number	Share (%)	Number	Share (%)
Illiterate	274	44.26%	243	43.32%	517	**43.81%**
Class 1 - 4	59	9.53%	61	10.87%	120	10.17%
Class 5 - 9	219	35.38%	205	36.54%	424	35.93%
Secondary School Certificate	37	5.98%	25	4.46%	62	5.25%
High School Certificate	7	1.13%	3	0.53%	10	0.85%
BA/BCom/BSc	18	2.91%	21	3.74%	39	3.31%
Masters Degree or Higher	5	0.81%	3	0.53%	8	0.68%
Total	619	100.00%	561	100.00%	1,180	100.00%

Note: * Only household members aged 18 years and above were surveyed.
Source: Household Survey of the JICA Survey Team, July 2013

Employment Sector of Household Members

Table 2.1.26 show the occupations of the surveyed household members. Most male household members are engaged in the agriculture sector (78%), while those in the business sector (4%) and service sector (3%) follow. The female members are mostly housewives (80%), dependents (10%), or students (5%). These figures imply the limited job opportunities for female members.

Table 2.1.26 Employment Sector of Household Members

Occupation	Sex				All	
	Male		Female			
	Number	Share (%)	Number	Share (%)	Number	Share (%)
Farmer	484	78.19%	4	0.71%	488	41.36%
Business	23	3.72%	3	0.53%	26	2.20%
Service	20	3.23%	3	0.53%	23	1.95%
Day labor	12	1.94%	1	0.18%	13	1.10%
Fisherman	5	0.81%	0	0.00%	5	0.42%
Boatman	3	0.48%	0	0.00%	3	0.25%
Driver	3	0.48%	0	0.00%	3	0.25%
Unemployed	9	1.45%	15	2.67%	24	2.03%
Housewife	0	0.00%	447	79.68%	447	37.88%
Dependent, Retired	37	5.98%	57	10.16%	94	7.97%
Student	22	3.55%	27	4.81%	49	4.15%
Disabled	1	0.16%	4	0.71%	5	0.42%
Total	**619**	**100.00%**	**561**	**100.00%**	**1,180**	**100.00%**

Note: * Only household members aged 18 years and above were surveyed.
Source: Household Survey of the JICA Survey Team, July 2013

Livelihood Condition

The basic living condition of households surveyed in the study is summarized in Table 2.1.27. More than 80% of constructed houses are of the fragile Kacha type, and only 43% have access to electricity. Drinking water is mainly procured from shallow and deep tube wells, while more than 30% of households procure water for domestic use from other water sources, such as rivers and ponds. Pit latrine is the popularly used sanitary facility.

Table 2.1.27 Living Condition of Surveyed Household

	Services								
1	Ownership of house	Own		100%		Rent		0%	
2	Average size of housing yard	355 m^2 (8.78 decimal)							
3	Type of house *1	Pacca	0.56%	Semi-pacca		15.49%	Kacha		83.94%
4	Power source (electricity)	Connected		42.82%		Not connected		57.18%	
5	Water source *2								
	Drinking: Rainy season	SW	75.49%	DTW	23.66%	River	0.85%	Other	0.00%
	Deinking: Dry season	SW	75.21%	DTW	23.66%	River	1.13%	Other	0.00%
	Domestic Use	SW	56.34%	DTW	11.55%	River	18.31%	Other	13.80%
6	Quality of drinking water	Good		85.35%		Bad		14.65%	
7	Sanitary (toilet)	Septic	11.83%	Pit latrine	72.11%	Open	11.27%	Hanging	4.79%
8	Fuel (for Cooking)	Wood/crop residue	82.82%	Kerosene	1.13%	Dung	16.06%	Other	0.00%

Note: *1 Pacca: robust house made of brick and concrete; Semi-pacca: basic house made of brick, timber, and corrugated iron roof; Kacha: fragile house made of organic materials (such as bamboo and straw).
*2 SW: Shallow well, DTW: Deep tube well

Source: Household Survey of the JICA Survey Team, July 2013

Land Holding Condition

The land holding condition of surveyed household is summarized in Tables 2.1.28 to 2.1.29. Almost all farms are cultivated with irrigated water. Out of all cultivated farm lands, 78% are owned by households, 11% are managed under farm tenancy, 8% are rented from other owners, and 3% are managed under sharecropping.

The average holding area of household is 1.62 acre, and the operational farm area which includes rent, tenant, and sharecropped area is 2.04 acre. From the viewpoint of farm category defined by GOB, the composition of small, medium, and large farmer groups are 87.4%, 11.2%, and 1.4%, respectively. Under small farmer groups, 25.9% of the households are categorized as marginal farmers (covering less than 0.99 acre).

The land holding character of respondents becomes similar to the distribution of land holding sizes stipulated in Table 5.1.2, referring to the Census of Agriculture 2008. Hence, the survey result illustrates the general living condition of farmers in the Project Area.

Table 2.1.28 Farmland Tenureship

Tenure	Number of Samples	Total Area (Acre)	Irrigated				Rainfed			
			Number of Samples	Total Area (Acre)	%	Average area (Acre)	Number of Samples	Total Area (Acre)	%	Average area (Acre)
Own	348	56,465	348	562.0	77.7%	1.62	2	263	0.4%	1.32
Rented	50	5,792	50	57.9	8.0%	1.16	0	0	0.0%	-
Tenant	67	7,973	66	79.4	11.0%	1.20	1	30	0.0%	0.30
Sharecropped	20	2,144	20	21.4	3.0%	1.07	0	0	0.0%	-
Total	354	72,374	354	720.8	99.6%	2.04	3	293	0.4%	0.98

Source: Household Survey of the JICA Survey Team, July 2013

Table 2.1.29 Farmland Area of Households

District	Number of Sampled Households by Land Holding Size (in Acre)						Total Farm Holdings	Average Land Holding Size (Acre)	Operational Farms	
	0.05-0.49	0.50-0.99	1.00-1.49	1.50-2.49	2.50-7.49	7.50+			Number	Average Size (Acre)
(Land Holding Categories)	*Small*				*Medium*	*Large*				
	Marginal									
Sunamganj	2	4	13	40	12		71	1.70	71	2.13
Habiganj	6	18	16	29		1	70			2.23
Netrokona	13	18	6	13	15	4	69	2.18	71	2.52
Kishoreganj	1	20	35	41	10		107	1.42	107	1.76
Brahmanbaria	4	4	10	11	2		31	1.27	35	1.40
Total	**26**	**64**	**80**	**134**	**39**	**5**	**348**	**1.62**	**354**	**2.04**
Share (%)	**7.47%**	**18.39%**	**22.99%**	**38.51%**	**11.21%**	**1.44%**				

Source: Household Survey of the JICA Survey Team, July 2013

(3) Household Income and Expenditure

Income

The basic information on household income and expenditure is summarized in Tables 2.1.30 and 2.1.31. The average annual income per household in the survey area is BDT 162,663, which corresponds to BDT 13,555/month. The average annual expenditure per household was calculated to be BDT 160,914/year.

Table 2.1.30 Average Annual Income and Expenditure of Households

District	Number of Household Member	Number of Earners	Sample numbers	Average Income (BDT/year)			Average Expenditure (BDT/year)
				Total	Dry Season	Rainy Season	
Sunamganj	5.96	1.62	71	135,533	107,226	28,306	143,559
Habiganj	6.14	1.66	70	205,465	119,055	86,410	191,636
Netrokona	6.07	1.53	72	163,787	*81,808	*81,979	169,014
Kishoreganj	5.77	1.85	107	149,291	101,487	47,804	140,736
Brahmanbaria	5.49	2.03	35	170,664	115,908	54,756	179,699
Total	**5.91**	**1.72**	**355**	**162,663**	**103,529**	**59,134**	**160,914**

Note: 1. * In Netrokona, incomes during the dry and rainy seasons are similar. Higher income from business/trade (18% of total income), and higher agriculture income during the rainy season (27% of total income) are considered very different from the rest.
2. There is a difference between income and consumption expenditure owing to the inconsistency of the answers collected from households.

Source: Household Survey of the JICA Survey Team, July/2013

In summary, the income from agriculture and fishery composes 64% of total income (44% in the dry season and 20% in the rainy season).

Table 2.1.31 Summary of Average Household Income per Season

Source of Income	Average Income (BDT/year)			Share		
	Total	Dry Season	Rainy Season	Total	Dry Season	Rainy Season
Agriculture and Fishery	104,200	72,130	32,069	**64.1%**	44.3%	19.7%
Others (305 out of 355 households)	58,463	31,399	27,064	35.9%	19.3%	16.6%
Total	**162,663**	103,529	59,134	100.0%	**63.6%**	36.4%

Source: Household Survey of the JICA Survey Team, July/2013

Upon closely reviewing the income sources, Paddy Cultivation has the largest share at 43% of the total income, as shown in Table 2.1.32. The income from inland fishing and fish culture composes approximately 9%. The above data clearly indicates the high dependency of household income on the agriculture and fishery sector in the survey area.

In terms of the composition of other income sources, business/trade activity (12%) and casual labour (7%) come in second and third, respectively. The income from international and domestic worker remittance shows a relatively lower share (4%) compared with the national level (14%).

Table 2.1.32 Average Income per Income Source and Season

	Total Income	Share	Dry Season				Rainy Season			
			Total Income (BDT/year)	Share	Count	Average (BDT/year)	Total Income (BDT/year)	Share	Count	Average (BDT/year)
Agriculture and Fishery Income										
Paddy cultivation	24,969,233	**43.2%**	20,299,073	35.2%	336	60,414	4,670,160	8.1%	126	37,065
Other crops cultivation	1,186,280	2.1%	1,011,820	1.8%	57	17,751	174,460	0.3%	11	15,860
Inland fishing	4,466,200	7.7%	561,500	1.0%	35	16,043	3,904,700	6.8%	129	30,269
Fish culture	763,670	1.3%	458,400	0.8%	19	24,126	305,270	0.5%	15	20,351
Poultry farming	3,212,944	5.6%	1,741,364	3.0%	103	16,906	1,471,580	2.5%	82	17,946
Dairy farming	2,348,922	4.1%	1,497,930	2.6%	104	14,403	850,992	1.5%	64	13,297
Others	43,600	0.1%	36,200	0.1%	2	18,100	7,400	0.0%	2	3,700
Subtotal	*36,990,849*	*64.1%*	*25,606,287*	*44.3%*	*355*	*72,130*	*11,384,562*	*19.7%*	*355*	*32,069*
Other Incomes										
Salary	2,241,200	3.9%	981,600	1.7%	30	32,720	1,259,600	2.2%	30	41,987
Business/trade	6,907,620	12.0%	3,732,650	6.5%	106	35,214	3,174,970	5.5%	95	33,421
Cottage industry	0	0.0%		0.0%	0			0.0%	0	
Farm labour	532,500	0.9%	230,500	0.4%	19	12,132	302,000	0.5%	18	16,778
Casual labour	3,728,400	6.5%	2,345,000	4.1%	111	21,126	1,383,400	2.4%	73	18,951
Remittances	2,176,000	3.8%	1,157,000	2.0%	25	46,280	1,019,000	1.8%	18	56,611
Others	5,168,800	9.0%	2,699,900	4.7%	102	26,470	2,468,900	4.3%	75	32,919
Subtotal	*20,754,520*	*35.9%*	*11,146,650*	*19.3%*	*355*	*31,399*	*9,607,870*	*16.6%*	*355*	*27,064*
Total	***57,745,369***	***100.0%***	***36,752,937***		***355***	***103,529***	***20,992,432***		***355***	***59,134***

Source: Household Survey of the JICA Survey Team, July 2013

Figures 2.1.4 and 2.1.5 show the composition of income sources inside and outside the agriculture and fishery sector, respectively.

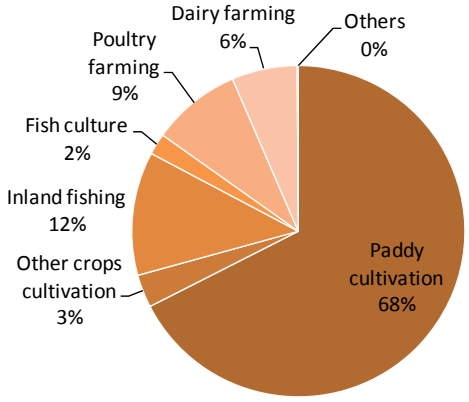


Figure 2.1.4 Composition of Agriculture and Fishery-related Income

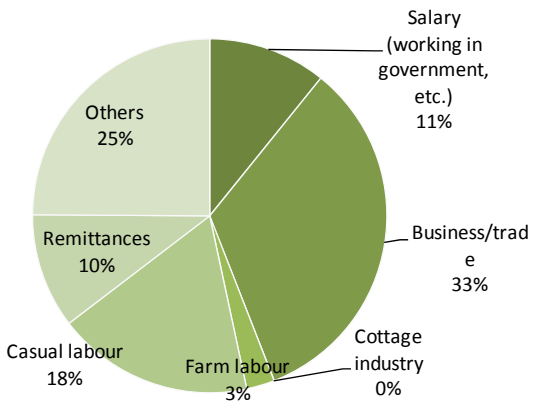


Figure 2.1.5 Composition of Income Source Outside the Agriculture and Fishery Sector

Selected Solutions for Emergent Financial Need

The procurement method of emergency cash is asked under two different conditions. The first case is when the income is insufficient for living expenses, and the second case is when the cultivated paddy is damaged by flash floods.

The result is summarized in Table 2.1.33. The most probable solution for the former case is borrowing money from relatives or friends where the interest rate would be lower. Whereas, in latter case, the share of responses of "borrowing money from village shops/money lenders", "sell property", and "pawn jewellry" increases significantly compared with the first case. It implies that the flash flood damage has significant negative impacts on household economy.

Table 2.1.33 Solution for Emergency Cash Needs (out of 355 Samples)

Countermeasure	Income is Insufficient		Suffered from Flood	
	Number of Samples	Share	Number of Samples	Share
Borrow from relatives and friends	175	**49.30%**	143	40.28%
Borrow (or take credit) from village shops/money lenders	173	48.73%	195	**54.93%**
Sell property	28	7.89%	47	**13.24%**
Pawn jewelry	6	1.69%	23	**6.48%**
Others	23	6.48%	24	6.76%

Source: Household Survey of the JICA Survey Team, July 2013

Expenditure

The share of expenditure items is summarized in Table 2.1.34. The food and beverage expenditure takes the largest share, which corresponds to 41% of the total expenditure, while the farming expenses for agriculture and fishery occupy around 25%. The average savings composes approximately 5.5% of their total income, which might be spent for preparing against flash floods or emergency expenses during disasters.

Table 2.1.34 Average Expenditure per Items

	Items	Total Expenditure (BDT/year)	Share of Total Expenditure	Average Expenditure (BDT/year/household)
1	Food	**23,460,250**	**41.11%**	66,085
2	Farming Expenses (crop & livestock)	**12,976,205**	**22.74%**	36,553
3	Farming Expenses (fishery)	**1,362,790**	**2.39%**	3,839
4	Utilities (water, electricity, etc.)	966,584	1.69%	2,723
5	Fuel for cooking, etc.	1,949,740	3.42%	5,492
6	Clothing	2,706,116	4.74%	7,623
7	Health care & medical purposes	1,571,660	2.75%	4,427
8	Education	2,149,900	3.77%	6,056
9	Travel & communication	1,986,762	3.48%	5,597
10	Social functions including entertainment	1,539,302	2.70%	4,336
11	Repayment of loans / debts	3,155,040	5.53%	8,887
12	Savings	**3,243,610**	**5.68%**	9,137
13	Others	0	0.00%	0
	Total	**57,067,959**		**160,755**

Source: Household Survey of the JICA Survey Team, July 2013

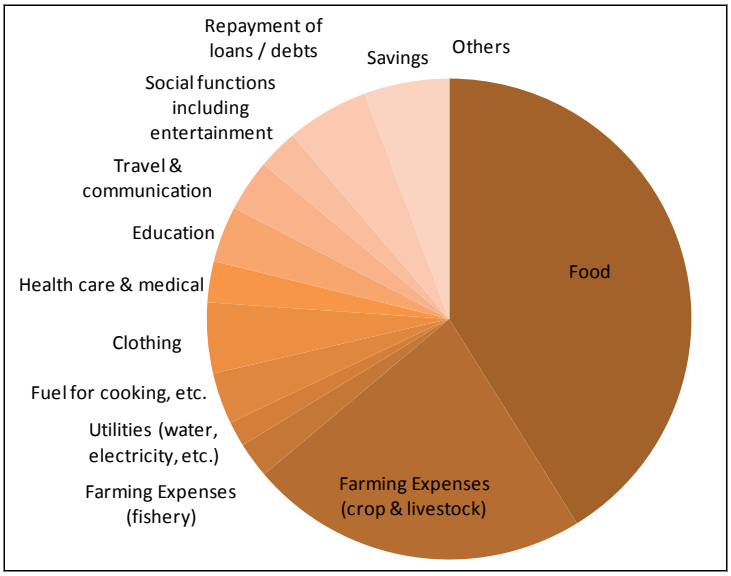


Figure 2.1.6 Composition of Expenditure

Relationship of Income and Main Income Source

The relationship of total income and main income source was analyzed and the result is summarized in Table 2.1.35. The annual income of farmers and fishermen show similarities at BDT 162,000/year and BDT 156,000/year, respectively. The income of farm labour is smaller at BDT 112,000/year. Farmers earn approximately two-thirds of their income during the dry season by Boro rice cultivation, whereas fishermen earn constantly throughout the year.

Table 2.1.35 Average Annual Income per Main Income Source

Main Source of Income	Number of Household Members	Number of Earners	Sample Number	Average Income (BDT/year)			Average Expenditure (BDT/year)
				Total	Dry Season	Rainy Season	
Farmer	5.91	1.73	323	163,148	106,405	56,744	161,892
Fisher	6.00	1.66	29	162,507	78,629	83,878	156,008
Farm Labour	5.33	1.33	3	111,933	34,667	77,267	103,053
Total	**5.91**	**1.72**	**355**	**162,663**	**103,529**	**59,134**	**160,914**

Notice: Surveyed households are categorized automatically into farmer, fisherman, or farm labour by their main source of income. There is a difference between income and consumption expenditure owing to the inconsistency of the answers collected from households.
Source: Household Survey of the JICA Survey Team, July 2013

(4) Survey Result of Agriculture and Fishery Sector

The survey results in the agriculture and fisheries sector are further analyzed in Chapter 4 and Chapter 5 of this report, respectively.

(5) Impact of Flash Floods on Local Economy

Damage to the Crops

In the household survey, the damage rate in agriculture and fishery production and assets is roughly questioned to understand the impact of flash floods on the local economy. The

collected answers show huge damages on rice products from flash floods that occurred especially in 2004 and 2010.

The number of farmers affected by flash floods were 291 (82%) in 2004, and 201 (59%) in 2010. Among the affected farmers, the average percentage losses of Boro rice were 75% and 53% of the total production, respectively.

The number of farmers whose assets were damaged (e.g., damage to houses for living or farming, agricultural warehouse, etc.) were 133 (37%) in 2004 and 71 (20%) in 2010. The average asset loss of affected farmers was estimated to be BDT 23,000 and BDT 14,000, respectively, which almost corresponded to their monthly income (BDT 13,600).

Table 2.1.36 Economic Losses on Products and Assets by Flash Flood

Year	Loss of Production (Average per Affected Household)						Loss of Assets*		
	Boro Rice		Other Crops		Fish Production				
	Number of samples	Average loss on production	Number of samples	Average loss on production	Number of samples	Average loss on production	Number of samples	Total Loss (BDT)	Average Loss (BDT/person)
2004	**284**	**75%**	57	79%	13	79%	**133**	**3,118,000**	**23,444**
2008	62	66%	1	90%			1	2,500	2,500
2010	**210**	**53%**	37	52%	9	31%	**71**	**995,000**	**14,014**
2013	84	39%	1	50%	1	23%	46	1,099,000	23,891

Note: * Asset loss value was asked through open-ended questioning to affected farmers.
Source: Household Survey of the JICA Survey Team, July 2013

Referring to Table 2.1.32, the rice production composes 43% of the total income in Project Area. Table 2.1.36 indicates that more than 50% of Boro rice have been damaged several times during the last decade, especially in 2004 and 2011. Therefore, when flash floods occurred, the financial loss for Boro rice climbed up to more than 21% of the total annual income of local individual households. In addition to the said income loss, the property asset loss of highly damaged farmer corresponds to their average monthly income. These results clearly testify the immense economic risk caused by flash floods which burdens farmers under their current living condition.

As it has been described in Table 2.1.28 that surplus of the household economy (or savings) is 5.5% of the total income, which seems not sufficient to achieve enough preparations against flash floods. The actions to be taken in the Project for income generation would surely contribute to the local society in the long term.

(6) Past Impact Assessment Survey of Rural Road Construction Project

In consideration of the Project impact on local society, assessing the impact of past rural road construction gives important indications for this Project.

Funded by the International Fund for Agricultural Development (IFAD), the "Community-Based Resource Management Project" has been implemented for 12 years from

2003 to 2012 under the supervision of LGED. The project focused on building village roads to connect communities with the main road network in nine upazilas in the Sunamganj District.

In the study of "Impact Survey of Five Roads, Community based Resource Management Project (LGED, 2010)", a household survey of 196 samples in five Upazilas in the Sunamganj District was conducted to assess the project impact on the society. The improvement in access to social services and impact on livelihood conditions as a result of the construction of new village roads were the focus during the interview.

The respondents basically answered the questions by selecting from four alternative answers, namely: "worse", "same", "better", and "much better". The result of the survey is briefly summarized in Table 2.1.37.

Table 2.1.37 Result of Household Survey after the Project

Access Condition	**Worse**	**Same**	**Better**	**Much Better**
Access to Health Services	0%	2%	42%	56%
Access to Schools	1%	5%	37%	57%
Access to Markets	0%	4%	38%	58%
Increase in Income	**Worse**	**Same**	**Better**	**Much Better**
Opportunities for Employment	0%	6%	54%	40%
Improvement in Income	0%	2%	59%	39%
Improvement in Food (Quantity)	1%	9%	60%	30%
Improvement in Food (Quality)	1%	7%	78%	15%
Improvement in Housing	0%	4%	89%	7%
Improvement in Household Assets	0%	4%	75%	21%

Source: Household Survey of the JICA Survey Team, July 2013

According to the respondents, the access to several social services dramatically improved after the project. The respondents gave the highest positive feedback (much better) for the access to health service, schools, and markets, which became 56%, 57%, and 58%, respectively. It is mentioned in the report that one household commented that "the roads enabled sick people to seek medical attention at earlier stages of their illnesses". Easier access to education facilities also ensures a better paying job to local people in the future.

Majority of the respondents answered that the livelihood conditions after the project are "better" than before. Especially, "employment opportunity" and "income" seem to receive the highest impacts as the answer of "much better" accounted for 40% and 39%, respectively. Improvement of "housing" shows a rather modest impact as the respondents choosing "much better" composes only 7% of all samples. In general, the report explained that it may take time for people to start spending substantial amount of money on housing.

As a result, the survey from households show that newly constructed rural roads had large benefits to the society, especially better access to social services and better working opportunities.

2.2 Overview of the Physical Conditions

2.2.1 Geography

The shape of the survey area almost forms a triangle. The northern edge appears straight that extends from east to west along the border with India. One side of the triangle extends from the northeastern edge of the survey area to the southernmost point of the area, facing the Indian border. The other side of the triangle forms the western border of the survey area facing the Brahmaputra River basin.

As mentioned in the previous chapter, floodplains are dominant in the survey area. The substantial rivers that have formed the floodplains are the Surma-Kushyara River, the old Brhamaputra River, and the old Meghna River. The watershed area of the Surma-Kushyara River shares more than 50% of the total survey area of 20,000 km^2, extending from northeast to northwest of the area. The floodplain formed by the old Brahmaputra River occupies the northwestern part of the survey area, which is adjacent to the Surma-Kushyara River basin at its eastern edge. The approximate share of this floodplain is 15% of the total survey area. The horn-shaped southern edge of the survey area is formed by the old Meghna Floodplain, which covers about 15% of the survey area. These floodplains are flat and low-lying with elevations of 2-5 m BSD[2]. Piedmont plains form two sides of the triangular survey area on its northern side (northern piedmont) and northeast to south side (eastern piedmont). The plains is comprised of alluvial fans. Several hills emerge in the eastern piedmont. The mountain in the north piedmont plain is the Shillong Mountain Range, which receives very heavy annual rainfall. Located on the southern slope of the mountain range, the town of Cherrapungi holds the world record for the highest mean annual rainfall of 12,000 mm. The piedmont plain drains the heavy rainfall into the Shillong Mountain Range and discharge it into the survey area. The total share of the piedmont plains is approximately 20%.

Sand and silt are substantial materials of the floodplains and piedmont hills. Meanwhile, the hills are formed with consolidated and unconsolidated sandstones, siltstones, and shale of various rocks of Tertiary age . The rocks have been uplifted, folded, faulted, and dissected to form hill ranges or areas of complex hills and valley reliefs. Slopes are mainly very steep but the relief varies from very steeply dissected to gently rolling.

There is a huge depressed area in the downstream reach of the Surma-Kushiyara River, which is almost the centre of the survey area. The area is called Sylhet Basin characterized by extensive low-lying, bowl-shaped depression, which is deeply flooded during the monsoon season. The depression is attributed to the subsidence caused by the effect plate of tectonics in the area. A geomorphologic study assumed a total of 10 m subsidence in the last 500 years. The estimated annual subsidence rate is 20 mm/year. Flood basins within this large subsidence form deeply inundated haors such as Tangua, Shanir, Matian, Karcher, and Kalner. The haors are divided by natural dikes of channels and are very poorly drained. The bottom elevation of these haors is less than 2 m PWD[3]. After the monsoon season, flood water in this area does not

[2] Bangladesh Standard Datum
[3] Public Works Datum

immediately drain as perennial water bodies occupy the lowest point of the haors and adjacent river dikes prevents rapid drainage. A large area in the basin stay wet for most or all of the dry season.

The geography of the survey area is presented in Figure 2.2.1.

2.2.2 Hydro-meteorology

(1) Climate in the Northeast Region

The sub-tropical monsoon characterizes the climate of the northeast region of Bangladesh as it is located entirely to the north of the Tropic of Cancer. The southwest monsoon brings wet air mass to the region from the Indian Ocean through the Bay of Bengal along a predominant northeastern direction from the middle of May to October. The air mass meets the steep and high hills located at the states of Assam, Meghalaia, and Tripura in India. The orographic effects of the hills bring the world's heaviest rainfall in the southern slopes of the hills and the piedmont plains, which extend to the northeast region of Bangladesh. The town of Cherrapunji in India receives the heaviest annual rainfall of 12,000 mm. The heavy rainfall results in high flows in major rivers that drain the region such as the Surma, Kushyara, Manu, Khowai, and Someswari rivers. The northeast Monsoon that overtop the hills bring the dry season to the northeast region of Bangladesh from December to the middle of April.

The pre-monsoon period from the middle of April to the middle of May is a special month in the haor area where sudden rises in river water level are observed from time to time due to the high discharges from the upstream reaches. These high discharges are called flash floods in Bangladesh. The season of flash floods falls during the period of Boro rice harvesting, which is the main source of income for the majority of people in the haor area. Flash floods have caused serious damage to the people in the area.

Meanwhile, similar magnitudes of discharges also occur in November. However, the rise in river water level is not so sudden as in the pre-monsoon period because the water level of the haor is maintained at certain level and the regulating capacity thereof is sufficient to keep the rise moderate. The period is called the post-monsoon season.

The Master Plan of Haor Area estimated the range of the mean annual rainfall recorded at the stations in each district belongs in the haor area on the basis of the recorded rainfall depths from 1960 to 2009. The estimated ranges are presented in Table 2.2.1.

Table 2.2.1 Estimated Range of Mean Annual Rainfall in Each District (1960-2009)

District	Range (mm)
Sunamganj	3,600-7,800
Sylhet	3,400-7,400
Netrokona	3,200-4,800
Maulvibazar	2,600-3,800
Habiganj	2,200-3,500
Kishoreganj	2,000-3,400
Brahmanbaria	2,000-2,500

Source: Master Plan of Haor Area

The difference in annual rainfall is rather distinctive. The master plan presented the differences in annual rainfall along the laps of time focusing on specific gauging stations. The estimated mean rainfall on record at selected stations are summarized in Table 2.2.2.

Table 2.2.2 Estimated Decadal Mean Annual Rainfall (in mm)

District	Station	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010
Sunamganj	Sunamganj	5,242	5,183	6,224	6,387	5,371
Sylhet	Sylhet	3,899	4,259	4,644	4,001	4,157
Netrokona	Netrokona	2,647	2,969	2,906	3,311	3,003
Habiganj	Habiganj	2,255	2,682	2,561	2,521	2,426
Kishoreganj	Kishoreganj	2,086	2,339	2,387	2,404	1,921
	Itna	2,509	2,590	2,526	2,309	2,383
Brahmanbaria	Brahmanbaria	1,629	2,179	2,201	2,099	2,013

Source: Master Plan of Haor Area

Although the table does not present the records of Maulvibazar District, the figures indicate a general tendency of a slight increase in the rainfall along the laps of time. However, further analysis is yet to be done in order to identify the trend.

The master plan further presented the estimated seasonal distributions of rainfall based on the records of several gauging stations from 1961 to 2010. Table 2.2.3 summarizes the seasonal distribution at the representative stations by districts.

Table 2.2.3 Mean Seasonal Distribution of Rainfall in 1961-2010 (in mm)

District	Station	Pre-monsoon Season	Monsoon Season	Post-monsoon Season	Dry Season
Sunamganj	Sunamganj	1,006	4,543	302	188
Sylhet	Sylhet	951	2,845	262	221
Netrokona	Netrokona	624	2,209	261	90
Maulvibazar	Maulvibazar	681	1,530	185	135
Habiganj	Habiganj	653	1,532	239	124
Kishoreganj	Kishoreganj	494	1,563	209	93
Brahmanbaria	Brahmanbaria	570	1,274	200	110

Source: Master Plan of Haor Area

Rainfall during the monsoon season is reasonably high. However, it should be noted that rainfall during the pre-monsoon period is very high when considering a period of only one month. This is evident in the districts of Sunamganj, Sylhet, and Netrokona, which are located in the northernmost part of the survey area adjacent to the Shillong Mountain Range. The fact implies that the watershed of the haor area receives very high rainfall during the pre-monsoon period. The root cause of significant magnitudes of flash floods could be due to the heavy rainfall during the pre-monsoon period. Protecting the haor area from flash floods is one of the most effective measures to enhance the living standards in the area.

2.2.3 River System

The Master Plan of Haor Area identified the river channels in the Upper Meghna River basin including the haor area. Figure 2.2.2 shows the identified river systems. Most of the upstream reaches are located inside India. The area inside India is 43,400 km^2, whereas, the area in Bangladesh is 23,100 km^2, or 35% of the total. Table 2.2.4 summarizes the drainage areas and average flow distribution of transboundary and international river basins.

Table 2.2.4 Distribution of Transboundary and International River Basins

Catchment System	Area in India (km^2)	Share of Area in India
Meghalaya	9,812	15
Tripura	7,434	11
Barak	26,165	39
Bangladesh	(23,137)	(35)

Source: Master Plan of Haor Area, April 2012

2.2.4 River Discharge

Table 2.2.5 shows the seasonal discharges and water levels of the Kushiyara River at the Sheola gauging station. The seasonal variability at the Sheola gauging station, which is located at the centre, is assumed to represent the variability in the haor area.

Table 2.2.5 Seasonal Discharge and Water Level

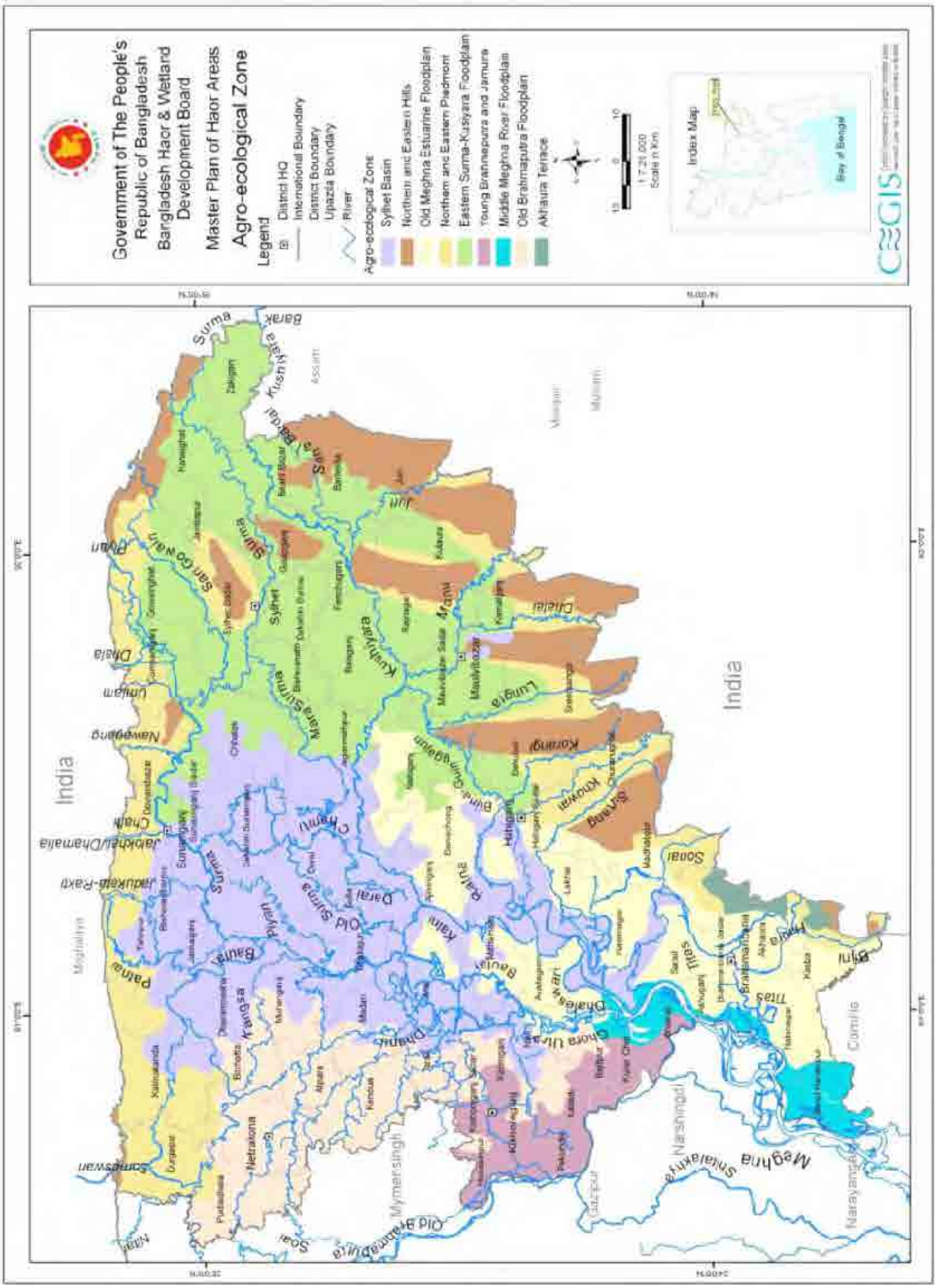
Season	Discharge (m^3/s)			Water Level (m PWD)		
	Max.	Mean	Min.	Max.	Mean	Min.
Pre-monsoon	1,582	506	141	12.31	7.97	5.22
Monsoon	2,315	1,448	631	13.96	12.28	9.05
Post-monsoon	1,716	598	209	12.65	9.08	6.33
Dry	531	128	70	7.91	5.34	4.38

Source: Master Plan of Haor Area, 2012

The mean water level in the dry season is estimated at 5.34 m PWD. The water level at the end of the dry season may be lower than 5.0 m. The mean water level is almost 8.0 m during the pre-monsoon period. In other words, the mean water level rises 3.0 m in 15 days assuming that the water level may reach 8.0 m in the middle of the pre-monsoon season or the beginning of May. The estimated rise in mean water level is about 4.3 m from the pre-monsoon to monsoon periods. The water level at the end of June may reach the mean water level of the monsoon period at 12.3 m. It could be assumed that water level rises to 4.3 m in 45 days. The rise in water level during the pre-monsoon period is very fast as compared with the other seasons. The sharp increase in discharge from the dry season to pre-monsoon period reflects the sudden water level rise. The range of daily water level fluctuation should be far wider due to varying daily discharges. Flash floods during the pre-monsoon period is liable to economic damages in the haor area with the sudden rise in water level.

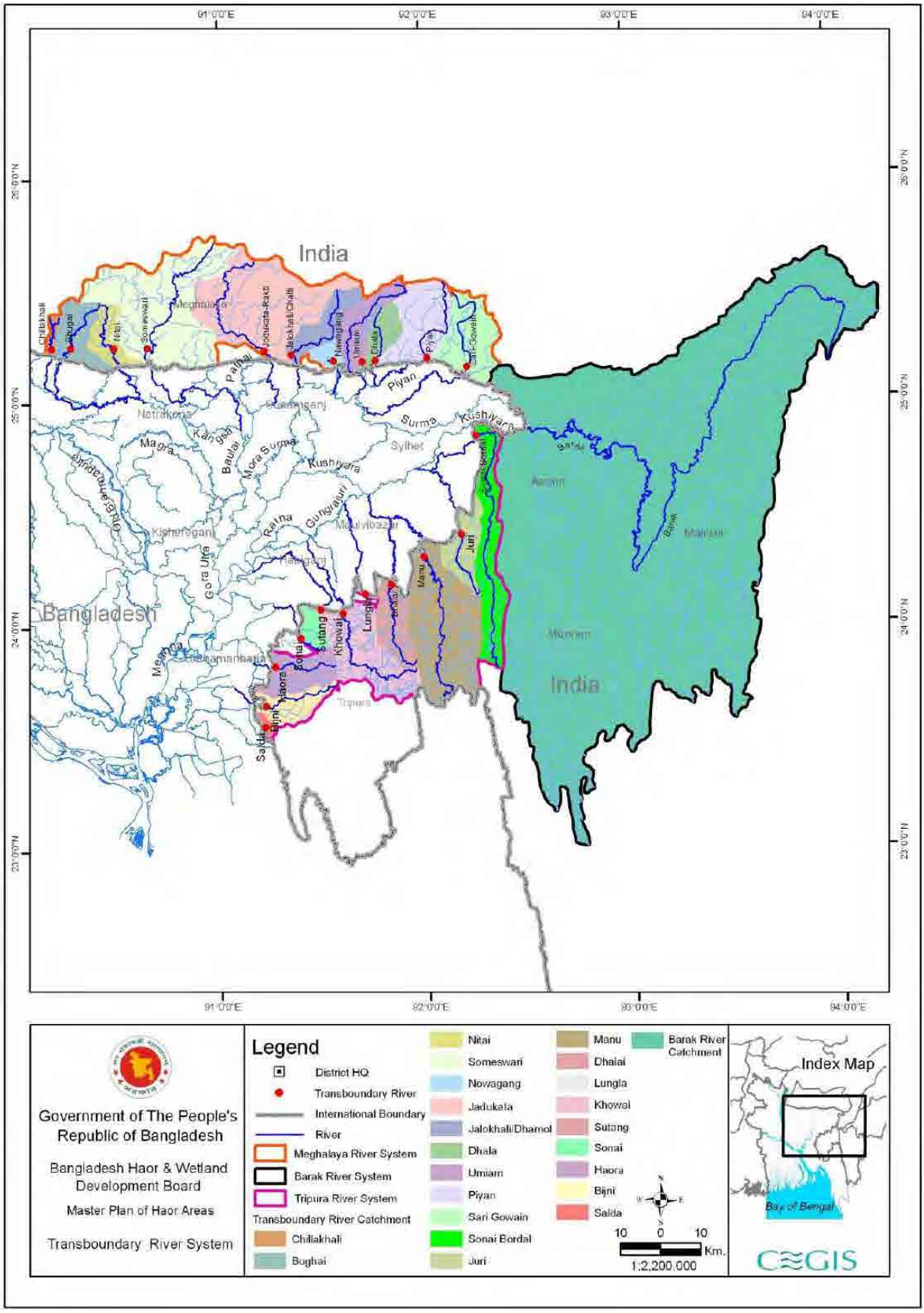
2.2.5 Sediment Runoff

As mentioned earlier, the haor area lies in an alluvial plain where considerable amount of sediments from the mountainous area flow into the area. The estimated average suspended sediment concentration of the Kushiyara River is at 253 mg/l as recorded at the Sheola gauging station according to the Master Plan of Haor Area. The estimated average annual sediment load is 8.6 million t at the station. The seasonal distribution of the load is 4% in pre-monsoon, 84% in monsoon, 11% in post-monsoon, and 1% in dry season. The properties of the sediment are sand (20%), silt (54%), and clay (24%). The annual bed load is estimated to be 2 million t. The value of D_{50} and D_{10} are 0.1 mm and 0.06 mm, respectively. Figure 2.2.1 shows the geographical map of the survey area while Figure 2.2.2 shows the river system.



Source: Master Plan of Haor Area, 2012

Figure 2.2.1 Geography of the Survey Area



Source: Master Plan of Haor Area, 2012

Figure 2.2.2 The River System in the Survey Area

2.3 Necessity of the Project

A series of studies concluded that water-related disasters culminating in floods have brought serious damages to the haor area. Flood damage is one of the substantial issues in the area. Boro rice damaged due to flooding, has been no doubt the cause of poverty among farmers. Heavy floods originating from the Megharaya Mountain Range deprive the farmers of their annual earnings. Therefore, flood control has been considered as one of the most important interventions to enhance the living conditions in the haor area. The preliminary analyses in Section 2.2 revealed that flash floods during the pre-monsoon cause substantial damages in the haor area. The data collection survey preliminarily identified 37 subprojects of polder dike construction and rehabilitation as countermeasures in solving flash flood problems.

On other hand, the studies mentioned in Section 2.1 revealed that poverty has been the other substantial issue. The government has tackled the issue and conducted various interventions through several agencies concerned. Technical and economic cooperation extended by donors and NGOs have been effective to support the endeavor of the government. LGED, DOA, and DOF have played significant roles in this aspect.

Section 4.3 of the Master Plan of Haor Area described that the hazards are noted for aggravating poverty in the haor area. The master plan further pointed out that poverty, in its turn, often leads to vulnerability to disaster in the haor area. The descriptions indicate the vicious cycle of poverty and damage in the haor area.

There is a well-known equation showing that damage brought by disasters on a society is the product of the magnitude of the disaster and the vulnerability of the society against the disaster, which is as follows:

$$D = M \times V \quad \text{.....(1)}$$

Where D : damage caused by a disaster
M : magnitude of the disaster
V : vulnerability of society against disaster

Damage caused by a disaster (D) exacerbates the economic conditions and aggravates poverty in the haor area, as indicated in the results of every study. Flood control is an intervention in reducing the magnitude of disaster (M) and in alleviating damage and eventually poverty.

There are several factors that define the vulnerability of a society (V), such as intensified land uses or assets with high values in a disaster-prone area. Economic activities in a disaster-prone area tend to heighten vulnerability. Relocations of land uses or economic activities are considered effective measures in reducing vulnerability.

Meanwhile, disaster preparedness is another index that defines vulnerability of a society. Disaster preparedness may be the only measure that can alleviate vulnerability in the haor area because the relocation of intensified land use nor economic activities are not conceivable in this case. The relationship between vulnerability and disaster preparedness (P) can be expressed by the following formula:

$$C = V \times P \quad \text{.....(2)}$$

Where C: constant
V: vulnerability of society against disaster
P: disaster preparedness of society

In most cases, a part of surplus income or the balance of income less the prerequisite expenses will become the source of investment in securing disaster preparedness. However, income is affected by flood-related disasters from time to time in the haor area. Accordingly, balance in the previous year could be assumed to define the disaster preparedness of the following year. These simplified and logical assumptions make the following equation effective:

$$P(i+1) = P(i) + a \bullet (A(i) - R) \quad \text{.....(3)}$$

Where P(i) : disaster preparedness in a given year, i
a : share of allocation to preparedness, assumed constant
A(i) : Net benefit minus disaster damage or actual income
R : Prerequisite (prioritized) expense , assumed constant

Working out the equations (1), (2) and (3), the following formulae are obtained;

$$D(i+1) = D(i) + C \bullet M \bullet (P(i) - P(i+1)) / (P(i) \bullet P(i+1)) \quad \text{.....(4)}$$

$$A(i+1) = A(i) - a \bullet M \bullet C \bullet (D(i) + R - N) / (P(i) \bullet P(i+1)) \quad \text{.....(5)}$$

Where N : Net benefit of economic activity, assumed constant
D(i) : Damage by disaster in a given year, i
Consequently $A(i) = N - D(i)$

The equations have been developed under several assumptions in specifying the interaction between disaster damage, actual income, and disaster preparedness. The adopted assumptions were as follows:

- Net benefit is the same for same investment;
- The source of investment for disaster preparedness is the surplus in the actual income less the prerequisite expenditures such as purchasing food. The amount to be invested could be a part of the surplus and is assumed to be proportional to the surplus; and
- Magnitude of the disaster is the same in the following year.

Equation (3) indicates that the actual income affects the disaster preparedness for the following year. It implies that disaster preparedness will be reduced if the actual income is less than the cost of basic needs for living. A livelihood enhancing intervention can increase the net income and eventual actual income. Meanwhile, a flood control intervention can decrease disaster damage and can subsequently increase the actual income.

Equation (4) indicates that the decrease in disaster preparedness increase damages. Increase in disaster preparedness is one of the important strategies in enhancing the living standards within the area. Equation (3) suggests that income generation increases disaster preparedness. It implies that income generation is a solution to reduce disaster damage in the future.

Equation (5) indicates that the increase in disaster damage decrease the income of the people.

The abovementioned descriptions indicate the fact nothing more than normally understood. It should be noted, however, that the equations (3), (4), and (5) present the interactions between income, disaster preparedness or vulnerability, and damage with time lags.

Superimposing the equations on the haor area, it can be said that poverty in the area have weakened disaster preparedness. The weak disaster preparedness has exacerbated disaster damage over the years. The overwhelming disasters have brought repetitive damages to the area and have reduced income.

The abovementioned explanations indicate how a disaster, for instance, in a given year (i) affects preparedness and income of the following year (i+1). However, it should be noted that preparedness and income of the following second year (i+2) will be automatically affected as well by the disaster in year (i) even if there are no damages in the first year (i+1).

In addition, equation (3) indicates that an intervention to enhance livelihood will be effective in enhancing future preparedness but not effective in improving the present preparedness. It is not necessary to quote equation (5) and mention that an intervention to control flood will not be effective in increasing the present actual income. The haor area suffering from poverty and frequent flood damage requires an increase in present and future income and protection from present and future flood damage. Accordingly, implementation of both interventions to enhance livelihood and mitigate flood damage at one effort is necessary to escape from the existing spiral of unfortunate events. Furthermore, the mechanism discussed above indicates that the interventions with substantial and having long-lasting effects will be effective in escaping from the spiral because of the time lags in the mechanism.

The mechanism of the vicious cycle described in the Master Plan of Haor Area as presented in the third paragraph of this section is proved and explained well by equations (3), (4) and (5). In particular, the paragraph above demonstrates that implementing flood control and livelihood enhancement in parallel is crucial in improving the living standards in the haor area.

According to the Master Plan of Haor Area, about 54% of the residents depend on agriculture including part-time fishing for their livelihood. The master plan identified that the reinforcement of agriculture and fisheries is the most important and effective intervention in improving the livelihood of residents. It further indicates that the upgrade in rural infrastructure, especially transportation system which transports agro-fishery products, is another key intervention for the improvement.

The Project being formulated envisages the solution against the vicious cycle of poverty and disaster in the haor area. The project is to have flood control (Component 1), to enhance livelihood by rural infrastructure improvement (Component 2) and to promote agriculture and fisheries (Component 3). These goals are challenges in the institutional and organizational viewpoints, but the implementation of the project is highly crucial in solving the problems.

CHAPTER 3 FLOOD MANAGEMENT FACILITY

3.1 Objectives of Component 1

Boro crops cultivated during the dry season are the main source of income for the livelihood of farmers in the haor area. The farmers usually plant boro crops in the flood plain in December after the post-monsoon season, and harvest in May. The river water level rises during the pre-monsoon season from April to May toward the monsoon season. The abrupt rise of water level due to flash floods brings damages to boro crops from time to time.

People have built polder dykes surrounding paddy areas to avoid damage of boro crops from the pre-monsoon floods. These polder dykes in "deep haor area" are usually built as submergible type embankment. After harvesting of boro crops, monsoon flood overtops the submergible embankment and inundates the paddy area surrounding it by the submergible embankment. Full flood type embankment is often built in the higher peripheral area around the deep haor areas. Such embankment is not overtopped by the flood and protects the landside area throughout the year. Crops other than rice or vegetables can be cultivated inside the full flood embankment even during the monsoon season.

Component 1 of the project consists of submergible and full flood embankments, regulators and re-excavation of canals. The embankment will protect the land side area from the pre-monsoon or monsoon floods. The regulator will introduce flood water into the project area after the harvesting of boro crops in order to avoid overtopping of flood water from the embankment, otherwise the embankment may be damaged due to erosion. The regulator will also drain the flood water inside the project area to outside rivers after the monsoon season. The canals in the project area are used for this drainage purposes after the monsoon season.

Some embankments and regulators in the existing projects have deteriorated and do not function adequately due to poor maintenance. Some canals in the existing projects do not have enough flow capacity due to sedimentation.

Component 1 includes not only the construction of these facilities in the new project but also rehabilitation of existing facilities such as re-sectioning of embankment, replacement of regulators or sluice gates, and re-excavation of canals in five districts, i.e., Netrokona, Sunamganj, Kishoreganj, Habiganj and Brahmanbaria.

3.2 Selection of Subprojects

The Data Collection Survey selected 15 rehabilitation projects and 22 new projects as priority subprojects.

(1) Rehabilitation Subprojects

The Data Collection Survey selected 12 rehabilitation projects proposed in the Haor Master Plan in five districts (Netrokona, Sunamganj, Kishoreganj, Habiganj and Brahmanbaria), excluding five projects implemented by the Water Management Improvement Project (WMIP).

Moreover, the Data Collection Survey selected three additional rehabilitation projects not proposed in the Haor Master Plan but their estimated ratios of benefits against the costs are almost equal to that of the projects proposed in the Haor Master Plan. Hence, the proposed rehabilitation projects, as listed in Table 3.2.1, number to 15, including the three additional ones.

Table 3.2.1 15 Rehabilitation Projects Proposed by Data Collection Survey

No.	Name of Project	Annualized Benefit B	Rank	Remark
R-1	Dampara Water Management Scheme	1,167	9	*1
R-2	Kangsa River Scheme	1,149	3	*1
R-3	Singer Beel Scheme	360	7	*1
R-4	Baraikhali Khal Scheme	768	5	*1
R-5	Alalia-Bahadia Scheme	135	12	*1
R-6	Modkhola Bhairagirchar Subproject Scheme	167	10	*1
R-7	Ganakkhalli Subscheme	154	2	*1
R-8	Kairdhala Ratna Scheme	758	1	*1
R-9	Bahira River Scheme	273	15	*1
R-10	Aralia Khal Scheme	100	11	*1
R-11	Chandal Beel Scheme	104	14	*1
R-12	Satdona Beel Scheme	188	13	*1
R-13	Gangajuri FCD Subproject	1,368	8	*2
R-14	Kaliajuri polder #02 Scheme	411	6	*2
R-15	Kaliakjuri polder #04 Scheme	399	4	*2

Note: *1 Proposed Project in M/P
*2 High ranking and high efficiency project
Source: JICA Survey Team

(2) New Subprojects

Twenty-six new projects are selected from the Haor Master Plan. Out of the 26 projects, the Golaimara Haor Project and the Joyariya Haor Project were excluded from the candidate projects because the ground elevations of these two projects are higher than the estimated ten-year probable water levels in the pre-monsoon period according to the results of the spot elevation survey and hydraulic analysis in the Data Collection Survey. Charigram Haor Project and Boro (Austagram) Haor Project were also excluded from the candidate projects of this study, since the provision of these projects would cause significant rise of the water level in the upstream reaches because the submergible embankment reduces the regulating capacity of the flood plain between the Surma-Baulai River and the Kalni-Kushiara River during the pre-monsoon period. Some countermeasures to alleviate the water level rising in the upstream reaches would be needed to implement these two projects. Through these studies, the total number of new projects is 22.

Table 3.2.3 shows a list of the 22 new candidate projects. The table also shows the order of priority of the projects. Priority is relatively determined by comparing the estimated index of economic efficiency of the projects as calculated by the following formula:

(Economic efficiency) = (Annualized damage of boro rice) / (Direct construction cost)

The annualized damage of boro rice was estimated as the annual mean decrease in paddy production due to inundation during the pre-monsoon period. The Kalni-Kushyara River Improvement Project estimated the damage ratio for a probable water level in submergence damage free land and in damaged land by submergence on the basis of the recorded yields in 1995 and 1996. In case of HYV boro rice, the estimated unit yield in damage free land is 4.69 t/ha, and in damaged land is estimated to be 2.90 t/ha. In the estimation, land submerged more than 0.3 m deep was assumed as damaged land. The ratio of estimated damage to each excess probability is presented in Table 3.2.2.

Table 3.2.2 Damage Ratio of Paddy

Excess Probability	Damage Ratio (%)
2-year	6.4
5-year	26.4
10-year	36.1
20-year	55.5*

Note: *Damage ratio of 20-year is calculated by extrapolation from the 5-year and 10-year damages.
Source: Kalni-Kushyara River Improvement Project

Table 3.2.3 Order of Priority of the 22 New Projects Selected by the Data Collection Survey

No.	Name of Project	Annualized Benefit B (ha)*	Rank	Remark
N-1	Boro Haor Project (Nikli)	479	1	
N-2	Naogaon Haor Project	667	2	
N-3	Jaliar Haor Project	114	4	
N-4	Dharmapasha Rui Beel Project	1,286	3	
N-5	Chandpur Haor Project	70	5	
N-6	Suniar Haor Project	118	6	
N-7	Badla Haor Project	85	7	
N-8	Nunnir Haor Project	207	8	
N-9	Dakhshiner Haor Project	180	9	
N-10	Chatal Haor Project	43	12	
N-11	Ganesh Haor Project	117	10	
N-12	Dhakua Haor Project	228	11	
N-13	Mokhar Haor Project	451	13	
N-14	Noapara Haor Project	141	14	
N-15	Dulapur Haor Project	29	15	
N-16	Bara Haor (Kamlakanda)	164	16	
N-17	Bansharir Haor Project	27	17	
N-18	Korati Haor Project	123	18	
N-19	Sarishapur Haor Project	10	19	
N-20	Shelnir Haor Project	10	20	
N-21	Kuniarbandh Haor Project	7	21	
N-22	Ayner Gupi Haor	3	22	

Note: *Annualized Benefit: The expected annual mean area to be prevented by the subprojects (economic and financial analyses are discussed in Chapter 13)
Source: JICA Survey Team

(3) Narrowing of Subprojects in this Survey and the Final List

This survey conducted a study of environmental and social considerations and project cost. There is not any legally protected area or sensitive area which can be affected by any large environmental or social impact. The 15 rehabilitation projects and 22 new projects selected in the Data Collection Survey will be further narrowed down in view of the total project cost.

Economic efficiency of the rehabilitation projects is usually higher than that of new projects, since the direct costs of rehabilitation projects are smaller.

In view of the estimated costs, the 15 rehabilitation subprojects listed in Table 3.2.1 and the 14 new construction subprojects listed as N-1 to N-14 in Table 3.2.3 were selected as the subprojects of Component 1.

3.3 Facility Planning

(1) List of Facilities for Component 1

A list of the target structures of the 15 rehabilitation projects and the 14 new projects provided in the Data Collection Survey is presented in Table 3.3.1.

Table 3.3.1 Principal Features of Rehabilitation and New Constructed Haor Projects

No.	Subproject Name	Location	Principal Features of Major Structures
i) Rehabilitation of existing haor projects			
r-1	Dampara Water Management Scheme	Upazila: Purbodhola District: Netrakona	Resection of embankment = 200 m (Full), 460 m (Submergible) Replacement of regulator gates = 15 nos. Re-excavation of canal = 12 km (Kalihor Khal) Pipe cleaning = 3 locations Sluice gate (0.6 m x 0.6 m) = 23 nos.
r-2	Kangsa River Scheme	Upazila: Sadar, Purbodhola District: Netrakona	Resectioning of embankment = 40 m (Full) Replacement of regulator gates = 16 nos. Maintenance equipment = 1 no.
r-3	Singer Beel Scheme	Upazila: Barhatta District: Netrakona	Resectioning of embankment = 100 m(Full), 125 m (Submergible) Replacement of regulator = 1 nos. Re-excavation of canal = 2 km (1 km + 1 km) Pipe cleaning = 2 locations
r-4	Baraikhali Khal Scheme	Upazila: Nandail, Hosenpur Kishoreganj Sadar District: Mymensingh, Nandail, Kishoreganj	Resection of embankment = 10 m (Full) Re-excavation of canal = 24.5 km Replacement of regulator gates = 6 nos. Flap gate (0.5 m x 0.5 m) = 2 nos. Pipe cleaning = 2 locations Maintenance equipment = 1 no.
r-5	Alalia-Bahadia Scheme	Upazila: Katiadi, Pakundia District: Kishoreganj	Replacement of regulator gates = 2 nos. Re-excavation of canal = 8km (5 km + 3 km)
r-6	Modkhola Bhairagirchar sub-project Scheme	Upzila: Pakundia, Katiadi District: Kishoreganj	Resectioning of embankment = 500 m (Full)
r-7	Ganakkhalli Sub-scheme	Upazila: Kuliarchar District: Kishoreganj	Replacement of regulator gates = 3 nos. Maintenance equipment = 1 no.
r-8	Kairdhala Ratna Scheme	Upazila: Ajmiriganj, Baniachong District: Habiganj	Resectioning of embankment = 60 m (Submergible) Replacement of regulator gates = 9 nos. Maintenance equipment = 1 no.
r-9	Bahira River Scheme	Upazila: Ajmiriganj, Baniachong District: Habiganj	Resectioning of embankment = 6,000 m (Submergible) Installation of regulators = 2 nos. Re-excavation of canal = 20 km Maintenance equipment = 1 no.

No.	Subproject Name	Location	Principal Features of Major Structures
r-10	Aralia Khal Scheme	Upazila: Baniachong District: Habiganj	Replacement of regulator gates = 4 nos. Re-excavation of canal = 2.4 km Maintenance equipment = 1 no.
r-11	Chandal Beel Scheme	Upazila: Bancharampur District: Brammanbaria	Resectioning of embankment = 100 m (Full) Reinstallation of regulator = 1 no. Re-excavation of canal = 1.5 km Maintenance equipment = 1 no.
r-12	Satdona Beel Scheme	Upazila: Bancharampur District: Brammanbaria	Reinstallation of regulators = 2 nos. Maintenance equipment = 1 no.
r-13	Gangajuri FCD Subproject	Upazila: Bahubol, Baniachong, Sadar District: Habiganj	Embankment = 600 m (Full) Replacement of regulator gates = 20 nos. Re-excavation of canal = 4.5 km
r-14	Kaliajuri Polder #02 Scheme	Upazila: Kaliajuri District: Netrakona	Embankment = 810 m (Submergible) Replacement of regulator gates =19 nos.
r-15	Kaliakjuri Polder #04 Scheme	Upazila: Kaliajuri District: Netrakona	Embankment = 630 m (Submergible) Replacement of regulator gates = 3 nos.
ii) Development of new haor projects			
n-1	Boro Haor Project (Nikli)	Upazila: Karimganj, Katiadi, Kishoreganj Sadar, Nikli District: Kishorganj	Embankment = 9.6 km Re-excavation of canal = 10 km 9-vent regulators = 2 nos. 3-vent regulator = 1 no. (including vent number of flushing gate)
n-2	Naogaon Haor Project	Upazila: Itna, Karimganj, Mithamain, Nikli District: Kishorganj	Embankment = 34.1 km Re-excavation of canal = 20 km 9-vent regulators = 2 nos. 8-vent regulator = 1 no. 4-vent regulator = 1 no. (including vent number of flushing gate)
n-3	Jaliar Haor Project	Upazila: Chhatak District: Sunamganj	Embankment = 6.8 km Re-excavation of canal = 8 km 2-vent regulator = 1 no. 2-vent regulator = 1 no.
n-4	Dharmapasha Rui Beel Project	Upazila: Dharmapasha, Kalmakanda, Barhatta, Mohanganj District: Sunamganj, Netrokona	Embankment = 57.1km Re-excavation of canal = 5 km 9-vent regulators = 3 nos. 8-vent regulator = 2 nos. 6-vent regulator = 1 no. 3-vent regulator = 1 no.
n-5	Chandpur Haor Project	Upazila: Katiadi, Nikli District: Kishorganj	Embankment = 2.1km Re-excavation of canal = 5 km 4-vent regulator = 1 no. 1-vent regulator = 1 no. (including vent number of flushing gate)
n-6	Suniar Haor Project	Upazila: Tarail District: Kishorganj and Netrokona	Embankment = 16.2 km Re-excavation of canal = 25 km 4-vent regulator = 1 no. 1-vent regulator = 1 no. (including vent number of flushing gate)
n-7	Badla Haor Project	Upazila: Itna, Karimganj, Tarail Dstrict: Kishoreganj	Embankment = 10.8 km Re-excavation of canal = 2 km 2-vent regulators = 2 nos.
n-8	Nunnir Haor Project	Upazila: Bajitpur, Kariadi, Nikli District: Kishorganj	Embankment = 25.5 km Re-excavation of canal = 20 km 5-vent regulator = 1 no. 2-vent regulators = 2 nos. (including vent number of flushing gate)

No.	Subproject Name	Location	Principal Features of Major Structures
n-9	Dakhshiner Haor Project	Upazila: Ajmirganj, Itna, Mithamain District: Kishorganj	Embankment = 18.3 km Re-excavation of canal = 10 km 6-vent regulator = 1 no. 3-vent regulator = 1 no.
n-10	Chatal Haor Project	Upazila: Tarail, Itna, Madan District: Kishorganj	Embankment = 5.7 km Re-excavation of canal = 11 km 1-vent regulators = 2 nos.
n-11	Ganesh Haor Project	Upazila: Madan, Atpara District: Netrokona	Embankment = 22.5 km Re-excavation of canal = 3 km 3-vent regulator = 1 no. 2-vent regulator = 1 no.
n-12	Dhakua Haor Project	Upazila: Dakshin, Sunamganj, Jamalganj, Sunamganj Sadar District: Sunamganj	Embankment = 36.5 km Re-excavation of canal = 30 km 5-vent regulator = 1 no. 3-vent regulator = 1 no. 1-vent regulator = 1 no.
n-13	Mokhar Haor Project	Upazila: Habiganj Sadar, Baniachanpur, Ajmirganj District: Habiganj	Embankment = 68.8 km Re-excavation of canal = 110 km 5-vent regulator = 1 no. 4-vent regulators = 2 nos. 3-vent regulators = 2 nos.
n-14	Noapara Haor Project	Upazila: Austagram, Karimganj, Nikli District: Kishorganj	Embankment = 28.3 km Re-excavation of canal = 7 km 3-vent regulator = 1 no. 2-vent regulator = 1 no. 1-vent regulator = 1 no.

Source: JICA Survey Team

(2) Design Water Level and Crest Elevation of Embankment

1) Safety Level

The subprojects are classified according to their embankment type. The subprojects involving submergible embankment would protect the landside area from the intrusion of haor water during the pre-monsoon period when the farmers harvest boro rice. It allows water to enter into the protected area and be submerged in the monsoon season. Meanwhile, the subprojects involving full flood embankment would protect the landside area from the intrusion of haor water throughout the entire year. This enables the cultivation of other crops even during the monsoon season when the haor water level is the highest. Subprojects involving full flood type embankments are usually planned in the peripheral area of deep haor areas. Submergible embankment is applied in deep haor areas, since full flood embankment may bring drainage problem, ecological problem, and conflicts between agricultural and fisheries people, and may also obstruct the supply of nutrition to the soil due to flooding.

The safety level of embankment for flood is stipulated in the Standard Design Manual by the BWDB Design Circle as ten-year probable water level in the pre-monsoon season and 20-year probable water level in the monsoon season are applied to submergible and full flood embankments, respectively. The elevation of operation decks of regulators should be higher than the 20-year water level in the monsoon season so that the gate can be

operated even during the monsoon season. The subprojects should comply with these regulations as well as the Haor Master Plan and other BWDB projects.

2) Design Water Level

The design water levels for each subproject were computed in the Data Collection Survey through the following procedure:

1) Simulate the water levels from 1980 to 2010 for Bairab Bazar, Itna, Sunamganj, and Sylhet by using the recently measured water level data and river cross sections updated in the Data Collection Survey.
2) Carry out statistical analysis to estimate the probable water levels for Bairab Bazar, Itna, Sunamganj, and Sylhet, and identify the flood years corresponding to a ten-year water level in the pre-monsoon season and 20-year water level in the monsoon season.
3) Simulate the water levels at un-gauged locations along the rivers near the location of the subprojects for each return period.

The North-East Region Model (NERM) developed by IWM was used for the simulation. The input data are as follows: a) discharge of the main stream and tributaries at border with India as the upstream boundary condition, b) water level at Bairab Bazar as the downstream boundary condition, and c) rainfall inside the analyzed area.

The crest elevation of the embankment is determined to have a freeboard of 0.3 m for submergible embankment and 0.9 m for full flood embankment on the design water level. Table 3.3.2 shows the design water levels and design crest levels of the embankment and regulator operation decks.

Table 3.3.2 Design Water Levels and Crest Levels of Embankments

New Project

Project	Submergible Embankment 10-year WL in PM		Regulator Deck Level 20-year WL in M	
	Water Level (m +PWD)	Design Level (m +PWD)	Water Level (m +PWD)	Design Level (m +PWD)
Boro (Nikli)	5.1m	5.4m	8.4m	9.3m
Naogaon	5.0m	5.3m	8.2m	9.1m
Jaliar	7.3m	7.6m	8.6m	9.5m
Dharmapasha	6.1m	6.4m	8.5m	9.4m
Chandpur	4.9m	5.2m	9.2m	10.1m
Sunair	5.7m	6.0m	8.4m	9.3m
Badla	4.9m	5.2m	7.9m	8.8m
Nunnir	4.4m	4.7m	7.9m	8.8m
Dakshiner	4.8m	5.1m	7.9m	8.8m
Chatal	5.4m	5.7m	8.1m	9.0m
Ganesh	6.1m	6.4m	7.7m	8.6m
Dhakua	6.0m	6.3m	8.2m	9.1m
Mokhar	5.6m	5.9m	8.2m	9.1m
Noapara	4.6m	4.9m	8.0m	8.9m

Rehabilitation Project

Project	Submergible Embankment 10-year WL in PM		Full Flood Embankment & Regulator Deck Level 20-year WL in M	
	Water Level (m +PWD)	Design Level (m +PWD)	Water Level (m +PWD)	Design Level (m +PWD)
Dampara Water	6.3m	6.6m	11.7m	12.6m
Kangsa River	6.3m	6.6m	11.7m	12.6m
Singer Beel	6.1m	6.4m	9.0m	9.9m
Baraikhali Khal	7.2m	7.5m	10.6m	11.5m
Alalia-Bahadia	5.9m	6.2m	9.3m	10.2m
Modkhola Bhairagirchar	5.6m	5.9m	9.0m	9.9m
Ganakkhalli	4.0m	4.3m	7.9m	8.8m
Kairdhala Ratna	5.3m	5.6m	8.1m	9.0m
Bahira River	4.9m	5.2m	7.9m	8.8m
Aralia Khal	7.5m	7.8m	8.9m	9.8m
Chandal Beel	3.8m	4.1m	7.0m	7.9m
Satdona Beel	3.8m	4.1m	7.0m	7.9m
Gangajuri FCD	10.6m	10.9m	12.7m	13.6m
Kaliajuri polder #02	5.5m	5.8m	8.1m	9.0m
Kaliakjuri polder #04	5.2m	5.5m	8.0m	8.9m

Source: JICA Survey Team

(3) Regulators and Re-excavation of Canals

1) Facility Plan

The gates of the regulators will be opened after harvesting of boro crop at the end of the pre-monsoon season in order to introduce flood water into the project area. This operation can avoid overtopping from submergible embankment and therefore avoid damages to the embankment due to the overtopping. In the post-monsoon season, the flood water which inundated the project area during the monsoon season will be rapidly drained through the canals and regulators.

The regulators which need repair in the rehabilitation projects have been identified through the structural survey (see Table 3.3.1).

The flow capacities of regulators in the new projects were determined by following the Standard Design Manual of BWDB. Then, the capacity of the regulators should be sufficient to ensure that the maximum head difference across the regulator when the

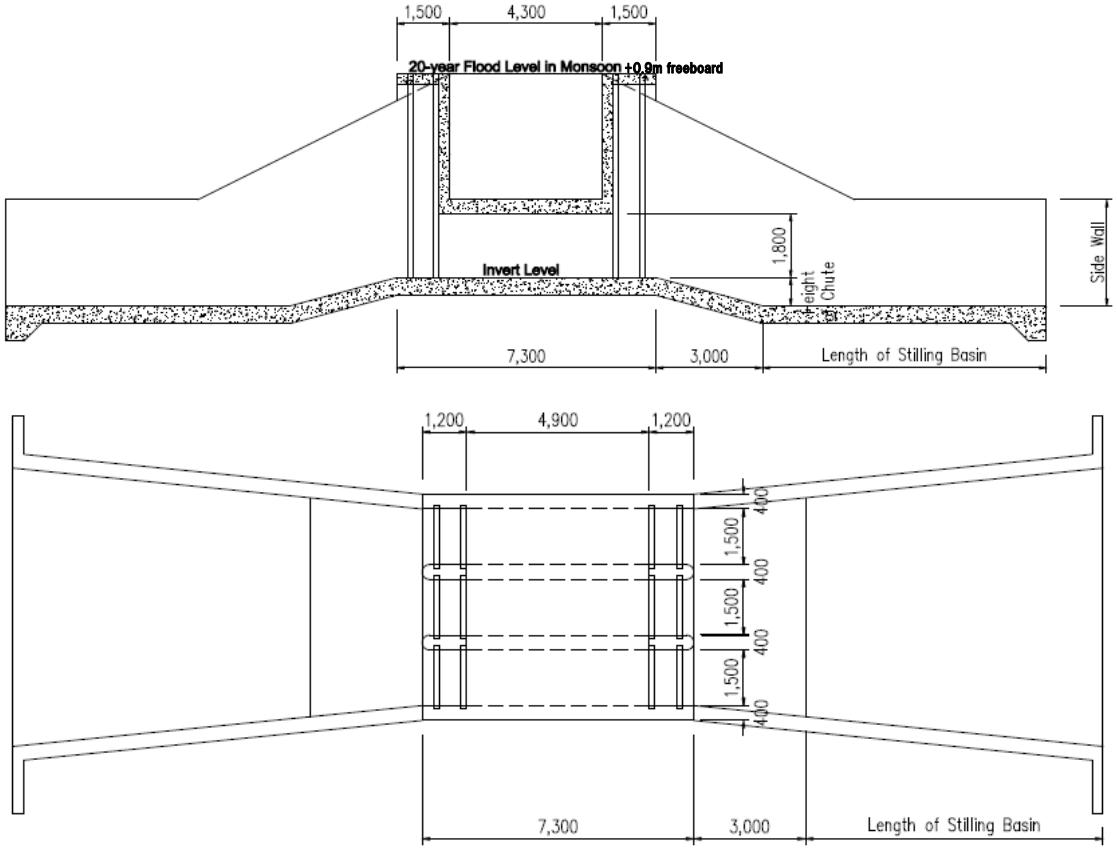
embankment is overtopped should not exceed 0.3 m with a return period of one in ten years.

Firstly, the locations and catchment areas of the regulators were set by using the digital elevation model (DEM) of BWDB. Then the capacity and number of gates were determined by following the manual. A list and the general features of the regulators in the new projects are shown in Table 3.3.3.

Table 3.3.3 List of Regulators in the New Projects

Project Name	Regulator	Catchment (ha)	Design WL (m PWD)	Number of gate	Invert level (m PWD)	Stilling Basin	
						Length (m)	Wall height (m)
Badla Project	No.1	763	4.9	2	3.5	6.0	3.0
Badla Project	No.2	513	4.9	2	3.5	6.0	3.0
Dharmapasha Rui Beel	No.1	6860	6.1	17	2.0	10.0	4.0
Dharmapasha Rui Beel	No.2	2404	6.1	6	2.0	10.0	4.0
Dharmapasha Rui Beel	No.3	3184	6.1	8	2.0	10.0	4.0
Dharmapasha Rui Beel	No.4	1033	6.1	3	2.0	10.0	4.0
Dharmapasha Rui Beel	No.5	6923	6.1	18	2.0	10.0	4.0
Bara Haor	No.1	1961	6.0	5	3.0	9.0	4.0
Bara Haor	No.2	507	6.0	1	3.0	9.0	4.0
Ayner Gupi Haor	No.1	809	4.0	3	2.5	6.0	3.0
Boro Haor(Nikli)	No.1	8053	5.0	18	3.0	7.0	3.0
Boro Haor(Nikli)	No.2	1096	5.0	3	3.0	7.0	3.0
Chandpur Haor	No.1	1573	4.9	4	4.0	5.0	3.0
Chandpur Haor	No.2	677	4.9	1	4.0	5.0	3.0
Dulalpur	No.1	355	4.0	2	1.5	8.0	3.0
Korati Beel Haor	No.1	726	4.8	1	2.8	7.0	3.0
Korati Beel Haor	No.2	2061	4.8	4	2.8	7.0	3.0
Kuniarbandh Haor	No.1	1327	4.0	1	3.5	3.0	4.0
Naogaon Haor	No.1	2394	4.9	9	2.0	8.0	4.0
Naogaon Haor	No.2	4760	4.9	17	2.0	8.0	4.0
Naogaon Haor	No.3	1125	4.9	4	2.0	8.0	4.0
Noapara Haor	No.1	783	4.5	2	2.8	6.0	3.0
Noapara Haor	No.2	586	4.5	1	2.8	6.0	3.0
Noapara Haor	No.3	1496	4.5	3	2.8	6.0	3.0
Nunnir Haor	No.1	2993	4.3	5	2.8	6.0	3.0
Nunnir Haor	No.2	1460	4.3	2	2.8	6.0	3.0
Nunnir Haor	No.3	894	4.3	2	2.8	6.0	3.0
Sarishapur Haor	No.1	1004	4.2	1	3.5	4.0	4.0
Bansharir Haor	No.1	333	5.8	1	4.5	6.0	3.0
Bansharir Haor	No.2	844	5.8	1	4.5	6.0	3.0
Chatal Haor	No.1	680	5.4	1	2.8	8.0	3.0
Chatal Haor	No.2	137	5.4	1	2.8	8.0	3.0
Dakhshiner Haor	No.1	1694	4.8	6	2.3	8.0	3.0
Dakhshiner Haor	No.2	789	4.8	3	2.3	8.0	3.0
Dhakua Haor	No.1	3430	6.0	5	3.8	7.0	3.0
Dhakua Haor	No.2	877	6.0	1	3.8	7.0	3.0
Dhakua Haor	No.3	1655	6.0	3	3.8	7.0	3.0
Ganesh Haor	No.1	984	6.1	2	3.8	8.0	3.0
Ganesh Haor	No.2	1944	6.1	3	3.8	8.0	3.0
Jaliar Haor	No.1	914	7.3	2	6.0	6.0	3.0
Jaliar Haor	No.2	1297	7.3	2	6.0	6.0	3.0
Mokhar Haor	No.1	3983	5.6	3	3.5	7.0	3.0
Mokhar Haor	No.2	3388	5.6	3	3.5	7.0	3.0
Mokhar Haor	No.3	5473	5.6	5	3.5	7.0	3.0
Mokhar Haor	No.4	4496	5.6	4	3.5	7.0	3.0
Mokhar Haor	No.5	4087	5.6	4	3.5	7.0	3.0
Shelnir Haor	No.1	1972	5.2	1	4.8	3.0	5.0
Shelnir Haor	No.2	469	5.2	1	4.8	3.0	5.0
Shelnir Haor	No.3	589	5.2	1	4.8	3.0	5.0
Sunair Haor	No.1	3197	5.7	4	4.0	6.0	3.0
Sunair Haor	No.2	697	5.7	1	4.0	6.0	3.0

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.3.1 Typical Diagram of Regulator

On the other hand, the canals which have deteriorated were listed based on the proposal in the Haor Master Plan. The master plan proposed compiling the results of the interview surveys with the BWDB district offices and local government offices to identify the canals and required length for re-excavation. For the rehabilitation projects which are not proposed in the master plan, the required length of the canals for re-excavation was identified through interview surveys with the BWDB district offices. Table 3.3.1 shows the length of re-excavation of the canals.

2) Study of Facility Plan in the Detail Design Stage

Data Collection Survey on Water Resource Management for Haor Area conducted the hydraulic analysis with IWM using North East Regional Model (NERM) in order to determine the design water levels for full and submergible embankment of new and rehabilitation projects. The regulators of the new projects presented in Table 3.3.3 were mainly planned by desk studies using DEM of BWDB. The length of re-excavation of the canals was determined through the interview surveys. There is a possibility therefore that these facility plans do not reflect the actual site conditions.

The foregoing hydraulic studies must be updated during the implementation stage in addition to updating of topographic and hydrological information.

The objectives and scopes of necessary hydraulic studies in the detail design stage are as follows: i) to obtain topographic information and clarify current hydraulic conditions and drainage system by further site reconnaissance, using data from the Survey of Bangladesh (SoB) and undertaking additional river/canal cross section survey, ii) to obtain the latest hydrological and hydraulic data from existing observation stations, iii) to calibrate NERM with updated topographic and hydrological data for both pre-monsoon and monsoon floods, iv) to establish the local model for the 15 rehabilitation subprojects and 14 new subprojects with MIKE-11 and connect with NERM, v) to define ten-year flood for the pre-monsoon and 20-year flood for the monsoon, vi) to determine the design water level of flood management facilities and required flow capacity of regulators and re-excavation of canal, and vii) to propose the location and number of vents for regulators and typical cross section of drainage canals for re-excavation in each subproject.

(4) Facility Design

1) Embankment

Embankments should be basically designed to comply with the Standard Design Manual by the BWDB Design Circle.

However, there is not sufficient description and stipulations in the Standard Design Manual especially regarding embankment material, quality control and construction method to maintain the required strength for stability of the embankment.

In addition, there are many embankments the crest thereof are eroded by overtopping and deformed by wheel trucks by site reconnaissance. Surface protection may be needed not only for the slopes but also for the crest of embankments.

a) Embankment Materials

Embankment material is usually procured from adjacent ground of the embankment site. Such material is composed of fine material of which more than 90% is occupied by silt and clay (grain size < 0.075 mm).

Compacted embankment which does not include coarse material may cause cracks due to drying shrinkage and causes gully erosion and decrease of strength by soaked with water. However, it is practically not easy to obtain coarse material and mix with fine silt and clay in case of the haor area, hence other measures should be considered.

b) Construction Method and Quality Control

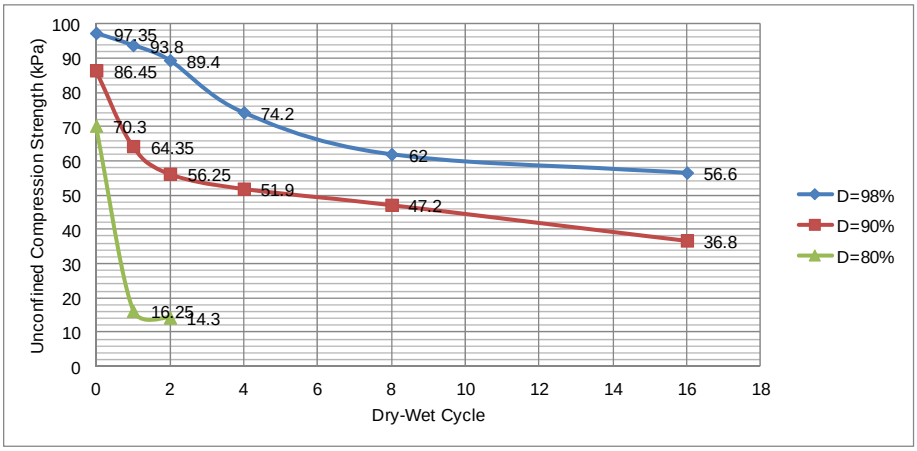
Contract drawings of embankments usually mention to use 7.0 kg rammer for compaction work. However, BWDB pointed out that any equipment such as rammer is seldom to be used in the actual construction.

According to geotechnical investigation carried out in the Data Collection Survey, the required cohesion of embankment for its stability should be more than 14 kN/m^2 (this corresponds to 28 kN/m^2 for unconfined compression strength), and the expected initial unconfined compression strength of embankment is 60–100 kN/m^2 in case of 90% degree

of compaction according to the unconfined compression test and tri-axial compression test. Therefore, 90% degree of compaction is enough for the required strength of embankment.

On the other hand, dry-wet cycle test was conducted in the Data Collection Survey in order to evaluate decrease of local durability by degree of compaction under repeated dry and submergence condition in the haor area. In this dry-wet cycle test, the unconfined compressive strength was used as an indicator for local durability, and unconfined compression tests were conducted for three degrees of compaction (80%, 90%, and 98%) and at six dry-wet cycles (0, 1, 2, 4, 8, and 16 cycles).

As shown in Figure 3.3.2, the unconfined compression strength as the local durability decreases under the repeated dry and submergence process.



Source: JICA Survey Team

Figure 3.3.2 Results of Dry-Wet Cycle Test in Data Collection Survey

In the case of 80% degree of compaction, the strength decreased rapidly and the specimens cannot keep their form. In the cases of D=90% and 98%, the strengths decreased to 36.8 kN/m^2 (42% of initial strength) and 56.6kN/m^2 (58% of initial strength), respectively.

These decreases in strength are inferred to be caused by deterioration on the upper and bottom surfaces of specimens under the dry-wet process. This means that the effect of infiltration of water and dry action which causes deterioration of embankment can be limited in the surface layer of the embankment by a higher degree of compaction. In other words, a higher degree of compaction is inferred to be able to bring higher surface durability of embankment.

As the total length of embankment is extremely long, a high degree of compaction, such as from 95% to 98%, is required as much as possible so that the maintenance cost of the embankment can be reduced.

Additional soil tests and trial embankments will be required before or during the detail design stage to identify and specify physical and chemical characteristics of embankment

material, adjustment method of grain size distribution and moisture content, appropriate type and method of equipment and machine for compaction.

c) Foundation of Embankment

It was confirmed by the circular slip analysis including foundation ground carried out in the Data Collection Survey that the embankment will be stable on foundation ground of which cone resistance is more than 0.7 MPa. Dutch Cone Tests (DCTs) conducted in the Data Collection Survey resulted that cone resistance in most of the foundation ground was more than 0.8 MPa; however, cone resistance of less than 0.7 MPa was observed in some parts of the foundation ground.

The DCTs should be carried out at least every 500 m in areas wherein the ground seems to have low strength and low bearing capacity in order to identify the super soft layer, which has cone resistance of less than 0.7 MPa.

d) Shape of Embankment

Although the Standard Design Manual recommends a slope gradient of 1:3.0 for both the side slope of submergible embankment and the river side slope of full embankment, the actual designs adopt 1:2.0 for one side slope or both slopes. The embankment slope theoretically maintains stability even for a 1:2.0 gradient if the expected initial strength obtained from the unconfined compression tests under 90% degree of compaction conducted in the Data Collection Survey is used. However, a slope gradient of 1:3.0 is absolutely required considering cracks due to drying shrinkage, uncertainty of quality control, and decrease of durability due to repeated submergence.

On the other hand, although the Standard Design Manual recommends that the crest width of embankment should be 4.3 m, the actual design adopted 3.6 m. However, the crest width of 4.3 m must be selected, since vehicles traffic may affect the shoulder of the slope if a narrow width such as 3.6 m is selected.

e) Surface Protection

The slope of the embankment made by BWDB is usually protected by turfing using local grass called *dubra grass*. However, the crest of embankment is not usually covered by any pavement, since the road construction is not the responsibility of BWDB.

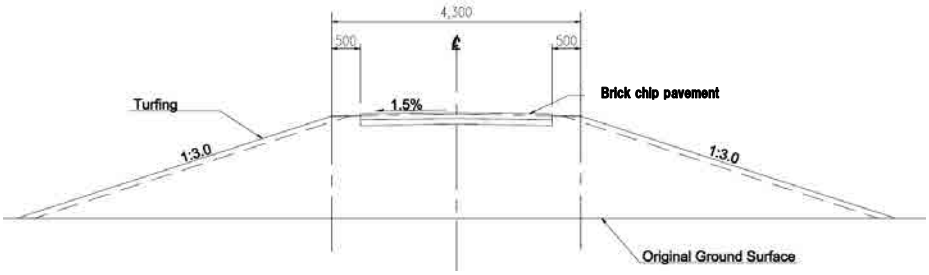
In order to protect the road from deterioration due to erosion and wheel trucks, pavement with bricks or concrete should be applied on the crest of embankment as “inspection road” for structures of BWDB.

Table 3.3.4 Shape of Embankment

Item		Submergible Embankment	Full Flood Embankment	Note
Design Water Level		10-year water level in the pre-monsoon season	20-year water level in the monsoon season	
Crest Width		4.3 m	4.3 m	
Slope Gradient	Country Side	1:3.0	1:2.0	
	River Side	1:3.0	1:3.0	
Free Board		0.3m	0.9m	
Slope Protection		Turfing	Turfing	
Pavement		Brick chips (20% of total length)*		
Degree of Compaction		95%	95%	

Note: *It is desirable to provide pavement for the entire stretch of embankment in order to avoid deterioration of embankment; however, BWDB was limited only to pave 20% of the total length of embankment due to budget limitation. The stretch of pavement should be extended as long as possible in the detail design stage or transportation on the embankment should be restricted to avoid damage from wheel trucks.

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.3.3 Typical Section of Embankment

f) Establishment of Maintenance Scheme

It is difficult to construct an everlastingly stable and sound embankment under unique and severe conditions such as using inadequate embankment material, uncertainty of construction and quality control, and repeated submergence.

Periodic inspection (once a year) and small maintenance works such as repair of eroded parts and cracks will be needed. However, the undertaking of large rehabilitation works may be reduced for several decades if a high degree of compaction, such as 95%, will be specified for the construction. In addition to the periodic inspection works mentioned above, detail geotechnical inspections are recommended once in every ten years. Tri-axial tests and unconfined compression tests will be conducted in the detail geotechnical inspections for a comparative study with the expected durability from the dry-wet cycle test mentioned above.

2) Regulator

Regulator can be also designed using the Standard Design Manual of BWDB. Some issues should be considered regarding quality control of structural concrete and types of regulators.

a) Quality Control of Structural Concrete

Concrete used for regulators is always mixed, placed and compacted by local people. Although BWDB has a standard mix proportion and standard aggregate gradation, the local people usually do not mind it. Accordingly, this may result in the concrete having much void and low strength. They also do not keep appropriate clear cover between surface of concrete and re-bars, do not keep appropriate space between concrete edge and bolts which fix gate hoist plates on deck slab concrete.

Consultants for supervision must instruct that labor will comply with the standard mix proportion of concrete and appropriate clear cover on reinforcement.

b) Type of Regulator

Some haor projects have problems such as regulators cannot be operated properly due to lack of maintenance, which causes overtopping with erosion on submergible embankment, and that local people often intentionally cuts embankment to make the passage of boats or transportation of crops more easily.

Presently, the District Office in Netrokona and Design Circle 1 of BWDB experimentally constructed a “causeway-type regulator”. This is a kind of “fuse dyke type spillway”. A causeway-type regulator is just a U-type concrete channel with temporary embankment inside during the Pre-monsoon season in order to prevent flash flood water from inflowing. The temporary embankment will then be removed by the local people after the end of the pre-monsoon season in order to introduce monsoon season flood water into the project area every year. The temporary dyke will be re-built again by BWDB, with its own budget, during the dry season in order to prepare for the next pre-monsoon floods.

BWDB will monitor the effectiveness of the causeway in terms of function, O&M by local people, and economic efficiency of temporary embankment, which is provided repeatedly by BWDB. This causeway can be applied in some of the candidate subprojects according to the results of BWDB monitoring.

CHAPTER 4 RURAL INFRASTRUCTURE

4.1 Policies on Rural Development

(1) Strategy for Rural Development Projects (1984)

In the early 1980s, the Bangladesh Planning Commission (BPC) designated the locations of about 1,400 rural local assemblies and secondary markets as growth centers, which are to be the focal points for rural economic and social development where investments in rural infrastructure and services should be concentrated at. They were selected from more than 8,000 rural markets in Bangladesh based on revenue potential and volume of trade, population served, and the distances between adjacent growth centers.

In 1984, GOB adopted a new strategy for Rural Development Projects (RDPs) (BPC 1984). This took into account the policy of developing growth centers as foci for rural development. The strategy aimed to reduce poverty and improve the life of rural people by emphasizing critical aspects of the rural development process, which include agricultural development, improved physical infrastructure, and income generation for the poor. The strategy defined that RDPs should comprise one or more of the following three investment components:

- Development of physical infrastructure including roads, storage, and rural markets
- Development of irrigated agriculture, minor drainage, and flood control works
- Production and employment programs for the rural poor

(2) Bangladesh Rural Infrastructure Strategy (1996)

In 1996, the Local Government Engineering Department (LGED) and BPC, in association with World Bank, jointly conducted a study to review the outcomes and impacts of the 1984 strategy with respect to the development of rural transportation and trading infrastructure (LGED and BPC, 1996). The study found that the strategy had provided a valid framework for investment in rural infrastructure and that the investments had generated positive socioeconomic impacts and contributed to reducing poverty. The approach of boosting local economic development by targeting public investments to growth centers with high potential was found to be effective. The designation of an additional 700 growth centers had reset the targets for spatial distribution of infrastructure development in line with agricultural potential of the different regions of Bangladesh. The study argued for the need to continue and increase investment in rural infrastructure and provide an efficient transport and trading system.

The study recommended adjusting or fine-tuning the strategy in the following ways:

- To give more emphasis to user and community participation in planning, implementation, and monitoring.
- To improve the use of local resources, such as local materials.
- To continue the use of labor-intensive techniques supported by appropriate construction equipment.

- To recognize and expand the role of the private sector, and strengthen the capacity of local contractors to provide cost effective and labor-intensive skills.
- To develop the role of labor contracting societies (LCS) as a mechanism to create additional employment for the poor, including disadvantaged women, in construction and maintenance works.
- To establish and fund a sustainable system for the maintenance of roads and markets in rural areas so that economic and social benefits from improved infrastructure continue to flow.
- To coordinate the development of the rural road network with the use of rural waterways.
- To continue institutional strengthening of LGED, at headquarters and at the local level, with an emphasis on community participation.

(3) Rural Roads Master Plan (2005)

In 2005, LGED formulated a rural roads master plan with a 20-year time horizon up to 2025. Despite its title, the document presents a long-term plan for developing rural markets and Union Parishad complex buildings as well as rural roads. The overall objectives of the plan are as follows:

- Identify and prioritize the most useful and effective rural road networks throughout the country.
- Provide all-weather access to all growth centers, all Union Parishads, rural markets, and other service delivery centers.
- Improve rural accessibility to facilitate agricultural production and marketing of products.
- Reduce poverty through employment generation and accelerating economic activities.
- Strengthen local government institutions (LGI) and promote local governance.

(4) Rural Road and Bridge Maintenance Policy (2013)

A new rural road and bridge maintenance policy has been prepared by LGED in 2013. About 80% of the population of Bangladesh lives in rural areas, and the rural economy, through the agricultural sector, substantially contribute to the national economy. In this regard, improvement of the living standards of the country's majority population mainly depends on an improved rural transportation system especially land transportation system. The goals of establishing a well-developed rural road system, by maintaining good riding surface, are as follows:

- Facilitate safe, comfortable, and fast transportation;
- Minimize travel time under a limited or nonexistent road transport system;
- Reduce operating cost of vehicles; and
- Reduce rate of accidents.

Road maintenance shall include maintenance of all appurtenant structures. The maintenance programs shall normally cover emergency, routine and periodic maintenance works. LGED shall prepare strategies, guidelines, and manuals.

4.2 Existing Rural Infrastructure

(1) Target Facilities of Component 2

There are many kinds of rural facilities in the study area, e.g., rural roads, hats (market), ghats (boat landing facility), schoolhouses, and irrigation facilities. The objectives of the project contemplated in this study are to mitigate flood damage and to improve people's living conditions in the haor areas through the three components of the project, namely, development of flood control facilities, development of rural infrastructures, and promotions of agriculture and fisheries. In collaboration with LGED, the survey listed candidate facilities related to the project objectives considering the conditions in the haor area.

Furthermore, the survey narrowed down the candidates, which will be selected as the target facilities, by applying the following two criteria in view of the objectives of the project:

- Contribution to livelihood enhancement through promotion of agriculture and fisheries.
- Having synergy effects with the flood management component.

Eventually, rural roads, hats, and ghats (including wave protection works as a part of hat and ghat structures) were selected as target facilities. Re-excavation of canal which links beels was included in the candidates for Component 3 (fisheries promotion) because the canals are a part of beel structures for improving fisheries resources. Irrigation and village protection are very important for improvement of living standards. However, these facilities have no distinctive synergy effects from the proposed flood mitigation works, especially submergible embankment, and were screened out from the candidates for Component 2. Table 4.2.1 presents a summary of the selection process.

Table 4.2.1 Target Rural Infrastructure

No.	Rural Infrastructure	Objective	Livelihood Enhancement and Synergy Effects
1	Rural road	Upgrading and/or rehabilitation of upazila roads, union roads and village roads (submergible and all-weather), including bridges and culverts.	High: reducing flash flood damage by transporting products quickly.
2	Hat (market)	Improvement and development of growth centers and rural markets (including wave protection works, length = 150 m/no.)	High: selling products from the polder dike area.
3	Ghat (boat landing facility)	Improvement and development of ghats (including wave protection works, length = 50 m/no.)	High: transporting products from the polder dike area.
4	Canal Re-excavation	Improvement of fisheries resources and waterways.	High: increasing fish population and transporting products from the polder dike area. Included in beel excavation (Component 3).
5	Village Protection	Wave protection around villages.	Low: not directly related with livelihood enhancement and synergy effect.
6	Irrigation	Buried pipe network system and low dike system by using low-lift pump.	Middle: increasing paddy yield. However, no synergy effect with the submergible embankment.

Source: Prepared by the JICA Survey Team

(2) Rural Roads

1) Road Types

Substantial parts of the haor area remain under water for about half of the year. Rural roads have not been developed as required because of this submergence. Therefore, the rural road network in the haor areas, particularly in deep haor areas, is still undeveloped.

The total length of rural roads is 290,026 km in Bangladesh and 30,862 km in the study area. In the study area, the total length of upazila roads is 4,341 km, of union roads is 4,938 km, and of village roads is 21,583 km. The total length requiring rehabilitation is 218,414 km in the whole nation. Meanwhile in the study area, road length of 23,674 km requires rehabilitation. The roads in the study which need rehabilitation comprise 1,407 km of upazila roads, 3,037 km of union roads, and 19,230 km of village roads. Substantial works required are upgrading of pavement and road widening in order to comply with the standards.

There are six classes of roads in Bangladesh, namely, national highway, egional highway, ila road, upazila road, union road, and village road. National highways, regional highways, and zila roads are constructed and managed by RHD. Upazila roads (also called district or feeder roads) and union roads are constructed and managed by LGED. Meanwhile, village roads are constructed and managed by LGED and LGI. The target rural roads of the project are upazila, union and village roads. Table 4.2.2 summarizes the classification, definition, and responsible organization of the roads.

Table 4.2.2 Road Reclassification, Definition, and Ownership

Sl No.	Type	Definition	Ownership and Responsibility
1	National Highway	Highways connecting the national capital with divisional capitals or seaports, land ports or the Asian Highway.	RHD*
2	Regional Highway	Highways connecting district capitals or main river or land ports, with each other not connected by national highways.	RHD
3	Zila Road	Roads connecting district capitals with upazila headquarters or connecting one upazila headquarter to another upazila headquarter by a single main connection with a national/regional highway, through the shortest distance/route.	RHD
4	Upazila Road	Roads connecting upazila headquarters with growth center/s, or one growth center with another growth center by a single main connection or connecting growth center to a higher road system**, through the shortest distance/route.	LGED*/LGI*
5	Union Road	Roads connecting union headquarter/s with upazila headquarters, growth centers or local markets or connecting two markets.	LGED/LGI
6	Village Road	(A) Roads connecting villages with union headquarters, local markets, farms, and ghats or connecting two ghats.	LGED/LGI
		(B) Roads within a village.	

Note: * RHD – Roads and Highways Department, LGED – Local Government Engineering Department, LGI – Local Government Institutions.
** Higher Road System – National Highway, Regional Highway, and Zila Road.

Source: Bangladesh Gazette 1st Part, 6 November 2003 (Government of the People's Republic of Bangladesh Ministry of Local Government, Rural Development and Co-operatives Local Government Division Rural Road and Bridge Maintenance Policy [English Translated Copy] January 2013 p.8)

The LGED and LGI share the responsibility for construction and maintenance works of village roads, as shown in Table 4.2.3.

Table 4.2.3 Responsibility of Village Roads

Village Road		Construction	Maintenance
Type-A	Important	LGED	LGED
	Not-important	LGED	LGI
Type-B	Important	LGED	LGED
	Not-important	LGED	LGI

Remarks: Important roads formed link between higher categories of roads (upazila roads and union roads).
Source: Prepared by the JICA Survey Team

The topography is flat and the areas are submergible in the haor area. To cope with the conditions, a road development avoids embankment as much as possible to secure smooth drainage of water. Thus pavement is the most important structure in the haor area. The finishing of pavement is an index of driving performance or the function of a road. Along this line, the rate of road pavement is adopted as a necessity of road development in this study. LGED is responsible for developing upazila roads, union roads, and village roads.

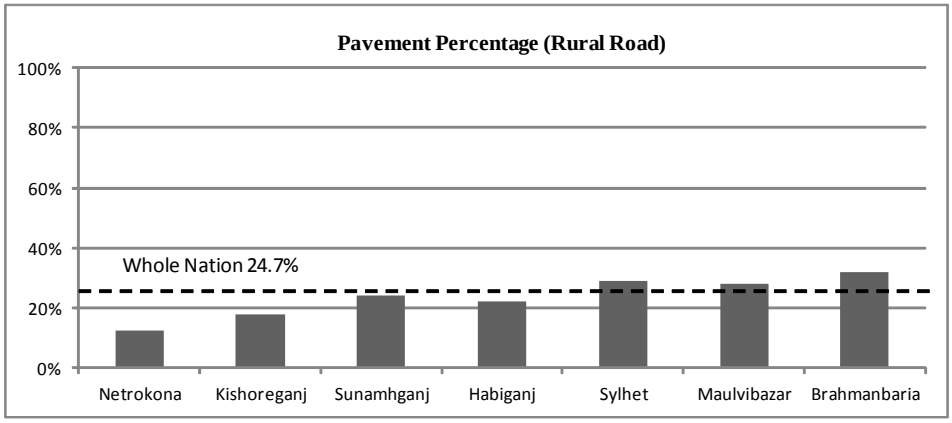
2) Rural Roads

According to statistics, the total length of rural roads in Bangladesh is 290,023 km. The mean pavement rate is 24.7% at present. The pavement percentage in four districts, namely, Netrokona, Kishoreganj, Sunamganj, and Habiganj, are lower than the national mean, as shown in Table 4.2.4 and Figure 4.2.1, and indicate the necessity for road development (refer to Appendices 4.1 and 4.4).

Table 4.2.4 Total Length and Paved Percentage of Rural Roads

District	Total Length* (km)	Pavement Percentage
Netrokona	5,044	12.3%
Kishoreganj	4,641	17.7%
Sunamhganj	3,703	23.9%
Habiganj	3,808	22.1%
Sylhet	5,855	29.2%
Maulvibazar	4,406	27.8%
Brahmanbaria	3,404	31.8%
Study Area Total/Average	30,862	23.3%
Whole Nation	290,026	24.7%

* Total Length : Rural Road (Upazila Road, Union Road and Village Road)
Source : LGRD Website (2012)



Source: Illustrated by the JICA Survey Team

Figure 4.2.1 Paved Percentage of Rural Roads

3) Upazila Roads

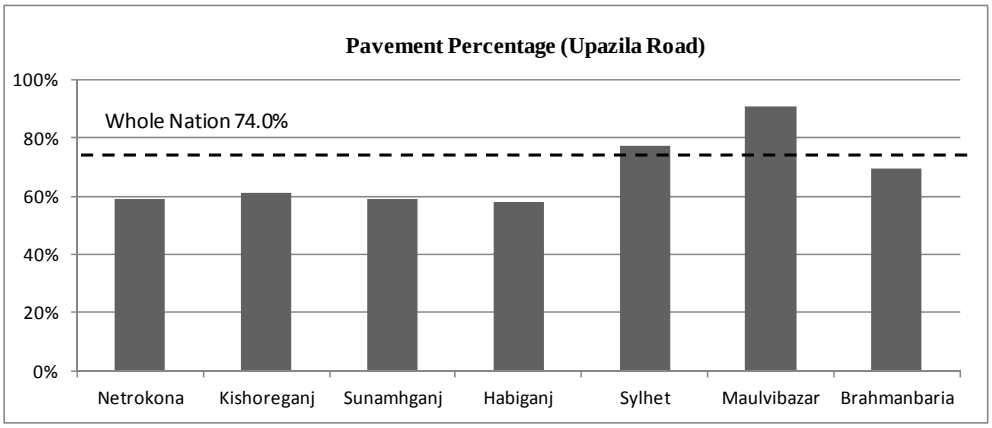
An upazila road is a major road and the most important one in the survey area. Total length of upazila roads in Bangladesh is 37,773 km. The rate of pavement is 74.0%. The pavement percentage in five districts, namely, Netrokona, Kishoreganj, Sunamganj, Habiganj, and Brahmanbaria, are lower than that of the whole nation, as shown in Table 4.2.5 and Figure 4.2.2. Improvement of upazila road pavement is required to enhance the living standards in the haor area.

Table 4.2.5 Total Length and Paved Percentage of Upazila Roads

District	Total Length* (km)	Pavement Percentage
Netrokona	621	59.2%
Kishoreganj	601	61.2%
Sunamhganj	733	59.1%
Habiganj	595	58.1%
Sylhet	763	77.0%
Maulvibazar	539	90.9%
Brahmanbaria	490	69.5%
Study Area Total/Average	4,341	67.6%
Whole Nation	37,773	74.0%

* Total Length : Upazila Road

Source : LGRD Website (2012)



Source: Illustrated by the JICA Survey Team

Figure 4.2.2 Paved Percentage of Upazila Roads

4) Union Roads

A union road is a branch road in the study area. The total length of union roads in Bangladesh is 44,781 km. The rate of pavement is 42.9%. The pavement percentage in four districts, namely, Netrokona, Kishoreganj, Sunamganj, and Habiganj, are lower than that of the whole nation, as shown in Table 4.2.6 and Figure 4.2.3.

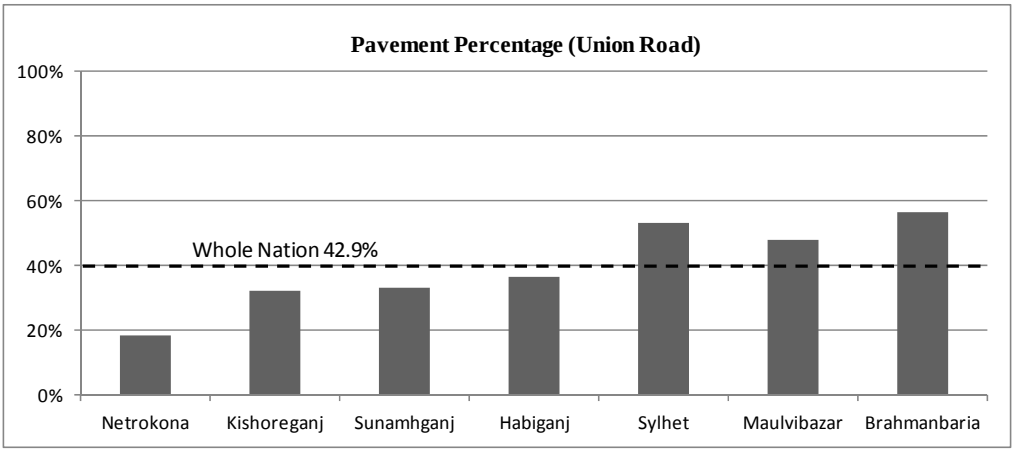
Table 4.2.6 Total Length and Paved Percentage of Union Roads

District	Total Length* (km)	Pavement Percentage
Netrokona	859	18.2%
Kishoreganj	737	32.1%
Sunamhganj	814	33.2%
Habiganj	539	36.4%
Sylhet	799	53.2%
Maulvibazar	661	47.8%
Brahmanbaria	529	56.5%
Study Area Total/Average	4,938	38.5%
Whole Nation	44,781	42.9%

* Total Length : Union Road

Source : LGRD Website (2012)

The low rate of pavement has no doubt hampered economic activities in the haor area wherein roads are muddy except in the latter half of the dry season.



Source: Illustrated by the JICA Survey Team

Figure 4.2.3 Paved Percentage of Union Roads

5) Village Roads

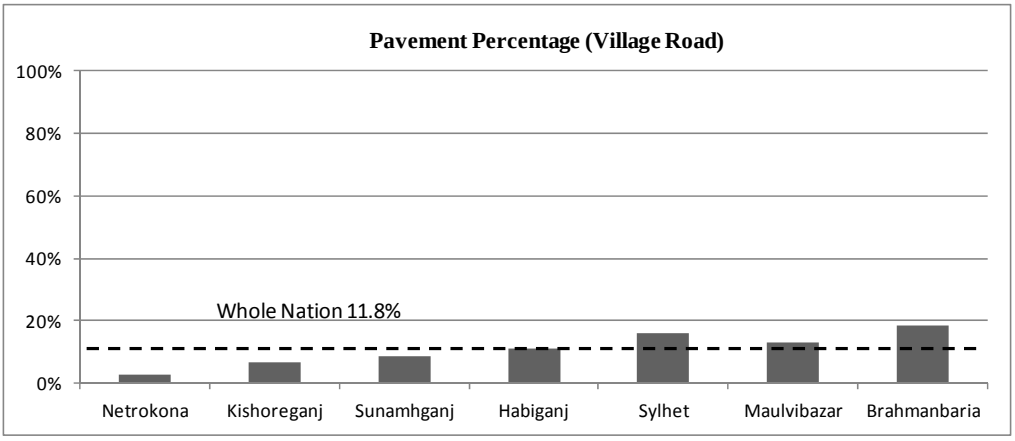
A village road is the smallest road but contributes well to the life of people in the study area. The total length of village roads in Bangladesh is 207,472 km and a low mean pavement rate of 11.8%. It should be noted that unpaved road conditions worsen in the period from December to February when the economy becomes active due to special hydrologic conditions in the area. The pavement percentage in four districts, namely, Netrokona, Kishoreganj, Sunamganj, and Habiganj, are lower than that of the whole nation, as shown in Table 4.2.7 and Figure 4.2.4.

Table 4.2.7 Total Length and Paved Percentage of Village Roads

District	Total Length* (km)	Pavement Percentage
Netrokona	3,564	2.7%
Kishoreganj	3,303	6.6%
Sunamhganj	2,156	8.5%
Habiganj	2,675	11.1%
Sylhet	4,294	16.2%
Maulvibazar	3,206	13.1%
Brahmanbaria	2,385	18.5%
Study Area Total/Average	21,583	10.9%
Whole Nation	207,472	11.8%

* Total Length : Village Road (Village Road A + Village Road B)

Source : LGRD Website (2012)



Source: Illustrated by the JICA Survey Team

Figure 4.2.4 Paved Percentage of Village Roads

6) Summary

Table 4.2.8 summarizes the paved percentage of rural roads (including upazila roads, union roads, and village roads). The pavement rates in the districts of Netrokona, Kishoreganj, Sunamganj, and Habiganj are poor as compared with the national average.

Table 4.2.8 Summary of Rural Roads

District	Total	UZR*	UNR*	VLR*
Netrokona	< Nation	< Nation	< Nation	< Nation
Kishoreganj	< Nation	< Nation	< Nation	< Nation
Sunamhganj	< Nation	< Nation	< Nation	< Nation
Habiganj	< Nation	< Nation	< Nation	< Nation
Sylhet				
Maulvibazar				
Brahmanbaria		< Nation		

* UZR : Upazila Road, UNR : Union Road, VLR : Village Road
< Nation : less than whole nation.

Source: Prepared by the JICA Survey Team

(2) Markets (Hats)

Local markets are essential to the lives of residents in the haor area. Boro rice and fish are the two main products in the haor area. Many of farmers and fishermen have been hampered to sell products at fair prices due to the poor facilities. Local consumers also have difficulty in buying quality products due to the difficulty of access to a market.


Hat (Growth Center)

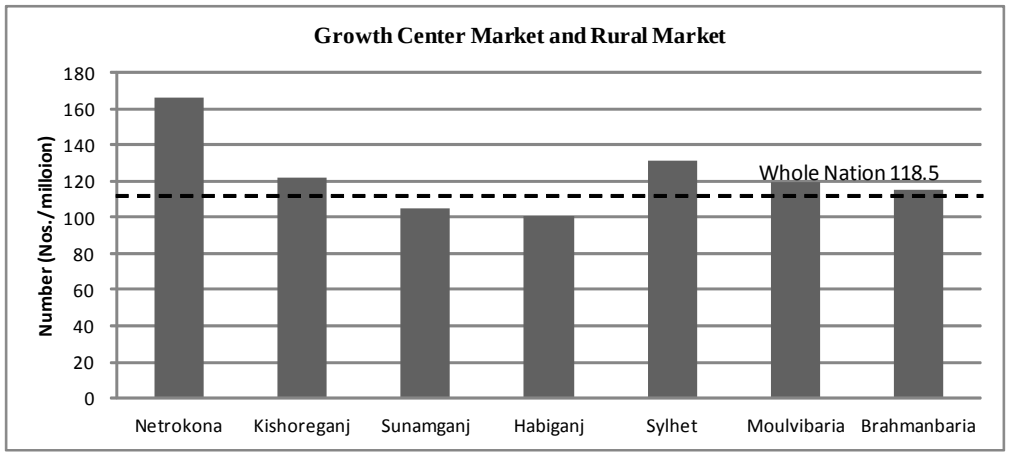
There are two types of hats. A growth center has a large capacity and is a major market in the haor area. Meanwhile, a rural market is a branch market. The total number of markets in Bangladesh is 17,840, and there are 118.5 markets per

million population, as shown in Table 4.2.9 and Figure 4.2.5. The density of each of the districts of Sunamganj, Habiganj, and Brahmanbaria is less than that of the national average (refer to Appendices 4.2 and 4.4).

Table 4.2.9 Growth Centers and Rural Markets by District

District	Population*	Growth Center**		Rural Market**		Total	
	(million)	(nos.)	(nos./million)	(nos.)	(nos./million)	(nos.)	(nos./million)
Netrokona	2.23	43	19.3	328	147.1	371	166.4
Kishoreganj	2.91	47	16.2	308	105.8	355	122.0
Sunamganj	2.47	44	17.8	216	87.4	260	105.3
Habiganj	2.09	33	15.8	177	84.7	210	100.5
Sylhet	3.43	52	15.2	398	116.0	450	131.2
Moulvibaria	1.92	32	16.7	197	102.6	229	119.3
Brahmanbaria	2.84	32	11.3	296	104.2	328	115.5
Whole Nation	150.49	2,100	14.0	15,740	104.6	17,840	118.5

Source : * District : DATA COLLECTION SURVEY ON WATER RESOURCES MANAGEMENT IN HAOR AREA OF BANGLADESH Interim Report (2013 JICA) , Whole Nation : World Bank, 2011
** Disirict : LGED District Office, Whle Nation: LGED Planning Monitoring and Evolution Unit.(2012)

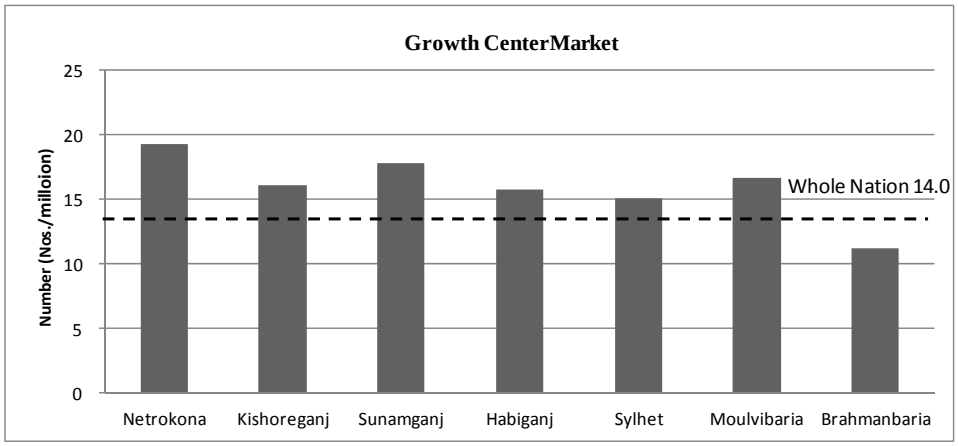


Source: Illustrated by the JICA Survey Team

Figure 4.2.5 Growth Centers and Rural Markets

1) Growth Centers

The total number of growth center markets in Bangladesh is 2,100, and there are 14.0 growth centers per million population. The density of Brahmanbaria District is less than that of the national average, as shown in Figure 4.2.6.

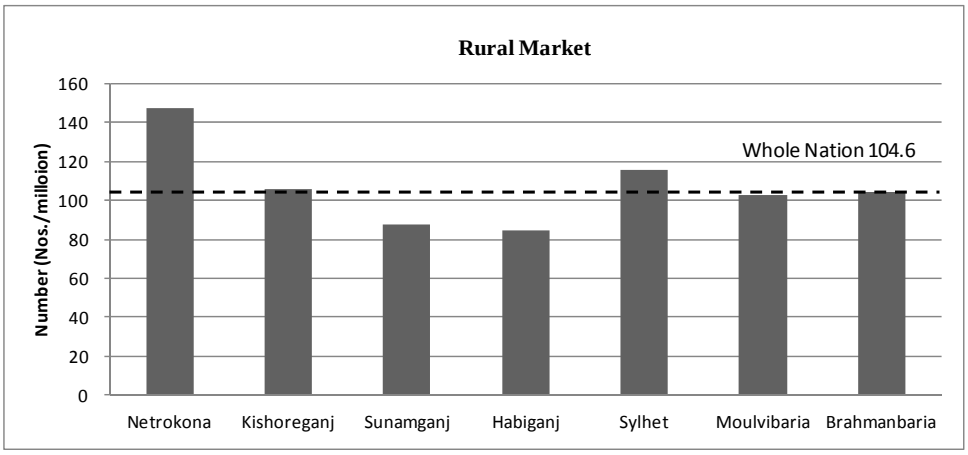


Source: Illustrated by the JICA Survey Team

Figure 4.2.6 Growth Center Markets

2) Rural Markets

The total number of rural markets in Bangladesh is 15,740, and there are 104.6 rural markets per million population. The density of each of the districts of Sunamganj, Habiganj, Maulvibazar, and Brahmanbaria is less than that of the national average, as shown in Figure 4.2.7.



Source: Illustrated by the JICA Survey Team

Figure 4.2.7 Rural Markets

4) Summary

Table 4.2.10 presents a summary of densities regarding markets (including growth centers and rural markets). The density of each of the districts of Sunamganj, Habiganj, and Brahmanbaria is less than that of the national average, as shown in Table 4.2.10.

Table 4.2.10 Summary of Markets

District	Total	GCM	RM
Netrokona			
Kishoreganj			
Sunamhganj	< Nation		< Nation
Habiganj	< Nation		< Nation
Sylhet			
Maulvibazar			< Nation
Brahmanbaria	< Nation	< Nation	< Nation

* GCM : Growth Center Market, RM : Rural Market
< Nation : less than whole nation

Source: Prepared by the JICA Survey Team

(3) Boat Landing Facilities (Ghats)

During the southwest monsoon period, the boat becomes the main means of transportation. Boat landing facilities are an important rural infrastructure for conveying food, fish, household goods, and construction materials in the haor area. These boat landing facilities are called ghats and closely related to the market (refer to Appendix 4.4).


Ghat (Boat Landing Facility)

4.3 Data Collection and Interview

(1) Interviewed Districts

In addition to the data collection survey discussed in the previous subsection, interview surveys were conducted to local people as well as to the LGED district offices of Habiganj, Netrokona, Sunamganj, and Kishoreganj. These districts are important areas in view of subprojects implementation in the study area as identified in the previous section. As shown in Table 4.3.1, meetings and over the phone interviews were the main means of interview (refer to Appendix 4.3).

Table 4.3.1 Outline of Interviews

No.	District	Name/Position	Date	Remarks
1	Habiganj	Mr. Rabiul Islam, Executive Engineer	June and November, 2013	Meeting
2	Netrokona	Md, Kamrul Hasan, Executive Engineer	July and November, 2013	Over the phone and meeting
3	Sunamganj	Md, Iqbal Ahmmed , Executive Engineer	July and November, 2013	Over the phone and meeting
4	Kishoreganj	Md, Amirul Islam, Senior Assistant Engineer	July and November, 2013	Over phone and meeting

Source: Prepared by the JICA Survey Team

(2) Results

Interviews were conducted using questionnaires on rural infrastructure with the purpose of clarifying the importance of facilities, physical distributions, and existing problems. The results of interviews in the four districts were almost the same and had no significant difference among each other. Below is a summary of the results of interviews.

1) Physical Distribution of Agricultural and Fishery Products

The importance of rural road, market facilities and boat landing facilities is very high in all districts. The interviewees revealed that these facilities play the most important roles for distribution of agricultural and fishery products in the districts.

Table 4.3.2 Importance of Facilities

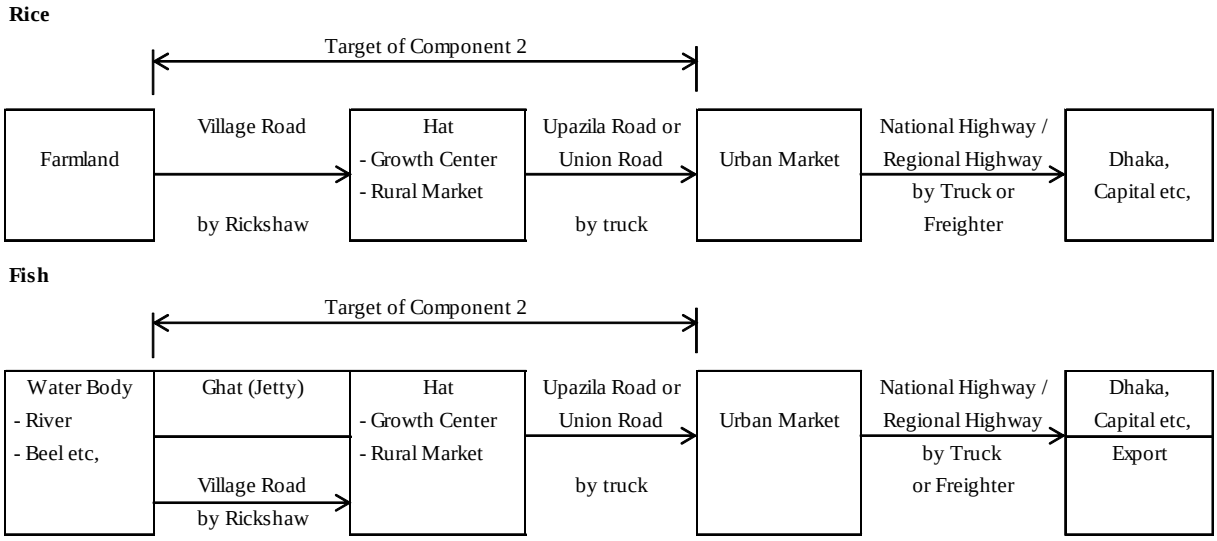
Facility	Importance	Reason
Rural Road	(Very High,) High, Middle, Low	Rural road carries out a very important part in distribution and marketing. Good roads have always reduced transportation cost* and create new jobs.
Market Facility	(Very High,) High, Middle, Low	Developed market facilities carries out the important role of economic development of the villagers. The villagers are able to sell produced commodities and buy their essential commodities under all weather conditions.
Boat Landing Facility	(Very High,) High, Middle, Low	Hoar areas are waterlogged for more than seven months a year. During such period only boats become the people's means of transport. Good boot landing facilities reduce the risk of loading and unloading.

Source: Prepared by the JICA Survey Team

According to standards of forest roads and farm roads applied in Japan, the design maximum speed for earth roads is 15 km/h and for paved roads is 30 km/h (20 to 40 km/h) in case of road width of 3.0 m. The required time for transportation on paved road is half the time on earth road.

2) Existing Main Distribution

The main products in the study area are rice and fish. The existing main distribution is from farmland/water body via hats to the urban market and Dhaka, etc., as shown in Figure 4.3.1. The main means of transportation is by vehicle and freighter. Therefore rural roads, market facilities, and boat landing facilities play a key role in physical distribution, as mentioned above.



Source: Prepared by the JICA Survey Team

Figure 4.3.1 Existing Main Distribution

3) Problems

Upazila roads, growth centers, and ghats are the main facilities for economic activities in the study area. Meanwhile, union roads and rural markets are branch facilities. Currently, parts of these facilities are undeveloped.

Table 4.3.3 Problems of Facilities

Facility	Problem
Rural Road	Upazila roads are the main roads in rural areas. Union roads are branch roads, while village roads are end roads. The most significant problem is that there are unpaved upazila, union and villages roads to the next.
Hat (Market Facility)	Growth center markets is the main market in rural areas, while rural markets are branch markets. The most significant problem is that the development of growth market centers and rural markets are not sufficient in terms of number and capacity.
Ghat (Boat Landing Facility)	Boat landing facilities also play a significant role in the village life in haor areas. During the monsoon season, boats are the only means of transport of village people in haor areas. The most significant problem is shortage in number and deterioration of ghats.

Source: Tabulated by the JICA Survey Team

4.4 Issues

(1) Issues Based on the Collected Data

Table 4.4.1 presents the issues to be tackled by the project based on the collected data and existing road database which were discussed in Subsection 4.2. The development level of rural infrastructure in six districts is lower than the national average.

Table 4.4.1 Issues Based on Collected Data

Facility	Issue
Rural Road	Pavement percentage in Netrokona, Kishoreganj, Sunamganj, and Habiganj is less than the whole nation.
Market Facility	Facility density in Sunamganj, Habiganj, Maulvibazar, and Brahmanbaria districts is less than the whole nation.
Landing Facility	Not available because landing facility is specific to the haor area.

Source: Prepared by the JICA Survey Team

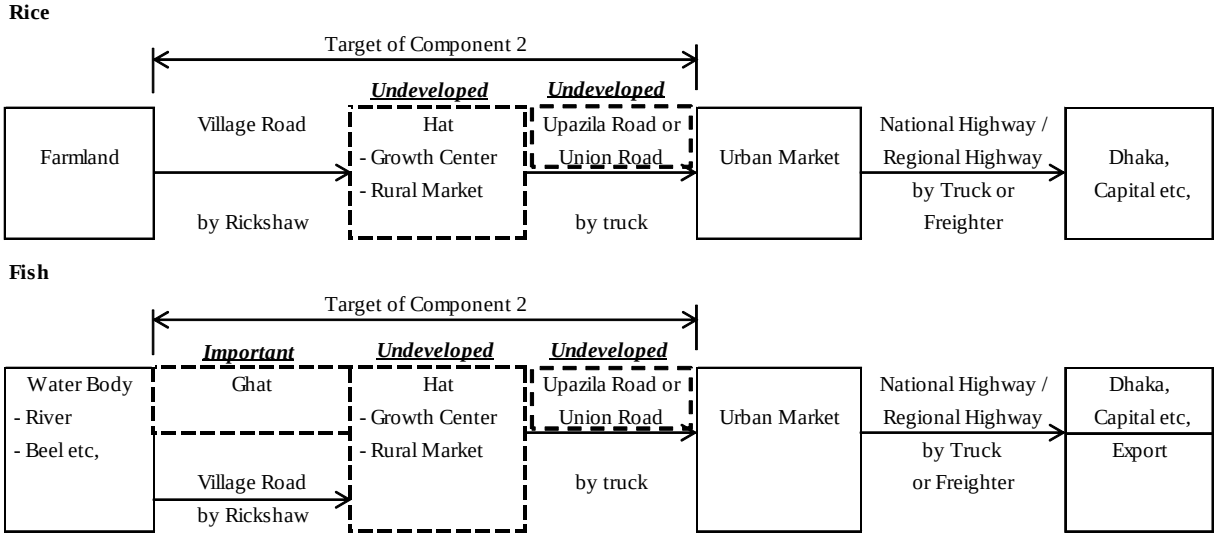
(2) Issues Based on Interview

The development of rural roads and market facilities are not sufficient despite being very important facilities. The following table presents issues based on interview.

Table 4.4.2 Issues Based on Interview

Facility	Issue
Rural Road	There are unpaved upazila roads and union roads.
Market Facility	Development of growth center market and rural market are insufficient.
Landing Facility	There is shortage and deterioration.

Source: Prepared by the JICA Survey Team



Source: Illustrated by the JICA Survey Team

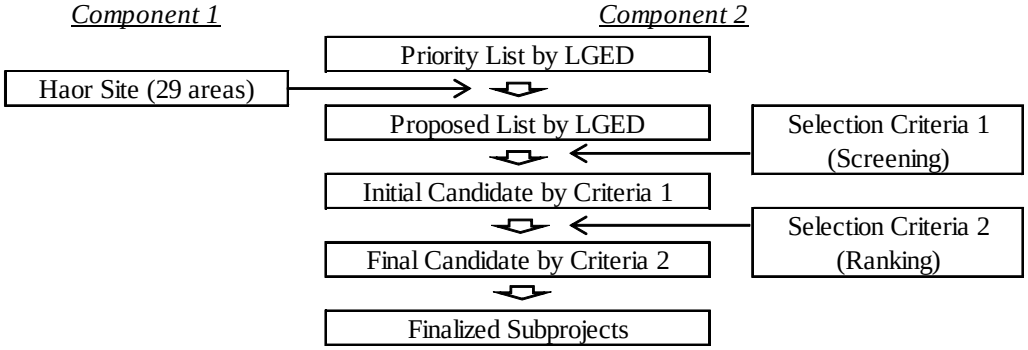
Figure 4.4.1 Distribution and Issues

4.5 Selection Criteria

4.5.1 Selection Procedure of Subprojects

Component 1 of the project has defined the target areas of Component 2 to be the areas covered by the 29 subprojects under Component 1. LGED has prepared a proposed list of target areas based on the priority list, which had been prepared in advance for their use. The list provided the basic data in selecting the target facilities for Component 2. The selection

procedure and criteria for Component 2 were prepared in this survey with consultation with LGED. On the basis of the proposed list and the selection criteria (selection criteria 1 screening), the initial candidate subprojects were selected. Then, selection criteria 2 (ranking) was used to rank the initial candidate subprojects and the final candidate subprojects were prepared. This process vested subprojects which were given priority to each subproject . Finally, the available budget selected the subprojects to be implemented by this project according to its priority. Figure 4.5.1 presents the selection procedure.



Source: Illustrated by the JICA Survey Team

Figure 4.5.1 Selection Procedure

4.5.2 Selection Criteria of Subprojects

(1) Approach

The survey identified the candidate subprojects in the first step through collection of data and information from LGED and interview to the local peoples. The proposed selection criteria comprise of two kinds of criteria, i.e., screening criteria and ranking criteria. The screening criteria are applied to judge if a proposed candidate subproject will pass or screened out for further evaluation, while the ranking criteria are applied to evaluate the priority of a candidate subproject.

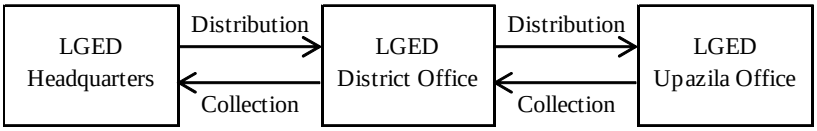
(2) Priority Lists

The LGED has prepared a priority list for rural infrastructure development based on the studies made by the district offices. The list well reflects the necessity of the sites.

(3) Proposed Lists

This survey prepared a form to develop the proposed list reflecting the results of the study discussed in previous Sections 4.2, 4.3, and 4.4.

The proposed lists were collected based on formats which LEGD and the JICA Survey Team discussed and agreed on. The forms for rural roads, hats (market facilities) and ghats (boat landing facilities) were distributed from the LGED headquarters to five LGED district offices. Some of them were distributed from the LGED district offices to the LGED upazila offices. The proposed lists were collected by the LGED headquarters from the LGED district offices. Figure 4.5.2 presents the procedure of distribution and collection of the priority lists.



Source: Prepared by the JICA Survey Team

Figure 4.5.2 Procedure of Distribution and Collection

(4) Selection Criteria 1 (Screening)

The target facilities are rural roads, hats, and ghats which have synergy effects with flood management and agricultural and fishery promotion. The criteria should be different among infrastructures because the functions and the expected impacts are different by infrastructure.

1) Rural Roads

Rural road development includes upgrading of upazila, union and village roads (submerged and non-submerged, including bridges and culverts).

Table 4.5.1 Screening Criteria for Rural Roads

No.	Objective	Criteria	Indicators
1	Developed type	Whether the proposed road is new construction	Yes (exclude), No (include)
2	Synergy effects	Whether the proposed road has synergy effects	Yes (include), No (exclude)
3	Existing road standards	Whether the quality of the proposed road is higher than all-weather standard without gaps	Yes (exclude), No (include)
4	Other projects	Whether the proposed road is included for implementation under an ongoing/pipeline foreign-financed project	Yes (exclude), No (include)
5	Reducing flash flood damage	In case of submergible embankment rehabilitation/new construction, whether the proposed road contribute to reduce damage of flash flood	Yes (include), No (exclude)
6	Resettlement	Whether the proposed road requires the resettlement of 15 or more people	Yes (exclude), No (include)
7	Distribution of rural road investments – Implementation capacity	Whether sufficient LGED at the local level capacity is sufficient to implement all the road subprojects selected	Maximum of three road subprojects per upazila

Source: Prepared by the JICA Survey Team

- 1. Developed type: Impact to society (resettlement, environment, etc.) of new construction is bigger than upgrading (new construction is excluded).
- 2. Synergy effects: In case the road is located in a union that includes an area protected by flood embankment, the priority of the road is judged to be high (included) because the road could serve socioeconomic activities which are protected by the embankment.
- 3. Existing road standards: Flexible pavement, brick pavement and rigid pavement are all-weather pavements according to the standards adopted in the Basic Information of Road with Priority Ranking (LGED). If the answer is yes, the road can serve without any additional intervention. However if there is a gap, it means that the road needs some upgrading to meet the standard and further examination is necessary to identify the reason for the gap (gap in the pavement or due to the bridge or culvert).

- 5. Reducing flash flood damage: In case the road is high enough to protect flash floods, the road (a kind of road dike) is judged to be effective (yes, include).
- 7. Resettlement: Resettlement was confirmed through interview with LGED.

2) Hats (Markets Including Protection Works)

Market development includes new construction and rehabilitation of growth centers and rural markets.

Table 4.5.2 Screening Criteria for Markets

No.	Objective	Criteria	Indicators
1	Synergy Effects	Whether the proposed market has synergy effects	Yes (include), No (exclude)
2	Resettlement	Whether the proposed road requires the resettlement of 15 or more people	Yes (exclude), No (include)

Source: Prepared by the JICA Survey Team

- 1. Synergy effects: If the location of the market is in the area to be protected by flood embankment, the market is judged to be effective (yes, include).
- 2. Resettlement: Resettlement was confirmed through interview with LGED.

3) Ghats (Boat Landing Facilities Including Wave Protection Works)

Ghat development includes new construction and rehabilitation.

Table 4.5.3 Screening Criteria for Ghats

No.	Objective	Criteria	Indicators
1	Synergy Effects	Whether the proposed ghat has synergy effects	Yes (include), No (exclude)
2	Resettlement	Whether the proposed road requires the resettlement of 15 or more people	Yes (exclude), No (include)

Source: Prepared by the JICA Survey Team

- 1. Synergy effects: If the location of the ghat is along the riverside of the flood embankment, the ghat is judged to be effective (yes, include).
- 2. Resettlement: Resettlement was confirmed through interview with LGED.

(5) Selection Criteria 2 (Ranking)

1) Rural Road

The effects of rural road development depend on the number of beneficiaries. Rural roads are ranked by the number of beneficiaries. Rural roads which there are many beneficiaries are higher ranking.

2) Hats and Ghats

Ranking of hats and ghats has not been prepared because the number of the facilities to be selected is limited.

4.6 Subproject Selection

4.6.1 Proposed Lists

As mentioned before, the proposed lists were developed based on the subprojects in the priority lists filed in the LGED's database to prepare development and maintenance plans. The proposed lists were scrutinized by the LGED district offices and upazila offices in view of the 29 haor areas and synergy effects. Based on the proposed lists finally provided by the LGED headquarters, the total length of rural roads which need upgrading is 1,109 km (proposed list), of which 225 km are upazila roads, 377 km are union roads, and 507 km are village roads, as shown in Table 4.6.1. The total number of hats is 136, growth center markets (GCM) 31, and rural markets (RM) 105. The total number of ghats is 111. The proposed lists submitted by Habiganj district indicate a large number of rural roads, while the ones submitted by Kishoreganj and Brahmanbaria districts indicate a large number of hats. Furthermore, the proposed lists submitted by Kishoreganj and Brahmanbaria districts indicate a large number of ghats.

Table 4.6.1 Summary of Proposed Lists

District	Subproject (Nos.)											
	Rural Road								Hat			Ghat
	Upazila		Union		Villgage		Total		GCM	RM	Total	
	(Nos.)	(km)	(Nos.)	(km)	(Nos.)	(km)	(Nos.)	(km)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
Kishoreganj	4	46.47	30	159.43	14	39.33	48	245.23	11	31	42	31
Netorkona	3	13.21	12	58.86	18	39.45	33	111.52	3	8	11	10
Sunamganj	12	54.15	23	20.32	83	184.19	118	258.66	4	16	20	22
Habiganj	12	80.29	26	102.96	82	170.37	120	353.62	3	15	18	7
Brahmanbaria	9	30.54	16	35.32	59	73.73	84	139.59	10	35	45	41
Total	40	224.66	107	376.89	256	507.07	403	1108.62	31	105	136	111

Source: Prepared by the JICA Survey Team

4.6.2 Final List of Candidates

The proposed lists were screened by the selection criteria 1 (screening) for the initial candidate lists. Rural roads were then ranked by the selection criteria 2 (ranking) for the final list of candidates (Resettlement is shown in Appendix 4.9.). The LGED district offices and upazila offices proposed the necessity of hats and ghats. The survey team prepared the initial list of candidates from the proposed list based on the screening criteria. The number of hats and ghats in the initial list of candidates were limited as compared to the number of rural roads. Therefore, no ranking were given to hats and ghats and all initial candidates were adopted for the final list of candidates.

The total length of the selected rural roads is 514 km, of which 126 km are upazila roads, 209 km are union roads, and 179 are village roads, as shown in Table 4.6.2. The total number of hats is 22, growth center markets 4, and rural markets 18, while the total number of ghats is 21. The final lists selected in Kishoreganj and Habiganj districts have a large number of rural roads. Those of Kishoreganj have a large number of hats. Final lists selected in Kishoreganj

district have a large number of ghats. (Refer to Appendix 4.5.) The total length of rural roads in Kishoreganj is relatively large compared to the other districts because the number of subprojects in Kishoreganj for the Component 1, which correspond to the target areas of Component 2, is the largest.

Table 4.6.2 Summary of Final Candidate Lists

District	Ranking												Selection			
	Rural Road												Hat			Ghat
	Upazila		Union		Village		Total				Remarks					
	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Total*		Bridge	Culvert	GCM	RM	Total	
									(Nos.)	(km)	(m)	(m)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
Kishoregnj	33.57	12.90	36.80	69.39	8.33	9.84	78.70	92.13	28	170.83	0	0	1	8	9	10
Netorkona	8.48	2.24	19.06	28.42	10.00	19.19	37.54	49.85	21	87.39	610	110	0	3	3	3
Sunamganj	33.23	9.65	18.39	8.05	35.67	9.29	87.29	26.99	28	114.28	510	470	1	1	2	5
Habiganj	7.02	19.06	5.73	23.42	36.25	45.27	49.00	87.75	36	136.75	280	570	2	6	8	3
Brahmanbaria	0.00	0.00	0.00	0.00	1.50	3.00	1.50	3.00	2	4.50	0	0	0	0	0	0
Total	82.30	43.85	79.98	129.28	91.75	86.59	254.03	259.72	115	513.75	1,400	1,150	4	18	22	21

Total*: including Bridge and Culvert

Source: Prepared by the JICA Survey Team

The finalized lists were selected based on the final lists of candidates considering the total investment cost. Table 4.6.3 presents a summary of the subprojects finally selected in this manner (refer to Chapter 11).

Table 4.6.3 Summary of Finalized Lists

District	Ranking												Selection			
	Rural Road												Hat			Ghat
	Upazila		Union		Village		Total*				Bridge	Culvert				
	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible	Submergible	Non-submergible					GCM	RM	Total	
									(Nos.)	(km)	(m)	(m)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
Total	79.645	41.485	55.755	101.615	79.770	55.610	215.170	198.710	84	413.880	760	860	4	18	22	21

Total*: not including Bridge and Culvert

Source: Prepared by the JICA Survey Team

4.7 Basic Design

4.7.1 Approach

The design standards of LGED and Haor Infrastructure and Livelihood Improvement Project (HILIP,) which are being implemented in the five haor districts of Netrokona, Kishoreganj, Sunamganj, Habiganj, and Brahmanbaria, were adopted in the basic design of structures.

4.7.2 Rural Road

(1) Standard Design

The LGED has design standards[1] for rural roads. LGED classifies upazila roads, union roads, and village roads to 15 design standard types. Table 4.7.1 below presents the design standard types.

[1] Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET).

Rural roads will be improved on existing alignments and earthworks. Embankments (with existing height of 1.0 m above ground level based on the standard section of the criteria) will not be raised in order to bring the roads above flood level. Experience in the haor area suggests that the raising of road embankments would impede the flow of water, hindering drainage, and cause water logging. This can result to the following: i) roads on embankments being washed away by flood water, and ii) cutting off of embankment in order to drain the land. Another reason for not constructing embankments that will bring roads above the flood water level is that very high embankments would be required[2] if it is in deep haor areas.

Table 4.7.1 List of Rural Road Standard Types

No.	Type		
1	B.C Road Section	(Non-submerged)	(Village Road)
2	B.C Road Section	(Non-submerged)	(Union Road)
3	B.C Road Section	(Non-submerged)	(Upazila Road)
4	RCC Road Section	(Non-submerged)	(Village Road)
5	RCC Road Section	(Non-submerged)	(Union Road)
6	RCC Road Section	(Non-submerged)	(Upazila Road)
7	RCC Road Section	(Submerged)	(Village Road)
8	RCC Road Section	(Submerged)	(Union Road)
9	RCC Road Section	(Submerged)	(Upazila Road)
10	Block Road Section	(Non-submerged)	(Village Road)
11	Block Road Section	(Non-submerged)	(Union Road)
12	Block Road Section	(Non-submerged)	(Upazila Road)
13	Block Road Section	(Submerged)	(Village Road)
14	Block Road Section	(Submerged)	(Union Road)
15	Block Road Section	(Submerged)	(Upazila Road)

Source: Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET)

There are two types of roads in the project area, i.e., submerged road and non-submerged road. Road class is divided into three types. There are a total of six types of rural roads as shown in the Table 4.7.2.

Table 4.7.2 Selected Rural Road Types

Class	Non-submerged	Submerged
Upazila Road	No.3 1)	No.9 2)
Union Road	No.2 3)	No.8 4)
Village Road	No.10 5)	No.13 6)

Source: Prepared by the JICA Survey Team

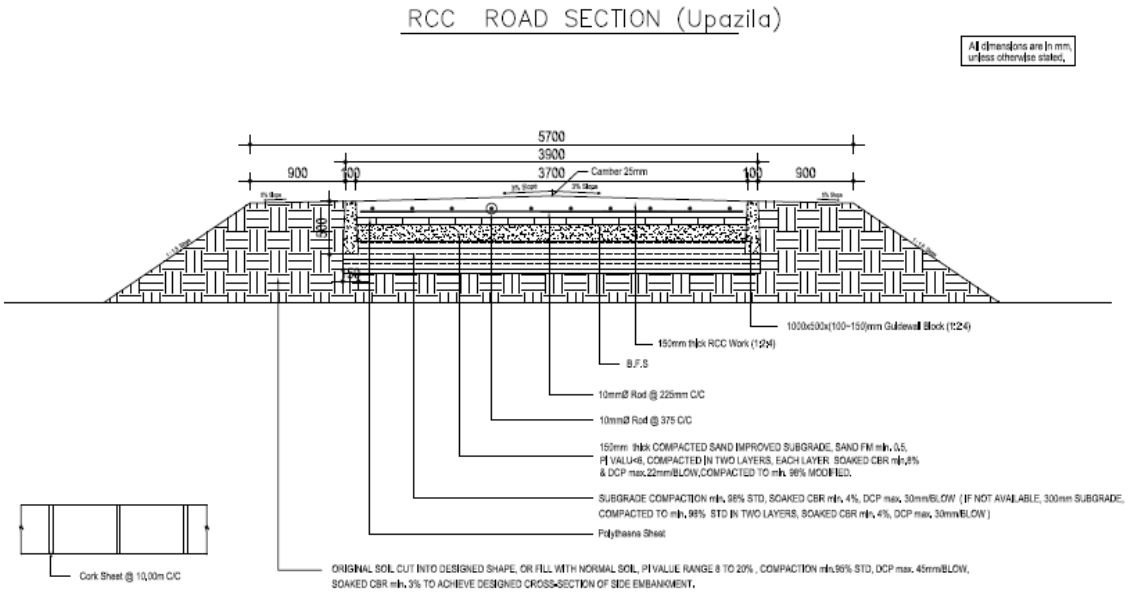
- 1): Upazila roads are main roads in rural areas. Traffic volume is heavy on the roads, and traffic includes large vehicles. Block pavement roads are not appropriate. Comparing bituminous carpeting (BC) roads to reinforced cement concrete (RCC) roads, BC roads are

[2] Haor Infrastructure and Livelihood Improvement Project (HILIP) Project Design Document (Appraisal) Working Papers Volume III (May 2011).

more economical. Therefore BC roads (non-submergible) are selected for non-submergible upazila roads.

- 2): BC roads are not appropriate for submergible. Therefore RCC roads (submergible) are selected for submergible upazila roads.
- 3): Union roads are feeder roads in rural areas. Traffic volume is heavy on the roads. Traffic includes large vehicles. Block roads are not appropriate. Comparing BC roads and RCC roads, BC roads are most economical. Therefore BC roads (non-submergible) are selected for non-submergible union roads.
- 4): BC roads are not appropriate for submergible. Therefore, RCC roads (submergible) are selected for submergible union roads.
- 5) and 6): Village roads are end roads in rural areas. Traffic volume is light on the roads. Traffic does not include large vehicles. Comparing with BC roads, RCC roads, and block roads, block roads are most economical. Therefore, block roads are selected for village roads.

A typical section of a submergible upazila road is presented in Figure 4.7.1. Typical sections of roads of other categories are presented in Appendix 4.6.



Source: Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET)

Figure 4.7.1 Typical Section of Upazila Road

The existing average road width (crest width) varies according to road class. The average widths of an upazila road, union road, and village road are 4.0 m, 3.7 m, and 2.6 m, respectively, based on the priority lists from LGED. Meanwhile, the design width (crest width) also depends on the road class. The design widths of an upazila road, union road, and village road are 5.70 or 5.75 m, 5.05 or 5.00 m, and 3.67 m, respectively, based on the Technical Viability Study of Block Road, Community based Resource Management Project Final Report

(April 2011, BRTC and BUET). Table 4.7.3 presents the widths of existing roads and design standards.

Table 4.7.3 Road Width

(Unit : m)

Class	Type	Existing	Design	
			Pavement	Road
Upazila Road	Submerged	4.0	3.70	5.70
	Non-submerged		3.70	5.75
Union Road	Submerged	3.7	3.00	5.00
	Non-submerged		3.00	5.05
Village Road	Submerged	2.6	2.27	3.67
	Non-submerged		2.27	3.67

Source: Prepared by the JICA Survey Team

The existing road pavement rates depend on the road class. The highest class based on the priority lists from LGED is 37% of upazila roads. The lowest class is 15% of village roads. The average of all roads is 24%. Meanwhile, all road standards are paved. The pavement rates of existing roads and the standards are presented in Table 4.7.4.

Table 4.7.4 Road Pavement Rates

Class	Type	Existing	Design
Upazila Road	Submerged	37%	100%
	Non-submerged		
Union Road	Submerged	24%	100%
	Non-submerged		
Village Road	Submerged	15%	100%
	Non-submerged		
Average		24%	100%

Source: Prepared by the JICA Survey Team (based on the proposed lists by LGED)

Design sections of pavement are presented in Table 4.7.5. BC pavement comprises of surface course, base course, subbase, and subgrade. RCC pavement comprises of RCC, subbase, and subgrade. Cement concrete (CC) block pavement comprises of CC block and subgrade.

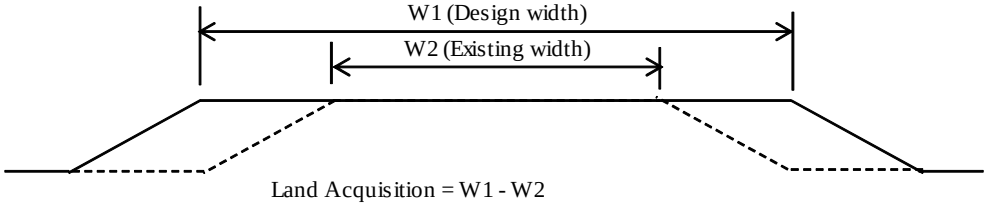
Table 4.7.5 Section of Pavement

Class	Type	Section of Pavement		
Upazila Union	Non-submerged	Surface		BC
		Base Course	150mm	Compacted WBM Base
		Subbase	150mm	Compacted Aggregate-sand Subbase
		Subgrade	150mm	Compacted Sand Improved Subgrade
				Subgrade Compaction
Upazila Union	Submerged	Surface	150mm	RCC
		Subbase		BFS (Brick Flat Soling)
		Subgrade	150mm	Compacted Sand Improved Subgrade
				Subgrade Compaction
Village	Non-submerged	Surface	150mm	CC Block
	Submerged	Subgrade	150mm	Compacted Sand Improved Subgrade
				Subgrade Compaction

Source: Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET)

(2) Land Acquisition

The width of existing rural roads is mostly less than the standard width. Therefore, land acquisition is required when rural roads are to be improved. The required land area is calculated by each road as shown in Figure 4.7.2. The estimated total land acquisition for rural road improvement is 506,733 m^2 (refer to Appendix 4.8).



Source: Prepared by the JICA Survey Team

Figure 4.7.2 Section of Land Acquisition

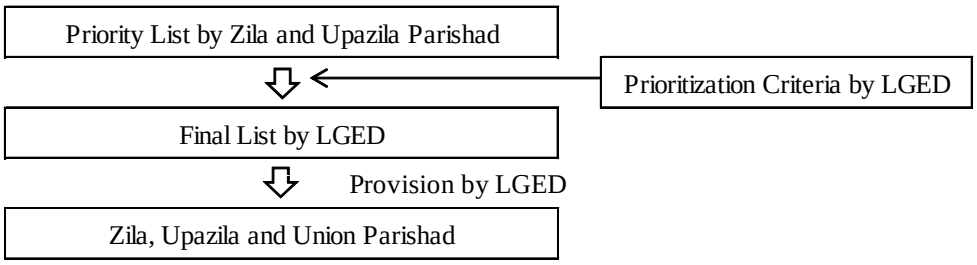
(3) Rehabilitation Project

1) Objective

In addition to road development discussed above, the rehabilitation of roads which have been transferred to local autonomies for their maintenance is crucial for the improvement of the living environment of residents. The Rural Road and Bridge Maintenance Policy (January 2013, Local Government Division) defined the targets of rehabilitation works. The survey selected the target of rehabilitation works in this project to be village roads. Zila and upazila parishads in the project area have no priority list which complies with the provisions of the Rural Road and Bridge Maintenance Policy at present. The superintending engineer (maintenance unit) shall select the target village roads.

2) Selection Procedure

Priority lists are prepared by zila and upazila parishads and screened by LGED criteria. Then the final lists are provided to the zila, upazila and union parishads. Figure 4.7.3 presents the selection procedure for rehabilitation projects.



Source: Prepared by the JICA Survey Team

Figure 4.7.3 Selection Procedure for Rehabilitation Projects

3) Priority List by Zila and Upazila Parishads

Zila and upazila parishads in the five districts of the project earmark a portion of their development budget to maintain their responsible village roads. Zila prepares a priority list of such village roads cooperating with upazila, considering capacity of their own budget. The priority lists are to be submitted to LGED.

4) Final List by LGED

The LGED has prepared the prioritization criteria. LGED prepares a final list from the priority list by applying the prioritization criteria. LGED provides the final list to the concerned zila parishads, upazila parishads, and union parishads in the five districts of the project.

5) Budget

The budget for rehabilitation projects to be prepared by the project is 10% of the rural roads cost of the project[3].

4.7.3 Hats (Market Facilities)

(1) Standard Design

There are no available design standards for hats. Therefore, the general layout of hats referred to the design adopted by HILIP, and the structure of sheds was based on the design adopted by NOBIDEP. Table 4.7.6 below presents the standard layout of hats. The structure of sheds is one-story. The size of a hat varies depending on the shed type. The maximum size is 18 m x 12 m, while the minimum is 18 m x 6 m. The shed structure consists of concrete open floors, concrete pillars, and roofs.

[3] Source: Rural Road and Bridge Maintenance Policy "12.3 Financing by Local Government Institutions" (January 2013)

Table 4.7.6 Standards for Hats

Item	Number
General Shed	1
Women's Shed	1
Fish and Meat Shed	1
Open Platform	1
Male Toilet	1
Female Toilet	1
Tube Well	1
Management Committee Office	1
Dust Bins	1

Source: Prepared by the JICA Survey Team

(2) Land Acquisition

In case of new construction, the land to be acquired is 2,464 m^2 per one hat. Meanwhile, a hat for rehabilitation does not require any land acquisition. Table 4.7.7 presents the number of hats for new construction and rehabilitation. The total land acquisition for hats is 41,888 m^2 (refer to Appendix 4.8).

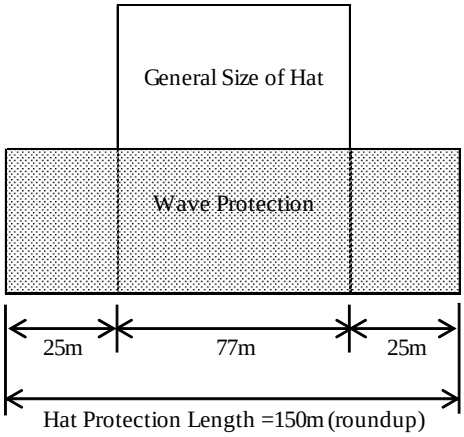
Table 4.7.7 Number of Hats

Item	Number
New construction	17
Rehabilitation	5
Total	22

Source: Prepared by the JICA Survey Team (based on the proposed lists by LGED)

(3) Hat Protection

Residential areas including hats and ghats in the haor area are being damaged by erosion due to wave action. Hats and ghats are vulnerable to damage from wave action since they are usually located on the riverside or canal side. There are several types of wave protection adopted by HILIP. The concrete block adopted by an NGO has demonstrated durability against waves in the haor area, although scientific study is yet to be conducted to confirm the durability. The project adopted the concrete block type for wave protection. Wave protection is constructed on the adjacent slopes of hats because waves first erode the embanked slopes adjacent to the hats. Figure 4.7.4 presents the general layout of a hat and wave protection.



Source: Prepared by the JICA Survey Team

Figure 4.7.4 General Layout of Hat Protection

4.7.4 Ghat (Landing Facility)

(1) Standard Design

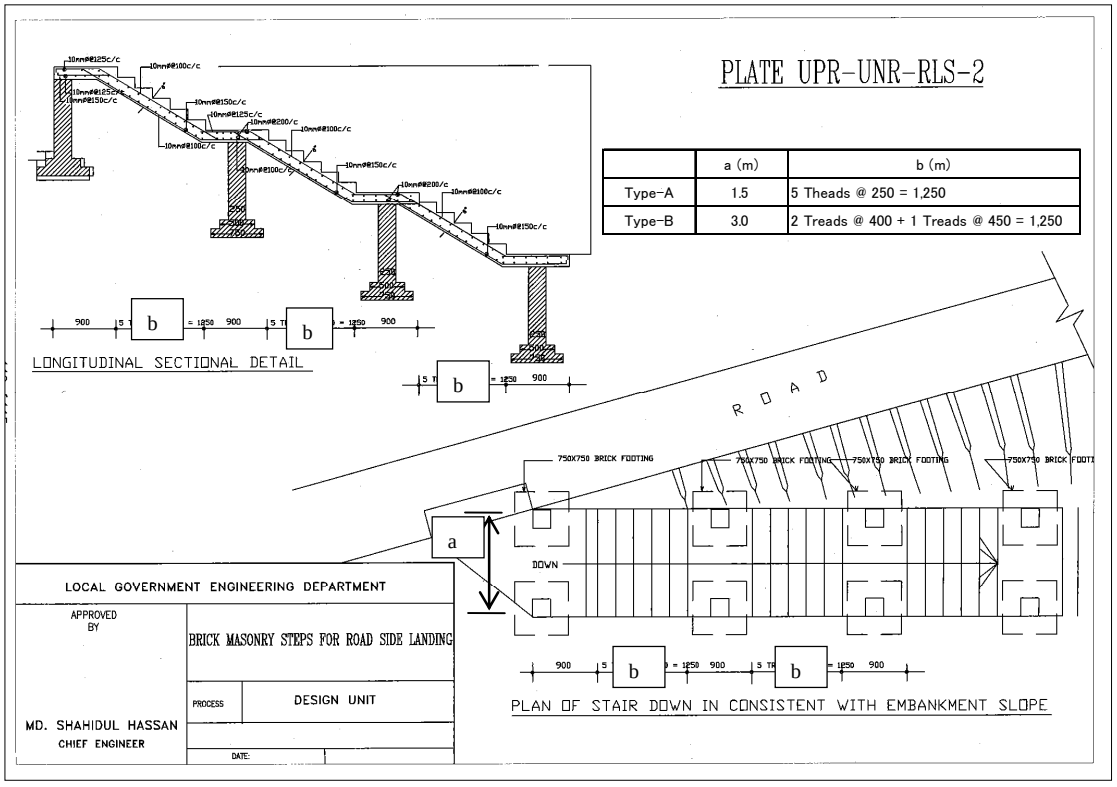
The LGED has standard drawings for ghats. LGED defines three types of ghats. As shown in Figure 4.7.5, the step type made from concrete is adopted as the standard ghat based on the information obtained through the field survey conducted.

1) Type-A

The width of the step is 1.5 m. The tread and the height of the step are 250 mm and 125 mm, respectively, for ordinary ghats.

2) Type-B

In case of a ghat related to a growth center, the width of the step is 3.0 m. The tread and the height of the step are 400 mm and 200 mm, respectively, for ordinary ghats.



Source: Road Design Standards rural road (LGED and JICA, 2005)

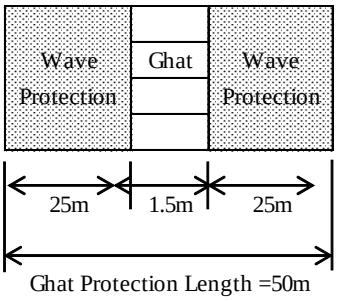
Figure 4.7.5 Standard Drawing of Ghat (Boat Landing Facility)

(2) Land Acquisition

In case of new construction, the land area to be acquired is 12 m^2 per one ordinary ghat. Meanwhile, a ghat for rehabilitation does not require any land acquisition. According to the proposed lists by LGED, all ghats are new construction. The total land acquisition of ghats is 252 m^2 (refer to Appendix 4.8).

(3) Ghat Protection

The earth embanked slopes adjacent to ghats are vulnerable to damage from wave action as mentioned in the discussion on hats above. The concrete block type is selected, the same as for hats. Wave protection is constructed on both side slopes of the ghat. Figure 4.7.6 presents the general layout of a ghat and wave protection.



Source: Prepared by the JICA Survey Team

Figure 4.7.6 General Layout of Ghat Protection

4.7.5 Drawings and Quantity

Drawings for standard structures were prepared based on the abovementioned design approaches for rural roads (upazila road, union road, and village road), hats, and ghats (refer to Appendix 4.6).

Table 4.7.8 presents a list of drawings and quantities based on the basic design (refer to Appendices 4.7 and 4.10).

Table 4.7.8 List of Drawings

No.	Title	Remarks
1	B.C Road Section (Non-submerged) (Union Road)	Source 1)
2	B.C Road Section (Non-submerged) (Upazila Road)	Source 1)
3	RCC Road Section (Submerged) (Union Road)	Source 1)
4	RCC Road Section (Submerged) (Upazila Road)	Source 1)
5	Block Road Section (Non-submerged) (Village Road)	Source 1)
6	Block Road Section (Submerged) (Village Road)	Source 1)
7	Existing Rad Cross-section	
8	Hat (Market)Layout Plan	Source 3)
9	Ghat (Boat Landing Step)	Source 2)
10	Hat and Ghat Protection	Source 3)

Source 1): Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET)
Source 2): ROAD DESIGN STANDARDS RURAL ROAD (LGED and JICA)
Source 3): Haor Infrastructure and Livelihood Improvement Project (HILIP)

Source: Prepared by the JICA Survey Team

The working quantities of the facilities were calculated referring to the above listed drawings and existing structures designed by the relevant project. The cost of Component 2 was estimated based on the estimated quantities.

Table 4.7.9 List of Quantities

No.	Title			Calculation Sheet No.*	Remarks
1	B.C Road Section	(Non-submerged)	(Union Road)	No.1	Source 1)
2	B.C Road Section	(Non-submerged)	(Upazila Road)	No.2	Source 1)
3	RCC Road Section	(Submerged)	(Union Road)	No.3	Source 1)
4	RCC Road Section	(Submerged)	(Upazila Road)	No.4	Source 1)
5	Block Road Section	(Non-submerged)	(Village Road)	No.5	Source 1)
6	Block Road Section	(Submerged)	(Village Road)	No.6	Source 1)
7	Culverts (double lane) on Upazila Road				Source 2)
8	Cunverts (single lane) on Union Road				Source 2)
9	RCC bridge (single lane) on Union Road				Source 2)
10	Road Safty Measures			No.10	Source 2)
11	Tree lantation and Caretaking				Source 2)
12	Fish and Meat Shed				Source 2)
13	Multi-purpose Shed				Source 2)
14	General Shed without Platform				Source 2)
15	Open Sales Platform				Source 2)
16	Women's Shed				Source 2)
17	Market Management Committee Office				Source 2)
18	Male Toilet				Source 2)
19	Female Toilet				Source 2)
20	Tube Well				Source 2)
21	Dust Bins				Source 2)
22	Boat Landing Step			No.22	
23	Hat and Ghat Protection				Source 3)

Source 1): Technical Viability Study of Block Road, Community based Resource Management Project Final Report (April 2011, BRTC and BUET)
Source 2): Preparatory Survey on the Northern Region Rural Development and Local Governance Improvement Project Final Repor Annex 1
Source 3): Haor Infrastructure and Livelihood Improvement Project (HILIP)
*Calculation Sheet No.: Quantity is basically based on HILIP etc..The calculation sheet is modified adopted by the structure.
Source: Prepared by the JICA Survey Team

CHAPTER 5 AGRICULTURE PROMOTION

5.1 Present Conditions of Agriculture

5.1.1 General

Agricultural promotion, together with flood management as discussed previously in Chapter 3, is one of the main aspects of the project and it is aimed at freeing people in the haor area from the vicious cycle of poverty and vulnerability to disaster.

The agriculture sector, which consists of the crop and livestock subsectors, is the most important economic activity in the haor areas. The households engaged primarily in agriculture sector activities account for 55% of the total households. If agriculture labor households are included, the households with their livelihood depending on the agriculture sector represent 88% of the total in the Study Area (Census of Agriculture 2008). However, the agricultural activities in the area face serious constraints such as early flash floods, prolonged inundation, limited land holding sizes, poor communication and transportation systems, insufficient agricultural extension and support services, and others. Accordingly, the livelihood of most of the people in the areas is poor and unstable and they are forced to live merely at subsistence levels.

5.1.2 Agro-demographic Features

In the Agriculture Census 2008, the agro-demographic features and landholding and tenure statuses in the Study Area (seven districts) and the project districts (five districts) are reported as follows:

(1) Farm Households

The total households in the Study Area (seven districts) numbered to 1,677,900 and in the project districts to 1,252,700 (Agriculture Census 2008). Among the households in the Study Area, farm households and non-farm households were at 55% and 45%, respectively. The percentages in the project districts are similar at 56% and 44%, respectively. The figures are also similar to those in whole Bangladesh, 53% and 47%, as shown in Table 5.1.1.

Table 5.1.1 Farm Households and Non-farm Households

District	Farm Households		Non-farm Households		Total Households		Agriculture Labor Households	
	No.	%	No.	%	No.	%	No.	% 1/
1. Sunamganj	206,720	53	180,485	47	387,205	100	144,194	37
2. Habiganj	197,143	58	145,035	42	342,178	100	135,531	40
3. Netrokona	282,651	62	175,821	38	458,472	100	203,758	44
4. Kishoreganj	308,733	52	289,019	48	597,752	100	224,153	37
5. Brahmanbaria	257,490	55	208,230	45	465,720	100	113,251	24
6. Sylhet	245,466	50	241,716	50	487,182	100	91,230	19
7. Maulvibazar	179,697	58	129,744	42	309,441	100	84,895	27
Study Area	1,677,900	55	1,370,050	45	3,047,950	100	997,012	33
Project Districts	1,252,737	56	998,590	44	2,251,327	100	820,887	36
Bangladesh	15,183,183	53	13,512,580	47	28,695,763	100	8,844,402	31

Note: 1/: Proportion to total households
Source: Census of Agriculture 2008, BBS

The ratio of agriculture labor households to total households in the Study Area and in the project districts, were at 33% and 36%, respectively. This indicates that about 73% and 83% of non-farm households in the Study Area and in the project districts, respectively, are agriculture labor households.

(2) Landholding and Tenure

In Bangladesh, farm households are classified by holding size, i.e., small farm (holding size of 0.05-2.49 acres), medium farm (holding size of 2.5-7.49 acres), and large farm (holding size of more than 7.5 acres). Households having less than 0.04 acres of land are classified as non-farm households. Furthermore, farm households with holding size of less than 1.0 acre are sometimes defined as marginal farmers. The distribution of farm households by holding size in the Study Area and in the project districts is presented in Table 5.1.2.

Table 5.1.2 Distribution of Farm Households by Holding Size

District	All Households	Non Farm Households	Farm Households by Holding Size							
			Small Farm Households							
			Marginal Farm Households				Total Small Farm Households	Medium 2.50 -7.49 Acre	Large 7.50 + Acre	Total Farm Households
			0..05 - 0.49 Acre	0.50 - 0.99 Acre	1.00 - 1.49 Acre	1.50 - 2.49 Acre				
1. Sunamganj	387,205	180,485	35,761	35,623	31,459	41,756	144,599	51,407	10,714	206,720
2. Habiganj	342,178	145,035	40,391	43,014	33,385	35,491	152,281	38,341	6,521	197,143
3. Netrakona	458,472	175,821	50,595	62,018	51,673	57,677	221,963	53,239	7,449	282,651
4. Kishoreganj	597,752	289,019	74,200	77,723	57,463	51,922	261,308	41,302	6,123	308,733
5. Brahmanbaria	465,720	208,230	60,050	78,105	43,676	47,183	229,014	26,813	1,663	257,490
6. Sylhet	487,182	241,716	82,749	43,432	30,052	39,111	195,344	44,286	5,836	245,466
7. Maulvibazar	309,441	129,744	58,689	40,306	22,227	29,343	150,565	26,046	3,086	179,697
Study Area (No.)	3,047,950	1,370,050	402,435	380,221	269,935	302,483	1,355,074	281,434	41,392	1,677,900
(%)			24	23	16	18	81	17	2	100
Project Districts (No.)	2,251,327	998,590	260,997	296,483	217,656	234,029	1,009,165	211,102	32,470	1,252,737
(%)			21	24	17	19	81	17	3	100
Bangladesh (No.)	28,695,763	13,512,580					12,812,372	2,136,415	234,396	15,183,183
(%)							84	14	2	100

Source: Census of Agriculture 2008, BBS

As shown in the table, small, medium, and large farm households represent 81%, 17% and 2%, respectively, of the total farm households in the Study Area. Those in the project districts indicate almost the same figures. Marginal farm households account for 47% in the Study Area and 45% in the project districts. Nearly half of farm households are classified as marginal farms.

The average operated area per farm household and per household in the Study Area were estimated at 0.72 ha and 0.39 ha, respectively. The same in the project districts were at 0.73 ha and 0.41 ha, respectively. These figures are less than half of the national average, thus indicating acute shortage of farmlands in the haor areas, as shown in Table 5.1.3.

Table 5.1.3 Average Operated Area per Household

District	All Households	No. of Farm Households	Operated Area (ha)	Average Operated Area/Household	
				All Households (ha)	Farm Households (ha)
Sunamganj	387,205	206,720	205,420	0.53	0.99
Habiganj	342,178	197,143	159,313	0.47	0.81
Netrakona	458,472	282,651	214,757	0.47	0.76
Kishoreganj	597,752	308,733	199,528	0.33	0.65
Brahmanbaria	465,720	257,490	140,052	0.30	0.54
Sylhet	487,182	245,466	173,444	0.36	0.71
Maulvibazar	309,441	179,697	110,931	0.36	0.62
Study Area	3,047,950	1,677,900	1,203,446	0.39	0.72
Project Districts	2,251,327	1,252,737	919,071	0.41	0.73
Bangladesh	28,695,763	15,183,183	23,505,192	0.82	1.55

Source: Census of Agriculture 2008, BBS

The farm households in the Study Area are categorized by land tenure status, i.e., owner farm households, owner-cum-tenant farm households, tenant farm households, and agricultural labor households, as shown in Table 5.1.4.

Table 5.1.4 Distribution of Farm Households by Land Tenure Status

District	Farm Households							
	Owner		Owner-cum-tenant		Tenant		Total	
	No.	%	No.	%	No.	%	No.	%
1. Sunamganj	281,207	73	73,254	19	32,744	8	387,205	100
2. Habiganj	227,724	67	71,398	21	43,056	13	342,178	100
3. Netrakona	309,405	67	111,447	24	37,620	8	458,472	100
4. Kishoreganj	406,914	68	139,610	23	51,228	9	597,752	100
5. Brahmanbaria	325,578	70	110,255	24	29,887	6	465,720	100
6. Sylhet	365,515	75	63,742	13	57,925	12	487,182	100
7. Maulvibazar	233,220	75	49,211	16	27,010	9	309,441	100
Study Area	2,149,563	71	618,917	20	279,470	9	3,047,950	100
Project Districts	1,550,828	69	505,964	22	194,535	9	2,251,327	100
Bangladesh	18,734,787	65	6,278,282	22	3,682,694	13	28,695,763	100

Source: Census of Agriculture 2008, BBS

Land tenure status in both the Study Area and the project districts show similar features and ratios of owner operator, owner-cum-tenant operator, and tenant farms to total farm households, i.e., 69-71%, 20-22% and 9%, respectively. There is not much difference with the national figures.

5.1.3 Soils

The characteristics and distribution of major soils in the Study Area are as shown in Table 5.1.5.

Table 5.1.5 Major Soils Distributed in the Study Area

Soil Type Unit	Characteristics and Distribution in the Study Area 1/
1. Acid Basin Clays	Strongly acid heavy clays, permanently wet. (Sunamganj, Sylhet, Kishoregonj, Habiganj)
2. Non-calcareous Dark Grey Floodplain Soils	Dark grey and brown soils with dark grey flood coatings with seasonally acid top soils and near neutral sub-soils. (Kishoregonj, Brahamanbaria, Netrakona)
3. Association of Grey Floodplain Soils & 2	Association of seasonally wet or shallowly flooded Grey Floodplain Soils & 2. (Netrakona)
4. Association of Grey Floodplain Soils & 1	Association of seasonally wet or shallowly flooded Grey Floodplain Soils & 1. (Sylhet, Habiganj, Maulvibazar)

Note: 1/: Distribution indicated in parenthesis
Source: General Soil Maps, SDRI, 1997

5.1.4 Land Use and Type

(1) Haor Type

As shown in Table 5.1.6 below, the haor areas in the Study Area can be categorized into the following three types based on geological locations and flooding characteristics: i) foothill and near hill haors, ii) floodplain area haors, and iii) deeply flooded haors.

Table 5.1.6 Major Haor Types Found in the Study Area Districts

District	Haor Types
Sylhet, Maulvibazar	Foothill and near hill haors
Netrakona, Kishoregonj, Brahmanbaria	Floodplain haors
Sunamganj, Netrakona, Habiganj	Deeply flooded haors

Source: GIS data, Master Plan of Haor Areas, 2012, CEGIS

(2) Land Use

The land use features of the Study Area and the project area are categorized, as shown in Table 5.1.7, into the following: i) agricultural land, ii) settlement, and iii) water body and forest.

Table 5.1.7 Land Use in the Project Area (29 Subprojects)

	Land Use Category				
	Agricultural Land	Settlement	Water Body	Forest	Total
Study Area (ha)	1,515,423	309,642	50,364	72,925	1,948,354
Proportion (%)	77.8	15.9	2.6	3.7	100
Project Area (ha)	156,393	23,473	5,611	0	185,476
Proportion (%)	84.3	12.7	3.0	0	100

Source: GIS data, Master Plan of Haor Areas, 2012, CEGIS

There are some differences in the land use patterns between the two areas as the project area is located in floodplain haor areas. However, agricultural land occupies around 80% in both cases. (Details are shown in Appendix 5.1.)

(3) Land Type

Haor areas are commonly categorized into land types defined by land level (height) and based on the depth of inundation during the monsoon season. The definitions and distributions of land types in the study area and the project area are as shown in Table 5.1.8.

Table 5.1.8 Land Types in the Project Area (29 Subprojects)

Land Type	Definition	Area Extent by Proportion (%)	
		Study Area	Project Area
Highland	Land which is above normal flood level.	22.9	6.0
Medium Highland (MH)	Land which is normally flooded about 90 cm deep during the flood season.	11.6	20.4
Medium Lowland (ML)	Land which is normally flooded between 90 cm and 180 cm deep during the flood season.	11.3	16.4
Lowland (L)	Land which is normally flooded between 180 cm and 300 cm deep during the flood season.	47.7	55.5
Very Lowland (VL)	Land which is normally flooded more than 300 cm deep during the flood season.	6.2	1.4
Others		0.3	0.3

Source: GIS data, Master Plan of Haor Areas, 2012, CEGIS

As shown in the table, 48% of the Study Area is classified as lowland (L), and 11% is classified as medium lowland (ML). Similarly, 49% of the project area is classified as lowland (L), and 19% of the same is classified as medium lowland (ML). (Details are shown in Appendix 5.1.)

5.1.5 Crop Production

(1) Cropping Season and Pattern

1) Cropping Season

The cropping season in Bangladesh is divided into Kharif I, Kharif II, and Rabi, as shown in Table 5.1.9.

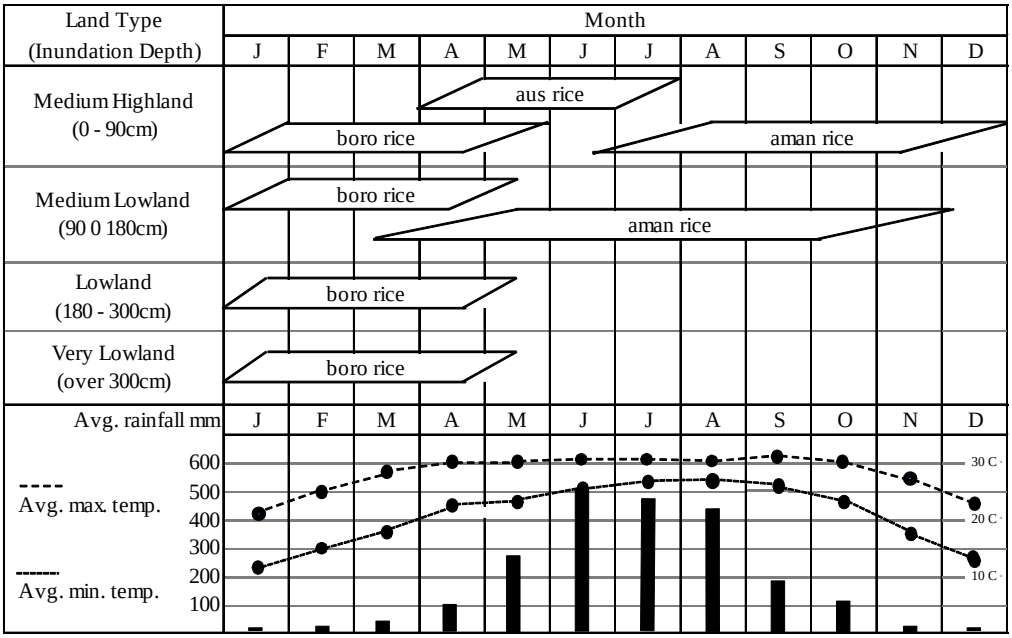
Table 5.1.9 General Cropping Seasons in the Study Area

Cropping Season	Period	Corresponding Rice Cropping Season
Kharif I	March to June	Aus rice season (Apr.-July)
Kharif II	July to October	Aman rice season (Mar./Apr.-Oct./Nov.) 1/
Rabi	November to February	Boro rice season (Dec./Jan.-Apr./May)

Note: 1/: Cropping season in medium lowland

As shown in the table, the cropping season for rice is termed as aus, aman and boro rice seasons, which basically correspond to Kharif I, Kharif II and Rabi seasons, respectively. For upland crop cultivation, the cropping seasons of Kharif I, Kharif II and Rabi are applied.

The cropping season in the haor areas are restricted according to the timing of receding of inundation water. In the haor areas of the Study Area, monoculture of boro rice is exclusive, and the cropping season of boro rice varies depending on the inundation depth of the subject area (land type) and extends from December/January to April/May. The cropping calendar of rice in the study area is illustrated in Figure 5.1.1.



Climatic data: average of 2007 to 2011 at Mymenshing Station, 2011 Agricultural Statistics of Bangladesh, BBS
Source: Prepared by the JICA Survey Team by modifying Fig. 4.1 of MP Annex 2 Agriculture

Figure 5.1.1 Prevailing Cropping Calendar of Rice in the Haor Areas by Land Type

2) Cropping Pattern

The haor areas are basically boro rice monoculture areas, and the prevailing cropping pattern in both the Study Area and the project area is *fallow - fallow - boro* rice. However, in the western part of Netrakona District, a cropping pattern of *fallow - aman - boro* (double cropping of rice) is practiced, while in the western part of Habiganj District, a cropping pattern of *aus - aman - fallow* is practiced. In the Master Plan of Haor Area, the prevailing cropping patterns in haor areas in the project districts have been estimated as shown in Table 5.1.10. (A detailed map is shown in Appendix 5.2.)

Table 5.1.10 Prevailing Cropping Patterns in Haor Areas in the Project Districts

Project Districts	Cropping Pattern 1/			% of NCA 2/
	Kharif I (March–June)	Kharif II (June/July–Nov./Dec.)	Rabi (Jan.–April/May)	
Sunamganj	Fallow	Fallow	Boro rice	75.9
	Fallow	T. aman	Boro rice	10.8
Habiganj	Fallow	Fallow	Boro rice	71.9
	Fallow	T. aman	Boro rice	12.5
Netrakona	Fallow	Fallow	Boro rice	70.0
	Fallow	T. aman	Boro rice	27.3
Kishoreganj	Fallow	Fallow	Boro rice	87.1
	Fallow	T. aman	Boro rice	10.2
Brahmanbaria	Fallow	Fallow	Boro rice	78.1
	Fallow	T. aman	Mustard - Boro rice	14.5

1/: Kharif II and Rabi – cropping season of rice 2/: NCA – net cultivated areas
Source: MP Annex 2 Agriculture

(2) Cropped Area, Production and Yield Levels

1) Agricultural Land Utilization

The agriculture land utilization features of the study area, project districts and haor areas have been estimated in the Master Plan of Haor Area, as shown in Table 5.1.11.

Table 5.1.11 Agricultural Land Utilization by District and by Haor Area

Unit: ha & %

Agriculture Land Utilization	Subject Area	Sunamganj	Habiganj	Netrakona	Kishoreganj	Brahmanbaria	Sylhet	Maulvibazar	Study Area	Project Districts	Bangladesh
Gross Area (ha)	District	367,000	263,700	274,400	273,100	192,700	349,000	279,900	1,999,800	1,370,900	
	Haor Area	268,531	109,514	79,345	133,943	29,616	189,909	47,602	858,460	620,949	
Net Area	District	254,000	162,926	211,130	196,900	150,381	208,680	126,928	1,310,945	975,337	17,671,319
	Haor Area	217,777	103,760	66,000	123,340	23,420	138,200	33,100	705,597	534,297	
Single Cropped Area	District	174,246	85,940	55,860	109,921	55,812	87,646	68,832	638,257	481,779	
	Haor Area	183,690	75,420	46,200	107,400	18,300	79,930	21,660	532,600	431,010	
Double Cropped Area	District	66,130	53,195	121,490	70,939	72,144	116,861	53,659	554,418	383,898	
	Haor Area	32,930	27,220	19,800	15,740	5,120	56,720	11,130	168,660	100,810	
Triple Cropped Area	District	13,640	23,791	33,790	16,040	22,425	4,174	4,437	118,297	109,686	
	Haor Area	1,180	1,120	0	200	0	1,550	310	4,360	2,500	
Total Cropped Area	District	347,426	263,703	400,210	299,919	267,375	333,890	189,461	2,101,984	1,578,633	30,485,315
	Haor Area	253,090	133,220	85,800	139,480	28,540	198,020	44,850	883,000	640,130	
Cropping Intensity (%)	District	137	162	190	152	178	160	149	160	162	173
	Haor Area	116	128	130	113	122	143	135	125	120	

Source: MP Annex 2 Agriculture, Table 4.1 (CEGIS estimation from DAE & BBS data, 2010)

The annual cropping intensities of the districts in the Study Area are in the range of 137% to 190%, and the same in the Study Area as a whole is 160%. Meanwhile, the same in the haor areas of the Study Area was estimated at 125%. Similarly, the cropping intensity in the project districts and the haor areas in the districts were estimated at 162% and 120%, respectively.

2) Irrigated Areas

In the Master Plan of Haor Area, the irrigated area was estimated at about 817,300 ha in the study area and 704,700 ha in the five districts. The proportion of irrigated area to net cultivable areas was estimated at 62% and 72% in the study area and in the five districts,

respectively. Pumping irrigation is by far the most used irrigation method in the study area, as shown in Table 5.1.2.

Table 5.1.12 Irrigated Area by Irrigation Method

District		Net Cultivable Area (1)	Area Irrigated by Pumping: Pumping DTW (2)	STW (3)	LLP (4)	Sub-total (5)	Traditional Method (7)	Total Irrigated Area (10)	By Water Sources: Surface Water	Ground Water	Non-Irrigated Area (11)	Proportion (%): Irrigated Area (10)/(1)	Non-Irrigated Area (11)/(1)
Sunamganj	(ha)	254,000	295	20,629	127,744	148,668	12,263	160,931	140,007	20,924	93,069	63.4	36.6
	(%)		0.2	13.9	85.9	92.4	7.6	100	87.0	13.0			
Habigabj	(ha)	162,926	5,762	26,275	53,463	85,500	21,045	106,545	74,508	32,037	56,381	65.4	34.6
	(%)		6.7	30.7	62.5	80.2	19.8	100	69.9	30.1			
Netrakona	(ha)	211,130	12,196	120,807	34,723	167,726	7,025	174,751	41,748	133,003	36,379	82.8	17.2
	(%)		7.3	72.0	20.7	96.0	4.0	100	23.9	76.1			
Kishoreganj	(ha)	196,900	9,698	85,985	56,207	151,890	1,274	153,164	57,481	95,683	43,736	77.8	22.2
	(%)		6.4	56.6	37.0	99.2	0.8	100	37.5	62.5			
Brahmanbaria	(ha)	150,381	8,767	51,334	46,042	106,143	3,142	109,285	49,184	60,101	41,096	72.7	27.3
	(%)		8.3	48.4	43.4	97.1	2.9	100	45.0	55.0			
Sylhet	(ha)	208,680	128	2,347	43,705	46,180	17,623	63,803	61,328	2,475	144,877	30.6	69.4
	(%)		0.3	5.1	94.6	72.4	27.6	100	96.1	3.9			
Maulvibazar	(ha)	126,928	72	905	19,288	20,265	28,558	48,823	47,846	977	78,105	38.5	61.5
	(%)		0.4	4.5	95.2	41.5	58.5	100	98.0	2.0			
Study Area	(ha)	1,310,945	36,918	308,282	381,172	726,372	90,930	817,302	472,102	345,200	493,643	62.3	37.7
	(%)		5.1	42.4	52.5	88.9	11.1	100	57.8	42.2			
Project Districts	(ha)	975,337	36,718	305,030	318,179	659,927	44,749	704,676	362,928	341,748	270,661	72.2	27.8
	(%)		5.6	46.2	48.2	93.6	6.4	100	51.5	48.5			

Source: Prepared by JICA Survey Team based on MP Annex 2 Agriculture, Table 4. 1 & 4.14 (Minor Irrigation Survey Report, 2010) and Census of Agriculture 2008, BBS

As shown in the table, the irrigated area by pumping accounts for 89% and 94% of the total irrigated areas in the Study Area and the five districts, respectively. By water source, surface water irrigation is dominant both in the Study Area and the districts. However, groundwater irrigation is also common. Among pumping irrigation methods, the prevailing method is by low-lift pump followed by shallow tube well. Irrigation by deep tube well is less developed in the haor areas.

The inventory on irrigation equipment in the Study Area is presented in Table 5.1.13. As shown in the table, the main irrigation equipment is shallow tube well followed by low-lift pump. The number of deep tube wells installed for irrigation purposes is rather limited. The average irrigation area per unit equipment in the Study Area was estimated at around 30 ha, 4 ha and 9 ha for deep tube well, shallow tube well and low-lift pump, respectively.

Table 5.1.13 Irrigation Equipment in the Study Area and Project Districts

Subject Area	Deep Tube Well (DTW)	Shallow Tube Well (STW)	Low-Lift Pump (LLP)
Study Area Total (No.)	1,110	76,894	43,134
Project Districts (No.)	1,074	70,611	28,038

Source: MP Annex 2 Agriculture, Table 4.14 (Minor Irrigation Survey Report, 2010)

3) Cropped Area and Production

Cropped areas of rice and other crops in the Study Area, project districts and haor areas have been estimated in the Master Plan of Haor Area, as shown in Table 5.1.14.

Table 5.1.14 Cropped Areas of Rice and Other Crops by District and by Haor Area

Unit: 000ha

District	Subject Area	Aus	T Aman	B Aman	Boro	Total Rice Area	Vegetables	Oilseeds	Pulses	Wheat	Others	Total Non-rice Area	Total Cropped Area
Sunamganj	District	3.9	67.8	0	193.8	265.5	8.5	2.9	0.4	0.6	3.7	16.1	281.6
	Haor Area	2.4	48.4	0	188.8	239.6	2.7	2.1	0.7	0.5	4.6	10.6	250.2
Habiganj	District	33.6	67.2	26.1	108.0	234.9	9.0	1.4	0.5	0.7	4.7	16.3	251.2
	Haor Area	5.5	15.5	13.2	92.5	126.7	3.5	1.0	0.3	0.0	1.7	6.5	133.2
Netrakona	District	1.8	139.2	0.0	176.3	317.3	6.1	3.1	0.6	1.0	12.5	23.3	340.6
	Haor Area	0.0	18.0	0.0	64.2	82.2	1.8	0.0	0.0	0.0	1.8	3.6	85.8
Kishoreganj	District	23.0	76.7	0.0	166.3	266	9.8	6.5	1.8	1.7	21.7	41.5	307.5
	Haor Area	1.0	12.9	0.0	122.5	136.4	1.0	1.6	0.0	0.0	0.4	3.0	139.4
Brahmanbaria	District	3.8	47.5	24.1	109.3	184.7	9.4	5.3	4.8	2.3	14.1	35.9	220.6
	Haor Area	0.5	0.9	0.5	21.6	23.5	1.3	0.8	0.7	0.3	2.0	5.1	28.6
Sylhet	District	45.9	162.9	6.3	77.2	292.3	18.8	4.8	3.8	3.2	10.1	40.7	333.0
	Haor Area	19.7	93.3	5.9	60.7	179.6	9.2	3.2	1.7	1.4	3.1	18.6	198.2
Maulvibazar	District	32.4	102.5	4.1	40.4	179.4	11.6	0.2	0.3	0.1	3.0	15.2	194.6
	Haor Area	2.0	14.6	2.5	22.1	41.2	2.5	0.1	0.1	0.0	0.9	3.6	44.8
Study Area	District	144.4	663.8	60.6	871.3	1,740.1	73.2	24.2	12.2	9.6	69.8	189.0	1,929.1
	Haor Area	31.1	203.6	22.1	572.4	829.2	22.0	8.8	3.5	2.2	14.5	51.0	880.2
Project Districts	District	66.1	398.4	50.2	753.7	1,268.4	42.8	19.2	8.1	6.3	56.7	133.1	1,401.5
		5	31	4	59	100						9	100
	Haor Area	9.4	95.7	13.7	489.6	608.4	10.3	5.5	1.7	0.8	10.5	28.8	637.2
		2	16	2	80	100						5	100

Source: MP Annex 2 Agriculture, Table 4.2 (CEGIS estimation from DAE & BBS data, 2010))

As shown in the table, rice is by far the most predominant crop—occupying 90% of the total cropped area in the Study Area. In the project districts, rice occupies 91%, and in the haor areas of the districts, the same is as high as 95%. Among the cropped areas of rice, boro rice accounts for 59% of the total rice cropped area and followed by transplanted aman (t. aman) rice in the districts; while the same in the haor areas of the districts is 80% and similarly followed by t. aman rice. This indicates the dominance of cropping pattern of monoculture of boro rice in the haor areas of the districts. The cropped area of other crops than rice is limited to 9% and 5% in the Study Area and the project districts, respectively.

The annual production of rice in the Study Area and the project districts was estimated at 5,250,000 t and 3,900,000 t, respectively. The production of other crops was at 1,500,000 t and 960,000 t, respectively. The production of rice and other crops in the Study Area, project districts, and haor areas have been estimated in the Master Plan of Haor Area, as shown in Table 5.1.15.

Table 5.1.15 Production of Rice and Other Crops by District and by Haor Area

Unit: 1,000 ton

District	Subject Area	Aus	T Aman	B Aman	Boro	Total Rice Area	Vegetables	Oilseeds	Pulses	Potato	Others	Total Non-rice Area
Sunamganj	District	8.4	140.0	0.0	652.8	801.2	138.3	3.4	0.5	31.0	4.7	177.9
	Haor Area	5.2	100.1	0.0	635.9	741.2	43.3	2.5	0.9	19.4	6.4	72.5
Habiganj	District	82.8	179.8	36.3	393.3	692.2	139.1	1.6	0.6	20.0	22.4	183.7
	Haor Area	13.6	41.6	18.4	336.9	410.5	54.4	1.1	0.3	7.3	3.2	66.3
Netrakona	District	3.9	333.6	0.0	573.6	911.1	122.3	2.7	0.7	31.8	22.6	180.1
	Haor Area	0.0	43.1	0.0	208.9	252.0	35.9	0.0	0.0	0.0	3.8	39.7
Kishoreganj	District	57.4	196.5	0.0	678.5	932.4	55.7	6.9	1.7	102.3	41.6	208.2
	Haor Area	2.5	33.2	0.0	499.9	535.6	5.7	1.7	0.0	3.2	0.4	11.0
Brahmanbaria	District	7.6	115.4	28.5	419.0	570.5	131.3	6.4	4.4	40.2	24.3	206.6
	Haor Area	1.0	2.3	0.6	82.7	86.6	17.9	1.0	0.7	7.7	3.1	30.4
Sylhet	District	113.0	423.4	8.4	316.4	861.2	281.8	5.4	4.4	63.5	23.7	378.8
	Haor Area	48.3	242.5	8.0	248.7	547.5	138.0	3.6	1.9	19.6	9.0	172.1
Maulvibazar	District	84.8	259.4	4.1	131.0	479.3	168.3	0.2	0.2	22.8	4.8	196.3
	Haor Area	5.2	36.9	2.6	71.7	116.4	36.5	0.1	0.1	7.9	1.0	45.6
Study Area	District	357.9	1,648.1	77.3	3,164.6	5,247.9	1,036.8	26.6	12.5	311.6	144.1	1,531.6
	Haor Area	75.8	499.7	29.6	2,084.7	2,689.8	331.7	10.0	3.9	65.1	26.9	437.6
Project Districts	District	160.1	965.3	64.8	2,717.2	3,907.4	586.7	21.0	7.9	225.3	115.6	956.5
		4%	25%	2%	70%	100%						
	Haor Area	22.3	220.3	19.0	1,764.3	2,025.9	157.2	6.3	1.9	37.6	16.9	219.9
		1%	11%	1%	87%	100%						

Source: MP Annex 2 Agriculture, Table 4.4 (CEGIS estimation from DAE & BBS data, 2010)

4) Yield Levels

Similarly, the yield levels of rice and other crops in the haor areas have been estimated in the Master Plan of Haor, as shown in Table 5.1.16.

Table 5.1.16 Yield Levels of Rice and Other Crops in Haor Areas

Unit: t/ha

Agriculture Land Utilization	Aus	T Aman	B Aman	Boro	Total Rice	Vegetables	Oilseeds	Pulses	Potato	Wheat	Maize
Yield Levels of Haor Areas											
Sunamganj	2.2	2.1	-	3.4	3.0	16.2	1.2	1.3	16.5	2.2	-
Habiganj	2.5	2.7	1.4	3.6	3.0	15.5	1.1	1.2	9.1	2.3	6.0
Netrakona	2.2	2.4	-	3.3	2.9	20.0	0.9	1.1	12.8	2.5	-
Kishoreganj	2.5	2.6	-	4.1	3.5	5.7	1.1	1.0	15.9	2.0	4.4
Brahmanbaria	2.0	2.4	1.2	3.8	3.1	11.1	1.2	0.9	11.1	1.9	2.0
Sylhet	2.5	2.6	1.3	4.1	3.0	15.0	1.1	1.2	11.7	2.2	5.2
Maulvibazar	2.6	2.5	1.0	3.2	2.7	14.5	0.9	0.8	12.0	1.8	-
Study Area	2.5	2.5	1.4	3.6	3.1	14.4	1.1	1.2	13.6	2.3	5.2
Project Districts	2.3	2.4	1.3	3.6	3.1	13.7	1.1	1.1	13.1	2.2	4.1
Overall Yield Level											
Project Districts	2.4	2.4	-	3.9	3.4	-	-	-	17.9	2.6	-
Bangladesh	1.9	2.4	-	3.9	2.9	-	-	-	18.3	2.6	6.2

Source: MP Annex 2 Agriculture, Table 4.3 (CEGIS estimation from DAE & BBS data, 2010)
Bangladeh figure - in 2010/11; Year Book of Agricultural Statistics of Bangladesh, BBS, 2011
Overall project district: average of 3 years from 2010/11 to 2012/13; source: project districts DAOs

As shown in the table, the yield levels of boro rice (3.6 t/ha) is about 1.0 t/ha higher than those of aus and t. aman rice (2.3-2.5 t/ha), which is mainly because of cultivation of HYV and hybrid rice in considerable areas during the boro season and cultivation of local varieties still prevailing in the aus and aman season. Furthermore, the yield level of broadcast aman (b. aman) rice is also 1.0 t/ha lower than that of t. aman rice. The boro rice yield in haor areas of the project districts is about 10% lower than that of the overall yield in the districts.

5) Prevailing Farming Practices

The prevailing farming practices for the production of boro rice, which is by far the most important crop in the haor areas, are summarized in Table 5.1.17.

Table 5.1.17 Prevailing Farming Practices of Boro Rice

Works	Prevailing Farming Practices
Land Preparation	- Land preparation is carried out by power tiller or draft animal. The use of power tiller has become a common and prevailing farming practice. Land preparation works consist of plowing and laddering/leveling in case of draft animal, or consist of rotary harrowing and laddering in case of power tiller. In the haor areas, shortages in power tiller or draft power during the boro planting season are a serious problem.
Seed and Nursery	- The use of HYV is common for boro rice. Hybrid rice is also introduced. - Cultivation of local variety for boro rice is limited. - Seeding rate is 30 to 40 kg/ha. Wet seedbeds are prepared in rice fields. - Nursery prepared from mid-November to early December.
Transplanting	- Regular planting of four to ten week old seedlings (depending on receding of inundation water), but random planting is also practiced. Broadcasting is seldom for boro rice. - Transplanting is to be done by January at the latest.
Fertilization	- Basal dressing before final land preparation. - Urea is commonly applied, while the use of DSP and K-fertilizer is limited. - Top-dressing of urea and pesticide application are commonly practiced.
Field Management	- Water management, weeding (1-3 times/season) and application of pesticide by use of sprayer.
Harvesting	- Harvesting manually by use of sickle. The use of power thresher has become common, but pedal threshers are still being used. Threshing using cattle (treading) is also practiced depending on the location. Manual threshing by beating rice plant against a wooden bar, bamboo frame or floor is also practiced. - Paddies, except those kept for family consumption, are usually sold to collector agents immediately after harvesting without drying.
Post-harvest Operation	- Post-harvest operations include threshing, drying, winnowing and storing. Paddy is sun-dried and winnowed for family consumption. Dried paddies are stored in earthen or bamboo containers. - Milling is done by a small and mobile rice milling machine. Rice straw is transported to housing yards and stored in open space for animal feeding.

Source: Prepared by the JICA Survey Team

(3) Crop Budget of Boro Rice

The crop budget of boro rice estimated by the project District Agriculture Offices (DAOs) and the JICA Survey Team are presented in Table 5.1.18.

Table 5.1.18 Estimated Crop Budget of Boro Rice in 2012/13 [1/]

Item	Unit	Crop Budget Estimated by DAO 2/			Crop Budget Estimated by Survey Team 3/		
		District			Yield Level		
		Sunamganj	Habiganj	Netrakona	3.6 ton/ha	4.0 ton/ha	4.5 ton/ha
Production Cost (BDT/ha)							
1. Farm Inputs	BDT	14,488	13,140	19,013	7,075	7,915	9,425
2. Land Preparation	BDT	15,000	3,750	7,500	8,000	8,000	8,000
3. Irrigation Cost	BDT	7,500	7,500	13,750	7,500	7,500	7,500
4. Interest on Investment	BDT	3,200	3,500	5,640	1,014	1,073	1,148
5. Hired Labor Cost	BDT	15,000	22,500	15,625	18,000	19,500	21,000
Production Cost (BDT/ha)	BDT	55,188	50,390	61,528	41,589	43,988	47,073
Production (paddy, kg/ha)	kg	4,750	5,475	5,575	3,600	4,000	4,500
Unit Price (BDT/kg)	BDT	20	15	18	18	18	18
Return/Ha	BDT	95,000	82,125	100,350	64,800	72,000	81,000
By-product (straw)	BDT	10,000	3,750	6,000	3,600	3,900	4,200
Gross Return/Ha	BDT	105,000	85,875	106,350	68,400	75,900	85,200
Net Return per Ha	BDT	49,813	35,485	44,823	26,811	31,912	38,127
	%	47	41	42	39	42	45

1/: In case of owner cultivator; land rent not included 2/: Estimated figures by District Agriculture Offices (DAOs)
3/: Estimated by JICA Survey Team

The net return rates of rice production estimated by the DAOs are in the range of 41% to 47% to the gross returns. The estimated crop budgets are estimated based on higher yield levels and compared with yield levels of 3.3~4.1 t/ha (3.6 t/ha on average) in haor areas of the project districts (Table 5.1.16). Accordingly, it appears that the net returns per ha estimated by the JICA Survey Team for crop budgets at the yield level of 3.6 or 4.0 t/ha represent the current crop budgets of boro rice in the areas.

5.1.6 Livestock

(1) Livestock Population

The livestock subsector is an important economic activity in the haor areas. This subsector provides draft power for farming and cash income for farm households. Livestock are possessed as personnel property and stored for their urgent needs. In the haor areas, a large population of livestock exists. The population of cattle and buffaloes, goat and sheep, and poultry in the study area account for about 20%, 9% and 14%, respectively, of the total livestock population in Bangladesh. The livestock population in the project districts is shown in the Table 5.1.19.

Table 5.1.19 Livestock Population in the Project Districts

Unit: 000 head & bird

District	Cattle	Buffaloes	Goat	Sheep	Fowl	Duck
Sunamganj	1,345	25	214	44	1,168	1,969
Habiganj	519	9	143	39	976	1,165
Netrakona	603	3	230	10	2,322	2,811
Kishoreganj	667	29	304	25	3,829	1,631
Brahmanbaria	483	3	111	22	2,104	776
Project Districts	3,617	69	1,002	140	10,399	8,352
Sylhet	856	63	157	54	3,940	953
Maulvibazar	533	147	133	14	1,809	440
Study Area	5,006	279	1,292	208	16,148	9,745
Bangladesh	25,135		17,459		188,398	

Source: MP, Annex 5 Livestock, Table 4.2.1 (original source Extension Department of DLS)
Bangladeh figure -in year 2010/11; Year Book of Agricultural Statistics of Bangladesh, BBS, 2011

As shown in the table above, the most important animal in the study area is cattle, followed by goat. The population of fowl (chicken) is nearly two times that of duck.

(2) Livestock Holders and Holding Size

The proportion of livestock holders and average holding sizes of such are reported in the Census of Agriculture 2008, as summarized in Table 5.1.20.

Table 5.1.20 Average Holding Size of Animal and Poultry of Livestock Holders

Unit: head & bird

District	Unit	Cattle	Goat	Fowl	Duck
Sunamganj	Households Possessing (%)	39	8	49	22
	Average Holding Size/Holder	3.4	2.5	6.3	6.1
Habiganj	Households Possessing (%)	40	15	58	32
	Average Holding Size/Holder	2.9	2.4	6.0	4.7
Netrakona	Households Possessing (%)	43	15	53	27
	Average Holding Size/Holder	2.6	2.3	5.8	5.4
Kishoreganj	Households Possessing (%)	36	12	53	19
	Average Holding Size/Holder	2.3	2.0	5.7	4.9
Brahmanbaria	Households Possessing (%)	30	9	55	35
	Average Holding Size/Holder	2.4	2.4	5.9	4.8
Project Districts	Households Possessing (%)	37	12	53	26
	Average Holding Size/Holder	2.7	2.3	5.9	5.1
Study Area	Households Possessing (%)	36	12	52	26
	Average Holding Size/Holder	2.8	2.4	6.0	5.1
Bangladesh 2/	Households Possessing (%)	35	23	63	
	Average Holding Size/Holder	2.4	2.5	9.3	

1/: % of holdings possessing subject livestock to all holdings
2/: Source: 2011 Yearbook of Agricultural Statistics of Bangladesh, BBS; goat represent sheep/goat
Source: Census of Agriculture 2008, BBS

(3) Livestock Production

Livestock production by district is shown in Table 5.1.21.

Table 5.1.21 Livestock Production in the Project Districts

District	Egg (million pieces)	Milk (000 ton)	Meat (000 ton)
Sunamganj	62.2	25	23
Habiganj	29.2	25	13
Netrakona	280.2	53	3
Kishoreganj	170.8	22	4
Brahmanbaria	78.9	35	2
Project Districts	621.3	160	45
Sylhet	119.0	28	14
Maulvibazar	74.9	27.0	12.0
Study Area	815.2	215	71

Source: MP, Annex 5 Livestock, Table 4.3.2 (original source: Ext. Dept. of DLS)

(4) Problems/Constraints of the Subsector

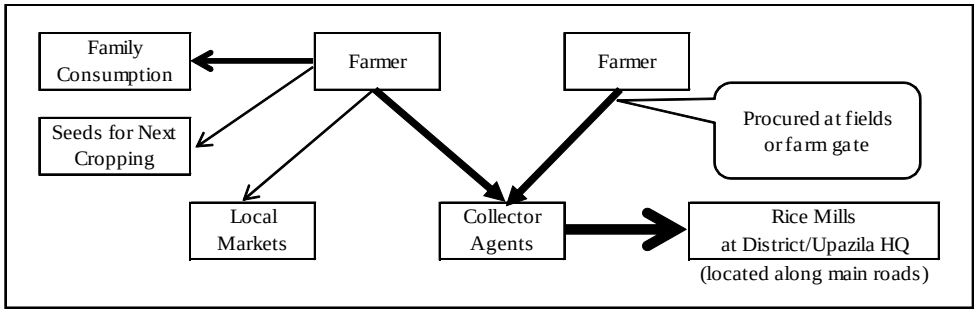
Major constraints for development of the subsector include the following: i) poor genetic resources of livestock, ii) feed and fodder availability, iii) livestock diseases and poor health management, iv) poor product quality, v) marketing issues, and vi) traditional livestock raising practices. Regardless of its economic importance in the haor areas, the subsector faces various problems/constraints for its promotion.

5.1.7 Marketing

The agricultural production system is closely linked with farm household needs and storage and marketing facilities. Inaccessibility to markets or proper outlets makes it difficult for farmers to receive reasonable prices for their products. Most farmers in the haor areas sell their products mostly to collector agents and partly in village markets immediately after harvest, when prices are at their lowest. The reasons for farmers' inability to store their crops are reported to be the following: i) need of cash, ii) lack of proper storage facilities, iii) crop loan obligations, and iv) tenure crop division arrangements. However, another essential reason for farmers selling their crops immediately after harvesting is lack of transportation facilities (roads, etc.) and means. Especially, in case of boro rice in the haor areas, farmers are forced to sell their wet paddies to collector agents without drying just after harvesting. This occurs because of lack of farm roads and transportation means to carry paddies from fields to home yards.

The marketing system of crops in the haor areas is traditional. Most farmers are compelled to dispose partially or all of their crops just after harvest. As stated earlier, farmers are unable to store their crops because of need for cash, crop loan obligations, high transportation cost, and lack of proper storage facilities.

The common marketing channels of boro rice in the haor areas are illustrated in Figure 5.1.2.



Source: Prepared by the JICA Survey Team

Figure 5.1.2 Prevailing Marketing Channels of Boro Paddy in Haor Areas

5.1.8 Agriculture Facilities and Farm Machinery

The results of inventory of agriculture facilities and farm machinery in the project districts are presented in Table 5.1.22.

Table 5.1.22 Inventory on Agriculture Facilities and Farm Machinery

Unit: No.

District	Farm Machinery						Agriculture Facility									Vehicle		
	Normal Rice Mill	Auto Rice Mill	Seed Dealer/Storage	Rural Market	BADC Branch	Growth Center	Veterinary Hospital	Tractor	Power Tiller	Power Thresher	Pedal Thresher	Combine Harvester	Low Lift Pump	Shallow Tube Well	Deep Tube Well	Motor Cycle (UAO)	4 Wheel Vehicle	Bank Branch
1. Sunamganj	674	246	381	216	4	44	10	14	5,267	n.a.	6,005	0	13,124	3,162	7	8	1	107
2. Habiganj	527	30	125	177	2	33	8	64	3,691	3,986	n.a.	1	6,414	5,120	135	8	1	49
3. Netrakona	177	43	43	308	2	39	10	42	6,011	5,842	2,057	2	4,589	38,160	376	7	1	44
4. Kishoreganj	27	6	40	308	6	47	13	62	5,907	6,068	n.a.	1	3,981	23,178	371	6	1	69
5. Brahmanbaria	n.a.	376	254	296	2	32	8	171	1,470	16,960	n.a.	1	3,974	12,915	337	9	1	106
Project Districts	1,405	701	843	1,305	16	195	49	353	22,346	32,856	8,062	5	32,082	82,535	1,226	38	5	375

Source: 5 project district agriculture offices

Compared with the cropped areas exclusively centered on the rabi season (boro rice), the number of power tillers and power threshers in the project districts is extremely limited[1]. The lack of power tillers is partly attributable to the prolonged cropping season of boro rice. This presents a restriction to the introduction of double cropping or crop diversification in the districts. Disregarding the chances for crop diversification provided by the embankment works under the project, the potential to improve cropping intensity would not be realized under such circumstances.

5.1.9 Farmer/Rural Organizations

The number of farmer or rural community-based organizations (CBOs) formed for agricultural purposes is rather limited, and the activities of most of such organizations are also limited in the haor areas. The organizations formed under agricultural extension activities in the project districts are as shown in Table 5.1.23.

Table 5.1.23 Farmer Groups Formed for Agriculture Purposes

District	IPMG	ICMG	CIG
Sunamganj	21	16	0
Habiganj	20	3	0
Netrakona	225	225	0
Kishoreganj	96	45	370
Brahmanbaria	206	18	490
Project Districts	568	307	860

Source: Five project DAOs

The Integrated Pest Management Groups (IPMGs) are farmer groups formed for the implementation of integrated pest management (IPM) farmer field school (FFS), while Integrated Crop Management Groups (ICMGs) are for integrated crop management FFS, and

[1] The rate of mechanization of land preparation works is estimated at 40% to 60% in the project upazilas based on the result of upazila inventory shown in Appendix 5.16, by assuming that the coverage of land preparation works per unit of power tiller is 15 to 20 ha/season.

CIGs are common interest groups formed for specific extension activities such as vegetable growing group, fruit production group, and improved rice cultivation group. The number of member farmers of such groups is usually 15 to 20.

The Master Plan of Haor Area reports that *"among the said farmers organizations, farmers' cooperatives (Krishok Sarnabaya Samity or KSS) and their upazila level organization, the Upazila Central Cooperative Association (UCCA) should have important functions in rural and agricultural development. KSS is village based farmers group and its members are farmers with land holding size of more than 0.2 ha. These groups of farmers are formed into cooperative society to derive benefits from farm operations, input supplies and output marketing through their collective strength and bargaining power. KSS groups are able to secure preference credit and are provided with regular training by government officials. Their ultimate goal is self-reliance in terms of financial and managerial aspect. The key objectives of KSS are: i) increase crop production and yields, ii) expand irrigation, and iii) organize mechanization of irrigation.*

The UCCA was established as the central institution at upazila level to coordinate, support and supervise activities of KSSs. Its main functions are to: i) train and educate KSS members, especially on developing leadership and management skills, ii) assist with marketing of outputs, iii) providing servicing center for repair and maintenance of machinery operated by KSS groups and iv) operate central cooperative banks owned and managed by KSS members." (MP Annex 2 Agriculture p. 19)

As discussed above, the formation/empowerment of farmers' organizations is considered essential to derive benefits from farm operations, input supplies and output marketing through their collective strength and bargaining power.

The Bangladesh Rural Development Board (BRDB) is the responsible agency for supervision of KSSs and assisting and guiding the UCCA.

Major constraints faced by rural organizations include lack of members awareness, lack of leadership and management skills, organizations formed to meet needs of public institutions and not based on member needs, financial constraints, etc. In many aspects, the strengthening of selected existing farmers organizations and establishment of new organizations appear to be seriously needed for agriculture promotion in the districts.

5.1.10 Agriculture Support Services

(1) Agriculture Extension

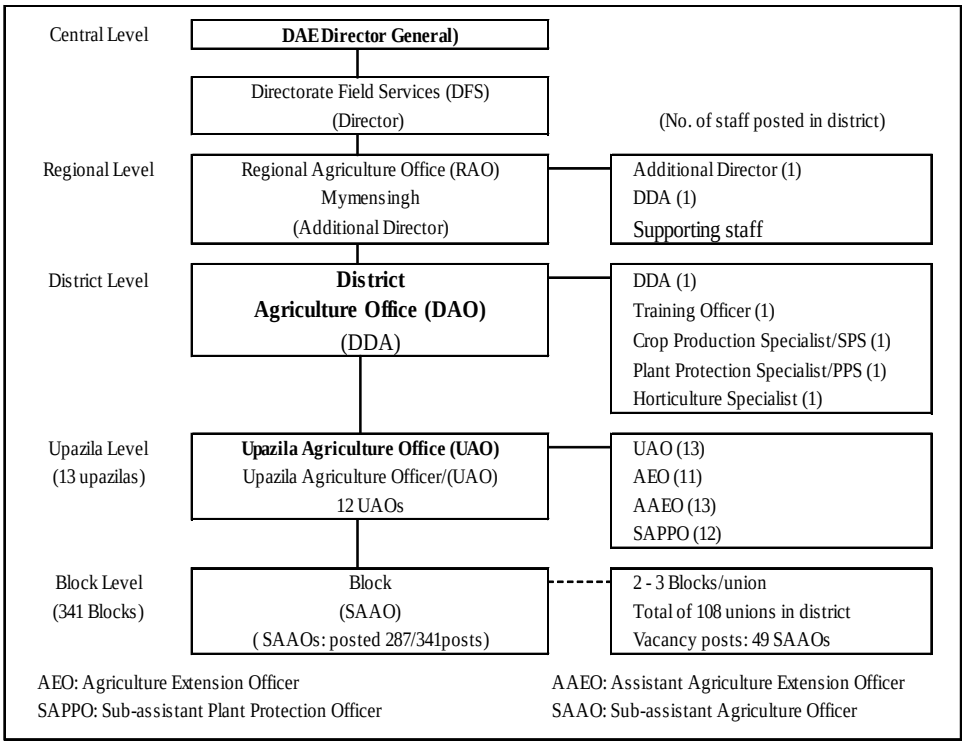
1) Crop Subsector

Crop subsector extension services are provided by the Department of Agriculture Extension (DAE) at the central level and its line agencies at regional, district and upazila levels. The institutional arrangement for the management of extension services consists of institutions/extension staff at block (union), upazila level, district, region (Bangladesh divided into ten regions), and the headquarters (national level). At the national level, DAE

is comprised of six divisions: 1) Food Crops, 2) Cash Crops, 3) Plant Protection, 4) Field Services, 5) Training, and 6) Planning and Evaluation. These divisions also maintain liaison with agricultural research institutes. The Field Services Division manages field extension services.

The DAO is the district level office for the management of extension services. Managerial direction and administrative support for upazila level office, i.e. Upazila Agriculture Office (UAO), is provided by the Deputy Director of DAE, with the support of a team of specialists (such as crop, horticulture, and plant protection specialists and training officers).

The UAO is the closest point for institutional services for farmers, and the most important focal point for the provision of extension services at field level. Presently, most of development funds of DAE are directly allocated to UAOs. Each unit is under an Upazila Agricultural Officer who is supported by technical officers. Field level extension staff, Sub-Assistant Agricultural Officers (SAAOs) who provide extension services to farmers or group of farmers, are assigned at the block level (union). The number of blocks in the project districts is as follows: 150 in Sunamganj, 166 in Habiganj, 220 in Netrakona, 341 in Kishoreganj, and 310 in Brahmanbaria. The typical organizational structure of DAO is as illustrated in Figure 5.1.3. (Organizational structures of MoA and DAE, and DAE project and budget data are presented in Appendixes 5.3 and 5.4.)



Source: Prepared by the JICA Survey Team

Figure 5.1.3 Organizational Structure of DAO, Kishoregonj

The deployment of extension staff in the project districts is as shown in Table 5.1.24.

Table 5.1.24 No. of Agriculture Extension Staff in the Project Districts

Unit: No.

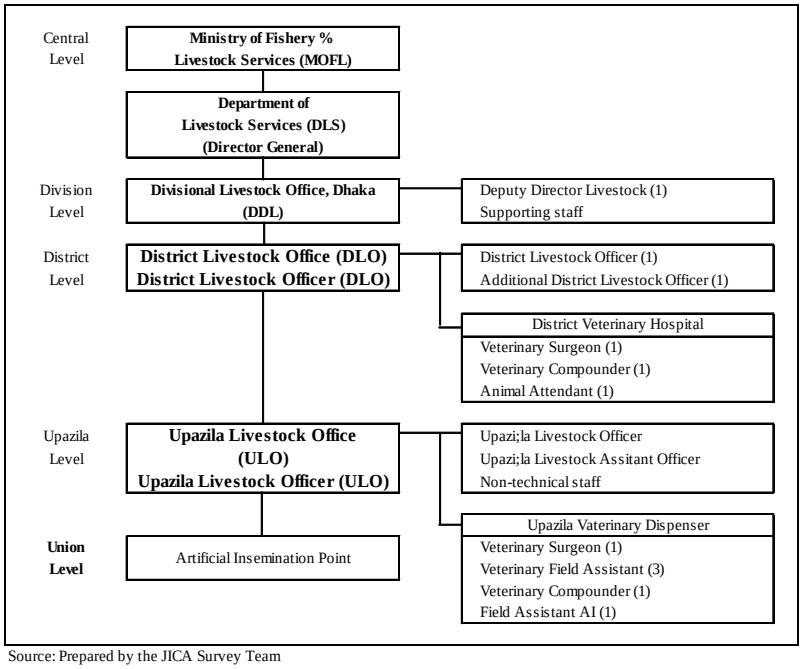
District	District Agriculture Office (DAO)					Upazila Agriculture Office						
										SAAO (at Block)		
	DTO	CPS	PPS	HS	SAAO	UAO	AEO	AAEO	SAPPO	Position	Posted	Vacant
1. Sunamganj	1	1	0	0	8	11	7	10	10	150	106	44
2. Habiganj	1	1	1	0	3	8	6	8	8	166	143	23
3. Netrakona	1	1	1	0	2	10	10	10	10	220	177	43
4. Kishoreganj	1	1	1	0	7	12	11	13	13	341	287	54
5. Brahmanbaria	1	1	1	1	2	9	9	9	9	310	205	105
Project Districts	5	5	4	1	22	50	43	50	50	1,187	918	269

DTO: District Training Officer, CPS: Crop Specialist, PPS: Plant Protection Specialist;
SAAO: Sub-assistant Agriculture Officer, UAO: Upazila Agriculture Officer, AEO: Agriculture Extension Officer,
AAEO: Assistant Agriculture Extension Officer, SAPPO: Sub-assistant Plant Protection Officer
Source: Five project DAOs

A substantial number of extension staff are deployed in the project districts. However, about 23% of the positions at blocks are yet to be posted with SAAOs, as shown in the table. Furthermore, due to serious financial constraints, lack of transportation means, poor logistics support and poor capability of extension personnel, the present extension services in the Study Area, especially in the haor areas, are poorly established. For agriculture promotion in the haor areas, the strengthening of extension services integrated with other agriculture support services is considered essential.

2) Livestock Subsector

Livestock subsector extension services are provided by the Department of Livestock Services (DLS) at the central level and its line agencies at the division level (Divisional Livestock Office or DDL), the district level (District Livestock Office or DLO) and the upazila level (Upazila Livestock Office or ULO). The typical organizational structure of DLO is as shown in Table 5.1.4.



Source: Prepared by the JICA Survey Team

Figure 5.1.4 Organizational Structure of DLO, Netrakona

Veterinary services are provided by the District Veterinary Hospital at the district level, and the Upazila Veterinary Dispenser at the upazila level. The deployment of livestock staff in the project districts are as shown in Table 5.1.25.

Table 5.1.25 No. of Livestock Staff in the Project Districts

Unit:No.

	District Livestock Office (DLO)					Upazila Livestock Office					
District	ADLO	VS	VC	AA	FA (AI)	ULO	ULAO	VS	VC	VFA	Assist. AI
1. Sunamganj	1	0	0	0	0	9	0	5	3	10	4
2. Habiganj	1	1	1	1	1	3	2	4	7	8	6
3. Netrakona	1	1	1	1	1	10	1	7	7	19	4
4. Kishoreganj	1	1	1	1	1	11	6	8	13	35	12
5. Brahmanbaria	1	1	1	1	1	8	0	7	6	18	8
Project Districts	5	4	4	4	4	41	9	31	36	90	34

ADLO: Additional District Livestock Officer, VS: Veterinary Surgeon, VC: Veterinary Compounder
AA: Animal Attendant, FA (AI): Field Assistant AI, ULO: Upazila Livestock Officer,
ULAO: Upazila Livestock Assistant Officer, VFA: Veterinary Field Assistant,
Source: 5 project DLOs

As is the case for agricultural extension services discussed earlier, livestock subsector extension and veterinary services in the study area, especially in the haor areas, appear to be very limited due to constraints in financial, logistics and manpower factors.

(2) Agriculture Research

The National Agricultural Research System (NARS) in Bangladesh was established by ten research institutes. The project-related agriculture research institutes include the following: Bangladesh Agriculture Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Soil Resources Development Institute (SRDI), and Bangladesh Livestock Research Institute (BLRI). The research programs of all the institutes are coordinated and supported by the Bangladesh Agricultural Research Council (BARC). The mandates and major activities of each project-related research institute are summarized in Table 5.1.26.

Table 5.1.26 Project-Related Research Institutes

Institute	Mandate and Major Activities
BARI	BARI deals with a wide range of non-rice food crops including field crops and vegetables. BARI has an On-farm Research Division (OFRD), which operates a farming system research program. In the study area, there are two substations, one in Sylhet and another in Moulvibazar, which work with fruit and spice crops.
BRRI	BRRI deals exclusively with rice. It is responsible for rice and rice-based cropping systems through demonstrations and training with DAE. BRRI has five substations located at specific rice ecological zones (deepwater, boro, upland, and saline). Two of BRRI's substations are working on rice cropping systems. The substation in the study area dealing with deepwater rice is in Habiganj.
SRDI	Mandates of the institution are: inventories and survey of soil and land resources, interpretation and analysis of soil and land resource data (demand-driven applied research), advice and service related to soil, farmers' service, analysis of soil, water, plant, fertilizer and heavy metal including arsenic and quality control of soil analytical services done by laboratories of GOs/NGOs.
BLRI	BLRI is responsible for livestock research in Bangladesh. Research takes place at the Veterinary Research Institute in Dhaka, the Animal Husbandry Research Institute in Comilla, the Sheep Development Farm in Noakhali, the Central Disease Investigation Laboratory in Dhaka, and seven field disease investigation laboratories. One of the field investigation laboratories is in Sylhet. BLRI also works with BARI on farming system research.

Source: Prepared by the JICA Survey Team based on information presented in websites

Agricultural research suffers from many of the same problems experienced for extension services. Reforming and strengthening of agricultural research systems is promoted under the National Agricultural Technology Project (NATP), as financed by the World Bank and IFAD.

(3) Seed Supply

The seed production and supply system in Bangladesh involves a number of institutions, such as research institutes, the Seed Certification Agency (SCA) and Bangladesh Agriculture Development Corporation (BADC) of MoA, seed growers or producers, and seed distributors/dealers. The formal supply chain is characterized by planned production, some form of mechanized processing, named varieties, seed marketed in identified packages and a system of quality assurance to the buyers. However, the volume of improved seeds produced by BADC is limited and is far less than the total seed requirement in the country. (Details are shown in Appendix 5.5.)

In the formal seed supply channel, BADC plays a key role. BADC has an extensive marketing network that includes 22 regional and 42 district level sales centers and 36 sale outlets at the upazila level which are located all over the country. In addition, BADC has about 1,300 licensed seed dealers for marketing certified seeds (CS) of BADC throughout the country (Annex 2 of Master Plan of Haor Area). (Organizational structure of BADC is presented in Appendix 5.6)

However, in the project districts, BADC has a limited seed marketing network, which include two regional (Kishorgonj and Sylhet), four district level (Netrakona, Brahamanbaria, Habiganj, Sunamganj), and 16 upazila level sale centers. Due to inadequate capacity and poor distribution facilities, BADC is unable to meet the demands for improved and HYV seeds in the districts. In most cases, farmers preserve their seeds from harvested crops for the next season. Sometimes they exchange seeds with others. The main constraints involved in the preservation of seeds that have been taken from harvested crops are the lack of proper containers to store such seeds and lack of knowledge of farmers on seed preservation.

Excessive use of seeds under traditional cultivation practices might be partly attributable to shortage of seed supply. Improvement of farming practices would contribute to narrowing the gap between demand and supply of quality seeds.

(4) Fertilizers and Agrochemicals

The public sector player for farm inputs supply is BADC, which was established to make necessary arrangements to distribute farm inputs (seeds, fertilizers, agrochemicals, farm machinery and equipment including water pumps). However, currently, many of BADC's functions are being transferred to the private sector. BADC is no longer the sole supplier of agricultural inputs. Improved seeds are now being supplied through BADC and the private sector. The supply of fertilizers and pesticides is now in the hands of the private sector as well as BADC. BADC no longer has any responsibility for procurement or distribution of fertilizers. Furthermore, BADC no longer monopolizes the sale of water pumps and the corporation now deals mainly with the installation, operation and maintenance of DTWs.

(5) Farm Credit

There are several credit institutions that provide agricultural loans to farming communities. The following general information on formal farm credit in Bangladesh are reported in the Master Plan of Haor Area:

- The main agencies with agricultural credit programs are as follows: the Central Bank (Bangladesh Bank), Bangladesh Krishi Bank (BKB), participating commercial banks, the Bangladesh Samabaya Bank, and BRDB.
- BKB is the main agricultural credit institution in Bangladesh. It provides short-, medium- and long-term credit to individuals for financing in agriculture, fisheries, livestock and agricultural processing and storage. Short-term credit is provided for crop production. Medium-term credit is given for purchasing animals, machinery and equipment, and for fisheries. Long-term credit is available for orchard development, land reclamation, warehouse construction, and so on.
- Participating commercial banks are second to BKB in terms of size of agricultural credit. They provide direct loans to farmers. Samabaya Bank is the leading bank among traditional cooperative banks. The said bank provides short-term credit to member-farmers through the Union Multipurpose Cooperative or farmer cooperatives (KSS). BRDB provides credit through the Thana Central Cooperative Association (TCCA). The loans are issued by commercial banks. (Annex 2 of the Master Plan of Haor Area)

In the project districts, there are 375 bank branches including BKB branches. Some of these bank branches are operating farm credit services. However, agricultural credits are still dominantly provided by non-institutional credit sources because the previously mentioned credit institutions are not easily accessible to farmers. Many small and marginal farmers, including share croppers, borrow money from moneylenders at very high interest rates. At harvest time, when rice prices are at their lowest, many farmers are forced to sell their products in order to pay back the moneylenders.

5.1.11 Agriculture Sector Projects of Donor Agencies

The main donor agencies supporting agriculture development in Bangladesh include the World Bank, ADB and IFAD. The major agriculture development projects of the said donors are summarized below.

(1) World Bank

The main agriculture projects of the World Bank include the Bangladesh Integrated Agricultural Productivity Project (IAPP), and NATP.

Table 5.1.27 Agriculture Sector Projects of the World Bank

Project	Bangladesh Integrated Agricultural Productivity Project (IAPP)
Project Period	Aug., 2011 (date of approval) - Sep., 2016 (closing date)
Project Cost	US$ 63.55 million – Agr. extension & research (30%), irrigation & drainage (25%), crops (20%), livestock (15%), fishery, forestry & others (15%),
Implementation Agency	Ministry of Agriculture (lead ministry), Ministry of Fishery & Livestock, – Implementation agencies at practical level BARI, BRRI, BFRI, DAE, DOF, DLS, SCA, BADC.
Target Areas	8 districts, 54 upazilas
Project Description/Objectives	To enhance the productivity of agriculture in pilot areas.
Major Project Components	– Technology generation & adaptation; to adapt & make available the technologies & management practices that will increase yields. – Technology adoption to enable farmers to adopt improved agricultural production. – Water management to improve the availability of irrigation water & efficiency of its use. – Project management to realize the project objectives.

Project	National Agricultural Technology Project (NATP)
Project Period	Feb., 2008 (date of approval) - Dec., 2013 (closing date)
Project Cost	US$ 84.60 million (co-finance with IFAD)
	– Agr. extension & research (50%), crops (20%), livestock (15%) & others (15%),
Implementation Agency	Ministry of Agriculture, Ministry of Fishery & Livestock,
Target Areas	25 districts, 120 upazilas (including non-haor areas of Kishoreganj & Brahmanbaria District)
Project Description/Objectives	To enhance effectiveness of the national agricultural technology system.
Major Project Components	– Agricultural research support, agricultural extension support, Private sector-led marketing & value addition, Project management & coordination

Source: World Bank Bangladesh web site & Staff

The implementation arrangements employed for IAPP and NATP are shown in Appendixes 5.7 and 5.8.

(2) ADB

The main agriculture projects of ADB include the Participatory Small-scale Water Resources Sector Project, and the Second Crop Diversion Project.

Table 5.1.28 Agriculture Sector Projects of ADB

Project	Second Crop Diversification Project
Project Period	June., 2010 (date of approval) - Dec., 2016 (closing date)
Project Cost	US$ 45.8 million (ADB 40.0 million & GOB 5.8 million)
Implementation Agency	DAE, MOA
Target Areas	Selected upazilas in the southwest & northwest of Bangladesh.
Project Description/Objectives	To foster commercialization of agriculture through interventions to promote diversification into high-value crops (HVCs) and value addition, gender mainstreaming, and climate change adaptation. The project is market oriented and demand driven, and will increase farmers incomes and enhance food security in Bangladesh.
Project Outputs	– Increased HVC production and commercialization – Reduced HVC postharvest losses, improved product quality and value addition, and enhanced market efficiency in supporting farmers to increase their incomes – Increased participation of women in commercial agricultural activities

Project	Participatory Small-scale Water Resources Sector Project
Project Period	Sep, 2009 (date of approval) - Jun., 2018 (closing date)
Project Cost	US$ 117.3 million (ADB 55.0 million, IFAD 32.0 million, GOB 30.3 million)
Implementation Agency	BWDB
Target Areas	230 new projects in 46 districts of Bangladesh
Project Description/Objectives	The Project will support the development of inclusive water management cooperative associations (WMCAS). The WMCAS should have sufficient social and technical capital to undertake small-scale water resources (SSWR) subprojects and to improve system operations. They should have clear financing partnerships and/or cost-sharing mechanisms and should be capable of maximizing their collective potential to increase agriculture production .
Project Outputs	– Institutional strengthening of government agencies at all levels to support SSWR development.
	– Participatory subprojects, which will include poor and vulnerable groups, and which will enable WMCAs to plan, implement, operate, and maintain subprojects
	– Construction and maintenance of up to 270 SSWR subprojects and performance enhancement of up to 150 subprojects (out of 560 completed) from SSW 1 and 2 projects.

Source: ADB Bangladesh website

(3) IFAD

The IFAD is supporting two large-scale projects in the haor areas, i.e., the Community-Based Resource Management Project (CBRMP), and HILIP. The target district of CBRMP is Sunamganj District. The target districts of HILIP are same as the target districts of the present project, i.e., the five project districts of Sunamganj, Habiganj, Netrakona, Kishoreganj and Brahmanbaria. Both of the projects have agricultural activities in their project components, agriculture and livestock improvement in CBRMP, and livelihood protection in HILIP. The profile of CBRMP is provided in Table 5.1.29.

Table 5.1.29 Agriculture Sector Project of IFAD

Project	Community Based Resource Management Project (CBRMP)
Project Period	Jan. 2003 - June 2014
Project Cost	US$ 26.7 million
Implementation Agency	Local Government Engineering Department (LGED) – Project partner agencies include Ministry of Land, Bangladesh Krishi Bank (BKB), BARI, BRRI, Bangladesh Livestock Research Institute (BLRI), die, Department of Fisheries (DoF), Department of Livestock Services (DLS).
Target Areas	Sunamganj District, 11 upazilas, 62 unions
Project Objectives	– To increase the assets and income of 90,000 households by developing self-managing grass-roots organizations to improve beneficiary access to primary resources, employment and credit, and – To support the development of available national institutions to replicate the project approach in other areas.
Major Project Components	– Labour intensive infrastructure development – Fisheries development – Agriculture & livestock production improvement – Micro credit – Institutional support

Source: IFAD website & LGED Project office for CBRMP

The CBRMP has been implemented in six upazilas of Sunamganj District. The project period is from 2003 to 20014. The implementation agency of CBRMP is LGED. Under the agriculture and livestock production improvement and fisheries development components of CBRMP, participatory research activities (PRA) for needs assessment, participatory research activities (adaptive trials, etc.), farmer training, demonstration and field work, and community-based fisheries development activities have been implemented with the support of related line agencies under a memorandum of understanding (MOU). (Institutional set-up for CBRMP is shown in Appendix 5.9.)

5.1.12 Agriculture Promotion Projects of DAE

The ongoing agriculture promotion projects of DAE are listed in Table 5.1.30.

Table 5.1.30 Ongoing Agriculture Promotion Projects of DAE

Project	Donor	RADP Allocation		
		Project Aid (RPA)	GOB	Total
1. Integrated Agricultural Productivity Project	IBRD	130.0	80.0	210.0
2. Greater Rangpur Agriculture & Rural Development Project	IDA	26.0	5.3	31.3
3. Agriculture Sector Program Support, 2nd Phase	DANIDA	113.9	28.9	142.8
4. Emergency 2007 Cyclone Recovery & Restoration Project	DANIDA	165.0	0	165.0
5. Establishment of Krishbid Institution of Bangladesh	-	-	360.2	360.2
6. Integrated Pest Management, 2nd phase	-	-	80.0	80.0
7. Integrated Quality Horticulture Development Project	-	-	170.0	170.0
8. 2nd Crop Diversification Project	ADB	138.0	100.0	238.0
9. Minimizing Rice Yield Gap Project	-	-	63.0	63.0
10. Farmers Training at Upazila Level for Transfer of Technology	-	-	346.0	346.0
11. National Agriculture Technology Project	IBRD	422.4	25.0	447.4
12. Farmers Level HYV Seed Production and Exchange Program	-	n.a.	n.a.	n.a.

Source: Planning Wing, DAE & project districts DAOs

As shown in the table above, the major agriculture promotion activities of DAE under GOB budget include the following: Integrated Pest Management (IPM), Farmer Level HYV Seed Production and Exchange Program (referred to as Seed Production Program), Minimizing Rice Yield Gap Project (referred to as Yield Gap Project) and Farmer Training at Upazila Level for transfer of technology. The IPM is implemented in all the project districts and its main activities are demonstration, training and field work. The Seed Production Program is carried out in the four project districts (excluding Sunamganj), and its main components are HYV seed production, seed storage and farmer-to-farmer seed exchange. The Yield Gap Project is introduced in Netrakona and Kishoreganj, and its main activities are demonstration and farmer training.

5.1.13 Agriculture Sector Activities of NGOs

There are many international and national NGOs operating in the haor areas. Their main working areas are microcredit, family planning, water and sanitation, health, and education. Their agricultural activities are rather limited, although their activities in seed distribution, IPM for vegetables, seed marketing (especially rice and vegetables), training of KSS and small-scale credit for purchasing agricultural inputs are reported.

The NGOs actively operating in the districts are shown in Table 5.1.31.

Table 5.1.31 Major NGOs Working in the Project Districts

District	Major NGOs Operating
Sunamganj	FIVBB, IRA, SUNCRID, CARE, IC
Habiganj	BRAC, ASHA, FIDB, CARE, IDEA, PASHA
Netrakona	BRRAC, SHA, CARE, PROSHIK, S.U. Samity
Kishoreganj	ASHA, BRAC, POPI, CARE,
Brahmanbaria	BRAC, ASHA, PODKKEP, CHANGE

Source: Five project DAOs

5.1.14 Problems/Constraints for Agriculture Promotion

(1) Problems/Constraints for Agriculture Reported by the District Offices

The problems/constraints for agriculture promotion reported by DAOs of the project districts in the interview survey conducted by the JICA Survey Team are summarized in Table 5.1.32. The results of the interview survey are detailed in Appendix 5.10.

Table 5.1.32 Major Problems/Constraints Reported by DAOs

Issue	Major Problems/Constraints Reported
Farming	Early flash flood, labor shortage during boro rice harvesting period, shortage of quality HYV rice seeds, shortage of farm machinery, and inappropriate farming practices
Post-harvesting	Lack of storage facility at home or in the village, and lack of space for drying
Extension Services	Poor logistics support, lack of training facility in block, and extension service area (block) size is too large
Marketing	Selling at low prices or forced to sell just after harvest due to poor transportation facilities and lack of transportation means, and lack of nearby market to sell products
Others	Limited accessibility to farm credit (complex procedures)

Source: Results of interview survey by the JICA Survey Team

(2) Findings of Household Survey

The results of the household survey conducted by the JICA Survey Team regarding the problems/constraints for agriculture promotion, respondent's suggestions to solve such problems/constraints, immediate needs, and future aspirations for agriculture promotions are summarized in Table 5.1.33.

Table 5.1.33 Findings of Household Survey: Crop Subsector [1/]

I. Problems/Constraints for Agriculture Promotion (Crop Sub-sector)		
Issues (Problems/Constraints)	No. 2/	Major Issues 3/
1. Irrigation Issues	318	general: 183 4/; costive: 96; water shortage 31; etc.
2. Farm Inputs Issues	232	general: 107 4/; costive: 73; supply problem: 38; etc.
3. Flash Flood/Heavy Rain	105	flash flood/heavy rain: 105
4. Transport/Road Issues	70	lack of road/transportation means: 70
5. Agronomic Issues	62	insect/pest occurrence: 32; high production cost: 15; etc.
6. Labor/Machinery Shortage	47	shortage of farm machinery/draft power: 25; labor shortage/high labor cost: 22
7. Marketing Issues	23	limited access to markets/unfair marketing price: 23
8. Farming Capital Issue	16	shortage of farming capital: 16
9. Other	22	
Total	895	
II. Suggestions to Solve Problems/Constraints for Agriculture Promotion (Crop Sub-sector)		
Suggestions	No. 2/	Major Suggestions 3/
1. Irrigation Issues	158	electricity/fuel supply etc: 107; irrigation system improvement: 28
2. Farm Inputs Issues	133	reduce inputs prices: 64; improvement of inputs supply: 50
3. Flood Management	144	rehabilitation/construction of embankment: 89; river dredging: 40; etc.
4. Road Construction/Improvement	55	road construction/improvement: 55
5. Agronomic Issues	33	farmer training: 13; appropriate chemical use: 8; etc.
6. Labor/Machinery Shortage	37	reducing hiring cost: 25; provision of machinery/hiring services: 9; etc.
7. Marketing Issues	22	higher/fixed/fair price of paddy: 22
8. Farming Capital Issue	24	improvement of access to credit/interest free credit: 24
9. Other	29	
Total	635	

III. Immediate Needs for Agriculture Promotion (Crop Sub-sector)		
Suggestions	No. 2/	Major Suggestions 3/
1. Irrigation Issues	156	irrigation water supply: 75; motor pump installation: 28; electricity supply: 27
2. Farm Inputs Issues	199	fertilizer/chemical/seed supply: 137; quality seeds supply: 32; etc.
3. Flood Management	33	embankment: 21; etc.
4. Road Construction/Improvement	33	road construction/improvement: 33
5. Agronomic Issues	13	training/extension services: 10
6. Labor/Machinery Shortage	90	provision of machinery/hiring services & power tiller: 76
7. Marketing Issues	21	Higher/fixed/fair price of paddy: 21
8. Farming Capital Issue	47	Improving access to credit/interest free credit: 47
9. Other	31	
Total	623	
IV. Future Aspirations for Agriculture Promotion (Crop Sub-sector)		
Suggestions	No. 2/	Major Suggestions 3/
1. Irrigation Issues	105	irrigation water supply: 43; electricity supply: 28; installation of power pump: 20
2. Farm Inputs Issues	65	provision of farm inputs: 65
3. Flood Management	151	rehabilitation/construction of embankment: 105; implementation of river dredging: 46
4. Road Construction/Improvement	54	road construction/improvement: 54
5. Agronomic Issues	98	provision of power tiller: 33; agriculture training: 29; farm machinery at low price/easy access to machinery: 16
6. Labor/Machinery Shortage	-	
7. Marketing Issues	25	fair market prices: 25
8. Farming Capital Issue	15	access to credit: 15
9. Other	66	
Total	579	

Note: 1/: Plural answers accepted; sample farmers 355; No. of answers per sample farmer was 1 to 4 answers; average no. of answers per sample farmer = 1.3 answers
2/: No. of respondents reported the subject answers
3/: Major problems/constraints or suggestions or immediate needs & aspirations responded
4/: Reported as irrigation problem or farm inputs problem (seed, fertilizer & agro-chemicals) without specifying
Source: Results of House Hold Survey conducted by the JICA Survey Team

As shown in the table, the most common problems/constraints reported by the sample farmers are irrigation issues followed by farm input issues, flash flood/heavy rainfall, transport and transportation facility (road) issues and agronomic issues. On irrigation issues, the prevailing problems are high pumping cost (fuel cost) and high irrigation water charge. Similarly, on farm input issues, the prevailing problem is the high cost of farm inputs followed by supply problems. On agronomic issues, the occurrence of insects or pests is reported.

The suggestions of respondents in solving the problems/constraints naturally correspond to each problem/constraint. For irrigation issues, electricity/fuel supply to reduce irrigation cost is suggested. For farm inputs issues, reduction of cost and improvement of supply conditions are suggested. For agronomic issues, activities related with improvement of farmers' skills are suggested.

The results of the same inquiry on the livestock subsector indicate the following: i) most common problems/constraints are insufficient veterinary services and diseases, ii) common suggestion is veterinary services strengthening, and iii) common needs are livestock loan and veterinary services. (Details are presented in Appendixes 5.11 and 5.12.)

The results of inquiries on extension services, farm input supply, farm credit, farmers organizations and marketing destination of crops are presented in Appendix 5.13.

(3) Prioritization of Problems

In the Master Plan of Haor Area, major problems in agriculture (crop subsector) and the livestock subsector are prioritized based on people's perception grasped through the

participatory planning approaches in matrix form (MP Vol. II Main Report, p. 29). In the same, three categories are assigned to the problems, i.e., very high significance (reported by more than 50% of upazilas in the study area/seven districts), high significance (reported by 15-50% of upazilas), and significant (reported by less than 15% of upazilas). The same matrix has been modified for the five project districts by categorizing to very high significance (reported by more than 50% of upazilas in the project districts), high significance (reported by 44-48% of upazilas), and moderate significance (reported by less than 44% of upazilas). The results of the prioritizations are presented in Table 5.1.34.

Table 5.1.34 Problem Matrix in the Master Plan of Haor Area

Problems	Level of Significance	
	Project Districts 1/	Study Area 2/
Crop Sub-sector		
- Crop damage due to early flood	VH	VH
- Shortage of agricultural labor	H	VH
- Excessive use of insecticide or pesticide	VH	VH
- Insufficient agricultural loan facilities with easy terms and conditions	H	H
- Poor drainage facilities	H	H
- Lack of proper irrigation system	MH	H
- Unavailability of cold storage	H	H
- Waterlogging	MH	H
- Lack of agriculture equipment	MH	H
- Problems in marketing of products	H	H
- Inaccessibility to actual price of crops	MH	H
- Scarcity of HYV seeds	MH	H
- Lack of agricultural technology	MH	H
- Undeveloped infrastructure	MH	H
- Lack of training	MH	H
- Lack of capital for investment	MH	H
- Poor transport and communications system	MH	H
- Lack of government support	MH	H
- Lack of skilled people	MH	H
Livestock Subsector		
- Inadequate number of skilled veterinary doctors	VH	VH
- Lack of suitable loan facilities	VH	VH
- Insufficient supply of medicines and vaccines	VH	H
- Feed scarcity during monsoon season	MH	H
- Low supply of HYV seeds	H	H
- Poor facilities for poultry transportation	H	H
- Undeveloped training opportunity to farmers	H	H
- Inadequate patronization	H	H
- Inadequate infrastructures	H	H
- Low number of hatchery for livestock and poultry	H	H
- Scarcity of space to keep livestock	MH	H
- Absence of public awareness	MH	H
- Shortage of feeds for duck	MH	H
- High price of necessary equipment	MH	H

1/: Total no. of upazilas – 50; VH – very high significance (over 25 upazilas reported significance), H – high significance (22–24 upazilas reported significance), MH – moderate significance (less than 22 upazilas reported significance)

2/: Total no. of upazilas – 69; VH – very high significance (over 35 upazilas reported significance), H – high significance (11–34 upazilas reported significance)

Source: Prepared by JICA Survey Team by modifying the table in p. 29, Volume II, Master Plan of Haor Area, 2012

The problem matrixes for the Study Area and the project districts indicate similar features as shown in the table. The problems categorized as very highly serious (VH) in the project districts are as follows:

Crop Subsector	Crop damage due to early flood, excessive use of insecticide or pesticide
Livestock Subsector	Inadequate number of skilled veterinary doctors, lack of suitable loan facilities, insufficient supply of medicines and vaccines

5.1.15 Policy Framework for Agriculture Development

An overview of the major thrusts and objectives of agriculture policies are comprehensively discussed in the Master Plan of Haor Area. (Details are presented in Appendix 5.14.)

5.2 Preliminary Plans for Agriculture Promotion and Livelihood Improvement

5.2.1 Issues and Proposed Development Approaches/Directions for Agricultural Promotion

The problems/constraints for agriculture development in the study area are comprehensively discussed in the Master Plan of Haor Area. Most of the problems/constraints discussed in the report are similar to those in the project districts identified through the present survey as discussed in the preceding section. The problems/constraints ("the issues") to be duly addressed for agricultural promotion (crop and livestock subsectors) and for livelihood improvement through its promotion in the project area and the proposed development approaches/directions for the promotion of subsectors are discussed below.

(1) General

The main constraints of agriculture production in the haor areas and, therefore, the project area, are basically associated with the physical and socioeconomic conditions in the areas. The major problems include flooding, flood damage, poor drainage conditions, farming practices, poor irrigation system and management, rice monoculture, rainfed crop production, inadequate extension services and technology development, land tenure status, access to farm inputs and credit, harvesting and postharvest practices, and lack of drying, storage and marketing facilities.

For agriculture promotion, comprehensive or integrated approaches should better be taken to materialize agriculture potential existing in the haor areas. Furthermore, livelihood improvement through agriculture promotion should primarily be realized because the agriculture sector is by far the most important economic activity in the haor areas.

(2) Flood Damage

Crop production in the project area is vulnerable to flash flood and drainage congestion. Rice is a main crop damaged by flooding. Flash floods usually occur during the pre-monsoon season (March/April to May). Losses in boro rice production are reported almost every other year in the study area and, in case of devastating flood, farmers suffer complete losses of their crops. Early floods and rapid rise of flood level adversely affect aus and aman rice and other crops such as vegetables, jute and spices, and also cause damages to rice seed beds. Floods

also seriously affect harvest and postharvest operations and marketing of boro rice in the haor areas because the time available for such operations is restricted by the timing of their occurrences. Sand carpeting and sedimentation caused by floods also adversely affect agriculture in the areas.

The envisaged works under the project, such as rehabilitation or new construction of embankments, would substantially mitigate flood damages caused by flash floods (and seasonal floods in some rehabilitation project areas). Also, crop production in the study area would be greatly stabilized. The development approaches/directions to be taken include agricultural promotion activities in order to enhance benefits of flood mitigation works under the project (synergy effects).

(3) Impeded Drainage

Impeded drainage (slow drainage or drainage congestion) of inundation water from fields results in the delay of farming activities in the project area, such as transplanting of boro rice, harvesting of aman rice and sowing of dry land rabi crops. Impeded drainage also results in low productivity of affected crops.

The project works will mitigate such drainage problems to a certain extent through the provision of drainage facilities. Especially in the areas provided with full embankments, substantial mitigation of seasonal flooding would be realized under the project. The development approaches/directions to be taken include agriculture promotion activities in order to enhance benefits of flood mitigation works under the project (synergy effects), as stated earlier.

(4) Poor Irrigation Systems

The existence of some 817,000 ha of irrigated fields in the study area has been estimated in the Master Plan of Haor Area. Also, the existence of about 704,700 ha of irrigated fields in the project districts has been reported in the same. In general, most of irrigation systems in the study area have been reported to be poorly established and operated/managed. The Master Plan of Haor Area indicates the possibility of expansion of irrigated areas through the improvement of water management and minor irrigation works such as improvement of on-farm level irrigation canals and rehabilitation or construction of field-level irrigation facilities. The findings of the household survey conducted by the JICA Survey Team revealed that the high pump operation cost and irrigation water charge are one of the serious farming problems reported by the survey respondents.

The development approach/direction to be taken is the empowerment of water management groups (WMGs) in the project area as a short-term strategy. Efficient utilization of irrigation water through the improvement of water management would mitigate the irrigation cost problem to a certain extent. The long-term approaches include investigation of the present conditions of irrigation systems and formulation of irrigation system rehabilitation plans. The primary step should be to carry out a detailed inventory study on the existing systems and ongoing or planned irrigation projects. Considering agriculture promotion, one approach to be

taken for this issue is to improve on-farm level water management through the empowerment of water users groups.

(5) Rainfed Agriculture

The Master Plan of Haor Area estimates that about 490,000 ha of farmlands in the study area are operated under rainfed conditions, while in the project districts, there exist about 270,000 ha of rainfed fields. Crop production in rainfed fields suffers from flash floods and water shortage during the dry and pre-monsoon season. Accordingly, poor crop performance occurs in many cases.

The development approaches/directions to be taken include the expansion of irrigated areas, conversion of rainfed fields to irrigated fields, through introduction of low-lift pumps, and utilization of surface water available in rainfed areas. Re-excavation of existing canals or excavation of additional canals would serve for efficient utilization of the surface water. A detailed investigation on the development potential of surface water in the subject areas is essential, as is the case for the improvement of existing irrigation systems.

(6) Cropping Pattern (Rice Monoculture)

The prevailing cropping pattern in the pre-monsoon season is rice monoculture, in which farmers are forced to reconcile themselves because of deep inundation of farmlands (lowland fields) for a long period. This resulted in the restriction of employment opportunities in farmlands to one cycle of boro rice cultivation in the pre-monsoon season and very limited employment opportunities in other seasons in the haor rural areas. Diversified crop production is essential to increase agricultural output and economic activities, and to improve the nutrition status and food habits of rural people

The development approaches/directions to be taken include the promotion of crop diversification by introducing early HYV boro rice, and the cultivation of upland crops or vegetables of short growth duration before or after boro rice. The introduction of HYV with the present growth duration in low-lying areas by adjusting the planting schedule is risky due to late drainage and early flooding. The availability of such rice variety has been confirmed, however, the adoption of other variety is still limited because of farmers' preference to the present varieties and inaccessibility to such new variety. The establishment of simple trial or adaptive trial sites operated by farming communities such as farmer research groups (FRGs), research institutes and extension staff should better be promoted for the purpose, followed by a seed multiplication program when the adaptive trials are successfully operated.

(7) Farming Operation and Practices

A number of problems/constraints related to farming operations and practices are reported in the project districts. The major ones include prevailing traditional farming practices, limited knowledge of farmers on improved technology, poor soil and crop management, limited access to potential HYV, late transplanting, scarcity of seedlings for replanting, weed infestation, excessive use of agrochemicals (insecticide), and inadequate postharvest operations.

These issues should better be addressed in an integrated manner by introducing farmer-participated extension activities for dissemination of improved farming practices in a large scale. The strengthening of field extension activities is considered essential in order to realize expected project benefits of the present project.

(8) Shortage of Farm Machinery/Draught Power for Land Preparation

Impeded drainage or drainage congestion in the project area brings about curtailing of the transplanting period for boro rice. It results in acute shortage of farm machinery (power tiller) and draught power due primarily to time restriction for land preparation. Small and marginal farmers and sharecroppers without draft animals are the most affected by farm machinery/draught power shortages. Peak shortages are reported during the short period of boro land preparation, after the receding of inundation water. Time restriction for land preparation and shortage of machinery/draught power sometimes results in a large extent of fields left under fallow because of failure in land preparation. Furthermore, timely tillage is essential for boro rice in order to avoid crop losses due to flash floods and to reduce crop damages due to seasonal inundation.

The development approach/direction to be taken is the establishment of farm machinery (power tiller, etc.) hiring services targeting small and marginal farmers and being managed by a group of farmers formed for such purpose in order to support timely operation of land preparation.

(9) Shortage of Farm Machinery for Postharvest Operations

The use of power thresher is common in the haor areas; however, the number of power threshers is still limited to meet higher demand for the boro rice harvesting season because the harvesting period for crops is rather limited due to the start of the rainy season.

The approaches to be taken are the establishment of machinery (power thresher, etc.) hiring services targeting small and marginal farmers and being managed by a group of farmers formed for such purpose and assurance of timely postharvest operations as is the case for shortage of farm machinery/draught power for land preparation.

(10) High Production Loss in Harvesting and Postharvest Operations

In the haor areas, the harvest time of boro rice is in the end of the pre-monsoon season when the intensity of rainfall is generally high. Farmers are very busy harvesting and threshing during the season. However, in addition to the difficulty of transport of harvested crops, the number of pucca (local threshing floor) is limited in the project area and they are usually located far away from fields. Therefore, prevailing practice for threshing is threshing at the home yard and at field when fields are located away from the home yard. Considerable postharvest losses during harvesting to threshing are reported due to the transportation of harvested crops from the field to the home yard. Furthermore, delay in threshing results in the deterioration of quality of paddy kept in wet conditions after harvest.

The issue could be addressed through the introduction of power thresher hiring services and by finishing threshing operations in the fields. The service can be provided together with the tractor (power tiller) hiring services as stated earlier. The services could be rendered as farm machinery hiring services operated by farmer groups formed for such purpose. The construction of drying floors in sites close to the fields should better be examined, if land spaces are available in strategic sites in or close to lowland fields.

(11) Lack of Agricultural Facilities

Shortage of agricultural facilities, such as drying floors, rice mills and storage facilities, are common constraints in the haor areas and hence in the project area. The establishment of such facilities is planned in the Master Plan of Haor Area. However, in the project portfolio, the implementation of such project is scheduled as a medium-term project. Furthermore, no details of such project have been presented in the Master Plan of Haor Area.

The development approach/direction to be taken is to conduct further investigation and study to identify the needs for such facilities and determine the locations and specifications of facilities. Another option is the empowerment of cooperatives for them to establish and manage such facilities. However, the construction of drying floors in sites close to lowland fields has been considered an action of high priority as stated in the preceding section.

(12) Livestock Subsector

The major constraints of the livestock subsector development include the following: i) poor genetic resources of livestock, ii) feed and fodder availability, iii) livestock diseases and poor health management, iv) poor product quality, v) marketing issues, and vi) traditional livestock raising practices. Regardless of its economic importance in the haor areas, the subsector faces various problems/constraints for its promotion.

The development approach/direction to be taken in the short term is the strengthening of livestock field extension activities and field veterinary services, as envisaged in HILIP of IFAD/LGED.

(13) Marketing Issues

In the haor areas, most farmers are compelled to dispose most of their crops (boro paddy) just after harvest to collector agents. Furthermore, farmers are unable to store their crops because of their need for cash, crop loan obligations, tenure crop division arrangements, lack of proper storage facilities, lack of nearby marketing facilities and high transportation cost. It is reported that many farmers are forced to sell their paddy just after threshing in fields to collector agents as stated earlier because of lack of transportation means from field to home yard and restriction of the harvesting period due to flash floods.

The issues are to be further investigated and addressed as integrated with the rural development components of the project (rural road construction, construction of landing places and construction of rural markets). Especially, further investigation for the selection of

strategic sites for marketing facilities is considered essential taking into account the road and landing places in the development plans of the project.

In the present project, rural road construction, construction of landing places and construction of rural markets are planned under the rural infrastructure development component. It is expected that marketing constraints would be considerably mitigated under the "with project" conditions.

(14) Inadequate Extension Services

In the Master Plan of Haor Area, the problems or shortcomings of the current extension services are pointed out seriously as follows: "*There has been a bias in the extension service towards the affluent farmers. However, small farmers are in the majority and, without their active participation, full improvement in farm productivity is not possible. Similarly, the extension services have not paid much attention to the rural women who actively participate in agricultural works. There is no arrangement for extension work to communicate the improved methods and practices to them. Lack of an effective linkage between extension service and agricultural research is also noticeable. Extension field workers are not familiar with the latest recommended farm practices. The lack of sufficient extension workers also results in poor motivation among the farmers. The extension personnel primarily concentrate in the use of modern varieties of rice. They give little attention to the non-rice crops. This creates poor motivation and knowledge of farmers on crop selection, input use, crop production practices, efficient irrigation and integrated water management, and maintenance of soil fertility*".

On the other hand, constraints faced by extension offices and personnel are also numerous and serious. The major ones include the following: i) shortage of fund for extension services, ii) inadequate logistics support, iii) restricted accessibility to target farming communities, iv) inadequate capability of extension staff, v) high turnover rate of extension staff, vi) poorly equipped extension facilities, and vii) poorly established research - extension - farmers linkage.

The Master Plan of Haor Area has no proposal for any specific project aimed at strengthening of extension services. However in some of the proposed projects, it appears that activities for strengthening of extension services are accommodated. The issues should better be addressed in an integrated manner with the other approaches/directions stated earlier. The conceived activities for the purpose include strengthening of extension services, empowerment of farming communities and field staff of line agencies, extensive field extension activities through demonstration, adaptive trial, IPM, ICM, farm mechanization support, seed multiplication by seed growers, strengthening linkage with research institutions/NGOs and so on. In order to ensure the sustainability of agricultural support activities planned under the project, the involvement of field staff of line agencies in program implementation should better be endeavored.

(15) Inadequacy of Research Program

In the Master Plan of Haor Area, the problems or shortcomings of the research programs have also been seriously commented on, as follows: "*Improvement of crop varieties has received more attention than improved cultivation practices in Bangladesh. Farming systems research is still in its infancy. On-farm testing was initiated only a few years ago. Soil and water conservation, utilization, and management research is yet to be initiated. Variety improvement has been directed towards increasing yields and resisting pests; breeding of varieties for specific local conditions remains secondary. Farmer's need of appropriate technologies for all aspects of the agricultural production system has not been considered. Labour intensive farming is needed so that the increasing farm labour forces can be employed. More research is needed for the development of farm level technologies on production, harvesting, handling, storage and processing. This would help rural people to develop small-scale workshops and factories and has the potential to absorb more workers"*.

The support of research institutes especially for the selection or development of short growth duration and cold tolerant HYV rice and for the adoption of promising varieties are considered essential in the haor areas. Furthermore, adaptive trials of potential short growth duration upland crops that are cultivated before or after boro rice with the support of research institutes are necessary for crop diversification in the areas. Such essential support given by the research institutes should better be provided in agricultural support activities covering strengthening of technology development, field extension services, and research - extension - farmer linkage.

Short duration HYV types of boro rice with high yield potential are considered essential for crop diversification in the haor areas. New varieties have to be developed so that the maturity period can be reduced about 15 days to 25 days. Similarly, suitable crop cultivars of rabi crops (upland crops and vegetables) that are cultivated before transplantation of boro rice are needed for crop diversification and increasing of land use intensity of limited land resources for farming in the areas.

(16) Inadequate Farm Input Supply

Issues on this subject in the haor areas and in the project area include the following: i) insufficient and untimely supply of seeds and fertilizers due partly to lack of transportation facilities in the remote areas, ii) insufficient supply of irrigation devices, and iii) limited scope of seed production due to natural disaster. Regarding seeds, farmers are sometimes forced to use seeds of low quality which are supplied through informal channels or low-quality self-produced paddies preserved under poor conditions.

The development approach/direction to be taken is the promotion of a well-planned group for the purchase of farm inputs and devices with the empowerment of cooperatives. The initial step for such purpose is to empower farmer organizations. The promotion of cooperatives will facilitate in solving the farm input supply and marketing issues through group purchase and marketing. Group purchase and marketing of cooperatives would improve access to supply/marketing information and it could provide alternative supply/marketing channels for farmers which will help improve the efficiency of procurement and marketing system in the

haor areas. The cooperative system may be developed through the formation of water management organizations (WMOs).

(17) Weakly Established WMOs and Other CBOs

Weakly established CBOs for agricultural activities is an issue which need to be duly addressed in plans for agricultural promotion under the project. Intensive empowerment programs of CBOs should include the following: practical training on water management, cooperative rules and regulations, marketing management, IPM, ICM, and disaster management.

(18) Limited Accessibility to Formal Farm Credit

Accessibility to formal credit by small and marginal farm households is limited because of complicated procedures involved and such farm households are not able to meet the eligibility criteria. Instead, these farm households take loans with higher interest rates from local moneylenders. At harvest time, when rice prices are at their lowest, farmers are forced to sell much of their products in order to repay their debts.

One possible approach to address this problem is the introduction of farm input supply to small and marginal farm households under group lending system and revolving arrangement.

(19) Limited Land Holding Size, Landless Households and Poor Female Headed Households

The proportion of small farm households is estimated to be around 80% of the total farm households in the project districts. Accordingly, integrated agriculture support activities to such farm households are especially necessary for agriculture promotion and livelihood improvement based on agriculture promotion in the project area.

The number of marginal farm households (farmland holding size of less than 0.4 ha) accounts for 55% of the total small farm households in the project districts (see Table 5.1.2). A special program targeting these marginal farm households is essential for the improvement of their livelihood. A conceived support activity to this effect includes the provision of farm inputs to marginal households through CIGs or other farmer groups, under the revolving arrangement if practical.

The existence of a number of agricultural labor households (about 36% of the total households, as shown in Table 5.1.1) and poor female headed households is another highly serious issue in the project districts. Accordingly, in addition to agricultural support activities, the introduction of small-scale income generating activities for marginal farm households, landless agricultural labor households and poor female headed households, which are the most vulnerable households and the least benefited from agricultural support activities due to their limited holding size of farmland, limited family labor forces and landless, is considered essential for livelihood improvement of majority of rural households in the haor areas. Possible agricultural based small-scale income generation activities accessible by such households include vegetable and fruit production in home yards and newly constructed elevated land under the

project civil works, micro poultry farming and floating bed vegetable cultivation (proposed project in the Master Plan of Haor Area).

5.2.2 Framework for the Formulation of Plans for Agriculture Promotion and Conceived Programs

In the formulation of plans for agriculture promotion in the project area, the proposed (conceived) development directions/approaches discussed in the preceding section, the priority ratings on the project lists presented in the Investment Project Portfolio (Volume III of the Master Plan of Haor Area) by the project DAOs and DLOs (refer to Tables 5.2.2 and 5.2.3), and the findings of the household survey (refer to Table 5.1.32) conducted by the JICA Survey Team are taken into consideration. The framework of the formulation of plans for agriculture promotion is presented in Figure 5.2.1 in the next page.

The framework consists of three columns, as shown in Figure 5.2.1. The first column enumerates the issues (problems/constraints) for agricultural development in the project area, as identified through the present study and discussed in the preceding section. The second column presents the conceivable development directions/approaches to address the issues. The third column is the formulation of the plan for agriculture promotion by categorizing and integrating the development directions/approaches into the conceived programs and activities for agriculture promotion. In the figure, the plans for agriculture promotion are formulated as Agriculture Promotion Support Subproject (APSS).

In order to achieve the development directions/approaches for marginal farm households, agriculture labor households and poor female-headed households, livelihood improvement support activities including vegetable and fruit production, microscale poultry farming, floating bed vegetable cultivation, and small-scale mushroom culture are conceived and formulated as Small-scale Income Generation Subproject (SIGS).

The planned programs of APSS and SIGS, which are identified according to the said framework for formulation, are summarized in Table 5.2.1.

Table 5.2.1 Conceived Programs of APSS and SIGS

Activities	Conceived Program	Primary Target Group
APSS	1. Field Program	Small farm households
	2. Farmer Training Program	Small farm households
	3. Field Staff Empowerment Program	Field staff of project & line agencies
	4. Farm Machinery & Facility Support,	Small (& medium) farm households
	5. Technology Development Program	-
SIGS	1. Floating Bed Vegetable Culture Scheme	Marginal farm households, agriculture labour households & poor female headed households
	2. Small-scale Vegetable Production Support Scheme	
	3. Fruit Production Support Scheme	
	4. Micro Poultry Raising Scheme,	
	5. Small-scale Mushroom Culture Scheme	

Source: Prepared by the JICA Survey Team

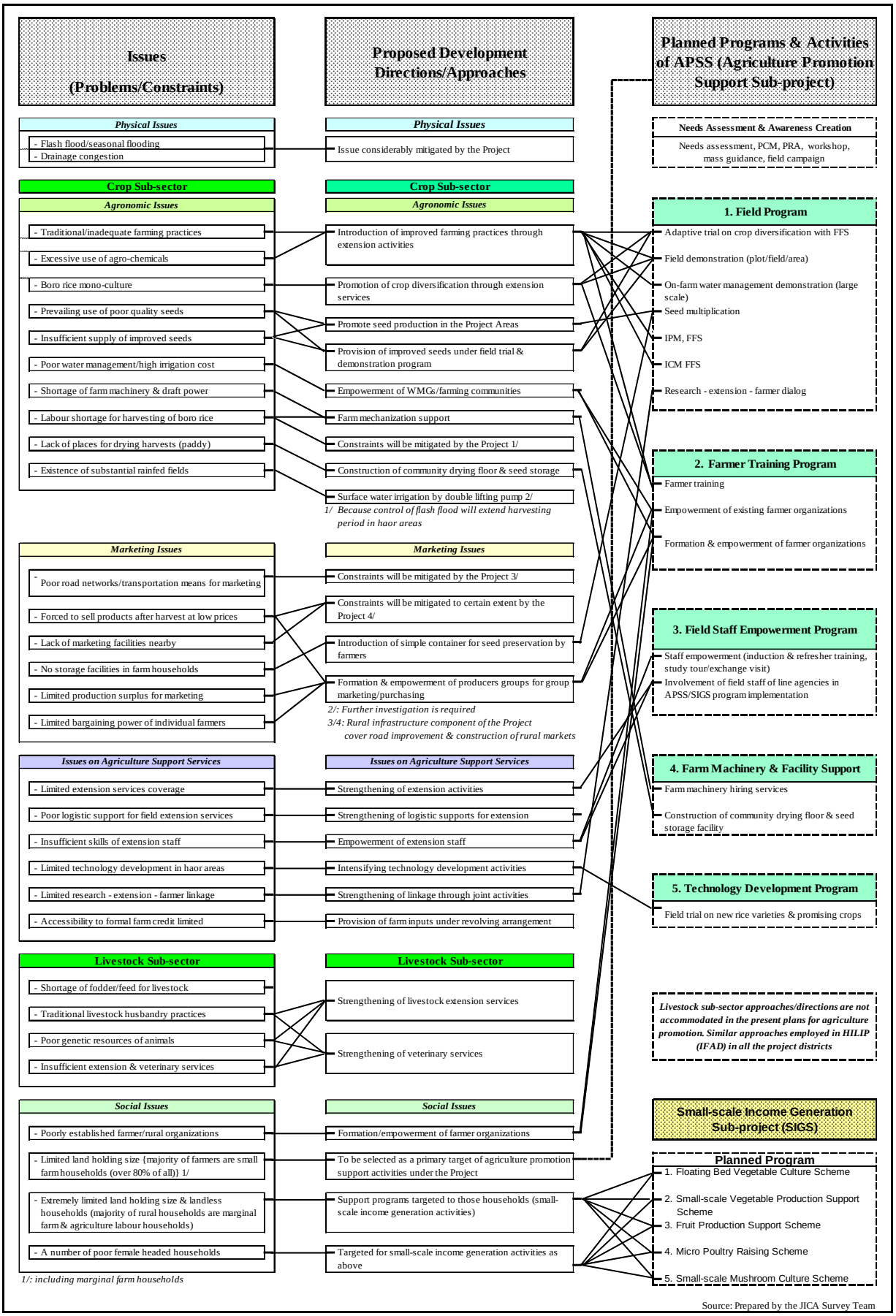


Figure 5.2.1 Formulation of Plans for Agriculture Promotion in the Project Area

5.2.3 Agriculture Promotion Plan and Projects Proposed in the Investment Project Portfolio of the Master Plan of Haor Area

The priority ratings on the project lists presented in the Investment Project Portfolio (Volume III of the Master Plan of Haor Area) by the project DAOs and DLOs are presented in Table 5.2.2.

Table 5.2.2 Priority Ratings of Projects in the Master Plan of Haor Area by Project DAOs and DLOs

1. Crop Subsector

DA Code	MP Proposed Project	MP Priority	Score on Individual Projects					Total Scores
			Sunamganj	Habigabj	Netrakona	Kishoreganj	Brahmanbaria	
AG-01.	Expansion of Irrigation through Utilization of Surface by Double Lifting in Haor Areas	1 (short)	6	4	7	7	5	29
AG-02.	Minor Irrigation by Low Lift Pumps Project	2 (medium)	7	7	7	7	7	35
AG-03	Investigation & Expansion of Ground Water Irrigation	1 (short)	7	7	7	7	7	35
AG-04	Agar Plantation Project	2 (medium)	7	7	7	7	7	35
AG-05	Automation of Rice Transplantation System by Auto Rice Transplanter	2 (medium)	7	7	7	7	7	35
AG-06	Mechanization of Agriculture through Combined Harvester	2 (medium)	7	7	7	7	7	35
AG-07	Crop Grain Dryer Project	2 (medium)	7	7	7	7	7	35
AG-08	Intensive Cultivation of Homestead Vegetables & Fruit Project	1 (short)	5	1	2	3	2	**13**
AG-09	Development of Short Duration Cold Tolerant High Yielding Varieties of Boro Rice	2 (medium)	4	6	7	7	3	27
AG-10	Selection of Short Duration Boro Rice Cultivars/Advanced Line Project	3 (long)	3	7	1	2	4	**17**
AG-11	Transfer of Cropping Pattern Technology Project	2 (medium)	1	7	7	7	7	29
AG-12	Extension of Integrated Pest Management Project	1 (short)	7	7	7	7	7	35
AG-13	Expansion of Integrated Crop Management Training	3 (long)	7	7	3	1	6	**24**
AG-14	Extension of Jute Cultivation Project	3 (long)	7	7	7	7	7	35
AG-15	Integrated Development of Applied Research for Improved Farming Systems	2 (medium)	7	7	7	7	7	35
AG-16	High Value Non-rice Cum Deep Water Rice Culture	2 (medium)	7	7	7	7	7	35
AG-17	Assistance to Landless, Marginal & Small Farmers to Overcome Soaring Input and Food Prices in Impoverished	2 (medium)	7	5	6	6	7	31
AG-18	Application of GIS for Farm Productivity Enhancement	1 (short)	7	7	7	7	7	35
AG-19	Improvement of Storage Facilities & Agricultural Marketing System in Haor Areas	1 (short)	7	2	5	5	7	26
AG-20	Cultivation of Innovative Agriculture through Floating Bed Vegetables	1 (short)	2	3	4	4	1	**14**

Note: Priority based on project needs is given up to 6th priority; scoring 1 to 6 to 1st to 6th priority rating, project not selected are given score 7
Therefore, projects with lower total scores are the projects with higher priority: AG-08, AG-20, AG-10 & AG-13

2. Livestock Subsector

DA Code	MP Proposed Project	MP Priority	Score on Individual Projects					Total Scores
			Sunamganj	Habigabj	Netrakona	Kishoregan	Brahmanbar	
LG-01	Improvement of Fodder Availability for Livestock Development	2 (medium)	5	5	4	5	5	24
LG-02	Integration of Livestock in Traditional Farming System	2 (medium)	5	5	5	5	5	25
LG-03	Farmers Training Programs for Capacity Building	1 (short)	2	3	2	2	1	**10**
LG-04	Establishment of Pilot Breeding Program for Cattle Development	2 (medium)	4	4	5	1	5	**19**
LG-05	Promotion of Small & Mini Dairy Farm	2 (medium)	5	5	5	5	5	25
LG-06	Promotion of Conventional & Alternative Feed Resources for Livestock Feeding	2 (medium)	5	5	5	5	3	23
LG-07	Extension of Livestock Services through Establishment of Union Livestock Service Center (ULSC)	2 (medium)	5	2	3	5	5	20
LG-08	Development of Livestock Products through Involvement of Community Organization	2 (medium)	5	5	5	5	5	25
LG-09	Development of Community Animal Health Workers for Livestock Health Care	1 (short)	1	5	5	5	2	**18**
LG-10	Promotion of Small & Mini Poultry & Duck Farms	2 (medium)	3	1	1	3	4	**12**

Note: Priority based on project needs is given up to 4th priority; scoring 1 to 4 to 1st to 4th priority rating, project not selected are given score 5
Therefore, projects with lower total scores are the projects with higher priority:LG-03, LG-10, LG-09 & LG-04.

Source: Interview survey with district agriculture offices of the project districts by the JICA Survey Team

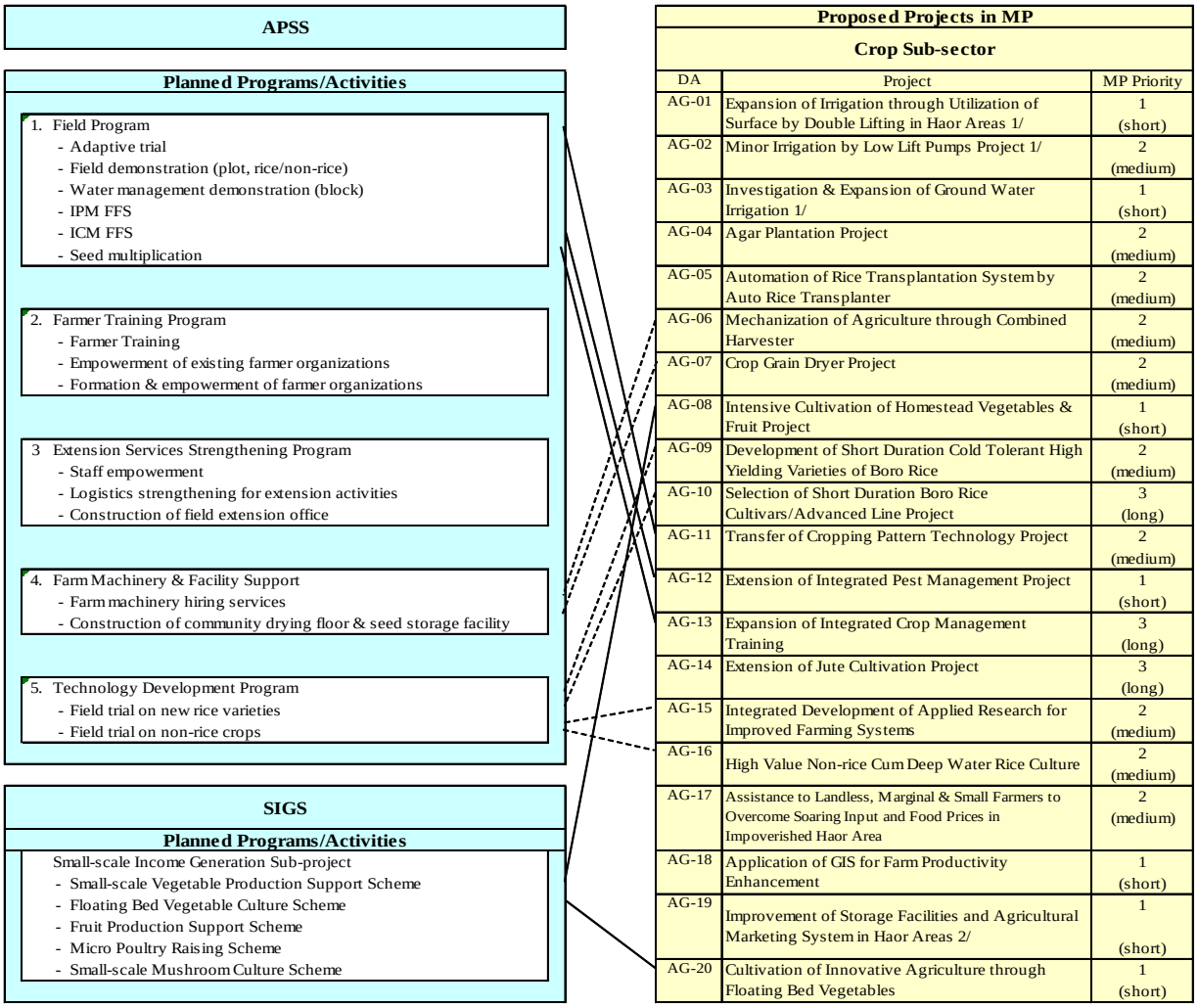
As shown in the table above, the projects in the Master Plan of Haor Area with the higher priority ratings, as evaluated by the five project DAOs and DLOs, are enumerated in Table 5.2.3.

Table 5.2.3 Projects in the Master Plan of Haor Area with the Higher Priority Ratings

Priority	Project in the Master Plan of Haor Area
1. Crop Subsector	
1st	Intensive Cultivation of Homestead Vegetables and Fruits Project
2nd	Cultivation of Innovative Agriculture through Floating Bed Vegetables
3rd	Selection of Short Duration Boro Rice Cultivars/Advanced Line Project
4th	Expansion of Integrated Crop Management Training
2. Livestock Subsector	
1st	Farmers Training Programs for Capacity Building
2nd	Promotion of Small and Mini Poultry and Duck Farms
3rd	Development of Community Animal Health Workers for Livestock Health Care
4th	Establishment of Pilot Breeding Program for Cattle Development

Source: Results of the questionnaire survey conducted by the JICA Survey Team, and as answered by the project DAOs and DLOs

In the proposed components, most of the project concepts or objectives of the projects listed in the Investment Project Portfolio of the Master Plan of Haor Area are accommodated except for those for which further investigations are prerequisite for project formulation such as irrigation projects proposed in the Master Plan of Haor Area. Figure 5.2.2 shows the relationships between the projects in the Master Plan of Haor Area and APSS/SIGS.



Source: Prepared by the Survey Team

Figure 5.2.2 APSS and SIGS and MP Proposed Projects

5.3 Plans for Agriculture Promotion and Livelihood Improvement

The proposed plans for agriculture promotion and livelihood improvement in the project area are formulated as APSS and SIGS, as discussed in the preceding section.

5.3.1 APSS

(1) Background

The haor areas in the northeast part of Bangladesh are placed under very vulnerable socioeconomic conditions as a result of serious flash floods occurring in March/April to May during the harvesting season of boro rice, which is a primary source of income of people in the survey areas, and seasonal flooding which restricts agricultural activities to six to seven months in a year and deprives employment opportunities for the people. The main component of the present project, which is the rehabilitation and new construction of embankments in the target haor areas, will substantially mitigate such socioeconomic vulnerability of the areas. However, for further enhancement of livelihood of the people, the promotion of the agriculture and fishery subsectors is essential as the two subsectors are the primary economic activities of most of the people living in the areas.

(2) Objectives

The primary objective of APSS is to enhance agriculture and livelihood in the project area through the introduction of comprehensive agricultural support activities primarily targeting small farm households (including marginal farm households) representing over 80% of farm households in the project districts (Census of Agriculture 2008). The envisaged agricultural promotion activities would lead to the materialization of the agriculture development potential as enhanced by the implementation of the project's physical works (Components 1 and 2 of the project) and, therefore, these would realize the synergy effects of the project.

(3) Target Areas and Groups

The primary target areas of APSS are the upazilas located in the project-benefited areas (project area) which are not selected as the target upazilas of HILIP[2] (non-HILIP upazila). However, when the proposed activities of APSS are quite different from the agricultural activities planned in HILIP and needs for the APSS proposed activities are high in the HILIP-benefitted upazilas (HILIP upazila), these areas could be selected as the target areas of APSS (the secondary target areas) after coordination of both projects by the a coordinating body established for such purpose. The selected primary target areas of APSS are some 94,800 ha (51% of the project area) and the secondary target areas are some 90,700 ha. The primary and secondary target area are summarized in Table 5.3.1 and detailed in Table 5.3.2.

The primary target groups of APSS are small farm households (including marginal farm households). However, depending on the program needs, advanced medium farm households will be selected as target groups for them to take key roles in program implementation. Such programs include farm machinery and facility support and adaptive trial programs.

[2] Haor Infrastructure & Livelihood Improvement Project of IFAD

Table 5.3.1 Primary and Secondary Target Areas of APSS by District (29 Subprojects)

District	Project Areas		Primary Target Areas		Secondary Target Areas	
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Sunamganj	24,778	100	-	-	24,778	100
Habiganj	44,478	100	24,133	54	20,345	46
Netrakona	51,087	100	36,042	71	15,046	29
Kishoreganj	54,892	100	30,349	55	24,543	45
Brahmanbaria	6,000	100	-	-	6,000	100
Other Districts	4,240	100	4,240	100	-	-
Total	185,476	100	94,764	51	90,713	49

Source: Prepared by the JICA Survey Team

Table 5.3.2 Primary and Secondary Target Areas of APSS and SIGS by District and Upazila

District	Upazila	Project Area (ha)	Target Area Primary 1/	Target Area Secondary 2/	Project ID
Rehabilitation Sub-project (15 sub-projects)					
Sunamganj	Derai	7		7	R-8
	Dharampasha	0		0	R-3
	Sulla	315		315	R-14
	District Total	**322**	**0**	**322**	
Habiganj	Ajmiriganj	1,673		1,673	R-9
		9,236		9,236	R-8
	Upazila Total	*10,909*	*0*	*10,909*	
	Bahubal	12,438	12,438		R-13
	Baniachong	22		22	R-13
		906		906	R-9
		1,501		1,501	R-10
		2,657		2,657	R-8
	Upazila Total	*5,086*	*0*	*5,086*	
	Chunarughat	0	0		R-13
	Habiganj Sadar	6,485	6,485		R-13
	Nabiganj	1,496	1,496		R-13
	District Total	**36,414**	**20,419**	**15,995**	
Netrakona	Barhatta	6,976	6,976		R-3
	Durgapur	5	5		R-1
	Kalmakanda	224		224	R-3
	Khaliajuri	4,847		4,847	R-15
		6,295		6,295	R-14
	Upazila Total	*11,142*	*0*	*11,142*	
	Madan	2,270		2,270	R-15
	Netrokona Sadar	6,061	6,061		R-2
	Purbadhala	5,277	5,277		R-2
		11,199	11,199		R-1
	Upazila Total	*16,476*	*16,476*	*0*	
	District Total	**43,154**	**29,518**	**13,635**	
Kishoreganj	Hossainpur	5,989	5,989		R-4
	Itna	84		84	R-15
	Katiadi	1,416	1,416		R-6
	Kishoreganj Sadar	2,309	2,309		R-4
	Kuliar Char	2,652	2,652		R-7
	Mithamain	1,942		1,942	R-9
	Pakundia	633	633		R-6
		2,464	2,464		R-5
	Upazila Total	*3,097*	*3,097*	*0*	
	District Total	**17,490**	**15,463**	**2,027**	
Brahmanbaria	Bancharampur	1,012		1,012	R-11
		4,988		4,988	R-12
	Upazila Total	*6,000*	*0*	*6,000*	
	District Total	**6,000**	**0**	**6,000**	
Comilla	Homna	**60**	**60**		R-12
Mymensingh	Dhobaura	21	21		R-1
	Haluaghat	2	2		R-1
	Nandail	369	369		R-4
	Phulpur	3,776	3,776		R-1
	District Total	**4,169**	**4,169**	**0**	
Narsingdi	Manohardi	**11**	**11**		R-6
Rehabilitation Total (ha)		**107,621**	**69,641**	**37,980**	
(%)		**100**	**64.7**	**35.3**	
Overall Project (ha)		**185,476**	**94,764**	**90,713**	
(%)		**100**	**51.1**	**48.9**	

District	Upazila	Project Area (ha)	Target Area Primary 1/	Target Area Secondary 2/	Project ID
New Construction Sub-project (14 sub-projects)					
Sunamganj	Chhatak	2,466		2,466	N-3
	Dakshin Sunamganj	1,347		1,347	N-12
	Dharampasha	17,565		17,565	N-4
	Jamalganj	176		176	N-12
	Sunamganj Sadar	2,902		2,902	N-12
	District Total	**24,456**	**0**	**24,456**	
Habiganj	Ajmiriganj	3		3	N-13
	Baniachong	4,347		4,347	N-13
	Nabiganj	3,714	3,714		N-13
	District Total	**8,064**	**3,714**	**4,350**	
Netrakona	Atpara	1,690	1,690		N-11
	Barhatta	3,989	3,989		N-4
	Kalmakanda	0		0	N-4
	Kendua	844	844		N-6
	Madan	1		1	N-10
		1,399		1,399	N-11
	Upazila Total	*1,401*	*0*	*1,401*	
	Mohanganj Thana	10		10	N-4
	District Total	**7,934**	**6,523**	**1,410**	
Kishoreganj	Austagram	36		36	N-14
	Bajitpur	1,386	1,386		N-8
	Itna	588		588	N-10
		1,504		1,504	N-7
		1,553		1,553	N-9
		2,375		2,375	N-2
	Upazila Total	*6,019*	*0*	*6,019*	
	Karimganj	15	15		N-14
		933	933		N-2
		2,847	2,847		N-1
	Upazila Total	*3,795*	*3,795*	*0*	
	Katiadi	278	278		N-8
		2,294	2,294		N-5
		2,990	2,990		N-1
	Upazila Total	*5,562*	*5,562*	*0*	
	Kishoreganj Sadar	866	866		N-1
	Mithamain	930		930	N-9
		3,925		3,925	N-2
	Upazila Total	*4,855*	*0*	*4,855*	
	Nikli	17		17	N-5
		1,871		1,871	N-2
		2,443		2,443	N-1
		3,128		3,128	N-14
		4,147		4,147	N-8
	Upazila Total	*11,606*	*0*	*11,606*	
	Tarail	0	0		N-7
		228	228		N-10
		3,050	3,050		N-6
	Upazila Total	*3,278*	*3,278*	*0*	
	District Total	**37,402**	**14,886**	**22,517**	
New Project Total (ha)		**77,855**	**25,123**	**52,733**	
(%)		**100**	**32.3**	**67.7**	

Target upazilas of HILIP
Upazilas not covered by HILIP

1/: sub-project areas in upazilas not targeted by HILIP
2/: sub-project areas in upazilas targeted by HILIP
Source: Prepared by JICA Survey Team based on data presented by Data Collection Survey Team

(4) Planned Programs and Activities

The planned programs of APSS are classified under five categories of support programs as discussed earlier (refer to Section 5.2.2). The activities carried out in the programs are summarized in Table 5.3.3.

Table 5.3.3 Planned APSS Programs and Activities

Program	Planned Activity
1. Field Program	- Adaptive trials, demonstration plots, demonstration field, demonstration area, cropping pattern demonstration, water management demonstration, seed multiplication, IPM FFS/ICM FFS, research-extension-farmer dialog
2. Farmer Training Program	- Farmer training, study tour/exchange visit, mass guidance/campaign/workshop, empowerment of existing farmer organizations, formation & empowerment of farmer organizations
3. Field Staff Empowerment Program	- Induction training of field staff, refresher training of field staff, study tour/exchange visit
4. Marginal Farmer Support Program	- Farm inputs supply, provision of simple seed storage container
5. Farm Machinery & Facility Support	- Farm machinery hiring services, construction of community drying floor & seed storage facility
6. Technology Development Program	- Field trial on rice, field trial on non-rice crops
7. Livestock sub-sector Program	- Farmer training, mass guidance & vaccination/deworming

Source: Prepared by the JICA Survey Team

A list of the planned APSS programs and their brief descriptions are presented in Table 5.3.5. Detailed descriptions of the programs and the bases applied for the estimation of program requirements during the project period are presented in Appendix 5.15.

(5) Overall Work Plan (OWP) for APSS

The OWP by subproject and by project upazila has been formulated based on the following: i) the size of the subproject benefited area by project upazila, ii) basis applied for the estimation of program requirements (Appendix 5.15), iii) the results of upazila inventory (Appendix 5.16), and iv) results of the preliminary needs assessment questionnaire survey of the major project upazilas (Appendix 5.17). The OWP has been formulated assuming that APSS is implemented for the period of five years from 2017/18 to 2021/22.

The OWP by subproject and by project upazila are presented in Tables 5.3.6 and 5.3.7, respectively. A summary table of the same is as shown in Table 5.3.4.

Table 5.3.4 OWP of APSS by District

Unit: No. of activities programmed

Program	Program Volume by District 1/						Total	Target Upazila
	SG	HG	NT	KS	BR	Others		
1. Field Program 2/	0	220	339	287	0	39	885	Non-HILIP upazila
2. Farmer Training Program 3/	0	129	198	160	0	23	510	Non-HILIP upazila
3. Field Staff Empowerment Program 4/	-	-	-	-	-	-	-	All upazilas
5. Farm Machinery & Facility Support	14	21	29	27	3	1	95	All upazilas
6. Technology Development Program 5/	-	-	-	-	-	-	-	-

Note: 1/: SG - Sunamganj, HG - Habiganj, NT - Netrokona, KS - Kishoreganj, BR - Brahmanbaria
2/: Research-Extension-Farmer Dialog not included, 3/: study tour & agricultural fair not included
4/: 50 units of programs planned district/project-wisely, 5/: 1 trial on rice & 1 trial on non-rice crops for 5 years
Source: Prepared by JICA Study Team

Table 5.3.5 Description of Programs/Activities of APSS and SIGS

Program/Activity	Description	Primary Target Group /Area 1/	Target Upazila 2/
I. Agriculture Promotion Support Sub-component (APSS)			
1. Field Program			Non-HILIP
1.1 Adaptive Trial (rice)	- Adaptive trial on new rice variety (short/cold tolerant etc.) (0.25 acre)	SFH	
1.2 Adaptive Trial (upland crops & vegetables)	- Adaptive trial on promising upland crops or vegetables (0.25 acre)	SFH	
1.3 Adaptive Trial (cropping pattern)	- Adaptive trial on cropping pattern of rice & upland crops or vegetables (0.25 acre)	SFH	
1.4 Demonstration Plot (rice)	- Demonstration on improved farming practices (0.25 acre)	SFH	
1.5 Demonstration Field (rice)	- Demonstration on improved farming practices (1 acre)	SFH	
1.6 Demonstration Area (rice)	- Demonstration on improved farming practices (10 acre)	SFH	
1.7 Water Management Demonstration Area (rice)	- Demonstration on improved water management & farming practices (20 acre)	SFH	
1.8 Demonstration Plot (upland crops/vegetables)	- Demonstration on improved farming practices (0.25 acre)	SFH	
1.9 Cropping Pattern Demonstration	- Demonstration on cropping pattern of rice & upland crops or vegetables (0.25 acre)	SFH	
1.10 IPM FFS/ICM FFS (rice)	- Integrated Pest Management (IPM) Farmer Field School (FFS) for rice	SFH	
1.11 Seed Multiplication (rice)	- Integrated Crop Management (IPM) Farmer Field School (FFS) for rice	SFH	
1.12 Research-Extension-Farmer Dialog	- Seed multiplication by farmers to improve seed supply in the sub-project areas	SFH	
2. Farmer Training Program			Non-HILIP
2.1 Farmer Training			
2.1.1 Farmer Training	- Practical farmer training in class/field (3 & 5 days, 25 participants/class)	SFH	
2.1.2 Study Tour/exchange Visit	- Visit to advanced areas, successful project sites, etc. (1 day; 25 participants/program)	SFH	
2.1.3 Mass Guidance/Workshop/Campaign	- Mass guidance/field campaign (1 day, 40 & 80 participants/program)	SFH	
2.1.4 Agriculture Fair	- Exhibition of agricultural products, appropriate agriculture practices introduced and the Project activities in the project upazilas	Stakeholders/ Public	
2.2 Empowerment of Existing Farmer Organizations (FO)	- Training of executive members on group management, leadership, financial issues, marketing, etc. (5 executive members/FO x 5 Foes = 25 participants) - Provision of continues guidance & monitoring	FO	
2.3 Formation & Empowerment of Farmer Organizations (FO)	- Formation of farmers organizations on need basis & training of executive members - Provision of continues guidance & monitoring	SFH/FO	
3. Field Staff Empowerment Program			All upazilas
3.1 Induction Training of Field Staff	- Staff training at the kick-off stage of the Project (5 days, participants 25 staff/class)	Field Staff	
3.2 Refresher Training of Field Staff	- Annual refresher training & evaluation meeting (5 days, participants 25 staff/class)	Field Staff	
3.3 Study Tour/Exchange Visit	- Visit to advanced areas, successful project sites, etc. (3 days, 25 participants)	Field Staff	
4. Farm Machinery & Facility Support			All upazilas
5.1 Farm Machinery Hiring Services	- Formation of machinery hiring service providers group - Training of group members (3 months) - Provision of machinery at subsidized rate - Provision of machinery hiring services	Progressive Farmers	
5.2 Construction of Community Drying Floor & Seed Storage Facility	- Construction of drying floor & seed storage facility in farm land area for community use - Drying floor is for drying paddy preserved for seed only - Scale depending on availability of land Standard: 40m2 & storage 20 m2	Block	
5. Technology Development Program			
6.1 Field Trial on Rice	- Simple trial on new rice varieties prior to adaptive trial (2 sites for 5 years)	Typical Haor Area	-
6.2 Field Trial on Non-rice Crops	- Simple trial on non-rice crops prior to adaptive trial (1 site for 5 years)		-
II. Small-scale Income Generation Sub-component (SIGS)			Non-HILIP
1. Floating Bed Vegetable Culture Scheme	- CIG formation (3 CIGs x 8 members/CIG = 24 beneficiaries FHH/unit) - Provision of bed making materials, vegetable seeds & 2 days training	MFH/AL	
2. Small-scale Vegetable Production Support Scheme	- CIG formation (3 CIGs x 8 members/CIG = 24 beneficiaries FHH/unit) - Plot size: 1 decimal (40m2)/FHH - Provision of farm inputs & fencing materials etc; 1 day training	MFH/AL	
3. Fruit Production Support Scheme	- CIG formation (3 CIGs x 8 members/CIG = 24 beneficiaries FHH/unit) - Provision of fruit saplings, farm inputs, fencing materials & 1 day training - Candidate saplings: Jujube (kul), litchi, guava, moringa, mandarin orange etc.	MFH/AL	
4. Micro Poultry Raising Scheme	- CIG formation (3 CIGs x 8 members/CIG = 24 beneficiaries FHH/unit) - Provision of package of chicks or ducklings, shed materials, feed & 1 day training - Package: 1 + chicks 9 or 1 + ducklings 9	MFH/AL	
5. Small-scale Mushroom Culture Scheme	- CIG formation (3 CIGs x 8 members/CIG = 24 beneficiaries FHH/unit) - Provision of mushroom spoon, shelve materials etc. & 3 days training - Package: spoons/FHH	MFH/AL	

1/:: Primary target group; SFH - small farm households including marginal farm households; MFH - marginal farm households & poor female headed farm households; AL: agriculture labour households

2/: Target upazilas of programs: Non-HILIP upazilas - upazilas not covered by HILIP, All upazilas - both non-HILIP & HILIP upazilas

Source: Prepared by the JICA Survey Team

Table 5.3.6 OWP for APSS and SIGS by Subproject

Unit: No. of Activities Programed

ID	Sub-project	Sub-project Area	Overall Work Plan for APSS & SIGS (No. of Individual Activities Programed for the Project Period)																								SIGS						Upazilas in Sub-project Area 1/
			1. Field Program											2. Farmer Training Program						3. F.S.E.P			4. F.M.F.S		5. T.D.P.								
			Adaptive trial (rice)	Adaptive trial (non-rice)	Adaptive trial (cropping pattern)	Demonstration Plot. (rice)	Demonstration Field, (rice)	Field demonstration (area)	Demonstration Plot. (upland crop/vegetable)	Cropping Pattern Demonstration	Water management demonstration	IPM FFS/ICM FFS	Seed multiplication	Research-Extension- Farmer Dialog	Farmer Training	Study tour/exchange visit	Mass guidance/field campaign	Agriculture fair	Empowerment of existing farmer organizations	Formation & empowerment of farmer organizations	Inception training	Annual training	Study tour/exchange visit	Farm machinery hiring services	Construction of community drying floor & seed storage facility	Field trial on new rice varieties	Field trial on non-rice crops	Floating bed vegetable culture scheme	Small-scale vegetable production support schme	Fruit production support scheme	Micro poultry raising scheme	Small-scale mushroom cukture scheme	Total	
			1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	2.1.1	2.1.2	2.1.3	2.1.4	2.2	2.3	3.1	3.2	3.3	4.1	4.2	5.1	5.2	1	2	3	4	5		
Rehabilitation Sub-project																																	
R-1	Dampara Water Management Scheme	15,004	14	8	5	48	14	5	10	8	5	8	14		19		15		23	23				3	5			7	7	6	7	3	30	All non-HILIP upazilas
R-2	Kangsha River Scheme	11,337	11	6	4	37	12	4	8	6	4	6	11		15		11		18	18				3	4			5	6	6	6	5	28	All non-HILIP upazilas
R-3	Singer Beel Scheme	7,200	7	3	2	23	7	3	5	3	2	3	7		9		7		12	12				1	2			2	4	4	3	3	16	Non-HILIP upazilas 97%
R-4	Baraikhali Khal Scheme	8,667	8	4	3	29	10	3	6	4	3	4	8		10		8		15	15				1	3			7	6	5	7	4	29	All non-HILIP upazilas
R-5	Aladia-Bahadia Scheme	2,464	2	1	1	8	3	1	2	1	1	1	2		3		2		4	4					1			3	3	1	3	2	12	Non-HILIP upazila
R-6	Modkhola Bhairagirchar Sub-project Scheme	2,060	2	1		7	3	1	1	1		1	2		3		2		3	3								2	3	2	2		9	All non-HILIP upazilas
R-7	Ganakkahali Sub-scheme	2,652	3	1	1	9	3	1	2	1	1	1	3		3		3		4	4					1			4	4	2	1	3	14	Non-HILIP upazila
R-8	Kairdhala Ratna Scheme	11,900																						2	4									All HILIP upazilas
R-9	Bashira River Scheme	4,521																						1	2									All HILIP upazilas
R-10	Aralia Khal Scheme	1,501																							1									HILIP upazila
R-11	Chandal Beel Scheme	1,012																							0									HILIP upazila
R-12	Satdona Beel Scheme	5,049																						1	2									HILIP upazila 99%
R-13	Gangajuri FCD Sub-Project	20,441	18	10	6	65	21	8	13	10	6	10	18		26		18		32	32				3	6			7	6	6	7	5	31	Non-HILIP upazila 39%
R-14	Khaliajuri Polder #02 Scheme	6,611																						2	2									HILIP upazila 95%
R-15	Khaliajuri Polder #04 Scheme	7,201																						2	3									All HILIP upazilas
Rehabilitatuion Sub-project Total		**107,621**	**65**	**34**	**22**	**226**	**73**	**26**	**47**	**34**	**22**	**34**	**65**		**88**		**66**		**111**	**111**				**19**	**36**			**37**	**39**	**32**	**36**	**25**	**169**	
New Construction Sub-project																																	
N-1.	Boro Haor Project (Nikli)	9,146	7	2	2	22	7	2	5	2	2	2	7		9		7		11	11				1	3			4	6	6	6	6	28	Non-HILIP upazila 73%
N-2.	Naogaon Haor Project	9,104	1			3	1		1				1		1									2	3			1	1	1	1	1	5	Non-HILIP upazila 10%
N-3	Jaliar Haor Project	2,466																						1	1									HILIP upazila
N-4.	Dharmapasha Rui Beel Project	21,563	4	2	1	13	4	2	3	2	1	2	4		5		4		7	7				3	7			1	2	2	2	2	9	Non-HILIP upazila 18%
N-5.	Chandpur Haor Project	2,311	2	1	1	8	3	1	2	1	1	1	2		3		2		4	4					1			2	2	2	2	2	10	Non-HILIP upazila 99%
N-6	Sunair Haor Project	3,894	4	2	1	13	4	1	3	2	1	2	4		5		4		6	6				1	1			3	4	3	1	2	13	All non-HILIP upazilas
N-7	Badla Haor Project	1,504																							1									All HILIP upazilas
N-8	Nunnir Haor Project	5,810	1	1	1	6	2	1	1	1	1	1	1		2		1		2	2				2	1			1	2	1	1		5	Non-HILIP upazila 29%
N-9	Dakhshiner Haor Project	2,482																							1									All HILIP upazilas
N-10	Chatal Haor Project	816				1																							1	1			2	Non-HILIP upazila 28%
N-11	Ganesh Haor Project	3,090	2	1	1	6	2	1	1	1	1	1	2		2		2		3	3				1	1				2	1		1	4	Non-HILIP upazila 55%
N-12	Dhakua Haor Project	4,425																						2	1									All HILIP upazilas
N-13	Mokhar Haor Project	8,064	4	2	1	12	4	1	2	2	1	2	4		5		4		6	6				2	2			1	1	1	1	1	5	Non-HILIP upazila 46%
N-14	Noapara Haor Project	3,180																						1	1									HILIP upazila 99%
New Construction Sub-project Total		**77,855**	**25**	**11**	**8**	**84**	**27**	**9**	**18**	**11**	**8**	**11**	**25**		**32**		**24**		**39**	**39**				**16**	**24**			**13**	**21**	**18**	**14**	**15**	**81**	
District Base Program																**33**		**10**			**9**	**36**												
Project Base Program														**10**									**5**			**1**	**1**							
Overall Project		**185,476**	**90**	**45**	**30**	**310**	**100**	**35**	**65**	**45**	**30**	**45**	**90**	**10**	**120**	**33**	**90**	**10**	**150**	**150**	**9**	**36**	**5**	**35**	**60**	**1**	**1**	**50**	**60**	**50**	**50**	**40**	**250**	

Note: F.S.E.P = Field Staff Empowerment Program; F.M.F.S.= Farm Machinery & Facility Support; T.D.P. = Technology Development Program

Prepared by JICA Survey Team

Table 5.3.7 OWP for APSS and SIGS by District and Upazila

Unit: No. of Activities Programed

District	Upazila	Sub-project Area	Sub-project ID	HILIP Upazila (H) or Non-HILIP Upazila (N) 1/	Overall Work Plan for APSA & SIGA (No. of Individual Activities Programed for the Project Period)																																	
					APSS																												SIGS					
					1. Field Program												2. Farmer Training Program						3. F.S.E.P. 1/			4. F.M.F.S. 1/		5. T.D.P. 1/									
					Adaptive trial (rice)	Adaptive trial (non-rice)	Adaptive trial (cropping pattern)	Demonstration Plot, (rice)	Demonstration Field, (rice)	Field demonstration (area)	Demonstration plot, (upland crop/vegetable)	Cropping pattern demonstration	Water management demonstration	IPM FFS/ICM FFS	Seed multiplication	Research-extension- farmer ldialog	Farmer training	Study tour/exchange visit	Mass guidance/field campaign	Agriculture fair	Empowement of existing farmer organizations	Formation & empowement of farme organizations	Inception training	Annual training	Study tour/exchange visit	Farm machinery hiring services	Construction of community drying floor & seed storage facility	Field trial on new rice varieties	Field trial on non-rice crops	Floating bed vegetable culture scheme	Small-scale vegetable production support scheme	Fruit production support scheme	Micro poultry raising scheme	Small-scale mushroom culture scheme	
					1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	2.1.1	2.1.2	2.1.3	2.1.4	2.2	2.3	3.1	3.2	3.3	4.1	4.2	6.1	6.2	1	2	3	4	5	Total
Sunamganj	Chhatak	2,466	N-3	H																						1	1									0
	Dakshin Sunamganj	1,347	N-12	H																						1	0									0
	Derai	7	R-8	H																						0	0									
	Dharampasha	17,565	R-3/N-4	H																						3	6									0
	Jamalganj	176	N-12	H																						0	0									0
	Sulla	315	R-14	H																																
	Sunamganj Sadar	2,902	N-12	H																						1	1									0
	District Total	24,778			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	8	0	0	0	0	0	0	0	0	0
Habiganj	Ajmiriganj	10,912	R-8, 9/N-13	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0
	Bahubal	12,438		N	11	6	4	39	12	4	8	6	4	6	11		16		11		19	19				2	4			2	3	4	5	3	17
	Baniachong	9,433	R-8, 9, 10, 13/N-13	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
	Habiganj Sadar	6,485		N	6	3	2	21	7	3	4	3	2	3	6		8		6		11	11				1	2			4	2	2	2	2	12
	Nabiganj	5,210	R-13/N-13	N	5	3	1	17	6	2	3	3	1	3	5	0	7	0	5	0	8	8	0	0	0	1	1	0	0	2	2	1	1	1	7
	District Total	44,478			22	12	7	77	25	9	15	12	7	12	22	0	31	0	22	0	38	38	0	0	0	7	14	0	0	8	7	7	8	6	36
Netrakona	Atpara	1,690		N	2	1	1	6	2	1	1	1	1	1	2		2		2		3	3				1	1			0	2	1	0	1	4
	Barhatta	10,965	R-3/N-4	N	11	5	3	36	11	5	8	5	3	5	11	0	14	0	11	0	19	19	0	0	0	1	3	0	0	3	6	6	5	5	25
	Durgapur	5		N	0	0	0	0	0	0	0	0	0	0	0																					
	Kalmakanda	224	R-3/N-4	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kendua	844		N	1	0	0	3	1	0	1	0	0	0	1		1		1		1	1				0	0			1	1	1	0	0	3
	Khaliajuri	11,142	R-14, 15	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0
	Madan	3,670	R-5/N-10, 11	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
	Mohanganj Thana	10		H																						0	0									0
	Netrokona Sadar	6,061		N	6	3	2	19	6	2	4	3	2	3	6		8		6		9	9				1	2			2	3	3	3	3	14
	Purbadhala	16,476	R-1, 2	N	15	9	6	53	16	5	11	9	6	9	15	0	21	0	16	0	26	26	0	0	0	5	6	0	0	10	10	9	10	5	44
	District Total	51,087			35	18	12	117	36	13	25	18	12	18	35	0	46	0	36	0	58	58	0	0	0	12	17	0	0	16	22	20	18	14	90
Kishoreganj	Austagram	36	N-14	H																						0	0									0
	Bajitpur	1,386	N-8	N	1	1	1	5	2	1	1	1	1	1	1		2		1		2	2				1	0			1	1	1	1	0	4
	Hossainpur	5,989	R-4	N	6	3	2	20	7	2	4	3	2	3	6		7		6		10	10				1	2			6	4	3	6	3	22
	Itna	6,104	R-15/N-2, 7, 9, 10	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
	Karimganj	3,795	N-1, 2, 14	N	4	1	1	12	4	1	3	1	1	1	4	0	5	0	3	0	5	5	0	0	0	1	1	0	0	3	4	4	3	3	17
	Katiadi	6,978	R-6/N-1, 5, 7	N	6	3	2	24	8	3	5	3	2	3	6	0	9	0	6	0	11	11	0	0	0	0	2	0	0	5	7	6	6	5	29
	Kishoreganj Sadar	3,175	R-4/N-1	N	3	1	1	11	4	1	3	1	1	1	3	0	4	0	3	0	5	5	0	0	0	0	1	0	0	1	3	3	2	2	11
	Kuliar Char	2,652	R-7	N	3	1	1	9	3	1	2	1	1	1	3		3		3		4	4				0	1			4	4	2	1	3	14
	Mithamain	6,797	R-9/N-2, 9	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
	Nikli	11,606	N-1, 2, 5, 7, 14	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0
	Pakundia	3,097	R-5/N-7	N	3	1	1	10	4	1	2	1	1	1	3	0	4	0	3	0	5	5	0	0	0	0	1	0	0	4	4	1	4	2	15
	Tarail	3,278	N-6, 7, 10	N	3	2	1	11	3	1	2	2	1	2	3	0	4	0	3	0	5	5	0	0	0	1	1	0	0	2	4	3	1	2	12
	District Total	54,892			29	13	10	102	35	11	22	13	10	13	29	0	38	0	28	0	47	47	0	0	0	9	18	0	0	26	31	23	24	20	124
Br. 2/	Banchharampur	6,000	R-11, 12	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
Others 3/	Nandail	369	R-1	N	0	0	0	1	0	0	0	0	0	0	0		0		0		1	1				0	0									
	Phulpur	3,776	R-1	N	4	2	1	13	4	2	3	2	1	2	4		5		4		6	6					1									
	Dhobaura	21	R-1	N																																
	Haluaghat/Homna	73		N																																
	District Total	4,239			4	2	1	14	4	2	3	2	1	2	4	0	5	0	4	0	7	7	0	0	0	0	1	0	0	0	0	0	0	0	0	0
		District Base Program																33		10			9	36												
		Project Base Program														10									5			1	1								
Overall Program		**185,475**			**90**	**45**	**30**	**310**	**100**	**35**	**65**	**45**	**30**	**45**	**90**	**10**	**120**	**33**	**90**	**10**	**150**	**150**	**9**	**36**	**5**	**35**	**60**	**1**	**1**	**50**	**60**	**50**	**50**	**40**	**250**

Note: F.S.E.P = Field Staff Empowerment Program; F.M.F.S.= Farm Machinery & Facility Support; T.D.P. = Technology Development Program

1/: H = HILIP target upazila; N = upazila not covered by HILIP 2/: Brahmanbaria 3/: Mymensingh: 4,168ha, Commila: 60ha & Narsingdi 11ha

The number of direct and secondary beneficiary farmers (participants of farmer field days and seminar) of APSS is estimated at about 27,000 and 65,000, respectively, as shown in Table 5.3.8.

Table 5.3.8 Direct and Secondary Beneficiaries of APSS

Program/Activity	Program Volume	Beneficiary/Unit Program		Beneficiary/Sub-project	
		Direct Beneficiary	Secondary Beneficiary 1/	Direct Beneficiary	Secondary Beneficiary 1/
1. Field Program					
1.1 Adaptive Trial (rice)	90	5	75	450	6,750
1.2 Adaptive Trial (upland crops & vegetables)	45	5	75	225	3,375
1.3 Adaptive Trial (cropping pattern)	30	5	150	150	4,500
1.4 Demonstration Plot (rice)	310	5	50	1,550	15,500
1.5 Demonstration Field (rice)	100	5	50	500	5,000
1.6 Demonstration Area (rice)	35	15	200	525	7,000
1.7 Demonstration Plot (upland crops/vegetables)	65	5	50	325	3,250
1.8 Cropping Pattern Demonstration	45	5	100	225	4,500
1.9 Water Management Demonstration Area (rice)	30	15	200	450	6,000
1.10 IPM FFS/ICM FFS (rice)	45	25	100	1,125	4,500
1.11 Seed Multiplication (rice)	90	25	50	2,250	4,500
1.12 Research-Extension-Farmer Dialog	10	12	-	120	-
2. Farmer Training Program					
2.1 Farmer Training					
2.1.1 Farmer Training	120	25	-	3,000	-
2.1.2 Study Tour/exchange Visit	33	25	-	825	-
2.1.3 Mass Guidance/Workshop/Campaign	90	60	-	5,400	-
2.1.4 Agriculture Fair	10	-	-	-	-
2.2 Empowerment of Existing Farmer Organizations (FO)	150	25	-	3,750	-
2.3 Formation & Empowerment of Farmer Organizations (FO)	150	25	-	3,750	-
3. Field Staff Empowerment Program					
3.1 Induction Training of Field Staff	9	25	-	225	-
3.2 Refresher Training of Field Staff	36	25	-	900	-
3.3 Study Tour/Exchange Visit	5	25	-	125	-
4. Farm Machinery & Facility Support					
5.1 Farm Machinery Hiring Services	70	10	-	700	-
5.2 Construction of Community Drying Floor & Seed Storage Facility	60	-	-	-	-
5. Technology Development Program					
6.1 Field Trial on Rice	1	88/year		440	-
6.2 Field Trial on Non-rice Crops	1	44/year		220	-
Overall				27,230	64,875

1/: Beneficiaries of Farmer Field Day (FFD) & seminar

Source: Prepared by the JICA Survey Team

5.3.2 SIGS

(1) Background

In the project districts, about 45% of farm households are categorized as marginal farm households, and the existence of a large number of agricultural labor households (about 36% of total households) are reported in the Census of Agriculture 2008. These households and poor female-headed households are considered to be the most vulnerable households of rural communities in the haor areas. The introduction of small-scale and easily accessible economic activities for them to engage in is an essential and sustainable step for gradual improvement of their livelihoods up to the most possible extent.

(2) Objectives

The objective of SIGS is to introduce small-scale income generation activities targeting the most vulnerable groups in the haor areas, marginal households, agricultural labor households and poor female-headed households, for gradual improvement of their livelihood. Because the primary and most common economic activities in the areas are agricultural activities (crop, livestock and fishery), livelihood enhancement through agricultural activities shall be more

reasonable and easily accessible. However, any promising income-generating activity of other sectors are identified in the course of the project implementation, and such activities identified as important components in the present SIGS.

(3) Target Areas and Groups

In principle, the primary target areas of APSS (non-HILIP upazilas) will be selected as the target areas of SIGS because similar activities are envisaged under HILIP. However, the areas wherein SIGS are seriously needed as identified during the preparatory works for the formulation of the annual work plan (AWP) will be selected as the target areas of SIGS.

The target groups of SIGS will be marginal households, agricultural labor households and poor female headed households as stated earlier. The two former categories of households are estimated to be about 60% of the total households in the project districts according to the Census of Agriculture 2008.

(4) Planned Programs and Activities

As discussed in the preceding section (Section 5.2.2), the planned programs of SIGS include the following: i) Floating Bed Vegetable Culture Scheme, ii) Small-scale Vegetable Production Support Scheme, iii) Fruit Production Support Scheme, iv) Micro Poultry Raising Scheme, and v) Small-scale Mushroom Culture Scheme. Brief descriptions of the programs accommodated in SIGS are presented in Table 5.3.4. Detailed descriptions of the programs and the bases applied for the estimation of program requirements during the project period are presented in Appendix 5.15. The performance of SIGS should be continuously reviewed in the course of the formulation of the AWP and promising activities, if any, are to be accommodated in the AWP.

(5) OWP for SIGS

The OWP of SIGS by subproject and by project upazila has been formulated in a similar manner as with the APSS overall plan, and based on the following: i) the size of subproject benefited area by project upazila, ii) basis applied for the estimation of program requirements (Appendix 5.15), iii) the results of upazila inventory (Appendix 5.16), and iv) the results of the preliminary needs assessment questionnaire survey of the major project upazilas (Appendix 5.17). The OWP has been formulated for a period of five years, from 2017/18 to 2021/22.

The OWP by subproject and by project upazila are presented in Tables 5.3.6 and 5.3.7, respectively. A summary table of the same is as shown in Table 5.3.9.

Table 5.3.9 OWP for SIGS by District

Program	Program Volume (No.) by District 1/						Total	Target Upazila
	SG	HG	NT	KS	BR	Others		
1. Floating Bed Vegetable Culture Scheme	0	8	16	26	0	0	50	Non-HILIP upazila
2. Small-scale Vegetable Production Support Scheme	0	7	22	31	0	0	60	Non-HILIP upazila
3. Fruit Production Support Scheme	0	7	20	23	0	0	50	Non-HILIP upazila
4. Micro Poultry Raising Scheme	0	8	18	24	0	0	50	Non-HILIP upazila
5. Small-scale Mushroom Culture Scheme	0	6	14	20	0	0	40	Non-HILIP upazila
Total	0	36	90	124	0	0	250	

1/: SG - Sunamganj, HG - Habigannj, NT - Netrakona, KS - Kishoreganj, BR - Brahmanbaria
Source: Prepared by JICA Study Team

The number of beneficiary farmers of SIGS is about 6,000, as shown in Table 5.3.10.

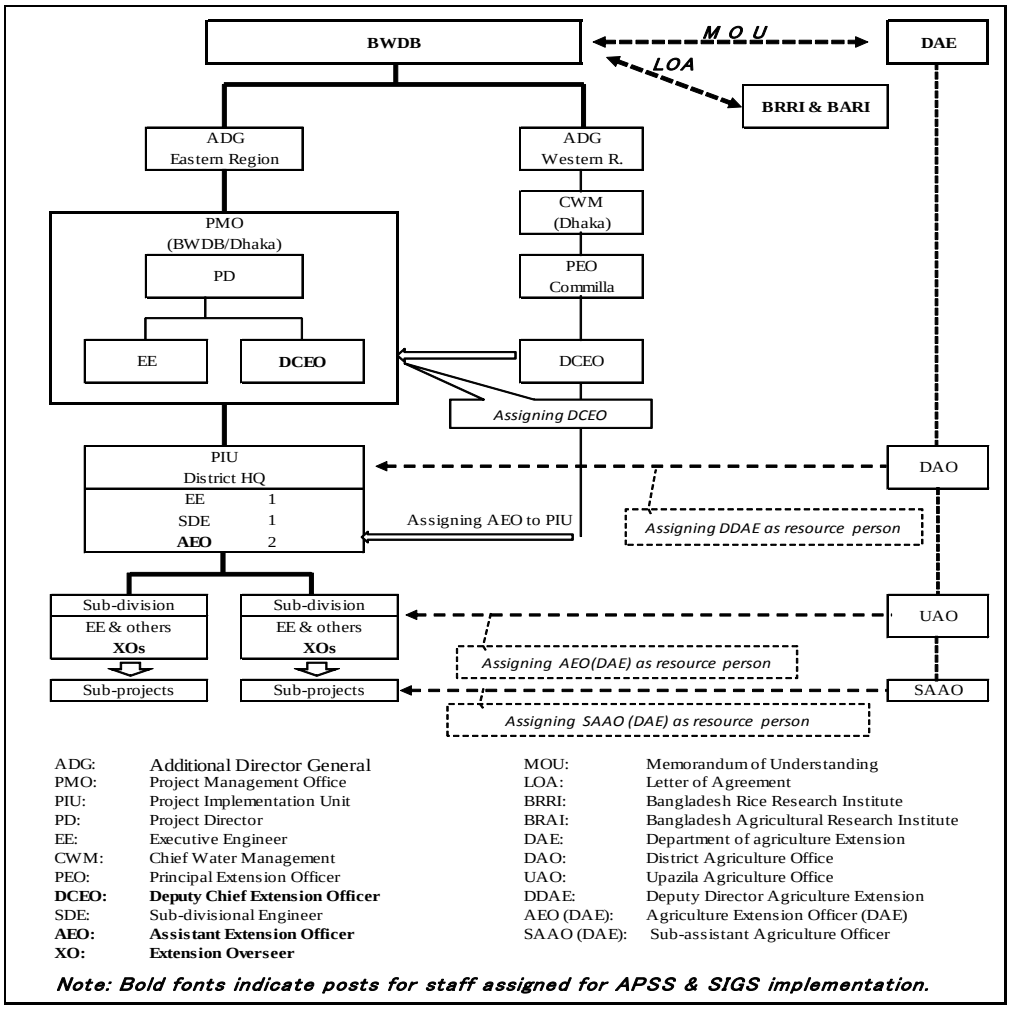
Table 5.3.10 Beneficiary Households of SIGS by District

Program	No. of Beneficiary Farmers by District 1/						Total	Target Upazila
	SG	HG	NT	KS	BR	Others		
1. Floating Bed Vegetable Culture Scheme	0	192	384	624	0	0	1,200	Non-HILIP upazila
2. Small-scale Vegetable Production Support Scheme	0	168	528	744	0	0	1,440	Non-HILIP upazila
3. Fruit Production Support Scheme	0	168	480	552	0	0	1,200	Non-HILIP upazila
4. Micro Poultry Raising Scheme	0	192	432	576	0	0	1,200	Non-HILIP upazila
5. Small-scale Mushroom Culture Scheme	0	144	336	480	0	0	960	Non-HILIP upazila
Total	0	864	2,160	2,976	0	0	6,000	

1/: SG - Sunamganj, HG - Habigannj, NT - Netrakona, KS - Kishoreganj, BR - Brahmanbaria
Source: Prepared by JICA Study Team

5.3.3 Implementation Arrangements of APSS and SIGS (Component 3-1: Agriculture)

The major institutions involved in the implementation of APSS and SIGS (Component 3-1: Agriculture) include the following: BWDB's project organizations established for project implementation, project management office (PMO), project implementation unit (PIU), and subdivision offices of BWDB. For the project, five PIUs (one for each project district) are established. The major supporting institutions for the implementation of APSS and SIGS are five DAOs and UAOs, which cover the subproject areas. The DAOs and UAOs shall support the implementation of APSS and SIGS of the project organizations by assigning their staff under MOU between BWDB and DAE. BRRI and BARI are involved in the implementation of the Technology Development Program under a letter of agreement (LOA) with BWDB. In addition, NGOs will be involved in the implementation by assigning facilitators for formation, guidance and empowerment of farmer organizations under APSS and SIGS. The draft organizational setup for APSS and SIGS implementation is illustrated in Figure 5.3.1.



Source: Prepared by the JICA Survey Team in consultation with BWDB.

Figure 5.3.1 Organizational Setup for APSS and SIGS Implementation (draft)

The tentative division of roles of the project organizations, DAO/UAO (DAE), consultants for Component 3-1, and other institutions involved in the implementation (research institutes, NGOs and others) are presented in Appendix 5.18.

CHAPTER 6 FISHERIES DEVELOPMENT PROMOTION

6.1 Present Condition of Fisheries Sector

Fishery is a substantial livelihood component in the haor area together with agriculture. Therefore, the promotion of fishery is a crucial component of the project to in relieving or alleviating the haor area from the vicious cycle of poverty and disasters. Several fishery-promoting interventions are proposed in the subproject areas to be protected by the works through flood management (Component 1).

6.1.1 Fish Production and Water Area of Bangladesh

(1) Importance of Fisheries to the Economy

The importance of fisheries to the economy is quite significant in Bangladesh. According to the 2010 annual report of the Department of Fisheries (DoF), around two million people are directly or indirectly dependent on fisheries. Of these, 1.2 million people are engaged full time in fishery-related activities. Fish provides about 60% of the national protein, 6% of export earnings, and 5% of the national GDP. The per capita availability of fish is estimated to be 10.0-12.0 kg (i.e., 27 to 33 g/head/day)

(2) Fish Production of Bangladesh

Bangladesh is blessed with rich and extensive resources in both inland and marine fisheries. Inland fisheries cover some 4.7 million ha, of which about 85% (or 4.0 million ha) comprise capture fisheries, while the remaining 15% (0.69 million ha) is associated with closed inland water culture (refer to Table 6.1.1). The culture fisheries include ponds (371,309 ha), ox-bow lakes or baors (24,435 ha), and coastal shrimp farms (276,492 ha). While the floodplains and beels covering about 3.0 million ha offer vast scope for fish production; the scope for marine fishing is rather limited as the country has only 460 km of coastline and covers an area of about 46,365 sq. nautical miles.

Table 6.1.1 Fish Production and Water Area of Bangladesh (FY2006/2007 to FY2011/2012)

(Unit: mt)

Source	2006/07	FY2007/08	FY2008/09	FY2009/10	FY2010/11	FY2011/12	Share	Water Area (ha)
A. Inland Fisheries	**1,952,573**	**2,065,723**	**2,186,726**	**2,381,916**	**2,515,354**	**2,683,162**	**82%**	**4,699,345**
(1) Capture	**1,006,761**	**1,060,181**	**1,123,925**	**1,029,937**	**1,054,585**	**957,095**	**29%**	**3,925,290**
Rivers and Estuaries	136,958	136,812	138,160	141,148	144,566	145,613		853,863
Sundarbans	17,751	18,151	18,462	20,437	22,451	21,610		177,700
Beels and Haors	75,137	77,524	79,200	79,209	81,564	85,208		114,161
Kaptai Lake	8,085	8,248	8,590	7,336	8,980	8,537		68,800
Floodplains	768,830	819,446	879,513	781,807	797,024	696,127		2,710,766
(2) Culture	**945,812**	**1,005,542**	**1,062,801**	**1,351,979**	**1,460,769**	**1,726,067**	**53%**	**774,055**
Ponds	811,954	866,049	912,178	1,140,484	1,219,736	1,342,282		371,309
Floodplains*	-	-	-	46,902	51,230	182,293		122,026
Baors (Ox-bow lake)	4,698	4,778	5,038	8,727	4,864	5,186		5,488
Shrimp/Prawn Farms	129,160	134,715	145,585	155,866	184,939	196,306		275,232
B. Marine Fisheries	**487,438**	**497,573**	**514,644**	**517,282**	**546,333**	**578,620**	**18%**	
Industrial	35,391	34,159	35,429	34,182	41,665	73,386		
Artisanal	452,047	463,414	479,215	483,100	504,668	505,234		
TOTAL	**2,440,011**	**2,563,296**	**2,701,370**	**2,899,198**	**3,061,687**	**3,261,782**	**100%**	

Remarks: * Refers to seasonal cultured water bodies
Source: Fisheries Statistical Yearbook of Bangladesh 2011-2012, DOF, MoFL

As shown in Table 6.1.1, the total fish production was around 3.3 million mt in FY2011/2012, which has increased from around 2.4 million mt in FY2006/2007. The shares of capture fisheries, culture fisheries, and marine fisheries in FY2011/2012 were 29%, 53%, and 18%, respectively.

The inland fisheries alone contributed around 82% (2.7 million mt), which consists of capture fisheries from open waters of about 957,095 mt (29%) and culture fisheries of about 1.7 million mt (53%).

Inland fish culture production from ponds showed an increasing trend from 811,954 mt (FY2006/07) to 1.3 million mt (FY2011/12). This has been attributed to fish farmers (aquaculturists) having access to extension support and training.

The inland capture fisheries, both in terms of their ecological conditions and biological productivity, have reached 1.05 million mt (FY2010/11), compared to the low production of 424,000 mt in FY1989/90. The production from inland water capture fishing has recovered somewhat largely through the intervention of DoF with the assistance of donors such as WB, IFAD, and DANIDA, and has achieved improvement in terms of production technology and management systems and programmes of open water stocking. The productions of the inland capture fisheries still remains below its potential.

6.1.2 Fisheries in the Study Area

(1) Study Area

The haor areas or the target areas are considered the largest flooding basin in the country comprising of 373 haors/wetlands according to the Haor Master Plan (HMP) in April 2012. During the monsoon season, about 90% of the study area of 1.77 million ha, is inundated and about 48% of the water flooded areas are in the floodplain, having huge fisheries resources, at an average depth of about 5 m having huge fisheries resources. During the wet season, the inundation removes the rigid boundaries of private lands, and the fisheries resources in the floodplain become a common property. People have a free access to the fisheries resources in the open water.

(2) Major Haors in the Study Area

Haor basins have a unique ecosystem that comprises a diversified wetland of complex hydrological, biological, and ecological systems, and supports a significant assemblage of rare and vulnerable species including endemic fishes and prawns. However, haor basins are not clearly delineated. During the high flood season (June-October), all haors are covered with 3-6 m of water, thus forming a huge single inland ocean. When the water recedes, various haor basins can be roughly recognized. During the dry season (December-March), a number of small and large depressions or beels contain water. Among the 373 haors in the study area, a significant number of haors have high potential for fisheries production. The most important haors with fish biodiversity and fish production in the study area are shown below (in Table 6.1.2).

Table 6.1.2 Most Important Fish Producing Haors

Major Haors	District	Area (km^2)
Hakaluki	Maulvibazar	204
Hail	Maulvibazar	244
Tanguar	Sunamganj	130
Dekker	Sunamganj	466
Matian	Sunamganj	63.8
Sonamoral	Sunamganj	37.3
Gurmar	Sunamganj	53.6
Khaliajuri	Netrokona	975
Companiganj	Sylhet	506
Humaipur	Kishoreganj	62.6

Source: Compiled from HMP, April 2012

(3) Fish Habitats

The estimated fish habitat area in the study area is nearly 966,846 ha, where capture fish habitats contribute about 96% while the rest (4%) is shared by cultured habitat (refer to Table 6.1.3).

1) Capture - Open Water Habitats

The open water fish habitats in the study area are represented by (i) river stream, most of which retain water perennially, and is a suitable habitat for river breeders and larger fish species particularly during the dry season in its deep pools or locally called duars; (ii) channel/khal, which connects rivers and beels, and mostly seasonal in nature; it also has functions in lateral migrations of river and beel breeders; (iii) beels/haors, which are seasonal and perennial in nature (where perennial ones are considered as the last resort of the brood stock), and possess huge potential in recruitment particularly the beel-resident indigenous fish species; (iv) floodplains, which are seasonal in nature, with great functions in fish population dynamics and production; and (v) ditches or borrow pits, characterized by the seasonal inundation, that have functions in fish propagation.

2) Culture – Closed Water Habitats (Ponds)

Culture fisheries include single closed water habitat, which is considered as fishpond. Fishponds that have already been brought under the improved extensive fish culture practice are considered as culture fish habitats. Ponds in Bangladesh are categorized into three types according to their aquaculture activity, namely: (1) cultured, or those using fish culture technology; (2) culturable, or those in need of limited infrastructure development; and (3) derelict, or those in need of substantial investment.

Table 6.1.3 Habitats of Capture and Culture Fisheries in the Study Area

Habitats		Area	
		Ha	Share
Capture – open water bodies	Floodplains	813,263	84.1%
	River streams	51,872	4.3%
	Beels	48,360	5.0%
	Channel/Khals	26,448	2.7%
	Ditch/b Borrow pits	2,524	0.3%
Culture – Closed waters	Fish ponds	34,379	3.6%
Total		966,846	100%

Source: Compiled based on FRSS 2008-09, UFOs 2010-11, and CEGIS Database as cited in HMP, April 2012

(4) Seasonal Phases of the Fish Habitats

There are four seasons for inland open waters as a result of the annual flood cycles that have a profound effect on ecology, biology and behaviour of the fishes including factors such as movement/migration, growth, breeding, feeding, etc. (refer Appendix 6.1). In other words, the annual flood pattern provides different habitats for different species of fish and prawn in the study area. The four seasonal phases are as follows.

1) Dry season (December to March): During this period, water remains only in perennial rivers, canals, and beels where fishes and prawns congregate to live through the dry winter season. Juveniles grow into adults, mature, and their gonads begin to ripen.
2) Pre-monsoon season (April to early June): During this period, the water level in rivers rises as a result of surface runoff from the upper reaches and local rainfalls. Fishes move from deep waters to shallow water in search for their spawning grounds. Fishes adapted to breeding in flowing water migrate from deep beels into shallow areas of rivers. Those living in deep portions of rivers move to shallow portions and then undertake upstream migration to reach their breeding grounds and spawn. This upstream migration can be over long distances as in the case of major carps. For fishes and prawns breeding in floodplains, their breeding migrations are usually over short distances.
3) Monsoon/flood season (June to September): During this period, larvae and fry of river-breeding fishes disperse to floodplains for feeding and growing. They are passively swept towards floodplains usually by currents overflowing the riverbanks and/or through khals. The larvae and fry remain in the floodplains for feeding. Also, fry and juveniles of estuarine prawns use floodplains as their nursery grounds until such time when floodwater starts receding in October. During these months, these fishes and prawns in the floodplains are vulnerable to high natural and fishing mortality.
4) Post-monsoon season (October to December): Floodwater in the floodplains starts receding during this period. Water at shallow areas starts to recede and eventually channel at the end of the season. As the water surface area shrinks, fishes and prawns move with the water flow into the deep-water areas in canals and rivers. Some also swim towards deep beels and ponds (or ditches) dug on floodplains by landowners. At the end of the season, fishes and prawns densely aggregate in deep-water areas, sometimes beyond the carrying capacity of water areas, leading to the occurrence of fish kill.

(5) Fish Species Composition, Fish Productivity and Production

1) Fish group composition

The haor basin in the study area is the largest flooding basin (depression), which is composed of 373 haors that are rich in freshwater fish and prawn biodiversity, and is often recognized as the “fish mine” of Bangladesh.

Out of the total 260 species of freshwater fish known to inhabit Bangladesh, some 143 native and 12 exotic fin fish species along with giant freshwater prawn and other several prawn species are known to inhabit the water bodies,. Table 6.1.4 shows an indicative list of fish species found in the haor basin.

Table 6.1.4 Indicative Fish Species Group in the Study Area

Groups	Local Name	Scientific Name
Major carps	Rui	*Labeo rohita*
	Catla	*Catla catla*
	Mrigel	*Cirrhinus cirrhosus*
	Kalibaus	*L. calbasu*
Large catfish	Boal	*Wallago attu*
	Guizza ayre	*Sperata seenghala*
	Ayre	*Sperata aor*
	Rita	*Rita rita*
	Baghayre	*Bagarius yarelli*
	Pangas	*Pangasius pangasius*
Minor carps (most common)	Gonia	*L. gonius*
	Lasu	*Cirrhinus reba*
	Nanid	*L. nandina*
	Angrot	*L. angra*
Small catfish (mostly commercially important)	Magur	*Clarias batrachus*
	Singi	*Heteropneustes fossilis*
	Kani pabda	*Ompok bimaculatus*
	Madhu pabda	*Ompok pabda*
	Bacha	*Eutropiichthys vacha*
	Gharua	*Clupisoma garua*
	Tengra	*Mystus tengara*
	Golsa	*Mystus cavasius*
	Others	
Herring (highly valued)	Ilish	*Tenualosa ilisha*
Snakeheads	Shol	*Channa striatus*
	Gazar	*C. marulius*
	Tila shol	*C. barca*
	Taki	*C. punctatus*
	Cheng	*C. orientalis*
Knife fishes	Chital	*Notopterus chitala*
	Foli	*N. notopterus*
Stingray (Gangetic)	Shakush	*Himantura fluviatilis*
Needle fishes	Kaikka	*Xenentodon cutcutia*
Minnows, Rasboras and Barbs	Punti	*Puntius spp.*
	Chela	*Salmostoma bacaila*
	Mola	*Amblypharyngodon mola*
	Jaya	*Apspidoparia jaya*
	Shar punti	*Puntius sarana*
Loaches	Rani	*Botia dario*
	Gutum	*Lepidocephalus guntea*
Anchovies and Sardines	Phasa	*Setipinna phasa*
	Kachki	*Corica soborna*
	Goni chapila	*Gonialosa manminna*
	Chapila	*Gudusia chapra*
Spiny eels	Baim	*Mastacembelus aculeatus*
Climbing perch	Koi	*Anabas testudineus*
	Kholisa	*Colisa fasciatus*
Mud perch	Bheda	*Anabas anabas*
Glass fishes	Chanda	*Chanda spp.*
Prawns	Golda chingri	*Macrobrachium rosenbergii*
	Gura chingri	*Leander styliferus*
Exotic introductions (Five carps, two cichlids and one barb)	Silver carp	*Hypophthalmichthys molitrix*
	Mirror carp	*Cyprinus carpio var. specularis*
	Grass carp	*Ctenopharyngodon idella*
	Big head	*Hypophthalmichthys nobilis*
	Black carp	*Mylopharyngodon piceus*
	Thai barb	*Barbodes gonionotus*
	Tilapia	*Oreochromis mossambicus*
	Nilotica	*Oreochromis niloticus*

Cyprinids and catfish dominate the ichthyofauna in the haor area. Based on weight percentage (FRSS 2008-09), the dominant species or group composition of fish for the seven haor districts is inland fish (59%, mostly small cyprinids and catfish), flanked by live fish (11%), snakeheads (10%), small prawns (10%), carps (8%), large catfish (2%), and exotic carps (1%), as shown in Table 6.1.5. Major carps and large catfish are the most commercially valuable, although live fish (such as koi, singi, and magur) are also important. Others include miscellaneous species that are of the highest importance for subsistence.

Table 6.1.5 Fish Groups of the Floodplains and Beels in the Study Area

(Unit: %)

Species Group	Floodplain	Beels
Major carps	8	35
Other carps	-	7
Exotic carps	1	10
Catfish	2	10
Snakehead	10	4
Small prawns	10	5
Live fish	11	-
Others	59	29
Total	100	100

Source: Compiled from HMP, April 2012

On the other hand, beel fish species are dominated by major carps including rui, catla, mrigal and kalibaus, which carry about 35% followed by the others such as small indigenous fish species (SIS) (26%), exotic carps (10 %), and catfish (10%), as presented in Table 6.1.5.

Fish species composition of the pond aquaculture is dominated by rui (24%), followed by silver carp (20%), catla (17%), mrigal (15.6%), Thai pangas (6%), tilapia (4%), and others (9%) as shown in Table 6.1.6.

Table 6.1.6 Fish Species found in Fish Ponds in the Study Area

(Unit: %)

Species	Share
Rui	24
Silver carps	20
Catla	17
Mrigal	16
Thai Pangas	6
Tilapia	4
Common carp	3
Grass carp	2
Others	9
Total	100

Source: Compiled from HMP, April 2012

2) Fish Productivity

Net fish productivity or catch per unit area (CPUA) of different open water habitats in the study area is significantly higher than that of other aquatic systems in Bangladesh. The

HMP cites that the FY2010/11 data analysis (from upazila fisheries offices or UFOs, and FRSS of FY2008-09) reveals that the annual average riverine fish yield rate (267 kg/ha) of the seven districts of the haor basin is quite higher than that of the national average (162 kg/ha). Accordingly, the annual average fish yield rate in the floodplains (305 kg/ha) is quite lower than that of the national average (310 kg/ha), while the annual average yield rate in beels (1,025 kg/ha) is higher than that of the national average (694 kg/ha). The annual average fish yield rate in ditches/borrow pits is 1,476 kg/ha, which is quite lower than that of the national average yield (1,510 kg/ha). The annual average production rate in fishpond aquaculture (3,304 kg/ha) is slightly higher than that of the national average (3,141 kg/ha). Table 6.1.7 shows the comparison between the fish yields of each individual fish habitat in the study area and the national average.

Table 6.1.7 Fish Yields of Different Fish Habitats in the Study Area

(Unit: kg/ha)

Fish Habitats	Study Area	National
River streams	267	162
Beels	1,025	694
Floodplains	305	310
Ditches/borrow pits	1,476	1,510
Channels/Khals	223	-
Fish ponds	3,308	3,141

Source: Compiled from HMP, April 2012

The production rate of fishponds is almost close to that in many parts of the country. Production of the culture fishery in the study area has relatively more potential due to water availability in ponds, as water is retained for 43-45 weeks a year. Hence, fish farmers produce culture fish in two cycles in many parts of the planning area, particularly in Kishoreganj, Netrokona, and Brahmanbaria districts.

3) Fish Production

The inland fish production in the study area was 432,409 mt in FY2010/2011 according to the UFOs data (refer Table 6.1.8), with 74% (318,666 mt) coming from inland capture fisheries, mainly from floodplains (248,293 mt) and beels (49,589 mt). The production from the culture fisheries was 26% (113,743 mt), which is mainly from ponds.

Overall, the fish production in the study area accounts for 2.7 million mt (16%) of the national inland fish production, as shown in Table 6.1.9. However, it should be noted that the contribution of the study area is quite significant in terms of open water capture fisheries, whereby the beels contributed 58% (49,589 mt) to its respective national total (85,208 mt), while the floodplains contributed 36% (248,293 mt) to its respective national total (696,127 mt).

Table 6.1.8 Fish Production in the Study Area (FY2010/11)

(Unit: mt)

Habitats	Study Area District								
	Kishore ganj	Netro kona	Brahman baria	Habi ganj	Sunam ganj	Maulvi bazar	Sylhet	Total	Share
Capture fisheries								**318,666**	**74%**
River stream	3,463	1,297	2,499	270	1,619	976	1,041	11,165	3%
Floodplain	41,145	40,696	22,973	22,268	61,251	17,378	42,582	248,293	57%
Beels	6,953	8,346	369	2,383	23,837	3,141	4,560	49,589	11%
Channel/Khal	614	1,070	405	470	1,442	883	1,009	5,893	1%
Ditch/Borrow pits	25	526	204	251	1,205	432	1,083	3,726	1%
Culture fisheries									
Fish ponds	17,633	21,193	28,520	9,223	12,031	11,341	13,802	113,743	26%
Total	**69,833**	**73,128**	**54,970**	**34,865**	**101,385**	**34,151**	**64,077**	**432,409**	**100%**
Share	16%	17%	13%	8%	23%	8%	15%	100%	

Source: Complied based on FRSS 2008/09, UFOs 2010/11 and CEGIS Database as cited in HMP, April 2012.

Table 6.1.9 Share of Fish Production of Study Area to National Inland Fish Production

Fish Habitats	National (FY2011/12)	Study Area (share to national) (FY2010/11)
Capture fisheries		
- Floodplain	696,127 mt	248,293 mt (36%)
- Beels	85,208 mt	49,589 mt (58%)
- Rivers	145,613 mt	11,165 mt (8%)
- Others	30,147 mt	9,619 mt (32%)
Sub-total	957,095 mt	318,666 mt (33%)
Culture fisheries		
- Ponds	1,342,282 mt	113,743 mt (8%)
- Semi-closed	182,293 mt	-
- Others*	201,492 mt	-
Sub-total	1,726,067 mt	113,743 mt (7%)
Total	2,683,162 mt	432,409 mt (16%)

Source: National figures compiled from Fisheries Statistical Yearbook of Bangladesh 2011-2012, DOF, MoFL, and figures for the study area compiled from FRSS 2008-09, UFOs 2010-11.

Remarks: * indicates others, i.e., production of marine shrimp/prawn culture production and Baor (Ox-bow lakes)

(6) Jalmohal or Public Water Bodies

The government owns public water bodies or Khas; when it is leased out for revenue, it is then termed as "*jalmohal*." Therefore, the GOB, through the Ministry of Land (MoL) has formulated the Jalmohal Management Policy, 2009. The policy grants privileges for the genuine fishermen community in leasing the khas or jalmohal for fisheries management in order to conserve fisheries resources and in turn to increase fish production and biodiversity. Jalmohals are divided basically in two types based on area (individual areas of less than 20 acres and more than 20 acres) for management aspects. The number and area of jalmohals in the study area as compiled from the MoL website are shown in Table 6.1.10.

Table 6.1.10 Number and Area of Jalmohals in the Study Area

Districts	Number of Jalmohals			Area of Jalmohals (acre)		
	< 20 acres	> 20 acres	Total	< 20 acres	> 20 acres	Total
Kishoreganj	151	179	330	1,145	31,782	32,928
Netrokona	343	161	504	1,709	12,408	14,117
Brahmanbaria	653	178	831	718	62,484	63,202
Habiganj	438	194	632	2,753	11,861	14,614
Sunamganj	674	418	1,092	5,052	42,590	47,642
Maulvibazar	398	136	534	1,621	17,430	19,052
Sylhet	418	176	594	2,570	19,959	22,529
Total	3,075	1,442	4,517	15,569	198,515	214,083

Source: Compiled from MoL website

The process for leasing is based on memoranda of understanding (MoUs). Jalmohals are handed over to the Ministry of Fisheries and Livestock (MoFL), LGED, or Ministry of Environment and Forests (MoEF) and will be managed in the planned projects. The concerned ministry or department will then arrange the necessary steps and measures so that genuine fishers or fishers' cooperatives can duly participate in managing the jalmohals. Different procedures are followed in the leasing of jalmohals based on the area of water bodies, and are classified in three broad categories as shown in Table 6.1.11.

Table 6.1.11 Categories of Leasing Procedures

Type of Water Bodies	Responsible Authority for Regulation and Leasing
Below 3 acres	Union Parishad (UP) Chairman – head of the local union council
Between 3 acres and 20 acres	Upazila Nirbahi Officer (UNO)
Above 20 acres	Deputy Commissioner (DC) oversees jalmohals above 20 acres

There are three types of fishing tenure rights in open water fishing water bodies including the jalmohals, as delineated defined in Table 6.1.12.

Table 6.1.12 Types of Fishing Tenure or Rights

Fishing system	Description	Remarks
1. Open Water Monsoon Fishing	- Open access system, becomes floodplain when completely flooded - All fishermen and a large proportion of households (for commercial and subsistence)	- Fish catch is usually low during this period - Earned income is low (about BDT 100/day)
2. Jalmohal Lease Fishery	- Restricted system, applies to medium to large beels during dry season - Restricted for fishing; lease holders (LHs) enforce their rights	- LHs are usually influential persons - LH exploit the resources for themselves - LH sub-contract to professional fishermen for a contract value.
3. Community Jalmohal Fishery	- Restricted system, applies to small beels for subsistence fishing	

(7) Post Harvest Processing and Fish Marketing

1) Post Harvest Processing

It is reported that around 90% of the fish production in the haor area is utilized in fresh or live forms (although in more remote beels, a large proportion of the catch may be processed). The main products are sun-dried and semi-fermented fish. Smoking or salting is apparently not practiced.

Fresh fish is normally sold in un-gutted form. Limited use of ice is made to preserve fish destined for local markets but all fresh fish (except live fish) destined for distant markets is preserved in ice.

Sun-dried fish is the common form of processed fish product. Women mainly do sun drying. Sun-dried fish is one of the main sources of protein for most land-less and economically marginal people. Sun drying is used for large catches of small fish harvested from beels. Fish are also sun-dried and stored for future sale when traders and fishermen cannot agree on the price of the fresh product.

Some catches such as large prawns, major carps, large catfish, and some small fish that are destined for export undergo high quality processing in factories in the study area.

Among these factories are Ajmiriganj Fish Industries Ltd., Kuliarchar Cold Storage Ltd., Saidowla Private Enterprise Ltd. in Sunamganj, and the fish receiving facility in Dabor owned by the Bangladesh Fisheries Development Corporation (BFDC) (currently not functioning).

2) Fish Marketing

Fish marketing is relatively well organized in the region, as elsewhere in Bangladesh. The three levels of traders are as follows:

- *Nikari*, who are under the Muslim/Hindu caste of small-scale fish traders (wholesale and retail);
- *Aratdars*, who are large-scale, well capitalized wholesale fish traders; and
- *Paiker*, who are small-scale urban fish retailers.

Figure 6.1.1 shows the flow diagram of the fish marketing chain from producers to retail fish markets in the hoar area.

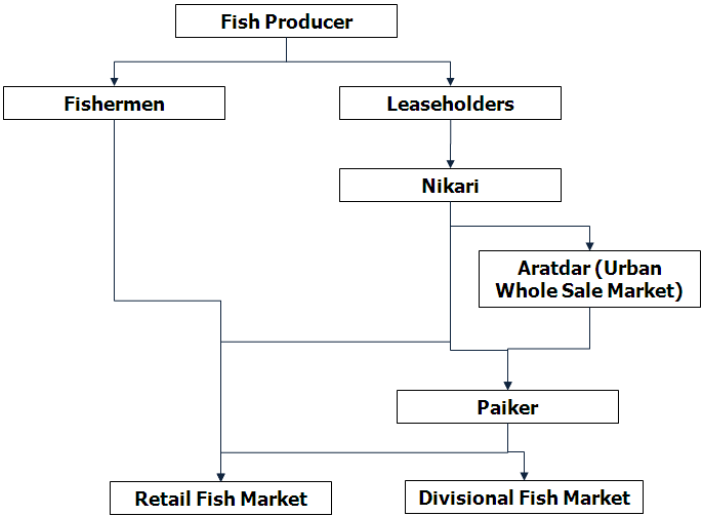


Figure 6.1.1 Organogram of Fish Marketing in the Haor Area

In general, the *nikari* are active in directly buying fish from fishermen. Typically, they go to a *khola* (fishing camp) or *ghat* (fish landing or assembly place) and buy fish from fishermen or jalmohal leaseholders, either by auction or by bargain. Sometimes, the competition between *nikari* is so intense that they wait in boats near the fishing grounds and buy catches almost as soon as the fish have been netted from the water (or floating fish markets). If a *nikar*i has purchased fish from his own capital, or has borrowed capital without a sale contract, he has two main options, namely: (i) transport the fish to a local retail market (maach bazar) and sell it himself, or (ii) transport the fish to a local wholesale market (or *arat*) and sell to an *aratdar* or a *paiker*.

Large consignments of high-value fish destined for Dhaka and other divisional towns may pass through a series of traders before reaching the consumer, with most of the finance put up by large fish wholesalers in Dhaka working in cooperation with district wholesalers and jalmohal leaseholders. Fish are transported to Dhaka either by road or rail.

On certain occasions, fishermen may take their catch themselves to wholesale or retail markets in order to get a better price. It seems a substantial proportion (possibly as much as 25%) finds its way to the neighbouring country. As shown in Table 6.1.13, the study area has 620 wholesale fish depots, and 1,237 fish markets (673 daily fish markets and 564 weekly fish markets). The most important commercial wholesale fish markets in the study area are located in Kazibazar, Kuliarchar, Amimirganj, Purbadhala, and Mohanganj upazilas.

Table 6.1.13 Number of Wholesale Fish Depots and Fish Markets

District	Wholesale Fish Depot	Retail Fish Markets	
		Daily	Weekly
Sunamganj	23	76	88
Kishoreganj	282	160	161
Netrokona	145	91	62
Habiganj	38	99	51
Brahmanbaria	49	106	77
Maulvibazar	33	38	42
Sylhet	50	103	83
Total	620	673	564

Source: Upazila Fisheries Office, FY2010/11 (as reported in HMP)

6.1.3 Fisheries Support Facilities

(1) Fish Landing Centers

Fish landing centers are very important for landing and marketing of harvested fish to the different fish markets of the country. According to UFOs (2011), there are about 87 fish landing centers (as enumerated in Table 6.1.14) that are distributed over the study area. Generally, ice, which is produced by nearby ice plants, is used to preserve the fish at the landing centres.

The landing centers are supposed to be regulated by BFDC, but due to the shortage of manpower, DoF also takes care of the centers.

Major fish landing centers in the planning area are located at Joykalash (Sunamganj), Azmiriganj, Mohanganj, Netrokona, and Kishoreganj districts. HMP has identified the problems such as poor infrastructure, lack of proper monitoring system and sanitation, inadequate drainage system, and dirty and unhygienic environment.

Table 6.1.14 Number of Fish Landing Centers and Ice Plants in the Study Area

District	Fish Landing Center	Ice Plants
Sunamganj	14	37
Kishoreganj	20	115
Netrokona	13	41
Habiganj	2	44
Brahmanbaria	2	39
Maulvibazar	33	21
Sylhet	3	29
Total	87	326

Source: Upazila Fisheries Office, FY2010/11 (as reported in HMP)

(2) Ice Plants

A large number of ice plants exist in the study area (as enumerated in Table 6.1.14 above) for temporarily preserving fish. According to UFOs, there are around 326 ice plants in the haor area and the distribution of plants are as follows: Kishoreganj has 115 ice plants, followed by Habiganj with 44, Netrokona with 41, Brahmanbaria with 39, Sunamganj with 37, Sylhet with 29, and Moulvibazar with 21. Most ice plants are located near the landing centers, retail markets, and wholesale markets. According to HMP, the UFOs reported that ice plants in different upazilas are still insufficient in meeting the demand for ice during the peak season (January to March).

(3) Fish Hatchery and Nursery

There are three government-owned fish hatcheries and 37 privately-owned hatcheries in the study area (refer Table 6.1.15). The government-operated hatcheries are located in the districts of Sunamganj (Shantiganj), Kishoreganj (Katiadi) and Nabiganj (Kursi). Many nurseries and fish farming communities in the area are dependent on the hatchlings or spawns from these two sources. The commonly cultivated six species, namely, rui (*Labeo rohita*), catla (*Catla catla*), marigal (*Cirrhinus mrigala*), silver carp (*Hypothalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*) and common carp (*Cyprinus carpio*), are considered to be the best culturable species of fish in the inland water system. These fish species originally belong to riverine environment and are then cultured in standing water such as ponds and tanks; they attain maturity but normally do not breed under confined conditions. They have to undergo artificial induced breeding by stimulating their endocrine system.

Another six species namely mono-sex tilapia (*Tilapia nilotica*), Thai pangus (*Pangasius sutchi*), Thai sharpunti (*Puntius gonionotus*), mirror carp (*Cyprinus carpio specularis)*, bighead carp (*Hypophthalmicthys nobilis*), and bata (*Cirrhinous reba*) can be bred in ponds without the need for hatcheries.

Table 6.1.15 Number and Production of Fish Hatcheries in the Study Area

District	Number		Production (t)	
	Government-owned	Privately-owned	Government-owned	Privately-owned
Sunamganj	1	3	-	0.440
Kishoreganj	1	10	-	2,013.249
Netrokona	-	2	-	0.085
Sylhet	-	1	0.066	0.002
Habiganj	1	6	0.092	1.930
Maulvibazar	-	6	1.343	2.094
Brahmanbaria	-	9	0.015	2.027
Subtotal	3	37	1.500	2,020
Total	40		2,022	

Note: About 1 kg of spawn (hatchling) contains about 400,000 spawns.
Source: Upazila Fisheries Office, 2011 (as reported in HMP)

As indicated in Table 6.1.16, there are 2,315 nurseries in the study area where majority are private-owned nurseries at 2,295, while the remaining 20 are owned by the government.

Table 6.1.16 Number of Fish Nurseries in the Study Area

District	Number	
	Government-owned	Privately-owned
Sunamganj	1	104
Kishoreganj	10	214
Netrokona	1	90
Sylhet	7	290
Habiganj	1	207
Maulvibazar	-	1,053
Brahmanbaria	-	337
Subtotal	20	2,295
Total	2,315	

Source: Upazila Fisheries Office, 2011 (as reported in HMP)

6.1.4 Fisheries Support Services

Several institutions provide fisheries support services, and the main ones are DoF, district fisheries office (DFO), UFO, and the Bangladesh Fisheries Research Institute (BFRI).

(1) Extension: Department of Fisheries (DoF)

The DoF focuses its work on pond, open water, marine, and brackish water fisheries. Fisheries extension is under the mandate of DoF. The focus is on upazila and unions, where the DoF staffs perform all fishery-related activities including aquaculture, extension, training, conservation, and enforcement. DoF is headed by the director general (DG), and has about 3,800 staff both in Dhaka and in the field.

DoF has launched its extension and institutional strengthening components for both carp and shrimp cultures in several development projects in the past. DoF also adopts different approaches and strategies under different projects. DoF also engages with NGOs in extension and common management activities under some of its projects.

- Demonstration: Under revenue budget, fish seed farms are operating for fish seed supply, training, and demonstration that are, operated by farm managers (permanent posts) of the DoF farms. Development projects have also demonstration farms that are implemented through Upazila Fisheries Officers.
- Fish Fry Release: Fish fry are being released in selected public water bodies from revenue budget and development programmes.
- Establishment of Fish Sanctuaries: Fish sanctuaries are being established in selected public water bodies both from revenue and development budget.
- LEAF program: In the Fourth Fisheries Project, the Local Extension Agents for Fisheries (LEAF) was initiated. Now, the National Agricultural Technology Project (NATP) is implementing the program. The agents are from localities that have fisheries input supply businesses or provide services with some remuneration and have direct supervision from UFOs of DoF. The agents are receiving fixed travel expenses from NATP.

The following are the main extension-related activities of DoF through its DFOs and UFOs:

- Provide technical knowhow to farmers through training and advice on aquaculture and management;

- Disseminate modern and improved technologies on aquaculture, fisheries management, hatchery operation, etc.;
- Render advisory services to provide credit on fisheries;
- Undertake surveys and investigation for fisheries resources;
- Implement development projects to support farmers and fishers;
- Restore fisheries habitat;
- Develop awareness on fisheries conservation;
- Improve marine and inland fisheries resource management and exploitation;
- Develop human resource through fisheries training institutions (fisheries diploma institutions) and fisheries training academy;
- Supply quality fish seed supply and develop brood fish for hatcheries;
- Organize associations and cooperatives for fisheries stakeholders; and
- Implement annual fisheries campaigns (such as Fish Week) and awareness building campaigns.

DoF also provides short-term training programmes on different aspects of fish culture and technology to field-level extension workers, fish farmers, and relevant staff engaged in various non-government and government organizations. DoF periodically conducts seminars, workshops, symposia, and conferences for the exchange of ideas among planners, academicians, and researchers of the country.

(2) District Fisheries Offices (DFOs) and Upazila Fisheries Offices (UFOs)

DoF has fisheries offices in all districts and upazilas in Bangladesh, but not at the union level. DoF focus its extension support in all upazilas and accordingly perform all fishery-related activities. The duties of DFOs and UFOs are summarized below.

1) District Fisheries Office

- Provide technical assistance for better fisheries management of the water bodies in the district.
- Support individuals, entrepreneurs, and organizations on project formulation and implementation in the fisheries sector.
- Collect, record, and supply information and statistics of fisheries of the district.
- Examine projects and technical feasibility studies of the fisheries projects submitted by upazila offices, and assist in implementation.
- Oversee the fisheries activities of the upazilas and provide necessary instructions and advice.
- Issue licenses to collect fish fry from natural sources.
- Identify problems and issues related to fisheries establishment programmes and take necessary measures for its mitigation.
- Execute the responsibilities and liabilities mentioned in the Development Project Proforma (DPP) of DoF.

2) Upazila Fisheries Office

- Provide training and advisory services to fish and shrimp farmers and entrepreneurs on advanced farming.
- Execute and operate community-based fisheries management in open water to enhance fisheries production and implement existing fisheries legislation to protect fisheries resources.
- Assist fish and shrimp farmers and entrepreneurs in technical feasibility studies for new fisheries enterprise, project formulation, and access to credit for fisheries development.
- Assist and cooperate with farmers and entrepreneurs in getting better quality fish and shrimp seeds and other aquatic farming inputs.
- Collect information and statistics on upazila fisheries resources and submit to higher authorities.
- Implement programmes under DoF's development projects.
- Ensure quality of fisheries, and conduct mitigation and awareness building on abuse of retracted chemical uses and biological contamination in fisheries products.
- Establish traceability and HACCP in value chain of fisheries.
- Inspect post-harvest and handling activities at fish landings and market chains, and conduct awareness building for their improvement.

The numbers of existing fisheries extension staff in DFOs and UFOs in the five project districts are summarized in Table 6.1.17. During the field survey, district fisheries officers pointed out that there is insufficient manpower at DFOs and UFOs to meet the demand of request from fishers and fish farmers.

Table 6.1.17 Number of Fisheries Extension Staff in the Project Districts

Project District	District Fisheries Office									Upazila Fisheries Office							
	DFO	AD	FM	SO	HO	FO	Position	Filled	Vacant	UFO	SUFO	EO (Dev)	AFO	FA	Position	Filled	Vacant
1. Sunamganj	1	1	1	1	1	1	6	4	2	9	2	0	11	11	33	19	14
2. Habiganj	1	1	1	1	1	1	6	5	1	5	3	0	8	9	25	15	10
3. Netrokona	1	1	2	1	0	0	5	5	0	8	2	0	10	11	31	24	7
4. Kishoreganj	1	1	1	1	1	0	5	3	2	6	7	4	11	17	45	34	11
5. Brahmanbaria	1	0	1	1	0	0	3	3	0	6	2	4	8	9	29	23	6
Total	5	4	6	5	3	2	25	20	5	34	16	8	48	57	163	115	48

Note 1: DFO = District Fisheries Officer; AD = Assistant Director; FM = Farm Manager; SO = Survey Officer; HO = Hatchery Officer; FO = Fisheries Officer; UFO = Upazila Fisheries Officer; SUFO = Sub-upazila Fisheries Officer; EO (Dev) = Extension Officer (Development); AFO = Assistant Fisheries Officer; and FA = Field Assistant.

Note 2: Provided figures are only the personnel directly involved with extension activities; supporting staff are not included.

(3) Fisheries Research - Bangladesh Fisheries Research Institute

Located in Mymensingh and under MoFL, BFRI is mandated to conduct and coordinate all research activities pertaining to fisheries development. BFRI's total manpower is 330 that include 90 professional staff members. BFRI operates four research centers as follows:

1) Freshwater Fisheries Research Centre at Mymensingh,
2) Riverine Fisheries Centre at Chandpur,
3) Brackish Water Research Centre at Paikagacha, Khulna, and
4) Marine Fisheries and Technology Centre at Cox's Bazar.

In addition to the four centres, there are two sub-stations: Reservoirs Fisheries Management at Rangamati and Floodplain Ecosystem Management at Santahar (Bogra). BFRI plans to establish two more fisheries research stations by 2015 with the financial assistance of the GOB. One of which is the Haor Fisheries Research Station located in Mulshatal Mouza in Bowlai Union, Kishoreganj Sadar Upazila, Kishoreganj District. Another is the Beel Fisheries Research Station located in Kushli Mouza in Kushli Union, Tungipara Upazila, Gopalganj District. The objectives of these two stations are as follows:

- For sustainable development and conservation of the haor and beel fisheries resources of Bangladesh, respectively;
- For carrying out demand-driven research for development of appropriate technologies for increasing production, diagnosis, and controlling fish diseases, while conserving haor and beel fisheries resources; and
- For creating modern training and demonstration facilities and provide training for dissemination of new aquaculture and inland open water fisheries management technologies to fishermen, farmers, and entrepreneurs.

(4) Fisheries Academy and Education

1) Fisheries Academy

There are five fisheries academies in Bangladesh that play substantial roles in the development of the fisheries sector. The locations and their roles are listed in Table 6.1.18.

Table 6.1.18 List of Fisheries Academies, Locations and Roles

Academy	Location	Roles
Marine Fisheries Academy	Chittagong, BFDC	Degree on Marine Fisheries including Navigation, Marine Engineering, Electrical Engineering, Refrigeration Engineering, Radio Engineering and Operation, Trawler Operation, Fish Processing and Boatmen Training.
Fisheries Training Academy	Savar, Dhaka	Provides administrative and technological training for DoF officials and NGOs workers.
Fisheries Extension and Training Center	Faridpur	Fish culture and fisheries management training for farmers and officers.
Fisheries Training Institute	Chandpur	In-service training on fish culture, management, and administration for fisheries officers; provides four-year course Diploma on Fishery.
Fish Hatchery and Training Centers	- Raipur and - Parbatipur (Dinajpur) - Kotchandpur (Jessore)	Fish culture and hatchery technology for farming and in-service training.
DFTCs	- Teknaf, Cox's Bazar - Kaliganj, Satkhira	Brackish water shrimp culture demonstration and training centre.

2) Fisheries Education

A number of public universities have the fisheries discipline and faculty in Bangladesh, and conduct fisheries education and research. The major universities that deal with the fisheries sector are as follows:

a) Bangladesh Agriculture University with Fisheries Faculty;
b) Dhaka University with Aquaculture and Fisheries;
c) Chittagong University with an Institute of Marine Science;

d) Khulna University with Fisheries and Marine Resource Technology;
e) Rajshahi University;
f) Shahjalal University of Science and Technology, Sylhet District;
g) Patuakhali Science and Technology University,
h) Hazi Danesh Science and Technology University;
i) Fisheries College, Jamalpur District;
j) Noakhali Science and Technology University; and
k) Chittagong Veterinary University.

(5) Non-government Organizations (NGOs)

There are many NGOs that work on fish and fisheries resources management, conservation, and alternate income-generating activities (AIGAs) in Bangladesh. Their main activities include the following:

- Community group formation,
- Alternate income generating activities (AIGAs),
- Monoculture and poly-culture of different species,
- Nursery management program,
- Baor fisheries development and management, and
- Extension Programmes.

The NGOs working on the fisheries sector include, among others:

- Bangladesh Rural Advancement Committee (BARC),
- Proshika Mannobik Unnayan Kendra,
- Rangpur Dinajpur Rural Service (RDRS),
- Care International Bangladesh (CARE),
- Caritas Bangladesh, Association for Social Advancement (ASA),
- Saptagram Nari Swanirvar Parishad,
- Christian Commission for Development in Bangladesh (CCDB),
- Friends in Village Development,
- Manabik Sahajaya Sangstha,
- Technical Assistance for Rural Development (TARD),
- Voluntary Organization for Social development (VOSD), and
- Activities for the Landless Organized with Consciousness (ALOC).

International agencies are also involved in fisheries in Bangladesh, such as the International Union for Conservation of Nature (ICUN); World Fish Center (Bangladesh); Department for International Development (DFID); South Asia Partnership-Bangladesh (SAP-Bangladesh); Nature Conservation Movement; Asian Wetland Bureau; and DANIDA.

In addition, input traders, suppliers, and companies such as aqua-feed industries have their own demonstration and training programmes. The leading companies are CP, ACI, Aftab, and Achme.

6.1.5 Fishing Community (Fishers and Fish Farmers)

DoF is implementing a "Fishers Registration and Identity Card (ID) Issue Project that began in January 2012 and expected to be completed in June 2015. The survey would help identify genuine, full-time, part-time, and seasonal fishers, and once completed, the survey will provide the number of full-time, part-time, seasonal, and professional fishers in the fisheries sector.

Fishers can be categorized based on the degree of involvement in fisheries that vary from full time to occasional fishing. Full-time fishers are professional and traditional fishers practically fishing all year round in a wide range of water bodies and using a wide range of fishing gears. Full-time fishers' investment on gears is relatively high. Seasonal fishers are small farmers, labourers, and traders who conduct seasonal fishing on a regular basis and their investment on gears is small. Subsistence fishers are opportunistic fishers who conduct fishing for food and income, and are composed of labourers, women, children, and vulnerable groups (such as the elderly, disaster victims, and widows). Subsistence fishers usually fish in shallow water bodies (floodplains, canals, ponds, and ditches) and their gears are push nets, traps, cast nets, spears, and dewatering

The number of fishers and fish farming communities (district level) presented in this report are based on the data and information reported in the HMP.

The number of fishers and fish farmers (district level) is shown in Appendix 6.2. These data were compiled from the records of each UFOs collected by the JICA Survey Team.

(1) Fishers Community

The rich and diverse nature of the haor basin provides opportunities for the majority of the farming population to engage in fishing for food and income particularly during the wet season. Such fishing can be categorized as subsistence, seasonal, and professional. The subsistence and seasonal categories of fishers are opportunistic fishers fishing for food and income, respectively, which are composed of labourers, traders, etc. The professional or full-time fishermen are those whose main occupation is fishing.

Seasonal inundation removes rigid boundaries of private lands, and the entire haor basin joins together to become a single body of water and form a unique fish habitat where people have free access to fisheries resources in the open water. Most poor people often depend on floodplain fishing for living. According to BBS (2010), some 2.5% to 3% of the northeast populations are full-time fishermen while around 70% of households are engaged in subsistence fishing. BBS stated that around 3% of households of the haor basin are full-time fishers who fish in different water bodies of the study area for their livelihood. According to UFOs in the HMP, over 367,500 fishers are fishing in the haor basin, out of which around 80% are male and 20% are female (refer Table 6.1.19).

Table 6.1.19 Number of Fishers and Fish Farmers in the Study Area

District	Fisheries		Fish Farmers	
	Male	Female	Male	Female
Sunamganj	44,037	9,874	35,070	987
Kishoreganj	40,971	3,063	22,671	2,586
Netrokona	22,310	4,712	42,191	6,443
Habiganj	28,468	2,360	11,974	1,210
Brahmanbaria	50,930	5,410	9,889	845
Maulvibazar	16,977	14,259	6,172	732
Sylhet	90,206	33,891	23,675	956
Sub-total	293,899	73,569	151,642	13,759
Total	367,468		165,401	

Source: Upazila Fisheries Office, 2011 (as reported in HMP)

(2) Fish Farming Community

There are over 165,400 fish farmers in the study area. Inland pond culture is the mainstay of aquaculture in Bangladesh, accounting for about 85% of the total aquaculture production. Pond culture is dominated by production of carps, followed by two important species, namely tilapia and Pangasius catfish. Hence, the fish culture practices of the fish farming community in the study area are mostly pond based in addition to some other types of culture practices that are present in this area, i.e., community-based and personal caged fish culture. Pond or farm fish culture practices are mostly 'improved extensive' to 'extensive' in nature although some semi-intensive type of fish culture practices are practiced in the ponds and farms. Commercial pond-based tilapia production (of typical market size, 200-300 g, in 3-4 months) exists in the study area. The pond productivities as cited by WorldFish Centre (2011) are around 15 mt/ha in Kishoreganj and Netrokona districts, and 8-9 tons/ha in Habiganj District.

6.1.6 Fisheries Sector Projects of GoB and Donor Agencies

A review of the fisheries projects undertaken by DoF and relevant institutions with funding sources is summarized in Table 6.1.20.

Table 6.1.20 On-going Projects of DoF at in the Haor Districts Area

Project Title	Project Components	Period	Amount	Donors	Remarks
National Agriculture Technology Transfer Project (Fisheries Component)	1. Decentralized participatory, demand-led and knowledge-based approach for agricultural extension. 2. Reforms for the agricultural research and extension systems.	1-7-2007 to 31-12-2013	(LC) BDT 651.2 million (PA) BDT 451.6 million	GoB and IDA	On going: BARC is the executing agency (EA). DoF extension and demonstration on technology improvement.
Expansion of Aquaculture Technology Services up to Union Level	Empowerment DoF at upazila level - Training DoF staff and farmers on improved fisheries technology - Organize Local Extension Agents for Fisheries (LEAF)	01-07-2009 to 30-06-2014	(LC) BDT 227.7 million (FC) Nil	GoB	On-going
Improvement of marked and degraded water bodies and conservation of native fish species project	Conservation and habitat restoration, training, awareness building, extension activities, and fish stocking.	01-07-2010 to 30-06-2014	(LC) BDT 394.2 million (FC)		PD-DoF implementing through DFOs and UFOs

Project Title	Project Components	Period	Amount	Donors	Remarks
Fisheries Management and Aquaculture in Haor Areas	Conservation and habitat restoration, training, awareness building, sanctuary establishment, beel nursery and stocking, and CBO empowerment.	01-01-2010 to 30-06-2014	(LC) BDT 222.9 million (FE) nil	GoB	PD-DoF implementing though DFOs and UFOs
Fisheries Establishment Rehabilitation and Development for Quality Fish Seed and Fry production	Improvement of existing DoF farms, training centers, and other establishments	01-01-2012 to 30-06-2015	(LC) BDT 1.22 billion (FE) nil	GoB	On-going, PD-DoF implementing through DFO and UFO
Fishers Registration and Identity Card Issue Project	Survey and fishers registration, ID issuance for fishers, awareness building, and ALG.	01-01-2012 to 30-06-2015	(LC) BDT 845.2 million (FC) nil	GoB	On-going, PD-DoF implementing through DFO and UFO
Fisheries Brood bank Establishment Project (Phase 2)	Brood development at DoF farms, distribution of quality brood to private farmers, training on brood management, and brood exchange.	1-07-2007 to 30-06-2013	(LC) 1370 (FC) nil	GoB	On-going, PD-DoF implementing through DFO and UFO
Abuse of Formalin for Fish Storage Mitigation and Awareness Building Project	Legislation and law enforcement, fish market inspection, awareness building, and capacity building of DoF Officers	01-03-2011 to 31-12-2014	(LC) BDT 77.0 million (FE) nil	GoB	On-going, PD-DoF implementing through DFO and UFO
Fresh Water Prawn Culture Extension Project (Phase 2)	Training and demonstration, training center establishment, hatchery establishment and operation, and existing hatchery operation	01-07-2012 to 30-06-2017	(LC) BDT 564.1 million (FE) nil	GoB	On-going, PD-DoF implementing through DFO and UFO
Poverty Elevation and Safeguard Livelihood at Economically Backward Areas Project	Training and demonstration, incentives to farmers, credit, and NGO involvement.	01-04-2010 to 31-12-2013	(LC) BDT 831.9 million (PA)	GoB	On-going, PD-DoF implementing through DFO and UFO
Establishment of Fisheries Diploma Institute at Gopalganj, Kishoreganj and Sirajganj Districta	Diploma course for three years in Fisheries. Graduates will be employed at DoF as assistant and fisheries officers (three components at three districts).	01-07-2011 to 30-06-2015	(LC) BDT 1.23 billion (PA) nil	GoB	Engineering cell of DoF
Integrated Fisheries and Animal Resources Development at Flood Control, Drainage, and Irrigation Areas	Re-excavation of borrow pits, training and demonstration, and incentives for farming.	01-07-2011 to 30-06-2014	(LC) BDT 1.15 billion (FE) nil	GoB	Implemented by MoFL
Community-based Sustainable Management of Tangwar Haor (Phase 3)	Conservation, livelihood improvement, and biodiversity monitoring.	01-07-2012 to 30-06-2015	(LC) BDT 165.6 million (PA) 1525	SDC	Forest and Environment
Haor Infrastructure and Livelihood Improvement Project (HILIP)	Communications infrastructure, community infrastructure, community-based resource management, livelihood protection, and project management.	01-2012 to 06-2019	BDT 94.5 billion Lac (US$118.0 million)	IFAD and Spanish Trust Fund	LGED
Community-based Resource Management Project (CBRMP)	Community organization and micro-credit: - Labour-intensive infrastructure development, - Agriculture and livestock production, and - Fisheries development.	01-2003 to 09-2014	USD 29.27 million IFAD loan USD 24.94 million	IFAD	LGED

Source: Annual Development Budget for development project, Planning Commission and website of respective organization.
Remarks: PD-Project Director

6.1.7 Relevant Fisheries Acts and Ordinances

The Acts and Rules on fisheries have a long history in Bangladesh. Table 6.1.21 briefly summarizes the historical development of acts and rules on fisheries, along with the key features of each event.

Table 6.1.21 Summary of Fisheries Acts and Rules

Acts, Rules and Ordinances Related to Inland Fisheries	Salient Points
Permanent Settlement Regulation 1 of 1793	Tracts of lands (including wetlands) under zaminders (landlords) who controlled the harvest activities and distributed to rural communities (traditional fishers).
Private Fisheries Protection Act, 1889	Prohibited fishing in private lands and specified punishments for violation that included both monetary penalty (fine) and imprisonment. Also, the act was designed to protect the interest of fishpond and Jolmohal owners but did not directly address the issue on fisheries management
State Acquisition and Tenancy Act, 1950	This act revoked the rent-receiving rights of landlords. The lease system was introduced to generate revenue from jalmohals that were still managed by the deputy commissioner (DC).
Protection and Conservation of Fish Act, 1950	A broad-based act covering all aquatic species at all stages of the life cycle. It also covers any water body where fish are grown (natural or artificial, open or closed, and flowing or stagnant). Management rules were specified and can be effective in promoting sustainable fish culture and conservation, such as providing appropriate fishing gears, building water management structures, and imposing fishing and non-fishing seasons.
Bangladesh Fisheries Development Corporation Act, 1973	Established with a specific responsibility to develop fishing industry; establish processing, marketing and distribution of fish products; encourage formation of fishermen's cooperatives; examine fisheries resources and establish institutes for research and training on modern fisheries management.
Fish and Fish Products (Inspection and Quality Control) Ordinance, 1983	Established an ordinance for inspection and quality control of fish and fish products; and provided power to set grades, quality, and standards.
Fisheries Research Institute Ordinance, 1984	Established an institute in Mymensingh that would conduct and coordinate fisheries research in the country, including development of efficient methods of production, processing, and marketing of fish.
Protection and Conservation of Fish Rules, 1985	Rules were designed to control harmful and unlawful fishing activities, illegal dredging and extraction of sands and gravel, discharge of waste, etc. that can disturb, alter, or destroy natural habitats. The rules prohibit the installation of fixed nets, cages, trap, etc.; ban construction of bund, weir, embankment, etc. except for the purpose of irrigation, flood control and drainage; and ban the use of explosives, poison, and small meshes
Fish Hatchery Act, 2010	This act aims to mitigate in-breeding and cross-breeding practices in hatcheries; thus, encourage hatchery and nursery owners to produce quality fish seeds.
Fish Feed and Animal Feed Act, 2010	This act aims to maintain a code of conduct in the production of quality fish feeds in order to avoid harmful feed ingredients for cultured fish.

6.1.8 Policies for Fisheries Development

(1) Relevant Fisheries Policies

Several policies relevant to fisheries that are in place are summarized in Table 6.1.22.

Table 6.1.22 Relevant Policies on Fisheries

Relevant Policies on Fisheries	Salient Points
National Fisheries Policy of Bangladesh (NFP), 1998	The most relevant government policy that aims to develop fisheries resources in order to alleviate poverty and improve socio-economic conditions of fishermen, along with fulfilling the demand for animal protein and earning foreign exchange through exports.
New Fisheries Management Policy, 1986	With this policy, ownership and management of water bodies were vested with the Ministry of Land, which administered the jalmohals to generate revenue through leasing fishing rights by auction. In order to establish fishing rights to genuine fishers, the leasing system was established and replaced by fishing licensing in selected jalmohals. Subsequently, this policy was modified and named the Jalmohal Management Policy of 2009 (refer to the item below).
Jalmohal Management Policy, 2009	This policy is to facilitate the lease of jalmohals to genuine fishermen communities in order to manage and conserve fisheries resources for their benefit through licensing system.

Relevant Policies on Fisheries	Salient Points
Public Water Body Management Policy, 2005; Amended Public Water Body Management, 2009	This policy is to ensure full access of poor fishers on public water bodies. However, there were several drawbacks and constraints during implementation, such as it allowed the rich to get lease, did not specify property rights, and resulted to lack of coordination among relevant ministries and agencies. The policy was amended in 2009 aiming to resolve the drawbacks and constraints, as follows: - Community-based fisheries management (CBFM) is encouraged in the policy through development projects. - An amendment made on March 15 2012 changed only the management committee members, but the duration of lease for open and close waters remained the same. District Jalmohal Committee (chaired by DC) is responsible for leasing out jalmohals of above 20 ac while Upazila Jalmohal Committee (chaired by UNO) leases out jalmohals below 20 ac. - In cases of projects by DoF, LGED and BWDB, the maximum duration is six years; but if the project continues, the lease can be extended through MoUs. - The Ministry of Land must ensure long-term lease for the fishermen community in order to enjoy the natural resources under CBFM through development projects implemented by DoF, LGED, and other public and private organizations.

(2) Policy Directives Relevant to Haor Fisheries

Development projects are governed by some legal and/or institutional requirements. Different policies and plans are in place and have addressed the fisheries sector in different ways. Some policies and plans have given impetus on sustainable management of jalmohals, some on aquaculture improvement, some on raising fish production in open water bodies, some on restoring aquatic and fish biodiversity, and some on improving fisheries dependent livelihoods. Many policies not directly relevant to fisheries have also addressed the haor/beel fisheries management issues. Directives of different policies and plans that are relevant to haor fisheries are described briefly below.

- Conserve, manage, and harvest the inland open water fish resources in a sustainable manner.
- Preserve water bodies such as haor, baor, beel, and roadside ditch/borrow pit for fish production and development to the fullest extent possible.
- Restrict pollutants of different point and non-point sources to control surface water pollution.
- Prevent deterioration caused by water logging, blockage of water flows, and shrinkage of water bodies due to flood control, drainage, and irrigation (FCD/I) projects.
- Construct and maintain fish passes and fish-friendly structures.
- Establish and maintain fish sanctuaries in different approaches.
- Impose seasonal ban, gear restriction, and limitation of number of fishers through licensing, species restriction, etc.
- Assist the fishermen in their access to social safety nets like vulnerable group development (VGD) and vulnerable group feeding (VGF) and livelihood support alternatives.
- Organize the fishers' communities under community-based organizations for the sustainable management of khas and jalmohals on a long-term basis for improving fisheries resources.
- Ensure lease of khas, ponds, haors, and jalmohals to genuine fishermen.

- Provide privilege to registered youth cooperatives (age limit: within 18 to 35) in leasing jalmohals.
- Keep enough opportunities to freely flow the water between rivers and beels.
- Rear fry of various indigenous species in nurseries and supplementing natural stocks.
- Maintain purity of brood stock of indigenous carps and other indigenous fish species in conserving the natural breeding, spawning, nursery, and grow-out areas to complete the whole lifecycle and natural reproduction process.
- Distribute pure strain brood fish from GOB and selected private and NGO hatcheries to produce good quality fish seed and fry of commercially important and endangered species.
- Constantly monitor the operation of hatcheries, nurseries, and supply of spawn and fry in which the private sector is the key player through GO-NGO collaboration and public-private partnership.
- Constantly monitor the production, import, and marketing of fish and shrimp feeds, feed ingredients, minerals and vitamin premix, and other inputs.
- Promote net-pen and cage cultures.
- Encourage rice-cum-fish culture and aquaculture by intensifying poly-culture.
- Emphasize management of aquacultures in floodplains under the community enterprise approach.
- Ensure disease and quality control of fish fry and fingerlings.
- Supply inputs and promote technical knowledge among the educated youth in pond and other closed water bodies.
- Introduce the proposed 'Certificate of Land Ownership' that will provide access to the fishing community for fishing in the floodplain.
- Protect breeding and nursery grounds of major fishes through the establishment of sanctuaries and re-excavation of canals, beels, and haors under different programmes.
- Adapt to fisheries in flood-prone areas in the North-East Region through adaptive and diversified fish culture practices.
- Prepare a database and update information regarding the public water bodies of the country.
- Improve quality and productivity of fisheries by strengthening research, training, and extension services.

6.1.9 Fisheries in the National Plans

(1) Fisheries Development Plans

A review of past policies and programmes incorporated in the successive five-year plans is summarized in Table 6.1.23 below.

Table 6.1.23 Past Fisheries Development Plans

Plans	Performance and Remarks
First Five Year Plan (1976-1980)	Overall performance not satisfactory due to, among others, the following: - Inadequate preparation and implementation of projects, - Inadequate allocation of funds, - Inadequate availability of technical manpower or delay in recruitment, and - Non-delivery of water areas from land agencies.
Second Five Year Plan (1981-1985)	Positive trend in fish production was achieved. However, targets remained unfulfilled to a large extent due to, among others, the following: - Lack of technical know-how on proper aquaculture, - Inadequate fisheries extension services, - Construction of flood control and irrigation structure and extraction of water for irrigation, and - Silting of river beds. Note: Under this Plan, fisheries was recognized as an integral parts of water sector development projects
Third Five Year Plan (1986-1990)	More emphasis on both aquaculture and open water fisheries conservation and management, such as breeding and nursery grounds of commercial fish species; pesticide use regulation; aquatic inlets in road-side canals, seasonal water bodies, and deep water paddy fields; reclamation of new ponds, baors, etc.; and seasonal and area restriction on hilsa fishing. Export earnings sharply increased in terms of value; however, the target quantity was not achieved. Some issues identified were limited financial power of project directors, delays in project implementation, and low utilization of funds.
Fourth Five Year Plan (1991-1995)	Emphasis on increasing fish production and nutrition from fish, employment, fisheries export, and improving socioeconomic conditions of the fishing community. Better utilization of floodplains through stocking programmes, and the government and donors began to recognize the development potential of floodplain fisheries.
Fifth Five Year Plan (1996-2000)	Major thrust on culture and capture fisheries, promotion of rice-fish farming system in floodplains and conservation and management on equitable distribution of benefits of common property water resources.

The Sixth Five-Year Plan (2011-2015) is the currently ongoing plan, which was formulated in compliance with the National Document of Vision 2020-21. The goals and objectives for the fisheries sector under this plan are described in Table 6.1.24.

Table 6.1.24 Ongoing Fisheries Development Plan (Sixth Five-Year Plan)

Goals	Objectives
- Enable self-sufficiency in fish production and generate surplus. - Improve livelihood security, income, and standard of living of fishers and fish farmers with priority to the poor, landless, women, and other vulnerable groups in order to contribute in reducing poverty. - Improve the conservation of aquatic biodiversity of rivers, beels, haors, baors, floodplains, and other water bodies. - Improve food safety standard of fish and fish products for both export and domestic consumption.	- Increase the national fish production to 3.7 million mt by 2015, from 2.7 m tons in FY2007/08. - Increase fish and shrimp export to 130,000 mt in 2015, from 75,000 mt in FY2007/08. - Increase employment opportunities in the fisheries sector by 20% in five years. - Increase participation of women in pond aquaculture from 25% to 30% in five years. - Establish and maintain sanctuaries in selected segments of rivers, estuaries, the whole of Sundarbans, important beels, haors, and the breeding grounds of hilsa and shrimp.

6.1.10 Department of Fisheries and Relevant Institutions

The DoF is the key organization responsible for fisheries development and management in both marine and inland waters of Bangladesh. The fisheries directorate was established in 1908 and was upgraded to a department in 1983. The DoF is presently functioning under MoFL. DoF is responsible for the following: (a) inland fisheries, (b) marine fisheries, (c)

fisheries resource survey system (FRSS), (d) fish inspection and quality control, and (e) personnel and human resources development.

The DG heads DoF, and under him are approximately 3,800 staff, both in DOF's headquarters and field offices. DoF is also mandated to enforce the implementation of national fisheries policies, acts, and ordinances in the management of fisheries. There is the district fisheries officer who is the head of the fisheries administration in the district, and upazila fisheries officer to supervise activities in upazilas.

There are three other fisheries-related organizations under the administration of MoFL, namely: BFRI, BFDC, and FLID. In addition, several other government agencies and government bodies like the Ministry of Local Government, Rural Development and Cooperatives; the MoL; and the Ministry of Irrigation, Water Development and Flood Control, with the help of their affiliated institutions, are actively involved in fisheries administration, management, and development. Table 6.1.25 shows the institutional framework of DoF and the fisheries-related institutions.

Table 6.1.25 Institutional Framework of DoF and Fisheries-related Institutions

Ministry	Institutions	Activities
Ministry of Fisheries and Livestock (MoFL)	Department of Fisheries (DoF)	Extension, management, project implementation, training and human resource development, laws and regulations enforcement, conservation, quality control, registration and certification, fishing license issuance, fisheries awareness building and motivation, policy formulation support, administration, etc.
	Bangladesh Fisheries Development Corporation (BFDC)	Marketing, production, training, etc.
	Bangladesh Fisheries Research Institute (BFRI)	Fisheries and other aquatic animal-related research and training
	Fisheries and Livestock Information Department (FLID)	Fisheries and livestock-related information dissemination
Local Government, Rural Development and Co-operatives	Upazila Administration	Management of water bodies less than 20 ha, field level supervision and management of fisheries resources, etc.
	Rural Development Board	Fisheries components of integrated rural development
	Directorate of Cooperatives	Registration and supervision of fishermen's cooperatives.
	Bangladesh Jatiya Matshyajibi Samabay Samiti (BJMSS)	Development of fishermen cooperation on ice plants and import of gears
	Bangladesh Samabay Bank Ltd.	Financing fishermen's cooperatives
Ministry of Land (MoL)	Land Administration and Land Reform Division	Leasing of public water bodies
Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Leasing of reservoirs and irrigation canals and implementing fisheries projects
Ministry of Planning	Fisheries Section	Planning and approval of fisheries sector projects, and monitoring and evaluation of different projects

6.2 Haor Fisheries Issues, Constraints, Development Potentials, and Directions

6.2.1 Issues and Constraints in Fisheries

(1) Issues and Constraints as Reported in the Haor Master Plan

The haor area with its extensive and rich wetland system in the project districts has a high potential for the development of the fisheries sector. Characterized by virtue of its

hydrological and ecological features, the haor area fisheries are divided to four seasons as follows:

a) Overwintering (dry season) from December to March,
b) Spawning-migration season (pre-monsoon) from April to June,
c) Nursery and grow-out season (monsoon) from June to September, and
d) Out-migration season (flood recession) from September to December.

Therefore, the haor area fisheries are very much susceptible to negative effects and remain under pressure through constraints and issues arising from man-made interferences. The present issues, constraints, and causes for fisheries promotion in the haor area are delineated in this subchapter considering the resources, technical, institutional, and support aspects. A few man-made interferences, among others, are listed as follows:

- Indiscriminate fishing of brood stocks and spawn;
- Destruction of breeding grounds by blocking the migration routes through the erection of embankments and unplanned roads;
- Reduction of water areas due to flood control and irrigation structures;
- Indiscriminate use of agro-chemicals and pesticides; and
- Leasing policies of water bodies for fisheries.

Table 6.2.1 Issues and Problems on Fisheries in the Haor Area

Items	Issues and Constraints	Causes and Reasons
Fish habitat	- Degradation of fish habitats and loss of biodiversity leading to decline in fish production; - Degradation of breeding grounds and mother fishery sanctuary, thereby, reducing fish recruitment; and - Limiting overwintering refuge areas for brood fish species.	- Siltation on account of FCD/I structures - Establishment of water regulatory structures, unplanned roads and agriculture pressure
Fish migration	- Restriction of fish migration and delays in spawning.	- Different water regulatory structures like submersible (pre-monsoon) and fully-flood embankments, and non-friendly structures on rivers along with sedimentation of riverbeds.
Fish recruitment	- Interruption or reduction of fish recruitment to open waters.	- Indiscriminate and over exploitation of brood & young fish and fry, and capture of fry for aquaculture limit fish recruitment.
Fish conservation	- Less initiatives or ignorance of fish conservation measures.	- Insufficient measures such as establishment of sanctuaries and beel nurseries, and restoration of brood fish habitats; - Lax in enforcing acts, rules, and regulations under the extension services by DoF - Inadequate support to fishermen during fishing ban
Fish susceptibility to catch	- Easy catching of brood fishes (spawners), thereby, affecting breeding and recruitment of fry/ and fingerlings	- Submersible embankment, structures on rivers and khals - Excess abstraction of water from beels for irrigation and less water retention capacity of water bodies.
Fishing methods	- Indiscriminate fishing practices (use of banned nets, chemicals, etc.) leading to decline of fish biodiversity.	- Lax in enforcement of fishing regulations and fisheries acts and rules
Pollution	- Decline in fish biodiversity and decline in fish catch .	- Release of domestic wastes, pesticides, fertilizers, and industrial effluents that have negative effects on fish biodiversity and migration.

Items	Issues and Constraints	Causes and Reasons
Deforestation	- Reduction and loss of fish grazing and nursing grounds	- Deforestation and depletion of swamp forests that have negative effects on reserve and pile fisheries.
Farmer-fishermen-leaseholder conflicts	- Conflicts between farmers and fishermen.	- Reclamation of beel area for paddy cultivation (farmers). - Complete dewatering of beels to harvest fish while the farmers need water for irrigation.
Leasing system	- Leaseholders conduct unsustainable fishing practices leading to depletion of fisheries resources.	- Short-term leasing encourages complete dewatering of beels in order easily to harvest fish. - Leaseholders tend not to practice biological management system in jalmohals* as a rule, which is needed to be strictly followed by leaseholders.
Community-based fisheries management	- Lack of institutional presence and support after the closure of project may pose legal challenges for the community groups who are expected to manage the water bodies; - Lack of legal recognition of the management approaches of community-based fisheries management plans after the completion of the project (between owners and tenants); - Inadequate funds and lack of proper promotion of alternative income-generating activities (AIGAs) that are pro-poor; - Conflicting claims of vested interest groups over water bodies and fish resources; and - Short-term lease and high lease values.	
Ice plants and fish storage facilities	- Lack of adequate number of ice plants (temporary fish preservation) and fish storages (fish preservation), especially during flood receding period when large volumes of fish are landed (high spoilage and waste).	
Fish processing centre	- Inadequate and improper utilization of existing fish processing facilities.	
Fish landing centre	- Inadequate number of safe and hygienic fish landing facilities, where lack of which affects fish quality (freshness) causing fishermen to sell fish at low prices.	
Fish hatchery and nursery	- Lack of hatcheries and nurseries at strategic places/sites discourages pond owners to culture fish; low quality fry and fingerlings (from distant hatcheries) are susceptible to high mortality as well as transportation difficulties.	
Quality fish feed	- Lack of quality fish feed mills in the haor area and inadequate supply of quality fish feeds for aquaculture. - Fish feed mills do not observe the code of conduct in preparing fish feeds.	
Fisheries laws and regulations	- Weak and poor enforcement of laws and regulations on fisheries; and - Inadequate support to fishers during fishing ban.	
Extension services	- Manpower scarcity in extension and monitoring of fisheries resources. - Lack of mobility to conduct extension and training.	

Note: *Jalmohal: A beel, khal (canal), or other water body registered for revenue collection purposes as a "fishery".
Source: 1) Compiled from the Haor Master Plan
2) Based on discussions with DFOs and fisheries officers of DoF (Dhaka) during field visits.

(2) Issues and Constraints as Reported by DFOs

The problems and constraints as reported by respective DFO officers are summarized in Table 6.2.2.

Table 6.2.2 Issues and Constraints on Fisheries as Reported by District Fisheries Officers

Problems/Issues	Descriptions
Technical	- Farmers are not acquainted with modern fish farming techniques, - Flash flood damages to fish farming, - Quality fish fry are not readily available and in-breeding problems for some species, - Farmer depends more on fish fry from other districts, - High siltation rate and suspended solids (SS) hampering productivity of beels and canals, - Less water in water bodies during dry months due to pumping water for irrigation, and - Incidence of pollution from agro-chemicals.
Economic and Financial	- High bank interest for fisheries venture and aquaculture (12%-17%), - High price of feed and fish fry, - Low fish prices during glut season and high price during lean season, - Disorganized and unhygienic fish markets, - Insufficient ice during glut season with no storage facilities, and - Non-readily available transport for live fish.

Problems/Issues	Descriptions
Fisheries Support	- No subsidy on fertilizers for fish farmers, - Extension activities are mostly project-based, - Organization of farmers and fishers are weak and politically influenced, - NGO involvement is project-based, - Coordination among government departments and project implementation is weak, - Most of fish seeds are imported from adjacent districts, leading to shortage of such, and - Demonstration facilities are very limited, and frequent request from farmers and fishers.
Institutional	- No DoF representative at union level, - Lack of manpower at DoF offices, - Difficulties in access to credit for fish farmer, which requires many documents that are not readily available, - Difficulties in mortgage for credit for poor fishers, - Cooperative societies are Jalmohal-based and driven by influential persons, and - Officers change frequently.
Social	- Reluctant to follow existing fisheries rules and regulations, - Credit tied with political influence, - Fish pouching, - Lease of water bodies requires political influence, and - Groups do not properly manage fish sanctuaries.

Source: Prepared by the JICA Survey Team, 2013

(3) Significance of Issues and Problems Expressed by Haor People during Workshops and Focus Group Discussions (FGDs)

Table 6.2.3 shows the significance of the issues and problems prevailing in the upazilas of project districts as expressed by the haor people during workshops and FGDs as reported in the HMP. Very highly significant (VHS) denotes that more than 50% of the upazilas have the same issues and problems; highly significant (HS) refers to a problem of about 15% to 50% of the upazilas; and significant (S) reflects a problem of less than 15% of the upazilas. The haor people's overview or perspective of their problems shall be taken into consideration during the formulation of plan for the sub-components.

Table 6.2.3 Significance of Issues and Problems Expressed during Workshops and FGDs

Problems/Issues	Level of Significance		
Illegal harvesting of brood fish and fingerlings	VHS		
Siltation of fish habitats		HS	
Inadequate number of fish sanctuaries	VHS		
Lack of fish fry		HS	
Excessive use of monofilament nets	VHS		
Excessive use of pesticides and chemical fertilizers	VHS		
Lack of training facilities for fish culture		HS	
Lack of interest in fish farming			S
Lack of necessary manpower and proper policies		HS	
Limited access of actual fishers to jalmohals due to leasing policies	VHS		
Lack of capital for investment		HS	
Fishers are deprived of reasonable fish prices		HS	
Weak marketing system		HS	
Unavailability of facilities for fish preservation		HS	
Debt of fishers to the rich	VHS		

Notes: VHS (Very Highly Significant) - concerns of more than 50% of the upazilas.
HS (Highly Significant) - concerns of 15% to 50% of the upazilas.
S (Significant) – concerns of less than 15% of the upazilas.

Source: Prepared by JICA Survey Team (2013) by modifying the Table on page 30, Volume II, Master Plan of Haor Areas, 2012

(4) Findings of Household Survey

The findings obtained during the household survey conducted by the JICA Survey Team were examined, and the results are delineated below. The responses received from the survey cannot be taken as indicative or general for the entire haor area. The reasons are as follows: the questionnaire targeted only selected upazilas, the responses obtained were not directly relevant to fisheries, and responses were mixed such as targeting the agriculture sector.

The total number of households (HHs) surveyed was 355; of which only 29 were identified as fishers from income sources (refer Table A.15 of Appendix 2.2). This number amounts to about 8% (or 29) of the total number surveyed. However, it should be noted that the inhabitants in the haor area are engaged in both farming and fishing depending on the season (wet and dry seasons). Therefore, the number of fishers interviewed must be more than 29 as there are also farmers engaged in fish farming (fish pond culture in addition to farming), and also those conducting open water fishing (full-time and occasional fishing). The income sources of the 29 fishers could be from open water fishing, fishpond culture, or both: and they could be classified as fishers or fish farmers.

There were 270 households (76%) of the total 355 HHs surveyed who expressed issues and problems as shown in Table 6.2.4. About 28% indicated the issue on open access to fishing that is controlled by powerful people for fishing, while 53% (or 142 HHs) expressed the problem in getting lease that could also be attributed to high lease fee and being controlled by influential persons.

Table 6.2.4 Issues and Problems Expressed during the Household Survey

Issues and Problems	Responses	Share
No open access to fishing (controlled by elites)	75	28%
No or limited knowledge on fish culture	17	6%
Problems with the leasing system (difficult to get lease or high lease fee)	142	53%
No access to loan or lack of capital for investment (needed for fish culture and fishing)	17	6%
High fish mortality due to flash floods	19	7%
Total number of respondents	270*	100%

Note: Asterisk (*) represents 76% of the total 355 HHs surveyed.
Source: Results of the Household Survey conducted (July 2013) by the JICA Survey Team.

The survey indicated that about 169 HHs (48%) were engaged in open water fishing and fishpond culture while only 29 HHs indicated fisheries as their main income source. This reveals that most inhabitants in the surveyed areas are engaged both in fishing and farming. Open water fishing (42%) is a popular and common activity that does not need much capital while fish pond culture activity (4%) needs capital investment for pond maintenance and management (refer Table A.21 of Appendix 2.2 for details).

Productive assets for open water fishing: Around 60 HHs (16%) have boats, of which only 6% are engine-operated. Push net is the dominant gear for fishing followed by cast net (refer Table A.29 of Appendix 2.2 for details).

Fish catch: Small fish varieties dominate the catch (148 kg/season). The overall average fish catch is around 264 kg/season per HH (refer Table A.30 of Appendix 2.2 for details).

Fish pond culture: About 19 HHs (5%) indicated fish farming (fish culture), that indicated 23 ponds (nursery and rearing ponds) which are owned or rented. Only 6 HHs indicated engaging in extensive and semi-intensive culture practices. Extensive practices require only fingerling but no fertilization, feeding, etc., whereas semi-intensive culture practice requires not only fingerlings but also partial feeding and fertilization. The source of fingerlings is from private hatcheries, and the main fish species cultured are Indian and Chinese carps that have high consumer demand (refer Table A.21, Table A.22, Table A.23, Table A.25, Table A.26, and Table A.27 of Appendix 2.2 for details).

Households who responded to issues and concerns relevant to fish culture are wishing to start engaging in fish culture but have no investment capital and access to technology. Those who are engaged in fish culture expressed lack of proper knowledge and experienced problem of disease, high mortality and low survival rate, high cost and bad quality of fish fry and fingerlings. It was noted that the participants in workshops and FGDs of HMP cited the lack of training facilities for fish culture, among others.

Fish marketing channel: Around 116 HHs indicated their fish marketing channel. Direct sale to resident retailers dominates the disposal of fish at 51% of the respondents while 36% of HHs are direct to resident wholesaler. Also, 29% of HHs are transporting fish to wholesalers in nearby towns and villages. About 10% of HHs are wholesalers collecting or purchasing from outside the village (refer Table A.32 of Appendix 2.2 for details).

Fisheries extension: About 55% of the respondents indicated that extension services, which are expected by the HHs, were not provided or even visited by extension officers. The absence of regular extension service was also expressed by DFOs. The reasons for these were lack of suitable manpower and logistics (mobility), and lack of adequate skills and knowledge, for example on fish diseases and aquaculture technology. Any extension service provided is based on projects; therefore, extension services are not provided on a regular basis.

Future aspirations, suggestions, and immediate needs: The responses to the question of aspirations, suggestions, and immediate needs are rather similar. Only 5% of the responses were relevant to fisheries while the rest are on livestock, poultry, etc. The respondents said that they aspire to take up fish culture, receive fish culture training/technology, gain investment capital, and have access to easy loan.

6.2.2 Development Potential of Haor Fisheries

The haor area has high potential for fisheries development even though the wetland system remains under pressure. The wetland system and its fisheries resources, human resources, and institutional settings are the strengths and opportunities for development. The strengths are delineated below.

(1) Natural Resource Potential

- Wetlands and open water fish habitats that have substantial value,
- Rich fish biodiversity,
- Carp and other fish breeding grounds (especially major carps of commercial value),
- Grounds for mother fishery for spawning, feeding, and refuge,
- High quality native brood fish (high quality species of major carps in the haor area),
- Dry season refuge areas (rivers and beels provide refuge for spawners), and
- Aquaculture fishponds (potential for fish culture).

(2) Human Resources

- Existence of organizations (GOs and NGOs) for coordinating in the interests of fisheries promotion,
- Traditional fishermen community (highly experienced fishers in the haor area),
- Knowledge and education system (several universities and research institutes near the haor area),
- Fish farming knowledge with fish farmers (collection of techniques especially on fish breeding, nursing, grow-outs, etc., in the haor area can be applied for better economic use),
- Livelihood support where a large number of people in the haor area directly and indirectly depends on fisheries products, and
- Fishers organizations (a large number of jalmohal-based fishermen societies or associations exist in the haor area).

(3) Fisheries Legislation and Administrative Support

- Fisheries policies, legislations, ordinances, and acts are in place, and
- Fish conservation measures, where various measures are practiced in the haor area.

6.2.3 Development Directions and Strategy

The development directions are to revitalize and improve haor fisheries by retrieving the degraded and diversified fish habitats, as well as involving the local communities. Thereby, relevant government and non-government stakeholders have to be given impetus on wetland management system. The aquaculture sector also has to be boosted by improving the floodplain aquaculture infrastructure and fish culture technology, and its dissemination to the farmer level. The directions are delineated below.

(1) Natural Resource

- Restoration of fish habitats and seasonal refuge areas,
- Establishment of fish sanctuary in deep beels and river duars,
- Revival of fish biodiversity through beel nursery,
- Protection and conservation of mother fishery and fish spawning grounds,
- Construction of fish passes and fish-friendly structures, and
- Making river and canal systems passable for migrating species.

(2) Human Resources

- Empowering local fisheries administration with skilled manpower and extension services at union levels.
- Initiations or launching of open water aquaculture to fishers and farmers (empowering the local fishers/farmers including women) with technical knowledge in fish culture practices using net-pens and cages in suitable floodplains (semi-closed water bodies).
- Empowering fishers and farmers with techniques on integrated fish cum chicken/duck farming and deep-water rice cum fish farming through technology demonstrations and awareness campaigns.
- Trade-off between agriculture and fisheries, where conflicts arise between farmers and fishers due to land reclamation for paddy, water for mid-winter irrigation, timing for draining for fish harvesting or flooding, etc. Mutually resolving these conflicts through trade-off by both fishers and farmers must be motivated with clear understanding of the issues.
- Involvement of the existing government organizations (such as DFOs and UFOs) and NGOs to coordinate in the interests of developing haor fisheries leading to poverty alleviation. This will also enable the transfer of knowhow of NGOS to the stakeholders and beneficiaries.

(3) Fisheries Legislation and Administrative Support

- Jalmohal leasing to fishers under co-management arrangement, and
- Regulation of fishing practices through strict enforcement of laws and regulations by DoF in order to prohibit indiscriminate and destructive fishing practices.

(4) Financial and Material Support

- Renovation of fishponds and other aquaculture units, and
- Financial support to entrepreneurs.

6.2.4 Development of Project Portfolios (HMP)

In light of the prevailing issues and constraints in the haor areas as described above along with the development potentials and strengths, the HMP has 22 project portfolios (or investment plans) in its Fisheries Development Area Plan (FDAP) for the haor area districts. These project portfolios aim to counter and resolve the problems and issues in order to revitalize and develop the haor fisheries sector by retrieving the degraded and diversified fish habitats, and involve the local communities whose livelihood depends on fisheries. These 22 projects are in line with the on-going Sixth Five-Year Plan and MDGs Vision 2020-21 that focus on food security, sustainable management of wetlands and its ecosystem, livelihood improvement, etc. The list of project portfolios is summarized in Table 6.2.5. Participants of upazila level workshops conducted during the HMP period identified probable solutions and identified three categories of priority projects.

Table 6.2.5 List of Prioritized Project Portfolios in the HMP

Code	Projects	HMP Priority and Term	
FI-01	Development and Establishment of Fisheries Sanctuaries	VHP	Long
FI-02	Habitat Restoration for Rehabilitation of Fish Diversity	VHP	Long
FI-03	Beel Nursery Program for Increasing Fish Fingerlings Recruitment	VHP	Long
FI-04	Good Fisheries Management Practices following the Mohanganj Experience	VHP	Long
FI-05	Floodplain Aquaculture under the Community Enterprise Approach	VHP	Long
FI-06	Community and Household-based Net-Pen Fish Culture in the Haor/Floodplain	VHP	Long
FI-07	Fish Fingerlings Stocking and Raising Program	VHP	Long
FI-08	Capacity Development and Alternative Income-generating Activities (AIGAs) for Fishers Community	VHP	Medium
FI-09	Renovation of Hatcheries for Conserving Quality Brood Stock and Production of Fish Seeds	VHP	Short
FI-10	Study on Review of Policies, Regulations, and Lease System for Sustaining Resources	VHP	Short
FI-11	Restoration of River Duars (Deep Pools) for Protecting Brood and Mother Fish	HP	Medium
FI-12	Renovation of Fish Ponds and Dissemination of Improved Aquaculture Technology to Fish Farmers	HP	Medium
FI-13	Development and Construction of Innovative Fish Pass and Fish friendly Structures	HP	Medium
FI-14	Establishment of Fisheries Information Service Centre	HP	Short
FI-15	Introduction of Deep Water Rice cum Culture	HP	Medium
FI-16	Establishment and Rehabilitation of Fish Landing Centre	HP	Medium
FI-17	Establishment of Fish Drying and Fermentation Centre	HP	Medium
FI-18	Study on Impacts of Climate Change and Interventions on Fisheries Resources	HP	Long
FI-19	Development and Establishment of Cold Storage and Ice Plants	HP	Medium
FI-20	Research on Fish Stock Improvement through Gene Pool Preservation and In-breeding Depression	MP	Long
FI-21	Rehabilitation of Existing Fish Processing Units and Establishment of a New Fish Processing Industry	MP	Medium
FI-22	Community and Household-based Cage Fish Culture	MP	Medium

Note: ST: Short term: 1-5 years (2012 - 2016)
MT: Medium term: 6-10 years (2012 - 2021)
LT: Long term: 11-20 years (2012 - 2031)
VHP Very High Priority (10 projects)
HP High Priority (9 projects)
MP Medium Priority (3 projects)

Source: Prepared by JICA Survey Team (2013) from data/info in Figure 9-2 on page 236, Annex 3 Fisheries, Master Plan of Haor Areas, 2012

Of the 22 projects, ten projects are ranked as very high priority (VHP) that are extremely significant for economically uplifting the haor area, independent of external actions in the haor area, and could be treated as an action plan for immediate implementation. Nine projects ranked as high priority (HP) are dependent on external and internal actions, where the projects are to be implemented in the medium-term period in order to address issues of ranking between FI-6 and FI-10. The rest of the projects are medium priority (MP) that are highly dependent on other types of priority projects and cannot be implemented in isolation. These projects may be highly significant nationally but not that significant in the haor area.

(1) Selection by DFOs of the Prioritized Projects of HMP

The prioritized project portfolios of the HMP were presented to respective DFOs of the project districts in order to identify and prioritize projects (for their districts) that would address specific issues and problems. The priority selections by DFOs are shown in Table 6.2.6. The DFOs have given the first to fifth priorities to almost all the VHP projects of HMP. This reflects that there are immediate needs of habitat restoration (fish sanctuaries and beel nurseries), floodplain aquaculture, net-pen fish culture, and fingerling stocking.

Table 6.2.6 Selection of the HMP Prioritized Projects by DFOs

LIST OF PRIORITIZED PROJECTS IN THE MASTER PLAN OF HAOR AREA																						
Status	Very High Priority (VHP)										High Priority (HP)										Medium Priority (MP)		
	Fish Sanctuaries	Habitat Restoration	Beel Nurseries	Good Management Practices	Floodplain Aquaculture	Net Pen Fish Culture	Fingerling Stocking and Raising	AIGAS	Renovation of Hatcheries	Review of Policies (Leasing System)	Restoration of River Duars (for Protecting Brood Stocks)	Renovation of Fish Ponds (Improved Aquaculture Technology)	Innovative Fish Passes and Fish-friendly Structures	Fish Information System	Deep Water Rice-Fish Culture	Fish Landing Centers	Fish Drying	Impact of Climate Change on Fisheries	Cold Storage and Ice Plants	Research on Fish Stock through Gene Preservation	New Fish Processing Industry	Fish Cage Culture (Household base)
Code	FI-01	FI-02	FI-03	FI-04	FI-05	FI-06	FI-07	FI-08	FI-09	FI-10	FI-11	FI-12	FI-13	FI-14	FI-15	FI-16	FI-17	FI-18	FI-19	FI-20	FI-21	FI-22
1st Priority	HAB	KIS BRA SUN	NET																			
2nd Priority	NET KIS BRA SUN		HAB																			
3rd Priority		HAB	SUN	NET BRA				KIS														
4th Priority					NET			SUN	HAB					BRA					KIS			
5th Priority		NET			BRA		KIS SUN											HAB				
6th Priority									NET KIS	SUN					BRA	HAB						
7th Priority			BRA	SUN				NET HAB				KIS										
8th Priority		NET									HAB					KIS BRA						SUN
9th Priority				KIS		HAB	NET BRA		SUN													
10th Priority					HAB SUN	BRA								NET							KIS	

Remarks: NET = Netrokona; KIS = Kishoreganj; HAB = Habiganj; SUN = Sunamganj; BRA = Brahmanbaria
Source: Prepared by JICA Survey Team, July-August 2013.

6.3 Preliminary Plans for Fisheries Promotion and Livelihood Improvement

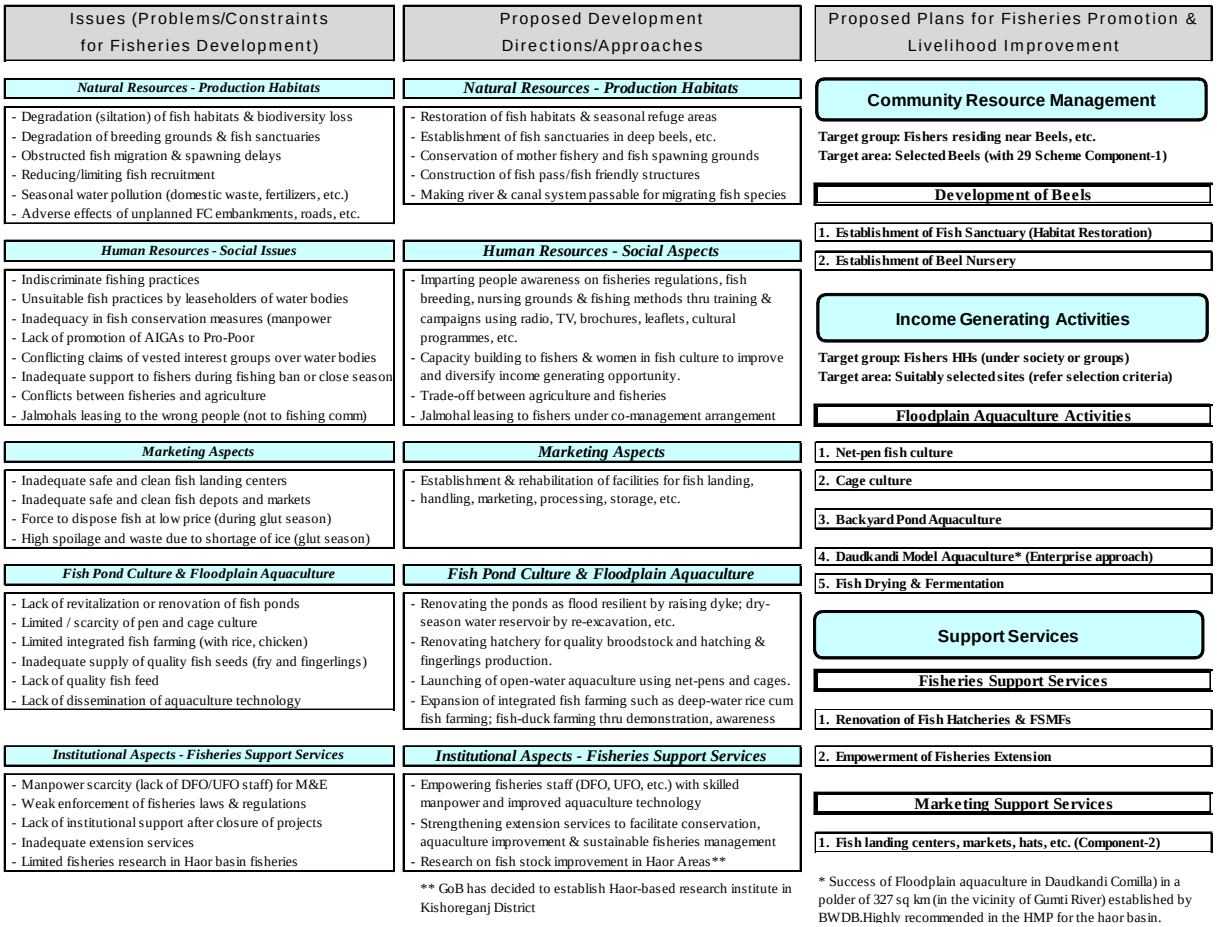
6.3.1 Framework for the Formulation of Plans for Fisheries Promotion

(1) Formulation of Proposed Plans

In framing the conceivable plans or sub-components and in addition to examining the comprehensive issues, constraints and potentials in the haor areas, the approach in the formulation of plans will take into consideration the following:

1) Prioritized investment project portfolios (refer Table 6.2.5) in HMP 2012,
2) Priority projects recommended by DFOs (in the five project districts, refer Table 6.2.6),
3) Relevance to government policies and plans to the fisheries sector, namely: the National Fisheries Policy (NEP) 1998, National Strategy for Accelerated Poverty Reduction II (NSAPR II), Sixth Five-Year Plan (2011-2015), and National Water Body Management Policy (2009).

The proposed plans can be categorized into three sub-components, namely: community-based resource management, income-generating activities, and support services (refer to the rightmost column of Figure 6.3.1). These sub-components are to adequately adopt the development potentials and approaches in order to resolve the immediate issues and concerns.



Source: Prepared by the JICA Survey Team, 2013.

Figure 6.3.1 Framework for Formulation of Plans for Fisheries Promotion

(2) Conceivable Sub-components for Fisheries Promotion

The conceivable sub-components proposed for the project to be formulated in this survey are carefully considered to support the relevant policy reforms of GOB, and to pertain to community involvement and responsibility for sustainable management of fisheries. The conceivable sub-components must accordingly ensure community involvement in all steps of fisheries management.

As discussed in the problems and issues in the haor area, the FCD/I projects have generally negatively affected the aquatic environment of varying water bodies. In addition, constructing polders in flood-prone areas, and general draining out of water have caused natural water bodies within the polder to dry up partly or sometimes even completely, which in turn is related to a reduction in fish catch. Hatchlings or fish fry of all types of wild fish that used to enter beels, baors, and haors from rivers can also be negatively affected. As the water in the beels started receding, these growing young fish or juveniles have started migrating to the river again in order to further feed, grow, and become brood stock of the following year. This cycle of natural production of fish can be negatively affected by flood control and drainage activities. To counter the possible negative impacts of FCD/I structures and other interventions, it is therefore necessary to carefully consider all the activities contemplated in the project during its planning stage in order to provide appropriate measures such as protecting and

conserving fisheries resources, in consultation with respective agencies. In the project, most of the flood management infrastructures, which are planned to be rehabilitated or be constructed, are submergible embankments that intervene with natural conditions by only one month in a given year during the pre-monsoon period. Although the impact of the project is expected to be rather small because of submergible embankment, the impacts of the proposed interventions should be monitored and analysed for future development of the haor area.

The development of beels with connectivity is, therefore, one of the countermeasures to remedy the negative impacts by establishing beel sanctuaries and nurseries to protect and conserve the haor fisheries resources.

Furthermore, the haor areas with its vast floodplain also offer opportunities for interventions that are expected to enhance household income of the marginal poor including women involvement, particularly in the fish net-pen culture, cage culture, backyard pond culture, fish drying, and fermentation. The focus on rural infrastructure development would also offer opportunities in the value chain.

The conceived sub-components for fisheries promotion and livelihood improvement are summarized in Table 6.3.1. The table also indicates the required scope of activities, and rationale and justification for the sub-components. Appendix 6.3 details the profiles of the sub-components.

Table 6.3.1 Sub-components for Fisheries Promotion and Livelihood Improvement

Proposed Plans	Sub-components	Scope of Work (Activities)	Rationale and Justification	Remarks
Community-based Resources Management (Participatory Resources Management)	• Development of beels	• Resource Mapping for selection of beels. • Identification of target beneficiaries.	• Basis for the development of sanctuary and nursery for positive impacts on biodiversity, conservation, fish increase, and employment creation.	• Selection criteria for beels (refer Table 6.3.3)
	• Establishment of fish sanctuaries	• Identification and delineation of beels (for fish sanctuaries). • Excavation of water bodies (in some cases). • Establishment of management committees. • Training of beneficiaries.	• Lack of sanctuaries to protect or conserve brood stocks that facilitate breeding. • Obligation to maintain conservation and biodiversity of beel fisheries.	• Habitat restoration for enhancing fish biodiversity.
	• Establishment of beel nursery for increasing fry and fingerlings for recruitment to Haor basins (floodplain)	• Selection and delineation of beels for nursery program. • Excavation of water bodies and making dikes (in some cases). • Arrangement of protective measures (for released fry and fingerlings). • Nursing of fry and fingerlings through proper nursery management. • Establishment of management committee. • Training of beneficiaries.	• Fingerling recruitment for floodplains to maintain production levels in situation of high fishing pressure and fish habitat degradations. • Proper utilization of mild flowing rivers in the haor area. • Women and family members of poor households. • Target groups are the poverty-stricken areas (livelihood protection component).	• Beel nurseries to be stocked with hatchery-produced hatchlings • After the three-month growing period, fry and fingerlings will be released into floodplains. • Source of juveniles for floodplain stocking (by DoF). • Open water and beel fisheries (publicly-owned but leased out to fishers). • Water bodies are leased out to cooperatives, fishers associations, and open water is normally open to all fishers.

Proposed Plans	Sub-components	Scope of Work (Activities)	Rationale and Justification	Remarks
Floodplain Aquaculture Development	• Net-pen fish culture (community and household-based approach)	• Identification and delineation of suitable location. • Identification of households and groups of fishers. • Arrangement of protection measures (for released fry and fingerlings). • Procurement of materials and setting up. • Establishment of management committees. • Monitoring and evaluation. • Training of fisheries officers and beneficiaries.	• Better use of flowing water bodies of floodplain to generate income for fishers.	
	• Fish cage culture (community and household-based approach) – Pilot Scale – seasonal cages and permanent cages	• Identification of rivers with mild and installing locations • Identification households to be engaged (organize interested farmers or CIGs) and to be willing to start or expand cage and pen fisheries, and receive training) • Provision of fish cages and other facilities with technical demonstration. • Capacity building to identified farmers. • Monitoring and evaluation • Training of fisheries officers and beneficiaries.	• Proper utilization mild flowing rivers in the haor area. • Women and family members of poor households. • Target groups are the poverty-stricken areas (livelihood protection component).	• Privately owned cage fisheries businesses are mainly fingerling nurseries and cultivation. • Cage and pen fisheries are slowly expanding, which can be accelerated along with dried fish. • Entry strategy is to assist sample farmers by providing fingerlings or cost fingerlings to start cage and pen fisheries.
	• Backyard pond aquaculture	• Selection of backyard ponds and households • Group formation of interested HHs, motivation, and awareness building. • Pond renovation (if necessary, fixing nets, etc.). • Pond preparation (drying, cleaning, liming, manure, etc.). • Training (pond management, etc.).	• Proper utilization of backyard ponds (with perennial water). • Target groups are women and family members of households in poverty-stricken areas (livelihood protection component).	
	• Floodplain aquaculture under the community-based enterprise approach	• Following the Daudkandi Model (Comilla District). Use of haor area extensive floodplain for fish and rice production (refer Appendix 6.4)	• Use of floodplain to enhance production from seasonal flooded areas after paddy harvest.	
Strengthening Fisheries Support Services	• Extension services strengthening	• DoF needs to fill in the vacancies in DFOs, UFOs, etc. • Strengthen the capacity of fisheries staff (in DFOs, and UFOs) to have requisite sufficient knowledge, skills, and techniques.		
Marketing Support Service (Improvement and Access to Market)	• Fish landing centres, markets (hats), etc. • Rural access roads			• Covered in Component 2. • HILIP (78 small village markets or hat bazaars and 52 markets)

Source: Prepared by the JICA Survey Team, 2013.

6.3.2 Locations (Sites) for Sub-Components and Activities

(1) Locations for Sub-components and Activities

The identification and requisition of suitable locations/sites, beels (water bodies) are prerequisites prior to planning and designing the programmes and activities. There is no prepared list of potential locations or sites (of beels) that examine the suitability and conformity to the selection criteria during the preparatory survey, except for the selected 29 subproject schemes in Component 1. The selection of beels and sites has to be identified within the haor upazilas of the selected 29 subproject schemes of Component 1. Therefore,

there may be some restrictions especially on the suitable locations and availability of khals for connectivity.

The core of the CFRM component is the requisition and leasing of beels for community-based management, and the formation of beel user groups (BUGs) that will manage the beels through their beel management committees (BMCs). Community-based management of beel fisheries will be supplemented by beel development (such as excavation, embankments, and sanctuaries), tree and vegetable planting on embankments or raised land, and swamp tree plantation.

Number, location, size and names of the beels (naturally occurring depressions) are not available in the 29 subproject schemes. Therefore, resource mapping must be conducted to examine the suitability of the selected khals to beel development. The selection criteria for screening both the beels and target beneficiaries are listed in Table 6.3.2, which would be applied to all the 29 subproject schemes. Normally, locations of beels vary geographically from different upazilas in number and size. Some beels may overlap or extend to the neighbouring upazilas and districts that are not under the subproject schemes. To resolve the identification and selection issues, there should be flexibility in identifying and selecting the beels outside the subproject zones or areas. In other words, beels in the vicinity of subprojects that will affect the subprojects should be considered. However, the selection of beels should adhere to the selection criteria, such as they should be free from conflicts, social issues, and legal issues.

Preferred sizes of beels within the 29 subprojects range from 10 to 50 acres; it must be noted that some of the beels in the 29 subproject areas might have been selected by HILIP. Therefore, identifying and selecting beels and developing them for operation and management will be a gradual process during project implementation, say, it may take two to three years, and it will be reflected in the project implementation schedule.

Table 6.3.2 Basic Selection Criteria for Beels

	Identification of Beels	Target Beneficiaries
Method	PRA and consultation meetings	PRA and consultation meetings
Items	- Khas area (Government-owned) - Beel area < 20 ac - Beel area >20–100 ac - Connectivity with canals/khals - Lease-free (not leased) - Lease status (if leased) - No conflicts - Productivity potential (of water) - Pollution free	- Number of villages and HHs - Population characteristics - Land holdings - Willingness to participate and form BUGs, BMCs, etc.

Source: Prepared by JICA Survey Team, 2013 based on the CBRMP and HILIP

(2) Formation of Beel User Groups for Beel Development and Operation

The project proposed to organize and form BUGs that will play very important roles in the community-based resource management. The BUG is not a new concept; it has been successfully formed to manage the developed beel systems in the on-going SCRMP in

Sunamganj District. HILIP also has plans to form BUGs in five districts. The requirements and conditions that are essential to community-based resource management, especially on group formation, fostering, activities and monitoring of activities, are explained below.

1) Leasing of Beels

The core of the community-based resource management component is to lease government-owned beels to the community. BUGs formed in the project will carry out the community-based management of beels; and BMCs formed within the BUG will be in charge of the beel management. Community-based management of beel fisheries will be supplemented by beel development (excavation, embankments, and sanctuaries), tree and vegetable planting on embankments or raised land, and swamp tree plantation.

The project management unit (PMU) will apply for lease and requisite the beels from relevant agencies and ministries to be handed over to the project. Handed-over beels will be selected on the basis of the following criteria:

- An open water body (with connectivity with canals/khals),
- Surface area between 15-100 acres,
- Free from current litigation,
- Free from pollution, and
- Free from conflicts with other crops.

On securing the approval from MoL for handing over the beel to the project, BUGs and BMCs will thus be formed to take over community-based management of beels and related resources.

2) Formation of BUGs

The BUG members will be selected through a participatory rural appraisal (PRA) process, which will involve examining the poverty and fishers status of applicants. Along with the project officials and applicants, Union Parishad (UP) members from the concerned villages will also be involved in the selection process.

The BUG members will be selected based on being full-time or part-time fishers, and owning less than 2.5 acres of land. BUG members will have to be composed of at least 25% women.

The BMC will consist of three persons, and will be elected by the members through a secret ballot, and at least one of the three members of the BMC has to be a woman. The BUGs have to adhere to the BUG key rules, which are equal sharing of costs and benefits (after paying wages), and adherence to fish conservation rules.

Once the BUG and BMC have been formed, the district project office will inform the district collector of the list of the BUG and BMC members who will carry out community-based management of beels. The district collector is a revenue collector

employed by the MoL in the deputy commissioner's office. The deputy commissioner also acts as district collector to collect the beel lease charges.

3) Function of BUGs

The BUG members through their own resources will raise money in order to pay the lease fees of the beel and deposit the same amount with the DC's revenue office.

The BUGs will specify the local rules for fishing in groups and individuals. They will make arrangements for guarding the beels, chiefly by rotation among members but may involve hiring guards. Women will have certain specific roles in resource management that will include the following:

- Sort fresh fish for sale,
- Plant trees and cultivate vegetables on embankments or raised land,
- Carry out swamp tree, nursery and plantation, where feasible, and
- Undertake fish processing, either drying or fermenting, for value addition.

With the support of project officials, the BUG will prepare a development plan for the beel. This will be subject to the approval of the district project office.

The BUG will open a bank account, where all money received and collected will be deposited. On days of group fishing, the surplus after paying wages will be deposited in the bank account in the next banking day. All money received from the project, for instance, to carry out the beel development plan, will be deposited in the same account.

The BUGs will receive financial support from the project as per the fund approved for development of the beel. This will be directly deposited in the BUG's account. Accounts have to be maintained for all expenditures, whether from the development fund or from the BUG's own resources. Accounts will be subject to periodic audit by the project.

4) Graduation

The Jalmohal Management Policy (2009) states that in the case of beels under the projects, such as HILIP and the planned JICA-funded project, the rules of that certain project will apply and determine who has access to the beel, in this case the BUGs. But without a project, leases will be given only to fishers' groups registered under either cooperative or social welfare departments. In preparation for the completion of the project, it is necessary to have a system of graduating BUGs, so that they can secure leases and manage on their own when the project ends.

Graduation will cover a step-by-step process of strengthening group functions and management. Whether BUGs are ready to graduate will be judged on the basis of the following:

- Sustained increase in fish catch,
- Increase in number of species in beel,

- At least 25% of members are women,
- At least one woman is a member of the BMC,
- Regular elections,
- Equal sharing of expenses and profits, and
- Audited accounts reveal no irregularities, including high and unspecified miscellaneous expenses.

5) Exit Strategy

BUGs that have graduated will be supported and encouraged to form cooperatives that allow the distribution of profits, which is not possible by registration under the social welfare department.

The project and local government department (LGD) will support the case for awarding of a ten-year post-project lease to these cooperatives. It is expected that the registration of fishers' groups as legal bodies, along with the renewal of lease recommended by the LGD, will sustain the beel resources through community management.

During the project period, links will be developed with DoF that will continue providing technical support. District fisheries officers will also be members of the beel leasing system, and will support the BUG along with LGED after the development phase.

(3) Proposed Programmes/Activities of Sub-components

The proposed components and the required activities are summarized in Table 6.3.3. The selection criteria for the sites and locations are shown in Appendix 6.5.

Table 6.3.3 Programmes/Activities of Sub-components

Sub-components (Programmes)	Activities
A. Community-based Fishery Resource Management	
Development of Beels	Resource mapping and identification of resources.
	Selection of Beels (in 29 schemes in five districts).
1. Establishment of sanctuary/nursery	Collection and preparation of list of beels from DC's office.
2. Target 150 beels in 29 schemes	Screening and selection of beels based on a set of criteria.
3. Beel connectivity (canal/khal excavation)	Mapping of selected beels at district level (through PRA and consultation meetings).
	Formation of BUGs, as discussed in Section 6.3.2 (2).
	Identification and delineation of sanctuary areas.
	Training (on excavation, conserving resources, etc.) of beneficiaries.
	Arrangement of process for leasing to BUGs.
	Excavation and setting up (plantation on raised land, etc.).
B. Income Generating Activities (*)	
Floodplain Aquaculture Activities Development (Model/Pilot Projects)	Selection of sites, formation of groups, and training.
1. Net-pen fish culture	Selection and delineation of suitable locations.
	Identification of HHs, fishers, and farmers and formation of groups.
	Establishment of management committee.
	Procurement of materials and setting up protection measures for fish fry and fingerlings.
	Capacity building and training (beneficiaries, fishery staff).
	Procurement and stocking of fingerlings sized 5-6".
	Monitoring and evaluation.
2. Fish cage culture	Selection, identification, and delineation of suitable locations.
	Identification of mild flowing water bodies and installing locations.
	Identification of households, fishermen, and farmers and formation of groups.
	Establishment of management committee.
	Providing fish cages and other facilities with technical demonstration.
	Capacity building and training (beneficiaries and fishery staff).
	Monitoring and evaluation.

Sub-components (Programmes)	Activities
3. Backyard pond aquaculture	Selection of ponds (earthen).
	Identification of HHs interested in pond culture.
	Group formation, motivation, and awareness building.
	Pond renovation (if necessary) and preparation (cleaning, liming, etc.).
	Fish species selection and stocking.
	Training (pond management, feeding, fertilization, etc.).
	Monitoring and evaluation.
4. Daudkandi Model Aquaculture	Selection of suitable floodplain areas (semi-closed waters).
	Identification and mobilization of interested HHs, farmers, fishers, etc.
	Formation of groups and committees, and awareness building on enterprise approach.
	Preparation of activity plan, budget, capital formation, etc.
	Land preparation for fish culture and agriculture farming.
5. Fish drying and fermentation	Site selection of fish drying (among HHs and groups).
	Mobilization and organization of beneficiaries groups.
	Training on improved processing and awareness on sanitation and hygiene.
	Monitoring and evaluation.
C. Fisheries Support Services	
Empowerment of Fisheries Extension	Strengthening the capacity of fisheries staff (DFO and, UFO) on knowledge, skills, and techniques.
D. Trainings/Workshops/Seminars	
- Training of project staff/officers - Training of beneficiaries - Consultation meetings (GOs and NGOs) - Workshops (on need based subjects) - Seminars on findings, new ideas, etc.	- Skill improvement of resources staff on biodiversity, beel management, aquaculture, livelihood promotion, monitoring, etc. - Information on programmes/activities to relevant agencies and offices. - Promotion of better understandings among central and local agencies. - Discuss on problems/issues and finding the respective solutions. - Disseminate and sharing of findings, new ideas, etc.
E. Exchange Visits for Experience Sharing – To share success and weakness for overall improvement of activities.	
F. Monitoring, Legal Support and Studies	
- Third party M&E - BUGs auditing - Legal support	- Generation of data/information to check on the performance, efficiency, and impacts of project activities. - Regular auditing of BUGs on financial performance, etc. - Legal support to protect from legal issues (beel leases, etc.)

Remarks: * Refer Appendix 6.5 for the selection criteria of locations/sites for Floodplain Aquaculture Development Activities
Source: Prepared by JICA Survey Team, 2013

6.3.3 Trainings and Relevant Activities

Appropriate and timely activities, namely: training, workshops, and seminars are planned, and these activities will be implemented in parallel with the above-mentioned sub-components. This will be done to achieve positive impacts of the sub-component activities especially on the development and community-based management of resources, skill development, and capacity building. The training and relevant activities are summarized in Appendix 6.6 and further discussed in Section 6.3.5.

6.3.4 Planned Sub-component Programmes and Target Beneficiaries

(1) Planned Sub-components and Volume

The program and activities are planned for seven years or more. The identification of resources through resource mapping will be implemented at the beginning of the project in order to identify and select the pre-requisites of beels prior to development.

The target numbers of beels within the 29 subproject schemes of the five districts are 150. The development of the selected beels will be conducted in phases. The connectivity of beels with canals/khals is necessary for the development sanctuaries and nurseries. Therefore, the closeness of the canals/khals will be one of the criteria for the selection of suitable beels.

Floodplain Aquaculture Development will introduce demonstration modules (sets) for promoting income-generating activities among interested farmers and fishers including

women participation. The technology on (aquaculture practices) will be disseminated to other interested inhabitants (farmers/fishers) at their own expenses.

For the fisheries support service, only the strengthening of fisheries extension is considered. The renovation or renewal of fish hatcheries is not considered in view of the high cost (say BDT 300 million for just three hatcheries in the project district). In addition, it is beyond the scope of the two implementing organizations, as it is under the responsibility of the DoF.

(2) Primary Target Beneficiaries of the Sub-components

The BUGs are the target beneficiaries of the selected beels, while the other beneficiaries are those engaged in floodplain aquaculture activities. The target beneficiaries of the sub-components are shown in Table 6.3.4, wherein both men and women can participate, who will be organized accordingly into groups. Women will be given preference in certain sectors or activities, e.g., backyard (homestead) pond fish culture, net-pen and cage culture fisheries, and dry fish. The participants must be willing and interested to learn through training, exchange visits, and technical assistance provided by the project. Participants should be able to mobilize financial resources to do actual fish farming or business since the project will only provide initial financial assistance for setting up and operation.

Table 6.3.4 Primary Target Beneficiaries of Sub-component Programmes

Program/Activity	Primary Target Group and Beneficiaries
A. Community-based Fishery Resource Management (CFRM)	
1. Resource Mapping and Identification of Resources	
2. Development of Beels System	Fishers/farmers living around the beels will be organized to BUGs*
Beel operation/sanctuary/nursery management	
B. Floodplain Aquaculture Activities	HHs, fishers, farmers will be encouraged to form groups, preferably those landless. Women will be given preference. Participants must be willing and interested to learn through training, exchange visits, and technical assistance provided by the project. Participants must also have some experience in certain activities.
Income Generating Activities (Pilots)	
Fish net-pen culture	
Fish cage culture	
Backyard fish pond culture	
Seasonal aquaculture (Daudkandi model)	
Dry fish and fermentation	
C. Fisheries Support Services	
Fisheries Extension Strengthening	DFOs and UFOs (in the project areas)
D. Trainings/Workshops/Seminars	
1. Training of Project Staff/Officer	Project field staff (PMO and PIU)
2. Trainings of Beneficiaries	
Net-Pen Fish Culture	All participants (groups) in the above income generating activities and BUGs.
Fish Cage Culture	
Backyard Fish Pond Culture	
Daudkandi Model Aquaculture	
Capacity Building BUGs	
Fish Drying and Fermentation	
3. Consultation Meetings with GOs and NGOs	Government officials and NGOs, etc.
4. Workshops (on need-based subjects)	Government officials, research organizations (agricultural universities, fisheries research institutions, NGOs, etc.
5. Seminars on Findings, New Ideas, and Results	
E. Exchange Visits for Experience Sharing	Representatives of above groups
F. Monitoring, Legal Support and Studies	
1. Third Party M and E/ Knowledge Management	
2. BUGs Auditing	All BUGs
3. Legal Support	BUGs having legal issues

Remarks: Asterisk (*) indicates to refer Section 6.3.2 (2) above on the formation of BUGs, its role, function, etc.
Source: Prepared by JICA Survey Team, 2013

(3) Technical Specifications of the Sub-components

A brief description of the technical specifications is summarized in Table 6.3.5 (refer Appendix 6.6 for further details).

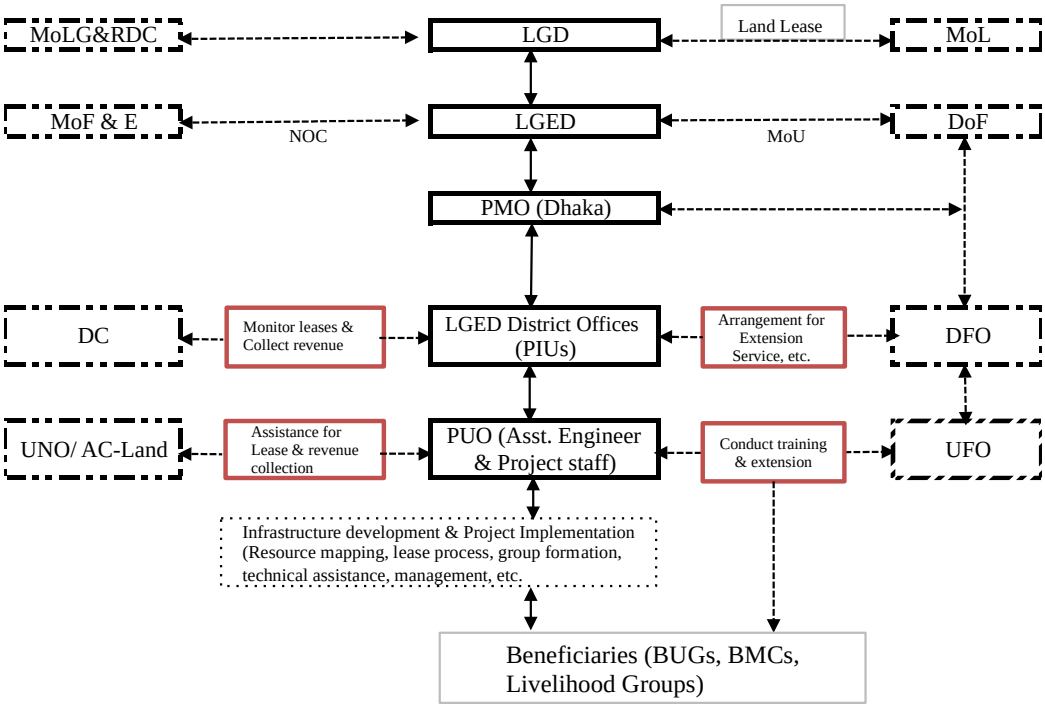
Table 6.3.5 Brief Technical Specifications and Description

Sub-components (Programmes)	Brief Description
A. Community Resource Management Development of Beels	
A-1. Resource Mapping and Resource Identification	Screening and identifying 150 beels in five districts within the haor area upazilas
	Preparation of list of beels (not covered in HILIP) and review by relevant authorities.
	Group formation
A-2. Development of Beel System	Establishment of sanctuary, swamp forest, etc.
	Beel connectivity (canal/khal excavation)
B. Floodplain Aquaculture Activities	
B-1. Alternate Income Generating Activities (Pilot Models)	
B-1.1 Net-Pen Fish Culture	Selection and identification of location for net-pen fish culture
	Area 10-ha/net-pen; 2 sets/district; total 10 sets (5 districts)
	Operation/management: Group approach
	Training provided
B-1.2. Fish Cage Culture	Selection and identification of location for fish cages installations
	Small cage set: 1 unit (m^3) x 20 units (20 m^3) per selected location
	One set per district; total 5 sets (5 districts)
	Large cage set: 10 units joint (25 m^3)m^3) per selected location
	One set per district; total 5 sets (5 districts)
	Operation/management: Group approach
	Training provided
B-1.3 Backyard Fish Pond Culture	Identification and selection of location for suitable backyard ponds
	Size: 5-10 ponds/group; 10 members of HHs/group
	Number: 4 groups/district; total 20 groups (5 districts)
	Operation/management: Group approach
	Training provided
B-1.4 Daukhandi Model Aquaculture	Identification and selection of location for seasonal floodplain aquaculture
	Area size: about 10 ha (Water: seasonal 4-5 months (depth not above 8 ft.)
	Water: seasonal 4-5 months (depth not above 8 ft.)
	Total 2 model sites within the 29 subproject schemes (Component 1)
	Operation/management: Group approach
	Training provided
B-1.5 Fish Drying and Fermentation	Training on improved processing and awareness on sanitation, hygiene, and new products
	Operation/management: Group approach
	Training provided
C. Fisheries Support Services	
Strengthening of Fisheries Extension	Fisheries training and material extension development
D. Training/Workshop/Seminar	
D-1. Training of Project Staff/Officer	Training for field staff deployed in field (PMO, PIU, and PUO)
D-2. Training of Beneficiaries	Training for beneficiaries (in the following activities)
	- Net-Pen Fish Culture
	- Fish Cage Culture
	- Backyard Fish Pond Culture
	- Daukhandi Model Aquaculture
	- Capacity Building of BUGs
	- Fish Drying and Fermentation
D-3 Consultation Meetings with GOs and NGOs	Meetings to inform relevant offices/agencies for support and sustainability
D-4 Workshops (on need based subjects)	To update on new technologies, ideas, etc. among project staff
D-5 Seminars on Findings, New Ideas and Results	Dissemination and sharing of findings, etc. among project staff, institutes, universities, etc.
E. Exchange Visits for Experience Sharing	Experience sharing on success and weakness among beneficiaries and project staff
F. Monitoring, Legal Support and Studies	
F-1 Third Party M&E/Knowledge Management	Assess impacts during/after the project intervention through annual surveys.
F-2 BUGs Auditing and Accounting Support	Check performance of BUGs and groups
F-3 Legal Support	Resolve the legal complication if any in the beel leasing process or conflict with others.

Remarks: Refer Appendix 6.6 further for details.
Source: Prepared by JICA Survey Team, 2013

6.3.5 Implementation Schedule of the Sub-component/Activity

Organizational set-up is shown in Figure 6.3.2 (refer Section 7.3.3 Implementation Arrangement of Chapter 7 for further details). The institutions involved in the implementation of beel development and floodplain aquaculture activities include: the LGD's LGED project organization established for the project implementation; PMO in Dhaka; PIUs in five districts, and project upazila offices (PUOs). Major supporting institutions are MoL for requisition of selected beels, DoF for fisheries training and extension, DFOs for fisheries support at district levels, and UFOs for fisheries support at upazila levels.



Remarks: NOC, No Objection Certificate from Min of Forestry & Environment);
UNO/AC-Land, Upazila Nirbahi Officer/Asst Commisioner of Land (for revenue collection)
MoLG & RDC, Min of Local Govt & Rural Development Cooperative

Figure 6.3.2 Organizational Setup for the Implementation

The other supporting agencies are MoFE for non-objection certificate (NOC)*; DC for arrangement of beel leases and valuation of lease charges; UNO/AC-Land for lease charge collection as supervised by UNO. (*NOC is not applicable for fisheries activities, and the NOC that will be obtained for the overall project is adequate).

Preparation of operational manuals and technical guidelines will commence with DoF whose full participation is important in the preparation and application processes. The existing manuals and guidelines of DoF and LGED that were prepared for areas outside the hoar area will be appropriately modified, revised, and updated to suit the project districts. DoF has various manuals for their aquaculture activities in districts outside the project area, and these will have to be modified according to conditions such as ecology, fish species, and location. It will be prepared with full participation of DoF, LGED, and beneficiaries. The guidelines and manuals will cover the implementation approach of activities and the provision of appropriate technology to the users. For example, the existing manuals and guidelines of LGED for beel

development and BUGs in the ongoing Sunamganj project will have to be modified accordingly to suit the conditions in the other four districts (or 29 subprojects under Component 1).

The development of the beel system follows the resource mapping and identification of resources. Resource mapping and resource identification must be conducted in the 29 subproject areas. Once beels have been identified and selected by PRAs, the leasing process begins with the MoL requiring the beels for lease that may take considerable time, as the MoL needs to review and examine the status before transfering to LGD/LGED*. BUGs will be organized and formed for the respective beels only after the complete requisition and acceptance of the beels from MoL. It is then followed by the establishment of beel sanctuary or nursery of beels (with connectivity) that involves zoning, removal of silt, strengthening of bunds, planting of tree saplings, etc., that will be done through labour contracting societies (LCS) by the BUGs in preparation for the operation and management of the beels. Once MoL has formally handed over the beels, LGD/LGED (as the project implementer) will assist the BUGs to get leases through MoUs between respective BUGs and the DC. The district collector, a representative of MoL, will then collect the appropriate lease charges.

Floodplain aquaculture activities are planned as alternate income generating activities, which are pilot or demonstration activities that would introduce the existing national aquaculture practices and technology to the haor areas. The aquaculture activities are net-pen fish culture, fish cage culture, backyard fishpond culture, and seasonal floodplain aquaculture (or the Daudkandi model). The site selection, model preparation, and group formation will be implemented within the 29 subprojects areas. Selected beneficiaries will be grouped and trained accordingly for the operation and management; extension service will also be provided throughout the project period.

Fisheries support service or fisheries extension services of DFOs and UFOs, particularly where the fisheries subprojects will be implemented, will be strengthened through the provision of promotional materials for training and extension services. DFOs and UFOs are expected to provide technical assistance to beneficiaries, whenever needed, and also to establish relationship with them to ensure sustainability even after the project period. Therefore, the provision of extension service to beneficiaries is a continuous process.

Training, workshops, and seminars will be planned accordingly to improve, strengthen, and sustain the development activities. Training of project staff based in PMO and PIU, is important to develop their skills on aquatic biodiversity, beel management, and aquaculture practices. They will be provided with training by resource persons (trainers), consultants, and officers from local administration, planners, DoF, etc. on a regular basis during the project period.

Training of beneficiaries will also be implemented through phases in order to provide appropriate skills on alternate livelihood through fisheries activities, such as fisheries management and aquaculture, for better operation and management. The groups will also be trained in accounting and savings. Consultants and experts of DoF, fisheries research

institutions, and parties with relevant knowledge will provide trainings while the project staff will arrange and facilitate them.

Women participation must be encouraged and ensured in the project (both the community-based fisheries resource management and floodplain aquaculture activities). In BUGs, women participation will be at least 25% and will be trained on subjects such as nursery management (feeding, feed preparation), harvesting implements, equipment making and repairing, and post-harvest management. In BMC, women will be trained to assist in record keeping, accounting, meeting arrangement, and office management. In floodplain aquaculture activities, such as backyard (homestead) aquaculture, cage culture, net-pen fish culture, and fish drying and fermentation, do not depend on or require leasing of water bodies. Women are primarily encouraged to get involved, with more than 60% of women expected to be involved in these activities. For net-pen fish culture and Daudkandi model aquaculture, 30-40% of the involved should be women as the activities may be far from their homesteads, assisting in feed management, post-harvest management, and daytime guarding. Beneficiaries including women will be appropriately trained.

Consultation meetings with GOs and NGOs are essentially important to formulate policies and train decision makers in the government on the project activities. The meetings will be held once every year that will be participated by government officials, public office representatives, local agencies, and NGOs. Local NGOs must also be aware of the project activities in order to promote and continue the activities in a sustainable manner.

Similarly, workshops and seminars are planned to disseminate the results/findings to government officials (planners and decision makers), research institutions, and universities, and simultaneously seek out and acquire ways to improve and obtain better benefits of the activities.

Exchange visits among the representatives of the beneficiaries and stakeholders are planned in order to share their successes and failures for the overall improvement of the activities. Successful privately owned farms should also be visited so that participants would receive information such as on costs, profitability, opportunities and challenges, and marketing system.

Third party monitoring and evaluation and knowledge management are intended to generate data/information that would measure the progress and achievements, such as increase in fish species, biodiversity, and income. The generated data/information shall be used to check on the performance, efficiency, sustainability, and impact of project activities, and will also assist in resolving weaknesses and improve the project activities.

In the providing auditing/accounting support to the target beneficiaries, the auditors of BUGs will conduct regular auditing on financial performance. This is for better group management and capacity building of BUG members in account transparency.

Legal support is also important for the overall check and balance of the project activities. Legal support is planned for six years and it will assist and protect the BUGs and its members

against legal issues (such as beel leases) from lease owners, external individuals or groups, or the elites.

CHAPTER 7 PROJECT IMPLEMENTATION AND O&M ARRANGEMENTS

7.1 General

As mentioned in the previous chapters, the project to be formulated in this survey consists of the following three project components: i) Component 1 is for construction and rehabilitation of flood management infrastructures including embankments, sluice gates/regulators and canals for the 29 selected subprojects in Netrokona, Kishoreganj, Habiganj, Brahmanbaria, and Sunamganj districts; ii) Component 2 is for construction and rehabilitation of rural development infrastructures such as rural roads including bridges and culverts, growth centers/rural markets (hats) and boat landing facilities (ghats) located in the Component 1 subprojects areas; and iii) Component 3 is for implementation of livelihood improvement activities including agricultural production improvement (Component 3-1) and fishery production improvement (Component 3-2) conducted in and adjacent to the Component 1 subprojects areas.

The executing agencies of the project are BWDB and LGED as confirmed by JICA and GOB in July 2013. BWDB will be responsible for implementation and operation and maintenance (O&M) of Components 1 and 3-1. LGED will be responsible for implementation and O&M of Components 2 and 3-2. Demarcation of the responsibilities for implementing Component 3 is discussed further in Subsection 7.3.1.

7.2 Current Organizational Structures of BWDB and LGED

7.2.1 BWDB

(1) Legal Background

The BWDB started its operation as the water wing of the former East Pakistan Water and Power Development Authority in 1959. After the recent transformation of BWDB, the reform program and structural adjustment process were undertaken by GOB in accordance with the enactment of the BWDB Act 2000 that requires the BWDB's functions be guided by the NWP of 1999 and the NWMP of 2004.

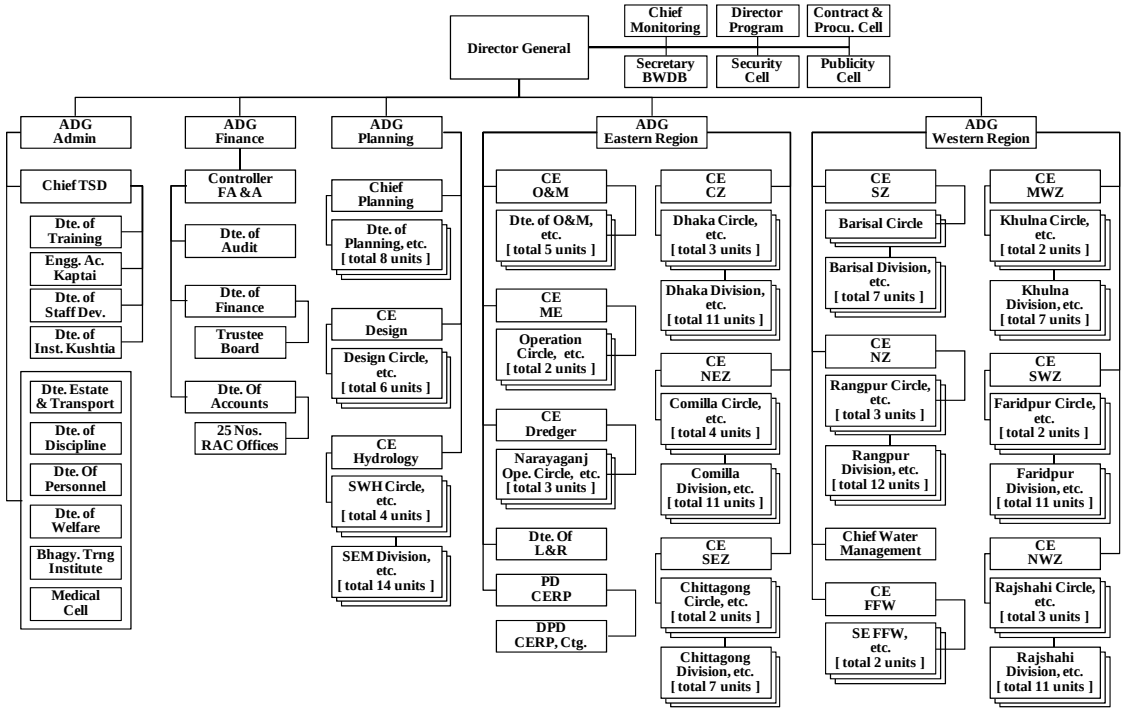
The BWDB Act 2000 was promulgated to replace the Act of 1972 as part of a reform agenda. A governing council was established as the top policy making body of the board while the board, which is led by the director general (DG), would be responsible for implementation and monitoring. The governing council is composed of one chairman, the Minister of MoWR, and 12 members, which include engineers and NGO representatives.

(2) Structure and Personnel

The chief executive of BWDB is the DG. The overall authority for board management is vested with the DG and under him there are five additional director generals (ADGs). The whole country is divided into eight BWDB zones. The zones are headed by eight chief engineers (CEs). Each zone is then divided into two to three circles. Each circle is headed by

one superintending engineer (SE). Furthermore, each circle is subdivided into three to four divisions, and each division is headed by an executive engineer (EE). There are eight zones, 33 circles, 86 divisions and around 200 subdivisions. A summary of the present organizational structure is shown in Figure 7.2.1 below.

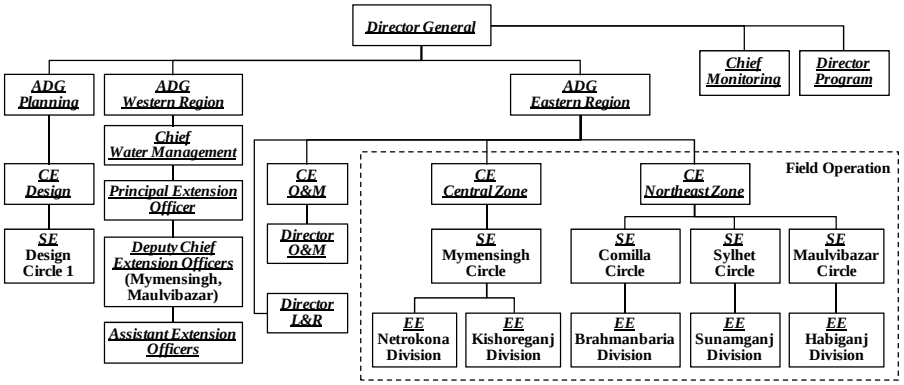
The overall manpower as of June 2013 is 6,061 officers including both headquarters and field offices while the total number of sanctioned posts is 8,935. BWDB has proposed a needs-based overall manpower increase to 13,594 to the government agencies concerned in order to fulfill their roles. The proposal is currently awaiting the approval of the Ministry of Finance.



Source: JICA Survey Team based on BWDB

Figure 7.2.1 Overall Organizational Structure of BWDB

The target area of the survey is under the jurisdiction of ADG of the Eastern Region. From the above structure, offices relevant to the survey particularly in terms of technical matters are summarized in Figure 7.2.2 below.



Source: JICA Survey Team based on BWDB

Figure 7.2.2 BWDB's Offices Concerned to the Survey

The current manpower of offices concerned with project implementation and O&M in BWDB is summarized in Table 7.2.1. The details are presented in Appendix 7.1. As shown in the vacancy rate in the table, actual manpower is insufficient relative to sanctioned posts at each level. However, a flexible mechanism has been created and necessary manpower is arranged when required, according to BWDB.

Table 7.2.1 Manpower Concerned to Project Implementation and O&M in BWDB

(Unit: person)

Office		Approved Nos.	Existing Nos.	Vacant Nos.	Vacancy Rate (%)
Headquarters	O&M Directorate	24	14	10	42
Local Offices *1	Netrokona O&M Division *2	64	23	41	64
	Kishoreganj WD Division *2	55	23	32	58
	Brahmanbaria WD Division *2	60	11	49	82
	Sunamganj O&M Division *2	97	32	65	67
	Habiganj O&M Division *2	61	23	38	62

Note: *1 Division offices include the number of manpower of sub-division and section offices.
*2 The name of "WD (water development)" or "O&M" is a vestige of BWDB's old organization structure.
Source: BWDB, O&M Directorate and Five Division Offices

(3) Division of Duties

As mentioned in Subsection 7.2.1 (1), policy making and overseeing the overall management of BWDB is now vested on the governing council and the Board of Directors. The major functions and duties of offices of the DG and the ADGs are provided as follows:

Office of the Director General:

a) Top management of BWDB in fulfillment of the mandate set down in Bangladesh Water Development Board Act and other applicable Laws, Regulations and Policies of the Government.
b) Overall charge of BWDB and all its offices for efficient functioning of the Body.
c) Carrying out responsibility as the Head of BWDB and taking decisions on all essential matters related to its operation.

Office of the Additional Director General Administration:

a) Management of matters relating to human resources recruitment, development, assignment and control for conduct of BWDB's business.
b) Management of matters relating to the acquisition of movable and immovable property for conduct of BWDB's business

Office of the Additional Director General Finance:

a) Management of all financial matters of BWDB including budgeting and disbursement of funds.
b) Administration of financial rules and procedures of BWDB including maintenance of financial discipline, account and audit requirements.

Office of the Additional Director General Planning:

a) Providing inputs and technical reviews for the preparation of National Level Perspective and the Five Year Development Plans.

b) Micro planning for water resources development consistent with the National Water Policy and within context of the National Water Management Plan (NWMP).

c) Hydrological studies, data collection, management and research.

d) Undertaking activities for formulation and preparation of planning documentation for BWDB projects.

e) Maintaining updated management information related to planning of water sector development.

f) Supporting WARPO and other water sector agencies in the development of efficient water resources management and utilization of plans and updating various guidelines on water management.

Offices of the Additional Director General Eastern Region and Western Region:

These two (eastern and western) offices are responsible for both project implementation and O&M matters. These two region-based offices were created by reconstructing the former "implementation wing" and "O&M wing", which covered whole area of the country.

Implementation:

a) Design, construction and implementation of plans for new large and medium scale water development projects.

O&M:

a) Preparing and updating of inventory of completed projects containing all basic project information.

b) Operation and maintenance of completed projects over 5,000 ha as outlined in NWPo.

c) Providing management guidelines and necessary assistance to local and community organizations and the local governments for O&M of schemes with command area below 5,000 ha.

d) Rehabilitation of projects under GOB funding and as directed by the Board from time to time.

e) Transfer of rehabilitated/operating projects of 1000ha or below to the local governments.

f) Water management activities as indicated in the NWPo.

g) All activities under the Food For Works (FFW) program.

h) Cost recovery, development and matters related to participatory water management.

i) Preventive work to forestall damage to water infrastructures due to natural disasters, damage assessment and emergency repairs.

In terms of this project, the office of ADG (Planning) is responsible for planning and design works and the offices of ADG (Eastern Region and Western Region) are responsible for implementation and land expropriation. Environmental matters are generally handled by the PMO headed by the PD because there is no particular unit in charge.

(4) Current Project Implementation Arrangement

1) Responsible Post for Project Implementation

The PDs are mainly responsible for project implementation at headquarters level, while EEs of division offices are mainly responsible at field level. The PD is designated at the beginning of project. Posts in BWDB associated with project implementation are ADGs (Eastern Region and Western Region), Director of Program, Director of Land & Revenue, zonal CE, and SE of O&M circles.

2) Decision Making Process of Project Implementation

Project Planning, Design and Implementation:

BWDB field offices submit the project proposal to Chief Planning or ADG of Planning. Medium- and large-scale projects are studied through consultant deployment. The physical components are checked by the design office headed by a SE working under the CE of design. Then, the project enters into a DPP, and after approval of the DPP by a competent authority, it enters into an Annual Development Program (ADP) for the next financial year.

During the implementation stage, Director Design's office prepares the design of the project infrastructures, and implementation is carried out by the field offices concerned.

Sanction Process at Each Implementation Step:

In the sanction process at each implementation step, the Planning Commission (PC) and Executive Committee of National Economic Council (ECNEC) under the PC are involved.

i) After formulation of DPPs by BWDB, the MoWR scrutinize the DPPs, and then Sector Divisions of the Planning Commission appraise the DPPs. This is followed by recommendation for approval by the Project Evaluation Committee (PEC)[1].
ii) Then the Minister for Planning give approval for projects costing up to BDT 500 million or the ECNEC give approval for projects costing over BDT 500 million. The approved projects are included in ADP for implementation[1].
iii) Physical break up of ADP allocation is approved by BWDB.
iv) Procurement plan is approved by the zonal CE.
v) Work authorization is approved by zonal CE.
vi) Tender is approved by competent authority as per Delegation of Administrative and Financial Power[2].

Regular Meeting:

Monthly coordination meeting for reviewing the progress of work is held under the chairmanship of DG. The participants are all the ADGs, chiefs, CEs, directors, and all other PDs.

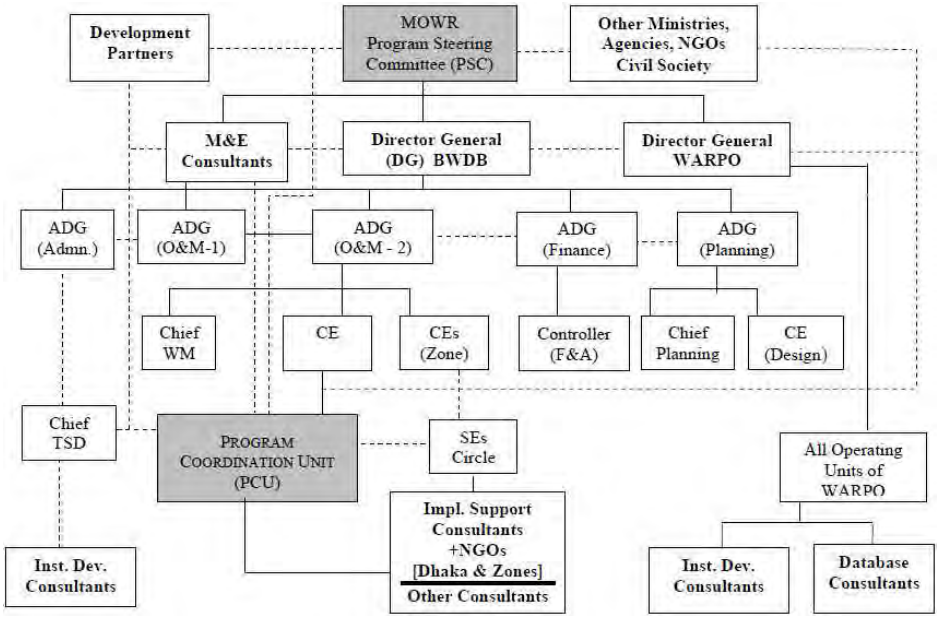
[1] Manual of Instructions for Preparation of Development Project Proforma (DPP), draft version as of August 2013, Ministry of Planning
[2] Central Procurement Technical Unit, Ministry of Planning, 2008

The monthly coordination meetings are held in the offices of SEs, PDs, and zonal CEs.

3) Example of Project Implementation Arrangement for Ongoing Projects

Water Management Improvement Project (WMIP):

The WMIP is an ongoing project of BWDB in the water management sector. The structure of project implementation of WMIP is shown in Figure 7.2.3.

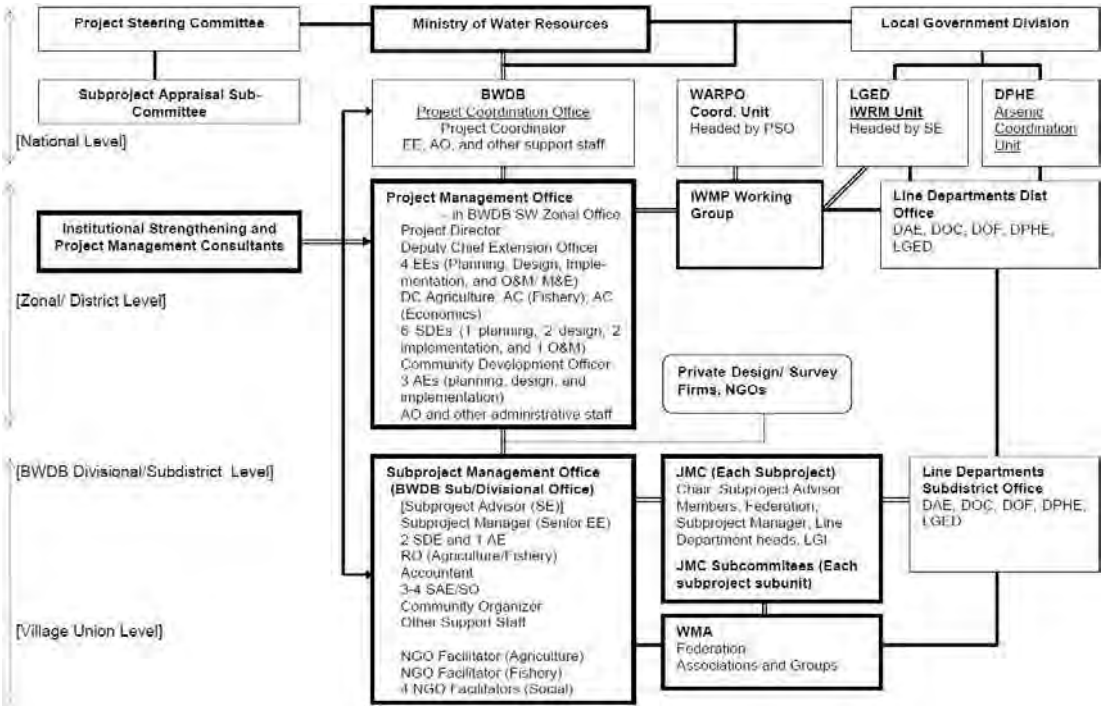


Legend: Normal: Permanent Units within BWDB/WARPO; Shaded: Temporary Unit/Committee
Source: Project Appraisal Document, Water Management Improvement Project (August 2007, WB)

Figure 7.2.3 Structure of Project Implementation of WMIP

Southwest Area Integrated Water Resources Planning and Management Project :

This project aims to rehabilitate and upgrade the existing FCDI schemes in the southwest region. This is one of the BWDB's representative projects related to income generation activities. The structure of project implementation is shown in Figure 7.2.4.

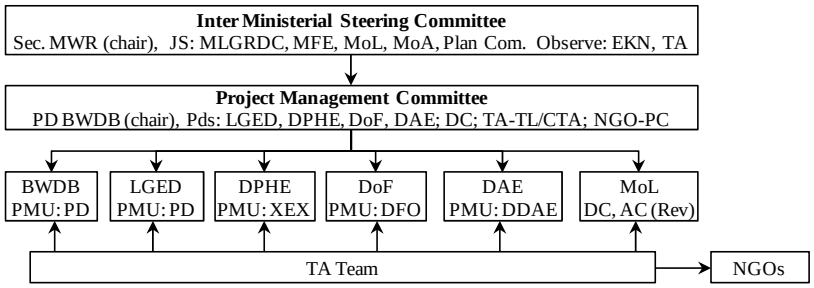


Source: Report and Recommendation of the President to the Board of Directors, Southwest Area Integrated Water Resources Planning and Management Project (October 2005, ADB)

Figure 7.2.4 Structure of Project Implementation of Southwest Area Integrated Water Resources Planning and Management Project

Char Development and Settlement Project (CDSP):

The CDSP is an ongoing loan project implemented by various agencies. The lead implementing agency is BWDB, while other agencies are also involved. The Secretary of MoWR chairs an Inter-Ministerial Steering Committee (IMSC). The structure of project implementation is summarized in Figure 7.2.5.



Source: CDSP Design Completion Report - Appraisal, Main Report

Figure 7.2.5 Structure of Project Implementation of CDSP (Draft)

(5) Current O&M Arrangement

1) Responsible Post for O&M

The CE of O&M is responsible for overall O&M matters with the assistance of the Director of O&M. Although the CE is under the ADG of the Eastern Region structurally, the CE is answerable for both Eastern Region and Western Region. The annual O&M work plan is prepared by the Director based on the requisition of field offices.

At field level, the EE of each division office is responsible for checking, supervising, monitoring and reporting the implementation of physical components of all O&M works of completed projects.

2) Procedure for O&M Budget Approval

The need-based maintenance is assessed by the field office. The field office then proposes to the Director of O&M for funding or inclusion in the O&M program. These works are originally planned by the field office and scrutinized by the Director of O&M. Finally, the modality of financing plan is prepared on a priority basis and proposed by BWDB to MoWR for approval. MoWR submits the proposal to the Ministry of Finance for their concurrence and funding.

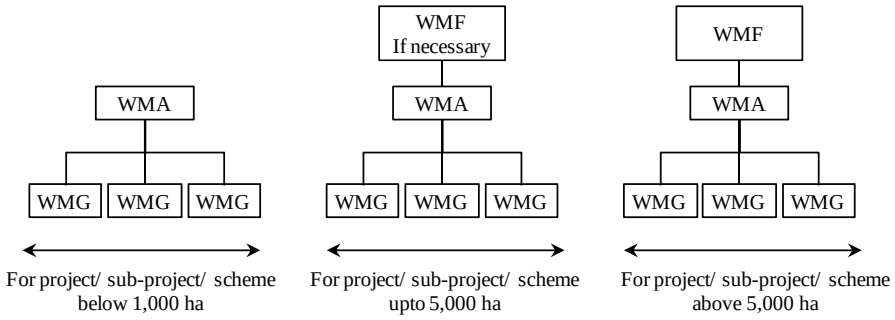
In order to effectively allocate the limited budget, the BWDB headquarters determines the priority based on information provided from local offices such as the importance of structures and the demand of project beneficiaries.

3) Involvement of Stakeholders in O&M Works

In accordance with the Guidelines for Participatory Water Management (MoWR), water management organizations (WMOs) consisting of stakeholders have been established in a number of projects.

The principal stakeholders in haor areas are the farmers who are major beneficiaries of the flood management structures. The other stakeholders who may become members of WMOs are fishermen, small traders, craftsmen, boatmen, aquaculturists, landless people, destitute women, project affected persons, etc. The following three levels of WMO are formed depending on the project sizes shown in Figure 7.2.6:

- Water management group (WMG) is formed at the lowest level for each smallest hydrological unit of social unit (para/village)
- Water management association (WMA) is formed either at the mid-level for each subsystem of the project/subproject/scheme or at the apex level for the project/subproject/scheme.
- Water management federation (WMF) is formed at the apex level of the project/subproject/scheme.



Source: Guidelines for Participatory Water Management (2000, MoWR)

Figure 7.2.6 Organogram of Water Management Organization (WMO)

The name "WMO" is an all-inclusive term for WMG, WMA and WMF. There are other different names of WMO, such as water users group (WUF), water users committee (WUC), water users association (WUA), federation of water users association (FWUA), water management committee (WMC), water management group, federation of water management association (FWMA), depending on the project.

(6) Technical and Financial Capabilities

Current Capabilities of Project Implementation

The present staff allocation of the existing BWDB division, sub-division and section offices in the target area of the project in Netrokona, Kishoreganj, Habiganj, Brahmanbaria, and Sunamganj districts is summarized together with the number of staff for each setup in Table 7.2.2.

Table 7.2.2 Number of Present Staff in the Division, Sub-Division and Section Offices in the Project Area

Office/District	Netrokona	Kishoreganj	Habiganj	Brahmanbaria	Sunamganj
Staff in division office	7 (21)	6 (15)	7 (20)	1 (9)	4 (20)
No. of sub-division offices	2	2	2	3	4
Staff in sub-division offices	6 (23)	8 (20)	7 (21)	5 (23)	14 (37)
No. of section offices	5	5	6	9	10
Staff in section offices	10 (20)	9 (20)	9 (20)	5 (28)	14 (40)
Total staff	23 (64)	23 (55)	23 (61)	11 (60)	32 (97)

Notes: Figures in parentheses are the number of staff as per setup (1998).
Source: JICA Survey Team based on BWDB data from field offices

The division, sub-division and section offices have the mandate of both project implementation and O&M. These offices have lesser number of staff at present than the setups shown in the above table.

The BWDB has a water management mandate and has the offices of Chief Water Management (CWM), principal extension officers (PEOs), and deputy chief extension officers (DCEOs) and assistant extension officer (AEOs) for the performance of this mandate. The existing deputy chief and AEOs are operating in the districts to manage irrigation water supply and to organize WMOs. These officers are also guiding farmers in their agricultural activities with the support of DAE under MOUs. In the haor area, there are two DCEOs and one AEO, and several extension overseers are working in the field among about 270 overseers with agricultural background (diploma) nationwide.

On the other hand, BWDB has only two fishery experts in the office of Chief Planning in the headquarters. According to interviews with officials of BWDB, they have experience in implementation of projects including fishery activities, but almost all substantial activities such as beel planning and development and guidance of fishermen have been carried out by DOF under MOUs.

Through the discussions mentioned above, the following capabilities of BWDB have been observed:

a) With regard to the number of the staff in division, sub-division and section offices in the project area, there are needs to increase the staff for smooth implementation of Component 1,

b) Regarding the agricultural activities of Component 3-1, BWDB is deemed to be capable of doing the activities judging from their experience, on the condition that support from DAE and increase in staff of the deputy chief and AEOs are materialized.

c) Regarding the fishery activities of Component 3-2, BWDB does not seem to have enough experience and key staff for implementing the activities.

Current Capabilities of O&M

The number of present staff is inadequate to fulfill their function of O&M works as described in the preceding paragraph and Subsection 7.4.1 (1).

In terms of the budgets requested by EEs of the division offices and allocated by the headquarters for O&M works in BWDB, the difference between the requested one and allocated one is increasing year by year because of insufficient allocation and the deficit for each year is being carried over to the next year as stated in Subsection 7.4.1 (1).

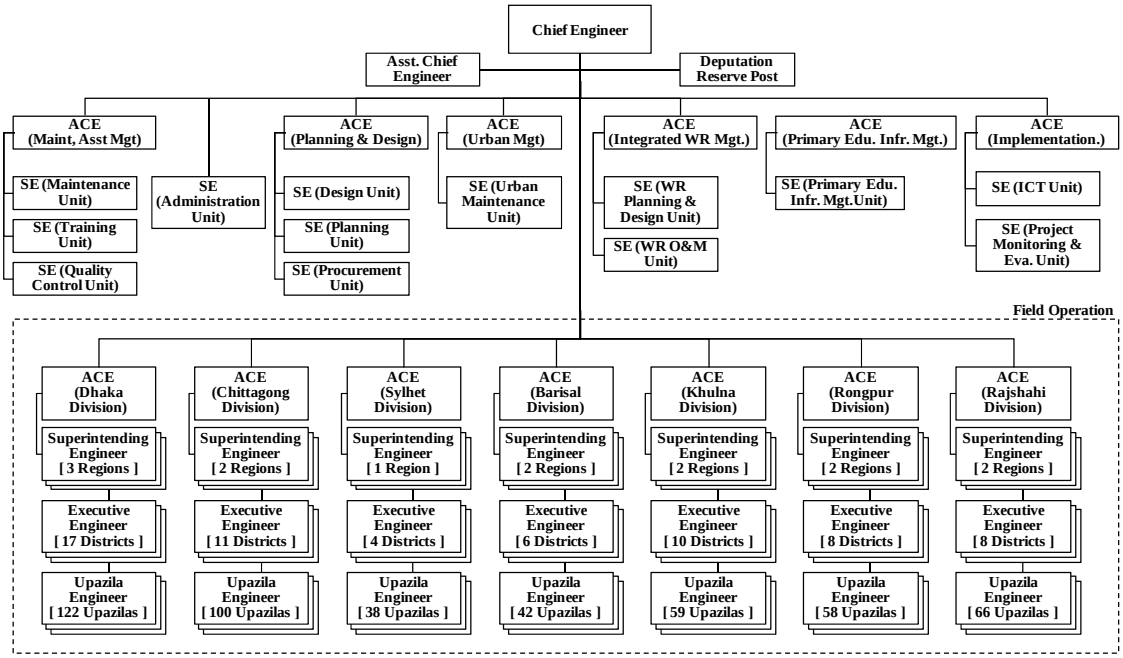
7.2.2 LGED

(1) Legal Background

The organizational background of LGED can be traced back to early 1960s when implementation of works program (WP) was started. A “Cell” was established in the Local Government Division (LGD) under the Ministry of Local Government, Rural Development and Cooperative (MLGRD&C) in the 1970s. To administer WP nationwide, the Works Program Wing (WPW) was created in 1982 under a development budget. It was reformed into the Local Government Engineering Bureau (LGEB) under revenue budget of the government in October 1984. Finally LGEB was upgraded to LGED in August 1992.

(2) Structure and Personnel

The LGED is a highly decentralized organization where 98% of its total manpower works are at the district and upazila (subdistrict) levels. Figure 7.2.7 is a condensed version of the LGED’s organogram (proposed version as of May 12, 2013).



Source: JICA Survey Team based on LGED

Figure 7.2.7 Overall Organizational Structure of LGED

The LGED consists of headquarters and three-layer local offices. Under the CE are six additional chief engineers (ACEs), namely, i) maintenance and asset management; ii) planning and design; iii) urban management; iv) integrated water resources management; v) primary educational infrastructure management; and vi) implementation. The ACEs' tasks are divided among 13 SEs and their tasks are further subdivided among 44 EEs.

The local offices are set up as three-layer hierarchies: regional, district and upazila. Bangladesh is divided into 14 regions, each with an office headed by a SE. District offices are deployed, one in each of the 64 districts, for basic functions that include planning and implementation of LGED projects, related financial management, and supervision of the activities of upazila offices in the district. Each district office is headed by an EE and has 21 or 22 staff. The 485 upazila offices are distributed throughout the country. Their basic function is the planning and implementation of LGED works and related financial management at their level. Each upazila office is headed by an upazila engineer with approximately 17 to 19 support staff.

The total manpower under permanent payroll before the approval of proposed organogram is 11,068 at both headquarters and field levels. The additional manpower will be a maximum of 226 if the proposal is approved.

The current manpower of offices responsible for project implementation and O&M in LGED is summarized in Table 7.2.3. The details are presented in Appendix 7.2.

Table 7.2.3 Manpower Concerned to Project Implementation and O&M in LGED

(Unit: person)

Office				Division	Region	District	Upazila
Headquarters	Maintenance Unit under ACE (Maint, Asset Mgt)			20 (at headquarters)			
	Project Monitoring & Eva. Unit under ACE (Implementation)			14 (at headquarters)			
Local Offices	Dhaka Div.	Mymensingh Reg.	Netrokona Dis.	15	12	21	17*
			Kishoreganj Dis.			21	17*
	Chittagong Div.	Comilla Reg.	Brahmanbaria Dis.	11	12	21	17*
	Sylhet Div.	Sylhet Reg.	Sunamganj Dis.	11	12	21	17*
			Habiganj Dis.			21	17*

Note: * 17 persons per upazila office
Source: LGED

(3) Division of Duties

The primary mandate of LGED is to plan, develop and maintain three broad programs, i.e., 1) rural infrastructure development; 2) urban infrastructure development; and 3) small-scale water resources development. The functions and duties of LGED field offices, which are stipulated in the LGED Charter of Duties (2010 and 2012), are summarized in Table 7.2.4.

Table 7.2.4 Summary of Functions and Duties of LGED Field Offices

Main Functions	Office	Duties of Office
Planning and implementation of development schemes	Regional	• Assist the LGED headquarters in the preparation of Development Project Proposals (DPPs) • Assist implementation of national government programs at the regional level • Supervise and monitor the updating of road inventory and road map in the region
	District	---
	Upazila	• Prepare and update the database of roads and other infrastructures in the upazila • Assist the upazila parishad in the preparation of development plans of roads and other infrastructures in the upazila • Assist in the preparation, maintenance and updating of the Upazila Plan Book • Plan and implement small scale water resource schemes such as canal excavation, embankment, drainage and water infrastructure in the upazila
Preparation and procurement of construction projects	Regional	• Supervise procurement activities undertaken by the LGED district and upazila offices
	District	• Direct upazila engineers in the preparation of all projects in the district
	Upazila	• Prepare planning and cost estimation of civil works directed by the upazila parishad and LGED • Accomplish procurement activities of upazila parishad and LGED projects • Arrange material collection and preservation of civil works • Responsible for timely preparation of store and goods
Implementation, supervision, and quality control of construction	Regional	• Supervise, inspect, and control quality of all civil works in the region • Monitor environment and gender issues in the region • Supervise and monitor road safety activities • Ensure proper utilization of district quality control laboratory • Order transfer of construction equipment between districts in the region • Monitor land use issues • Manage material stock • Visit district and upazila offices and activity sites, and prepared and send field visit reports to LGED headquarters and all other offices concerned
	District	• Implement projects in the district • Send progress reports of activities at the district and upazila levels to the LGED headquarters • Visit projects and submit reports to SEs at the district offices • Resolve disputes with contractors • Ensure laboratory tests for quality control of projects under the district and upazila • Arrange payment of contractor's bill • Ensure utilization, and update inventory list, of all equipment belonging to the district
	Upazila	• Supervise civil works as directed by upazila parishad and the LGED • Review the progress of development activities • Implement civil works related to primary education as directed by the upazila parishad and LGED • Submit implementation progress reports of civil works under the jurisdiction of the upazila parishad and respective authority

Main Functions	Office	Duties of Office
Technical assistance and capacity development	Regional	• Provide technical assistance, supervise and coordinate activities of local government institutions • Assist the district and upazila offices in the design of large bridges • Supervise and monitor training, workshops, seminar, and so on at the regional and district levels • Take necessary actions to utilize information and communication technology in official activities
	District	• Initiate disciplinary actions against third- and fourth-class LGED employees within the district • Assist the upazila offices in activities related to the Upazila Plan Book • Arrange training for all LGED officials within the district
	Upazila	• Render technical advice and assistance to the upazila parishad and union parishad in civil works • Coordinate utilization of information and communication technology at the upazila office
Coordination among stakeholders	Regional	• Invite district EEs for monthly coordination meetings to review and update all LGED works • Coordinate and supervise activities of consultants, NGOs, and so on who have been deployed under projects and programs of LGED • Coordinate among concerned stakeholders to address issues related to disaster management and land acquisition in the region
	District	• Coordinate and supervise various activities and stakeholders at the upazila level
	Upazila	• Ensure participation of local government institutions in management committees of growth center markets and ghats (river jetties)

Source: Preparatory Survey on the Northern Region Rural Development and Local Governance Improvement Project, Final Report (JICA, November 2012)

(4) Current Project Implementation Arrangement

1) Responsible Post for Project Implementation

Project directors (PDs) are mainly responsible for monitoring, evaluation and implementation of projects at headquarters level, while EEs of district offices are mainly responsible for implementation of all types of projects at field level. PD is designated by the Minister at the beginning of project. Under every EE, there are upazila engineers. The upazila engineers and sub-assistant engineers supervise the implementation of works.

2) Decision Making Process of Project Implementation

Project Planning, Design and Implementation:

The internal decision for project approval is taken by the competent authority as per the project appraisal rules of the government. For other issues, the CE in consultation with the ACEs makes the decision.

Sanction Process at Each Implementation Step:

Since LGED is one of the department/directorate/institutions of Local Government Division (LGD) under MLGRD&C, for all operational matters, LGED's main inter-agency relations are with LGD. Also it is important to note that in relative terms, LGED is a strongly decentralized organization and has delegated a greater level of authority over procurement than is typically found in other departments in Bangladesh.

The flow of sanction process at each implementation step is summarized as follows:

i) After formulation of DPPs by LGED, MLGRD&C scrutinizes the DPPs, and then sector divisions of the Planning Commission appraise the DPPs. This is followed by recommendation for approval by the Project Evaluation Committee (PEC)[3].

[3] Manual of Instructions for Preparation of Development Project Proforma (DPP), draft version as of August 2013, Ministry of Planning

ii) Then the Minister for Planning give approval for projects costing up to BDT 500 million, or the ECNEC give approval for projects costing over BDT 500 million. The approved projects are included in ADP for implementation[3].

iii) PDs prepare an annual procurement plan and obtain CPTU's[4] approval in accordance with the Public Procurement Regulation (PPR).

iv) The CE has powers to approve tenders up to a value of BDT 140 million. Any tenders between BDT 140-500 million have to be approved by the Minister and anything above BDT 500 million requires Cabinet approval.

- While the CE recently delegated responsibilities for administration and finance to ACEs, procurement responsibility above BDT 100 million remains with the CE.
- EEs at the district level have been delegated authority of tender approvals up to BDT 40 million.

v) All transactions passed by the EE are reviewed by the staff from the chief accounts officer of the LGD under the MLGRD&C prior to payment.

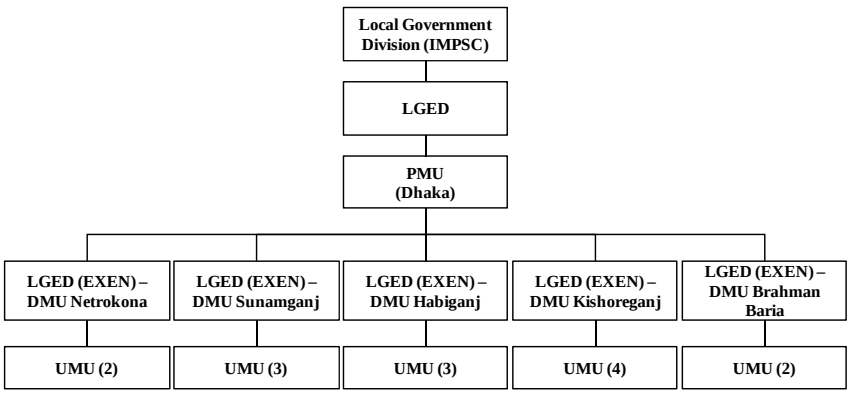
Regular Meeting:

There is regular coordination meeting every month at different levels. The coordination meeting is held at the office of the EE in every 64 district, at the office of the SE in every 14 region, at the office of the PDs at headquarters, and at the office of the ACE in the headquarter and zonal levels.

3) Example of Project Implementation Arrangement for Ongoing Projects

Haor Infrastructure and Livelihood Improvement Project (HILIP):

The project is implemented only by LGED and its lower organizations. The structure of project implementation for HILIP is therefore simply created as shown in Figure 7.2.8.



Source: LGED website

Figure 7.2.8 Structure of Project Implementation of HILIP

Second Rural Transport Improvement Project (RTIP-II):

The primary objective of the project is to improve rural accessibility in project areas and strengthen institutional capacity for sustainable rural road maintenance.

[4] CPTU: Central Procurement Technical Unit, Ministry of Planning

The LGED established a Project Monitoring Unit (PMU) headed by a PD and other associated staff at both the LGED headquarters and field levels. They are responsible for carrying out day-to-day project activities. A project coordinator, having the rank of SE, under the CE of LGED, is responsible for the oversight coordination and supervision of project activities.

(5) Current O&M Arrangement

1) Responsible Post for O&M

The LGED has different persons responsible for O&M works depending on the type of structure. The person responsible for the maintenance works of rural infrastructure is the SE (Maintenance Unit) at the headquarters level. The ACE (Maintenance and Asset Management) monitors the overall program and progress. At field level, the EEs are mainly responsible for O&M works.

Separately from this unit, LGED has an SE office (Water Resources O&M Unit), which is responsible for O&M works of all completed small-scale water resources projects under LGED.

2) Procedure for O&M Budget Approval

The O&M proposals are made by the EE of district offices and sent to the SE (Maintenance Unit) for scrutiny and allocation of funds. The concerned SEs, in consultation with the concerned ACEs and CE, allocate funds for the O&M works.

In order to effectively allocate the limited funds, district-wise weightage calculation is made by the maintenance unit of LGED. Annual maintenance need is assessed by analyzing roughness survey data, road surface condition data, traffic survey data, bridge/culvert condition survey data and road attribute data like surface type, connectivity, other socioeconomic features, etc. A computer program is used to assess maintenance needs of each district network. The maintenance work program is then optimized as per budget provision.

3) Involvement of Stakeholders in O&M Works

The Labor Contracting Society (LCS) is a group of landless male and female laborers organized by LGED to be contracted for routine maintenance, tree planting and, in some cases, construction. It was innovated by LGED in the early 1980s as way to involve the poor segment of people directly with work. The principles in arranging LCSs are to ensure fair wages and skill development of members and to create responsiveness among them.

The LCS members sign a contract with the upazila engineer for the works in each year. They receive training from LGED or NGOs contracted by LGED.

(6) Technical and Financial Capabilities

Current Capabilities of Project Implementation

The present staff allocation of the existing LGED district offices and upazila offices in the target area of the project in Netrokona, Kishoreganj, Habiganj, Brahmanbaria, and Sunamganj districts is summarized in Table 7.2.5.

Table 7.2.5 The Number of Staff in District and Upazila Offices in the Project Area

Office/District	Netrokona	Kishoreganj	Habiganj	Brahmanbaria	Sunamganj
Staff in District Office	17	17	17	17	17
No of Upazila in District	10	13	8	9	11
Staff in Upazila Offices	190	247	152	171	209

Source: JICA Survey Team based on LGED data

Project Implementation Units (PIUs) will be established in the existing LGED district offices for implementation of Components 2 and 3-2. Similarly, project upazila offices will be established for the respective upazila offices. PIUs and project upazila offices will be composed of deputized staff from the existing offices of LGED and newly employed by LGED for the project. The system of establishment of new PIUs and project upazila offices has been applied for implementation of LGED rural infrastructure development projects with successful outputs. This fact proves capability of LGED in implementing the project.

Although LGED has only one agronomist and one aquaculturist as revenue staff (permanent staff), LGED is successfully implementing rural infrastructure and livelihood improvement projects such as SCBRMP in the haor area through the active involvement of the LGED field offices, having employed project staff such as agricultural, fishery and livestock experts in cooperation with DAE/DOF under MOUs, consultants and NGOs. Based on these experiences, LGED is deemed to be capable of implementing the project.

Current Capabilities of O&M

The LGED has prepared the guideline for rural roads and culverts maintenance in 2010. The guideline includes classification of maintenance and necessary activities, surveys and database, maintenance program, maintenance organization, and so forth.

The GOB has made very significant progress in financing rural road maintenance over the last 20 years. However, due to the limited amount, LGED assesses maintenance needs of the district road network by applying district-wise weightage calculation for efficient budget use as explained in Subsection 7.4.2 (1) 2).

The activities of LGED mentioned above imply that it is maintaining rural infrastructures systematically and efficiently under a limited budget.

The latest Rural Road and Bridge Maintenance Policy (2013) has introduced a new budgetary mechanism to provide a budget for maintenance of the existing rural roads in the new development projects located in the same areas of the roads to be maintained. This budget is expected to reduce backlog maintenance of the rural roads.

7.3 Project Implementation Arrangements

7.3.1 Executing Agencies and Committees

(1) Executing Agency for Project Component 1

The BWDB started its operation in 1959, followed by its reformation after independence in accordance with the Bangladesh Water and Power Development Boards Order 1972. The NWP of 1999 stipulates the role that BWDB will implement all major surface water development projects and other FCDI projects with command area above 1,000 hectares. The Bangladesh Water Development Board Act 2000 legalized the roles of BWDB stated in the policy.

The BWDB has implemented more than 700 surface water development projects in the country in conformity with the order, policy and act stated above. The projects include those of FCD, FCDI, irrigation, bank revetment, river training works, etc. In the haor area, the Matian Haor, Baram Haor, Joal Bhanga Hoar, Shanghair Haor, and many other haor projects were implemented in Sunamganj District. The Kangsha River FCD Improvement Subproject was implemented in the northern Mymensingh District. The Zilkar Haor and Patharchauli Haor and other haor projects were constructed in Sylhet District. The World Bank-assisted Water Management Improvement Project (WMIP) is one of the ongoing water management projects including the area of haor.

In view of the roles and experiences of BWDB stated above, Component 1 for construction and rehabilitation of flood management infrastructures will be implemented by BWDB.

(2) Executing Agency for Project Component 2

The LGED has the mission to develop and manage local infrastructure for increasing farm/non-farm production, generating employment, improving socioeconomic conditions, promoting local governance, reducing poverty and acting as an agent of change at the local level. The main functions of LGED can be categorized in three programs: i) rural infrastructure development and maintenance, ii) urban infrastructure development, and iii) small-scale water resources development. The rural infrastructure development and maintenance include those for rural road transport network, growth centers and rural markets (hats), boat landing facilities (ghats), union parishad complexes and schools, and cyclone shelters.

The LGED has implemented a large number of local infrastructure development projects. In the haor area, foreign-assisted projects such as SCBRMP, Rural Roads and Market Improvement Project in Greater Sylhet District, and HILIP are ongoing.

In view of the mission, functions and experiences of LGED stated above, Component 2 for construction and rehabilitation of rural development infrastructures will be implemented by LGED.

(3) Executing Agency for Project Component 3

Component 3 consists of agricultural and fishery production improvements as mentioned in Chapters 5 and 6.

The agricultural production improvement activities (Component 3-1) include: i) APSS such as field program (adaptive trial and demonstration for crops and cropping patterns), farmer training program, field staff empowerment program, farm machinery and facility support program, and technology development program (field trial on rice and non-rice), and ii) SIGS such as vegetable, fruit, micro poultry and mushroom culture schemes.

Fishery production improvement activities (Component 3-2) include: i) development of beels together with establishment of fish sanctuary and beel nursery, ii) income generating activities (net-pen fish culture, fish cage culture, backyard pond aquaculture, and enterprise approach), and iii) support services for fisheries and marketing.

Table 7.3.1 shows characteristics of the agricultural and fishery production improvement activities for Component 3.

Table 7.3.1 Characteristics of Agricultural and Fishery Activities in Component 3

Items	Component 3	
	Agricultural Production Improvement	Fishery Production Improvement
Area of activities	Areas of Component 1 subprojects, in which agricultural lands are extended, are larger than 1,000 ha/subproject.	Areas of beels to be selected for fishery in Component 1 subprojects are generally less than 10 ha/beel.
Synergy effect	Positive effect on agricultural production due to reduction of flood damage by Component 1.	Positive effect on quality of fish due to roads/hats/ghats improvement by Component 2 shortening time of fish transport.
Water management	Water drainage and irrigation water supply	Water storage
Beneficiaries	Community	Community
Experts required	Agriculture experts	Fishery experts
Survey of land ownership	Not necessary generally since the existing agricultural lands are owned by individuals.	Necessary because ownership of beels is complicated.
Relationship with Deputy Commissioner and UNO	Not necessary generally because of clear agricultural land ownership	Necessary because ownership of beels is complicated.
Required cooperation by other agencies	District agriculture office, upazila agriculture office	District fisheries office, upazila fisheries office

Source: JICA Survey Team

The mandates, staff and experiences of BWDB and LGED in project implementation are summarized in Table 7.3.2.

Table 7.3.2 Mandates, Staff and Experiences of BWDB and LGED

Items	BWDB	LGED
Mandates	Implementing all major surface water development/ FCDI projects with command area above 1,000 ha.	Implementing FCDI projects having a command area of 1,000 ha or less.
Existing organization in the field	Division, sub-division and section offices for water management infrastructures, Deputy chief extension offices and assistant extension offices for water management	District offices and upazila offices for development and maintenance of rural/urban infrastructures and small-scale water resource infrastructures
Total existing staff	6,061 (June 2013)	11,068 (May 2013)
Existing agricultural and fishery experts in the organization	27 agricultural experts or agronomist, 270 extension overseers (agriculture, diploma), 2 fishery experts	One agronomist, one aquaculturist,
Experience in project implementation	GK (Ganges-Kobadak) irrigation project and Tista irrigation project for agricultural activity, SWAIWRP&MP for agriculture and fishery activity(excluding beel development), not in haor	SCBRMP and HILIP in haor area including agriculture and fishery activity including beel development

Source: JICA Survey Team

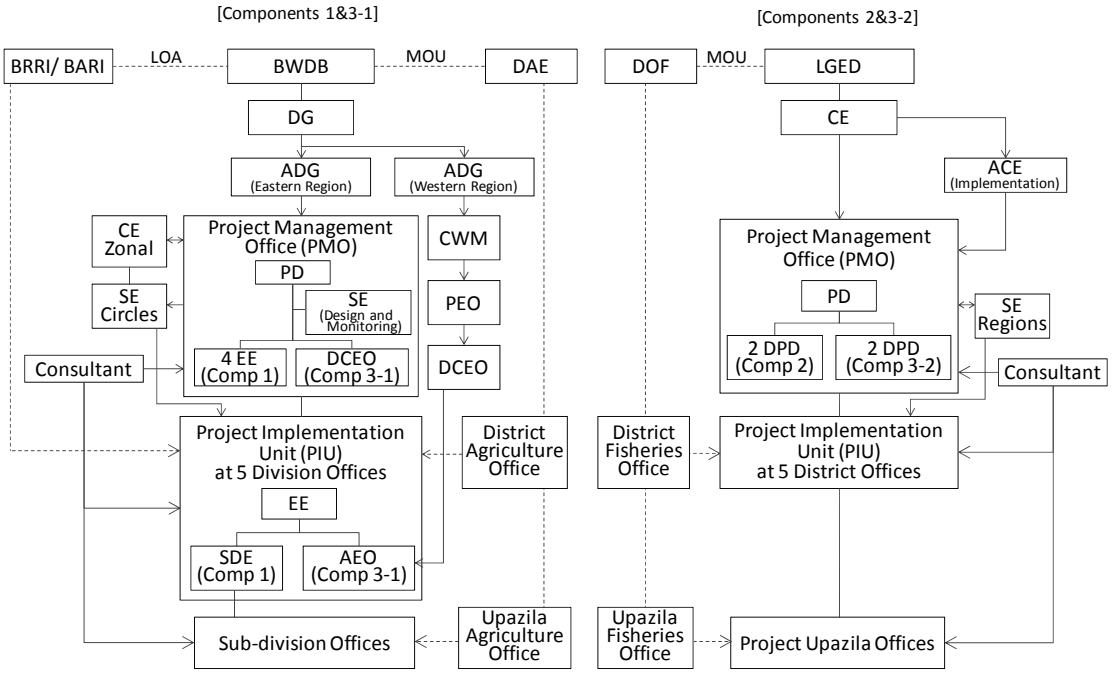
One of the conclusions in terms of executing agencies for Component 3 in the discussion held in July 2013 between JICA and GOB was that LGED will be responsible for the livelihood improvement activities in relation to rural infrastructure developed in Component 2, and BWDB will be responsible for livelihood improvement activities to augment the impact of flood management infrastructure developed in Component 1. Table 7.3.1 above indicates synergy effects of the flood management infrastructure on agricultural production due to reduction of flood damage, and positive effects of rural infrastructure on fish production due to shortening of time of fish transport. Table 7.3.2 shows that BWDB's experiences include support to farmers' activities, and LGED's experiences include beel development, which is an important and substantial part of the fishery activities.

Based on the above considerations as well as discussions with officials of GOB, it was concluded that BWDB will implement agricultural production improvement and LGED will implement fishery production improvement.

(4) Overall Institutional Arrangement for Implementation

The overall institutional arrangement was developed for implementation for both of BWDB and LGED as shown in Figure 7.3.1 below, through discussions with officials of GOB and in consideration of the following:

a) The arrangement conforms to results of discussions between JICA and GOB made in July 2013 as stated in the minutes of meeting and further discussions in October 2013. Those include establishment of PMOs, PIUs, and holding a steering committee meeting and project monitoring meetings.
b) The arrangement follows the existing organograms of BWDB and LGED.
c) The arrangement refers to that of past and ongoing project implementation.



Notes: DG=Director General, ADG=Additional Director General, CE=Chief Engineer, ACE=Additional Chief Engineer, SE=Superintending Engineer, CWM=Chief Water Management, PEO=Principal Extension Officer, DCEO=Deputy Chief Extension Officer, PD=Project Director, DPD=Deputy Project Director, EE=Executive Engineer, SDE=Sub-divisional Engineer, AEO=Assistant Extension Officer

Source: JICA Survey Team

Figure 7.3.1 Project Institutional Arrangement

The PMOs of BWDB and LGED will be established newly for the project in their respective headquarters.

The existing BWDB division offices in Netrokona, Kishoreganj, Habiganj, Brahmanbaria and Sunamganj will be called as the PIUs of BWDB, and the number of office staff will be increased for the project. The existing BWDB sub-division offices and section offices will also function for implementing the project by increasing the number of staff. The increase in number of staff will be realized in principle by transferring the existing staff of BWDB currently engaged in various projects nationwide which will have been completed.

The LGED PIUs will be newly established within the existing LGED district offices in Netrokona, Kishoreganj, Habiganj, Brahmanbaria and Sunamganj. The LGED project upazila offices will also be created newly within the existing LGED upazila offices. The staff of the PIUs and project upazila offices will be deputized from staff of the existing offices of LGED, or newly employed by LGED as project staff instead of permanent staff.

The existing posts or organization such as CEs/ACEs-Zonal, SEs-O&M Circles, CWM, PEOs, and DCEOs of BWDB and LGED regional offices are included in the institutional arrangement to fulfill their designated duties to receive reports relating to the project and give necessary guidance.

(5) Steering Committee for the Project

The steering committee will be established for the project to oversee the overall project progress and effective coordination among various stakeholders. The steering committee will be headed by the Secretary of MoWR. The committee will include members of LGD of MLGRD&C, BWDB, LGED, BHWDB, DAE, DOF, ERD of MOF, MOEF and MOL (when necessary), and JICA as an observer, which was decided through discussions between GOB and the JICA Survey Team.

The roles of the steering committee will be as follows: i) to ensure smooth inter-ministry/agency coordination, and ii) to oversee project implementation and progress, and guide to resolve implementation problems and issues that require higher level interventions.

The steering committee meeting will be held every six months and whenever necessary.

(6) Coordination Meeting and Progress Review Meeting

The coordination meeting will be held every three months to be headed by the ADG (Eastern Region) of BWDB with the attendance of BWDB (PD, SE, EEs, DCEOs), LGED (PD, DPDs, EEs), DAE and DOF to discuss the progress of Components 1, 2 and 3 and coordinate the inter-linked activities.

The progress review meeting of BWDB will be held monthly to be headed by the PD with the attendance of the SE, EEs, DCEOs, and DAE to discuss the progress of Components 1 and 3-1 (agriculture) and related issues to be addressed. However, the participation of EEs in the PIUs and staff of district agricultural offices will be quarterly.

The progress review meeting of LGED will be held monthly to be headed by the PD with the attendance of DPDs, EEs, and DOF to discuss the progress of Components 2 and 3-2 (fisheries) and related issues to be addressed.

In addition to the above mentioned meetings, BWDB and LGED will attend the district coordination meeting in the district level. This meeting is the one currently being held monthly and chaired by the deputy commissioner to discuss about activities of the ongoing projects in the district.

(7) Consultants

A consultant will each be procured by both BWDB and LGED. The consultant will act to assist the PMO and PIUs for design of project structures, procurement of contractors, construction supervision, and so forth. The terms of reference of the consulting services are stated in Chapter 12.

7.3.2 Implementation Arrangement for BWDB

(1) Institutional Arrangement of BWDB for Implementation

As illustrated in Figure 7.3.1, the offices for implementation of Component 1 and Component 3-1 (agriculture) consist of PMO, PIUs, Sub-Division Offices (SDOs) including Section Offices (SOs).

In addition, DAE will be involved in the implementation of Component 3-1 (agriculture) by providing MOUs between BWDB and DAE. This procedure has been applied for the ongoing SWAIWRP&MP with successful interim results. The MOU describes the following: i) scope of cooperation, ii) responsibilities of BWDB, iii) responsibilities of DAE, iv) effectiveness of MOU, and so forth. The responsibilities of BWDB may include providing necessary direct and logistical support and information to DAE. The responsibilities of DAE may include providing necessary direct support to BWDB, carrying out tasks and technical assistance, and facilitating sessions at training programs.

The BRRI and BARI will also be involved in the implementation of technology development program of Component 3-1 under an LOA with BWDB.

(2) PMO

The PMO of BWDB will be established in their headquarters for Components 1 and 3-1 (agriculture).

Roles and Responsibilities

The PMO will be responsible for overall management of Components 1 and 3-1 (agriculture) in order to achieve the outputs efficiently. The PMO will perform the following roles and responsibilities for the implementation of the project:

a) Planning overall implementation for Components 1 and 3-1,
b) Procuring and managing the consultants,
c) Conducting detailed designs with the Design Circle,
d) Verifying tender documents for construction,
e) Monitoring land acquisition,
f) Supervising overall implementation of Components 1 and 3-1 and monitoring their progress,
g) Coordinating Components 1 and 3-1,
h) Providing guidance to PIUs,
i) Certifying the consultants' and contractors' bills,
j) Ensuring compliance with environmental and social considerations,
k) Reporting to the relevant organizations, and
l) Preparing MOUs with DAE and supervising the activities.

Staff

The PMO will be headed by the PD (grade of CE or ACE) with the support of SE (design and monitoring), four EEs for Component 1 and a DCEO for Component 3-1. The PMO will consist of the staff listed in Table 7.3.3.

Table 7.3.3 Staff of BWDB PMO

Name of Post	Quantity	Qualifications
Project Director (PD)	1	B.Sc. Engg. in Civil
Superintending Engineer (SE)	1	B.Sc. Engg. in Civil
Executive Engineer (EE)	4	B.Sc. Engg. in Civil
Deputy Chief Extension Officer (DCEO)	1	B.Sc. in Agriculture
Sub-Divisional Engineer (SDE)	2	B.Sc. Engg. in Civil
DD/ Accounts Officer	1	M.B.A/M.Com (Minimum 2nd Class)
Assistant Engineer	2	B.Sc. Engg. in Civil
Sub-Assistant Engineer (SAE)	2	Diploma in Civil Engg.
Research Officer Agriculture	1	B.Sc. in Agriculture
Research Officer Environment and Forest	1	B.Sc. in Environment
UD Assistant	1	B. in any discipline
Senior Accountants Assistant	2	M.B.A/M.Com (Minimum 2nd Class)
LD Assistant cum Typist/ DEO	2	H.S.C
DEO (PA to PD)	1	H.S.C
Driver	3	S.S.C
Guard	2	S.S.C
MLSS	4	S.S.C
Total	31	

Note: DD=Deputy Director, UD=Upper Division, LD=Lower Division, DEO=Data Entry Operator, MLSS=Member of Lower Subordinate Staff, H.S.C=High School Certificate, S.S.C=Secondary School Certificate

Source: JICA Survey Team based on BWDB data

All the members of the PMO are full-time staff exclusively in charge of the project. The members will be experienced personnel transferred from existing offices of BWDB. General training for the personnel does not seem to be necessary.

Component 3-1 will be implemented by the extension overseers (EOs) of sub-division offices with DAE staff through the supervision of DCEO of PMO and AEOs of PIUs.

Project Meetings

The following meetings will be held regularly:

a) Progress Review Meeting: to be held monthly to be headed by the PD with the attendance of SE, EEs, DCEOs, and DAE to discuss the progress of Components 1 and 3-1 and related issues to be addressed. However, the participation of EEs of the PIUs and staff of district agricultural offices in the meeting will be quarterly.

b) Coordination Meeting: to be held every three months headed by the ADG (Eastern Region) of BWDB with the attendance of BWDB (PD, SE, EEs, DCEOs), LGED (PD, DPDs, EEs), DAE and DOF to discuss the progress of Components 1, 2 and 3 and coordinate the inter-linked activities.

(3) Project Implementation Units (PIUs)

Roles and Responsibilities

The PIUs of BWDB will be responsible for implementing Components 1 and 3-1. The units will perform the following roles and responsibilities for the implementation of the project:

a) Preparing implementation plans for the concerned subprojects of Components 1 and 3-1,

b) Carrying out surveys and investigations,

c) Preparing tender documents for the project including cost estimates, and managing tender process (evaluation of the tenders will be carried out by the tender evaluation committees formed for the respective contracts),

d) Carrying out land acquisition,

e) Guiding the sub-division and section offices,

f) Supervising and checking the construction of the concerned subprojects conforming to the specified checking procedures,

g) Managing the activities of DAE,

h) Checking the contractors' bills, and

i) Preparing monthly progress reports.

Staff

The PIUs will be headed by EEs of the division offices. The unit staff will be the existing staff of the division office with added staff including EE, AEs, AEOs, estimator, and support staff as listed below in Table 7.3.4 and in Appendix 7.4.

Table 7.3.4 Staff of BWDB PIU

Name of Post	Quantity in Netrokona PIU	Quantity in Kishoreganj PIU	Quantity in Habiganj PIU	Quantity in Brahmanbaria PIU	Quantity in Sunamganj PIU
Executive Engineer	1	1	1	1	1
Assistant Engineer	1	1	1	1	1
Assistant Extension Officers	2	2	2	2	2
Sub-divisional Engineer*	1 per SDO	1 per SDO	1 per SDO	1 per SDO	1 per SDO
Sub-assistant Engineer*	1 per SO	1 per SO	1 per SO	1 per SO	1 per SO
Estimator	1	1	1	1	1
UD Assistant	1	1	1	0	1
Assistant Accountant	1	1	1	0	1
Senior Accounts Assistant	1	1	1	0	1
Accounts Clerk/ Senior Clerk	1	1	1	1	1
D.E.O	3	3	3	1	3
Revenue Surveyor	1	1	1	1	1
DMO***	1	1	1	1	1
Driver	1	1	1	1	1
Speedboat Driver	1	1	1	1	1
Tracer	1	1	1	1	1
MLSS	4	4	4	2	4
Chowkidar (Guard)	1	1	1	1	1
Mali (Gardener)	1	1	1	0	1
Total**	23	23	23	15	23

Note: *=Sub-divisional Engineers are stationed in Sub-division Offices and Sub-assistant Engineers are stationed in Section Offices but their assignment places can be adjusted flexibly depending on the workload within the division.
**=Total amount does not include Sub-divisional Engineers and Sub-assistant Engineers as marked*.
*** DMO=Duplicating Machine Operator

Source: JICA Survey Team based on BWDB data

The addition of the staff in the existing BWDB division offices to form the PIUs will be carried out prior to the commencement of the construction works of subprojects. The division

offices with the added staff will be then maintained for project maintenance after completion of the subprojects.

Among the above PIU members, at least one SDE, two AEOs, and one sub-assistant engineer will be assigned to work full time for the project.

Project Meetings

Monthly meeting will be held regularly to be headed by the EE with the attendance of AE, sub-divisional engineers (SDEs), AEOs, and DAE to discuss the progress of Components 1 and 3-1 and related issues to be addressed.

In addition to the above, EE of the PIU will attend the district coordination meeting chaired by the deputy commissioner.

(4) Sub-Division Office and Section Office

Roles and Responsibilities

The sub-division offices of BWDB will be responsible for supervising the implementation of subprojects in Components 1 and 3-1. The offices will perform the following roles and responsibilities for the implementation of the project:

a) Checking cost estimates made by section offices,
b) Supervising and checking the implementation of the concerned subprojects,
c) Checking the contractors' bills, and
d) Preparing monthly progress reports.

Due to the heavy workload undertaken by the Kishoreganj PIU as summarized in Appendix 7.3, this PIU will have an additional sub-division office newly established for the project as shown in Appendix 7.4. The establishment of this new sub-division office will be approved by the Governing Council of BWDB, and the office is scheduled to function before implementation of the project. The approval process and its organization may take a maximum of around six months according to information from BWDB. The new sub-division office is required to be established prior to the commencement of the construction works of subprojects.

The Section Offices of BWDB will be responsible for implementation of subprojects in Project Components 1 and 3-1. The offices will perform the following roles and responsibilities for the implementation of the project:

a) Preparing cost estimates based on approved design drawings,
b) Implementing the subprojects,
c) Helping preparation of the contractor's bill, and
d) Preparing monthly progress reports.

Staff

The sub-division offices will be headed by SDEs. The office staff will be the existing staff of the sub-division office with added staff including SDE, EOs, and support staff.

The section offices will be headed by SOs. The office staff will be the existing staff of the section office with added staff including SO, work assistants and supporting staff.

7.3.3 Implementation Arrangement for LGED

(1) Institutional Arrangement of LGED for Implementation

As illustrated in Figure 7.3.1, the offices for implementation of Components 2 and 3-2 (fishery) consist of PMO, PIUs and project upazila offices.

In addition, DOF will be involved in the implementation of Component 3-2 by providing MOUs between LGED and DOF. This procedure has been applied for the ongoing SCBRMP and HILIP with successful interim results. The MOU describes: i) scope of operation, ii) term, iii) responsibilities of LGED, and iv) responsibilities of DOF. The responsibilities of LGED may include making physical arrangement for the training program, extending technological support and expertise to DOF, and reimbursing required costs. The responsibilities of DOF may include providing qualified personnel to support the project.

Appendix 7.5 summarizes the workload of upazila for Components 2 and 3-2.

(2) Project Management Office (PMO)

The PMO of LGED will be established in their headquarters for Components 2 and 3-2 (fisheries).

Roles and Responsibilities

The PMO will be responsible for overall management of Components 2 and 3-2 to achieve the outputs efficiently. The PMO will perform the following roles and responsibilities for the implementation of the project:

a) Planning overall implementation for Components 2 and 3-2,
b) Procuring and managing the consultants,
c) Conducting detailed designs,
d) Monitoring land acquisition,
e) Supervising activities and monitoring progress,
f) Coordinating Components 2 and 3-2,
g) Providing guidance to the PIUs,
h) Certifying the consultants' and contractors' bills,
i) Ensuring compliance with environmental and social considerations,
j) Reporting to the relevant organizations, and
k) Preparation of MOU with DOF.

Staff

The PMO will be headed by PD supported by four DPDs for respective Components 2 and 3-2. The PMO will consist of the staff as summarized in the following table and detailed in Appendix 7.6:

Table 7.3.5 Staff of LGED PMO

Name of Post	Quantity	Qualifications
Project Director	1	B.Sc. Civil Engineering
Deputy Project Director	4	B.Sc. Civil Engineering for two, and M.Sc. Fisheries/Master in Sociology for others
Senior Assistant Engineer	2	B.Sc. Civil Engineering
Community Resource Management Specialist	1	B.Sc. Fisheries/ Sociology
Accounts Officer	1	Master in Finance/Accounting
M&E Specialist	1	Master in Economics/Statistics/B.Sc. in Economics/Statistics
Sub-Assistant Engineer	3	Diploma in Civil Engineering
Environment Engineer/Expert	1	B.Sc. in Civil Engineering with M.Sc. in Environment/B.Sc. in Environment
Administrative/Human Resources Manager	1	Bachelor in any discipline
Finance Expert	2	Bachelor in any discipline
Office Assistant cum Computer Operator	2	Bachelor in any discipline
Driver	3	J.S.C.
Office Helper	2	J.S.C.
Guard	1	J.S.C.
Total	25	

Source: JICA Survey Team based on LGED data

All members of PMO are full-time staff exclusively in charge of the project. The members will be deputized among staff of the existing offices of LGED, or newly employed by LGED as project staff instead of permanent staff. The members should have knowledge to be transferred on experiences from ongoing SCBRMP in the haor area.

Project Meetings

The following meeting will be held regularly:

a) Progress Review Meeting: to be held monthly headed by PD with the attendance of DPDs, EEs, and DOF to discuss progress of Project Components 2 and 3-2 and issues to be addressed,

b) Coordination Meeting: to be held every three months headed by ADG (Eastern Region) of BWDB with the attendance of BWDB (PD, SE, EEs, DCEOs), LGED (PD, DPDs, EEs), DAE and DOF to discuss progress of Project Components 1, 2 and 3 and coordinate the inter-linked activities.

(3) Project Implementation Unit (PIU)

Roles and Responsibilities

The PIUs of LGED will be responsible for implementing Project Components 2 and 3-2. The PIUs will perform the following roles and responsibilities for the implementation of the project:

a) Preparing the subproject and scheme implementation plans,

b) Carrying out surveys and investigations,

c) Preparing tender documents, calling tenders, awarding and signing contracts (evaluation of tenders will be carried out by tender evaluation committees, and approval of the evaluation will be made by the officials specified in the government rules),

d) Reviewing designs,

e) Carrying out land acquisition,

f) Supervising the construction of rural infrastructures and implementation of fishery activities,

g) Checking the contractors' bills, and

h) Preparing progress reports.

Staff

The PIUs will be headed by EEs of the district offices. One PIU will consist of the staff as shown in Appendix 7.6 and summarized in the following table:

Table 7.3.6 Staff of One LGED PIU

Name of Post	Quantity	Qualifications
Executive Engineer*1	1	B.Sc. Civil Engineering
District Project Coordinator	1	B.Sc. Civil Engineering/B.Sc. Fisheries
Sub-Assistant Engineer (Structure) and (Fisheries), respectively	2	Diploma in Civil Engineering
District Training Coordinator	1	Masters in any discipline
Community Infrastructure Coordination Expert	1	B.Sc. Civil Engineering
Community Resource Management Coordination Expert	1	B.Sc. in Fisheries/Bachelor in any discipline with CBFM experience
District M&E Officer	1	Masters in Economics/Statistics/MBA/MDS
Accountant	1	Bachelor in Finance/Accounting
Computer Operator/Office Assistant	1	Bachelor in any discipline
Driver	1	J.S.C.
Boat Driver	1	J.S.C.
Office Helper	1	J.S.C.
Guard	1	J.S.C.
Total	14	

Note: *1= existing post in the district office.
Source: JICA Survey Team based on LGED data

All the staff members above except EE will be assigned to work full time for the project.

The staff of the Brahmanbaria PIU will be re-arranged after identification of Component 3-2 (fisheries) subprojects.

Project Meetings

The following meetings will be held:

a) Monthly Meeting: headed by EE with the attendance of UEs and DOF to discuss the progress of Components 2 and 3-2 and related issues to be addressed.

b) District Coordination Committee Meeting: chaired by Deputy Commissioner of the districts and held by-annually with the attendance of representatives of the district offices of the central related committees to look into the matter of water body handover process and progress related to the management of water bodies.

In addition to the above meeting, EE of the PIU will attend the district coordination meeting chaired by the deputy commissioner.

(4) Project Upazila Offices

Roles and Responsibilities

The project upazila offices of LGED will be responsible for the implementation of subprojects and schemes in Components 2 and 3-2. The offices will perform the following roles and responsibilities for the implementation of the project:

a) Calculating work quantities based on detailed design and estimating costs for tender document preparation,
b) Monitoring and supervising the infrastructure development subprojects and implementing fishery schemes,
c) Checking the contractors' bills, and
d) Preparing progress reports.

Staff

The project upazila offices will be headed by UEs of the upazila offices. The office staff will include UE, SAEs, surveyor, work assistants and support staff.

The staff of some project upazila offices in Netrokona, Brahmanbaria and Sunamganj districts shown in Appendix 7.6 will be reshuffled after identification of the Component 3-2 subprojects.

7.4 O&M Arrangements

7.4.1 O&M Arrangement for BWDB

(1) Current O&M Situation of Flood Management Structures

1) Relevant Policy Paper to O&M of Flood Management Structures

Policy on O&M of Permanent Structures of BWDB:

The BWDB has formulated the "Policy on O&M of Permanent Structures of BWDB". It was prepared by the Director of O&M, BWDB and approved by the MoWR in October 2010. The significant principles of the policy include conceptual improvement, procedural improvement and allocation rationale improvement. The major contents are as follows:

a) Extent of Repair Allocation Expenditure

- The policy defines the extents of O&M activities and includes the following: 1) repair of main structure, 2) protection of physical environment, 3) service and supply for the operation, 4) maintenance dredging, 5) survey and investigation, 6) collection, processing and preservation of hydrological data, and 7) maintenance, repair and operation of survey vessels and vehicles.

b) Classification of O&M Works

- The policy defines classification of O&M activities and provides a procedure to assign priority to them. The O&M works are divided into four categories, namely: 1) routine maintenance work, 2) emergency works, 3) periodic repair works, and 4) flood damage repair work.

c) Need-Based Budget Framework

- Need-based budget framework is a concept about preparation of estimated budget, which will provide a useful basis to determine countrywide combined budget demand. Primarily, quantity of annual O&M budget is estimated based on structural designs, technical specification, standard depreciation rate, standard operation, and so on. Later, actual requirements will be decided on the basis of monitoring and evaluation.

d) Prioritization of Project and Infrastructure

- Project priority needs to be considered to efficiently allocate funds for O&M works. With this objective, each project or scheme will be prioritized on the basis of socioeconomic evaluation. It is proposed to have six project priority ranks.
- There will also be a priority rank for each infrastructure within the projects showing the role of the infrastructure as follows: 1) strategic, 2) important, and 3) marginal.

e) Standard O&M Work Description

- Different types of repair works may be required for each water management structure. However, all types of repair works may not be required to be carried out at the same time. Budget demand with only a mention of "repair works" is not sufficient to demonstrate the extent of works clearly. To facilitate management, several standard O&M work descriptions for different types of structure are attached to the policy.

f) Establishment of O&M Management Information System (O&M MIS)

- A management information system (MIS) should be developed to support preparation of operation, repair maintenance work plan, budget distribution and monitoring works. The specialty of the O&M MIS should include: 1) computerized database, and 2) computer program/routine to identify maintenance requirements.

g) National Based Priority

- BWDB projects and infrastructures are located throughout the country, but all of them are not equally important. For limited resources, O&M works need to be prioritized on a national basis. During the preparation of annual repair work plan, highest priority will be given to repair and maintenance works for projects in coastal areas, for projects in haor areas and for irrigation projects.

h) Distribution of Expenses for O&M Works based on Classification

- In light of importance and requirements, the policy proposes that the fund be divided into three parts to prepare O&M work plan and spending. Of the annual fund allocation, 50% will be spent for periodic repair works, 10% for routine repair works and 40% for emergency repair/flood damage repair works.

i) Long-Term Maintenance Plan

- In most times, repair work is undertaken and carried out piecemeal, which is not always productive. Therefore, taking up long-term repair plan, preparation and implementation of annual O&M work plan will be more productive. Only periodic repair works will be included in the long-term plan and this will be a 3-5 year

revolving work plan. The long-term plan will be followed in preparing the annual work plan, and will be prepared centrally.

j) Procedures to Prepare and Finalize Annual Work Plan

- In view of reality, an annual work plan can be prepared in two phases. The phases will be: 1) basic plan and 2) supplementary plan. The basic plan will be prepared using 60% of the available allocated fund and supplementary plan using 40% of the fund. The policy also provides a guideline to prepare both plans with specific completion dates.

k) General Policy to be Followed in Allocation Distribution

- The general policies to be followed in the distribution of allocation are proposed as follows:
  - i) Allocation will be provided against the particular structure or component of project;
  - ii) Structure or component will be considered for distribution of allocation subject to information available in database;
  - iii) Allocation for annual repair works will be provided on the basis of the long-term O&M work plan;
  - iv) Standard repair work description should be followed for budget demand; and
  - v) Priority of budget demand for any structure/component will be decided by: 1) national priority rank of the project as defined in database, 2) role of structure or component in project, 3) technical specification and importance of the proposed works, 4) overall effect of the project, and 5) presence of active beneficiary organization.

l) Local Beneficiaries Involvement and Local Resources Use

- Involvement of local beneficiaries at all stages of project's operation, repair and maintenance is mandated by the NWP of 1999. For the purpose of effective utilization of available resources, the EE will prepare an annual repair maintenance plan in consultation with the beneficiaries.

m) Management of Unanticipated Demands

- Since unanticipated demands are unforeseen, there remains no opportunity to include these demands in annual repair maintenance program. A proposal should be submitted to Ministry of Finance through MoWR to carry out the unanticipated maintenance work with the allocation of fund in the form of the government's "unforeseen expenditure management head".

n) Monitoring and Evaluation Framework

- An organized method should be followed for monitoring and evaluation to ensure rational fund use. The EEs will prepare a project-wide report on overall conditions of completed projects annually. The report should include project effects/expected benefits, description of O&M works completed in the previous year, evaluation on the conditions and effectiveness. An annual project evaluation report should be submitted to the CE (O&M).

At present, this is an exclusive policy paper on O&M of water-related infrastructures. BWDB has no other strategies, regulations and/or guidelines for O&M.

Since the formulation of the policy, significant improvements have not yet been observed except for three points out of the above articles a) to n). Regarding the article k), the limited allocation has been distributed on the basis of the importance of structures and work items. Also, 10% of the O&M budget has been kept for unanticipated O&M activities since FY2013/14 by reflecting the article m). In addition, WMIP is improving the existing database as a part of the article f) above.

Guidelines for Participatory Water Management (GPWM):

In view of too many similar guidelines that have been issued since 1994 by relevant organizations including MoWR and LGED, an interagency taskforce committee reviewed all approaches and prepared this guideline. It was approved by GOB in November 2000. The major features in terms of the O&M stage are summarized below.

a) Scope of the Guidelines

- The guidelines should be applied to both new and existing projects at all stages of project cycle covering water management issues relating to land use/agriculture/fisheries/aquaculture/biodiversity/water quality.

b) Formulation of WMO

- The institutional framework in which the local stakeholders will participate for water management will be WMO.
- The implementing agency will undertake all necessary steps for the formulation of WMO. The number and level of WMO to be formed in any project will be decided by stakeholders in association with the size and complexity of the project.

c) Responsibilities of WMO

- WMOs will be responsible for planning, implementing, operating and maintaining local water resource schemes in a sustainable way depending on the type of project.
- WMO will contribute towards the investment and O&M cost as determined by the government or decided by them acting in their own interest.

The type and/or level of O&M works to be performed by stakeholders, the type of structures to be maintained by stakeholders or the demarcation of roles between implementing agencies and stakeholders during the O&M stage are not clearly mentioned in the guideline since they are different depending on the size, nature, and complexity of projects. However, the guidelines state that the implementing agency will advise and assist the local stakeholders in preparing O&M plan, technical inspections of infrastructure, making estimates and budgets, training for specific activities, quality control, etc.

2) Preparation of O&M Work Plan and O&M Cost

Each year, the EE of each division assesses the requirements of repair and operational works for the infrastructures under his control and prepares an annual work plan including budget demand.

3) Database on the Existing Structures

The current database regarding flood management structures was originally developed through the FFW Program. Although the database is not accessible from outside BWDB, it contains specifications of structures, locations indicated by upazila and union names, construction year and so on, according to BWDB.

The database is currently being improved through WMIP as of September 2013. The updated database will contain the coordinate data of structure location. In addition, a computer program/routine to identify maintenance requirements will be developed by WMIP.

The Chief of Monitoring who is directly under DG will be responsible for the management of the database.

4) Current Situation of Flood Management Structures

The BWDB has so far completed more than 700 projects. The types of projects are mostly FCD, FCDI, irrigation, bank revetment, and river training works. However, it has been reported[5] that more than half of the completed projects are not performing as intended, some due to inadequate planning, but mostly due to lack of proper O&M.
A geotechnical/structural study, and inventory survey on the existing flood management structures in the target haor areas were conducted in the data collection survey. The survey revealed that there are two causes for nonperformance, namely: i) problems in design or construction at the initial stage, and ii) lack of maintenance at the operations stage.

i) Problem of Design and Construction

i-a) Design and Construction of Embankment

Submergible embankment and regulators are usually designed following the Standard Design Manual of the BWDB Design Circle. Table 7.4.1 presents the descriptions of contents of the manual. The manual mentions mainly alignment, geometry and stability of embankment; however, the problem is that there is an incomplete description regarding requirement of embankment material such as grain size gradation, method and quality control of construction such as degree of compaction and compaction machine/ specifications.

[5] Water Institutions – Bangladesh Experience (Water Resources Planning Organization, Ministry of Water Resources)

Table 7.4.1 Description Regarding Embankment in the Standard Design Manual of BWDB

Table of Contents	Description
7.1 General	-
7.2 Types of Embankment	Full flood embankment, submergible embankment, sea dike
7.3 Alignment of Embankment	Stable ground should be selected as foundation and avoid peat soil, availability of appropriate embankment material near the site, avoid sharp curves, possibility to use existing road, etc.
7.4 Set Back	Distance between river side toe of embankment and river bank is stipulated to prevent scouring of the toe due to river flow.
7.5 Design Crest Level	Design water level (10-year for submergible, 20-year for full flood embankment), freeboard, crest width, slope gradient of embankment, etc. are mentioned.
7.6 Design for Section	Stability and resistance against rapid water level fluctuation, piping, wave action, and rainfall are required.
7.7 Phreatic Line or Line of Seepage	Description of the phreatic line calculation method used for seepage analysis and circular slip analysis.
7.8 Uplift and Seepage Quantity	Requirement for stability against uplift and seepage.
7.9 Slope Stability Analysis	Requirement for stability against circular slip.
7.10 Settlement of Embankment	Description of settlement calculation method, however, no limit of settlement is mentioned.
7.11 Slope Protection	Turfing using local grass, planting of trees on embankment is not allowed.
7.12 Submergible Embankment	Submergible embankment is designed for 10-year flood in pre-monsoon season, freeboard = 0.3 m, crest width = 4.3 m (minimum 2.5 m), slope gradient = 1:3
7.13 Closure Dams	-

Source: Standard Design Manual, BWDB Design Circle, summarized by JICA Survey Team

Generally, river embankment material should include 15-50% of fine material such as silt and clay (grain size < 0.075 mm). If fine material is less than 15%, permeability of embankment may not be enough. On the contrary, if fine material is more than 50%, drying shrinkage of embankment may produce cracks. These cracks cause gully erosion in the next flood season.

Surface soil mainly consists of silt and clay in the haor area, and enough coarse material like sand and gravel cannot be found. Embankment material is usually borrowed from grounds adjacent to the embankment. According to physical investigation of the material near some candidate haor projects in the data collection survey, more than 90% of the soil is composed of fine material.

As for embankment method, contract drawings of submergible embankment in the haor area usually stipulate the use of 7.0 kg rammer as the compaction machine; however, the degree of compaction and method of quality control of embankment are not stipulated even in the drawings. Moreover, embankment is often constructed without using the stipulated 7.0 kg rammer, hence the embankment may not reach the required strength for its stability.

According to the compaction test and unconfined compression test using material near the candidate haor projects in the data collection survey, at least 90% degree of compaction may be needed to meet the required stability of embankment.

i-b) Design and Construction of Regulator

Regulators are constructed with concrete and gate equipment.

The design manual of BWDB mentions mainly hydraulic issues regarding design of regulators such as flow capacity of regulator (i.e. number of gates), length of stilling basin and height of sidewall.

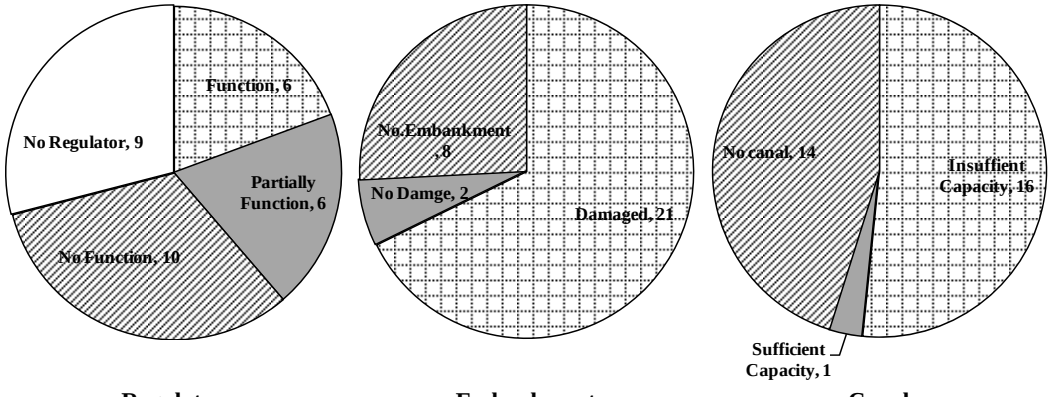
According to visual observations of the existing regulators, deterioration of regulator concrete is caused by honeycombs and small cracks on deck slab and concrete handrail. It is believed that honeycombs occur due to aggregate gradation and lack of mortar and small cracks occur due to inadequate installation of gate hoist and shaft and not enough concrete cover on reinforcing bars.

A regulator is a very small structure and does not need any special techniques. The deterioration of regulator concrete can be minimized by simple and easy construction supervision and quality control.

ii) Lack of Maintenance

An inventory survey was carried out in the data collection survey of the 31 existing haor projects. In order to assess whether the maintenance system in the project has been properly established, the survey results were evaluated depending on the number of projects functioning well.

As shown in Figure 7.4.1, the survey resulted that regulators do not function in more than 70% of haor projects, embankment has some damages in more than 90% of haor projects, and canals do not have sufficient capacity in more than 90% of haor projects. The status of "sufficiency" or "insufficiency" of canals was evaluated based on the interview survey with local communities. If there is any part of canal that has no water flow due to sediment buildup in the canal, the status was categorized as "insufficient".



Source: JICA Survey Team (using the result of inventory survey carried out in the Data Collection Survey)

Figure 7.4.1 Present Situation of Existing Structures

The major causes of malfunction are damaged gear box, no operation committee and lost or loose bolts which are fixed at the hoisting equipment to the deck slab concrete. Theft of equipment such as gear box and hoist rod is also a serious problem.

Major cause of damage to the embankment is erosion by rainfall. However, damages caused by rainfall are usually not so serious. Artificial embankment cut and overtopping of embankment usually follows. Local people often cut and remove the embankment intentionally for drainage, navigation for crop transportation, and fishery purposes. BWDB has constructed a pilot causeway (fuse dike inside concrete channel) instead of a normal regulator in Khaliajuri Scheme to control these artificial embankment cuts. BWDB will monitor O&M of the causeway for the next two to three years to make sure of the effect.

The main causes of the insufficient capacity of canals are sedimentation in the canals and land deterioration of side slopes.

5) Transfer of Subproject Facility

In BWDB's current system, subproject facilities are not transferred to community groups even after completion. The facilities remain under BWDB control. Therefore, maintenance works including inspection of facilities are conducted by BWDB. Only operations can be transferred to the community group in the current system.

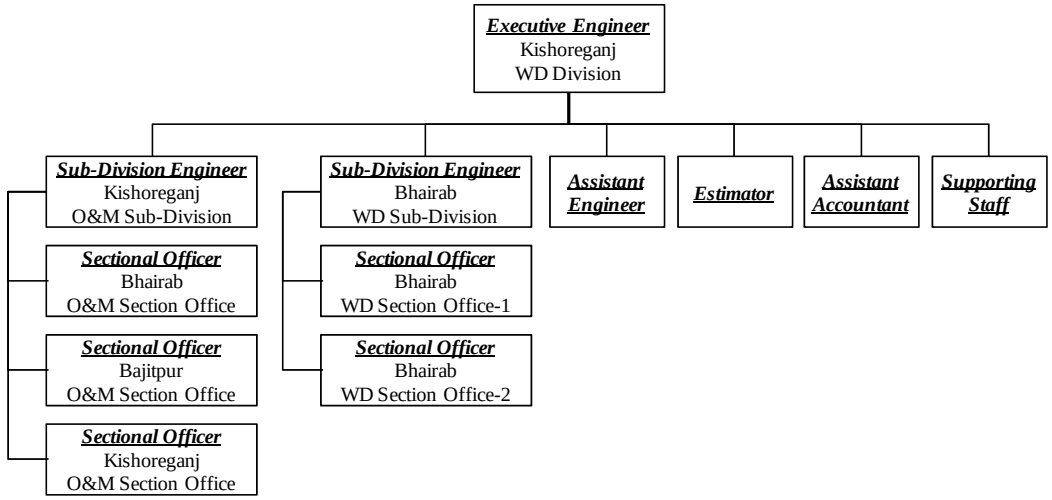
6) O&M Activities for the Existing Structures

In the current system, maintenance works are being performed by BWDB field offices since all the structures belong to BWDB, while communities are in charge of operations under the technical guidance of BWDB. However, actual O&M works have not been recorded though some verbal information was obtainable.

The necessities of gate operation in submergible embankments are to allow water to flow into the polder at the end of pre-monsoon season after harvesting of crops and to drain water from inside the polder at the end of monsoon season. When water flows into the polder, it is required to keep the equilibrium of water level inside and outside the polder to avoid embankment failure due to seepage or overtopping.

<u>Field Offices of BWDB:</u>

Regular O&M works are carried out by division/sub-division offices under the EE of each division office. Figure 7.4.2 shows the organogram of Kishoreganj WD (water development) Division as an example of division office.



Note: WD = Water Development
Source: Kishoreganj Division Office, BWDB

Figure 7.4.2 Organogram of Kishoreganj WD Division

i) Operation Works

Regular operation of regulator is supposed to be handled by communities. The BWDB field offices provide them with technical guidance when required. According to the results of the inventory survey conducted by the data collection survey, 22 out of the surveyed 31 subprojects have regulators. All of them are operated by a regulator committee formed by beneficiaries though the regulators of almost half of the subprojects are not working. The operation rules of all 22 regulators are provided on a seasonal basis, as shown in Figure 7.4.3 below. As shown in the figure, the gates of non-submergible regulators are closed during the monsoon season for the purpose of farming in the polder that is surrounded by full flood embankment, while the gates of submergible regulators are open during monsoon season to avoid overtopping.

Under the present circumstances, a lot of regulators in haor areas are not functioning due to loss of gates or hoisting devices. In these cases, the equilibrium of water level is forced to be kept without gate operation. In some cases, wooden fall boards (stop logs) are used instead of gates. In some emergency situations, regulators are closed using earth-/sand-filled gunny bags. After harvesting of crops, water is allowed to flow into the polder by removing the fall boards or gunny bags. In other cases, it occasionally happens that embankments are cut by stakeholders in order to make water rapidly flow into the polder for the purpose of attaining rapid equilibrium of water level.

No.	Sub-project Name	Type*	Operation Rule											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Sukhaijuri	F	O				C					O	C	
2	Gozaria	-	O				C					O	C	
3	Boraikhali	F	O				C					O	C	
4	Char	F	O				C					O	C	
5	Adampur	-	O				C					O	C	
6	Aladia Bahadia	-	O				C					O	C	
7	Motkhola-Bairagir	F	O				C					O	C	
8	Ganakkhali	-	O				C					O	C	
9	Binnabaid	F	O				C					O	C	
10	Satdona Beel	-					C			O				
11	Chandal Beel	F					C			O				
12	Kairdhala Ratna	S						O				C		
13	Bashira river	S						O				C		
14	Chegaia	S					C					O		
15	Aralia Khal	-						O				C		
16	Gangajuri	F	O				C					O	C	
17	Singer	B						O				C		
18	Thakurakona	F					C	O				C		O
19	Kangsha	F					C	O				C		O
20	Dampara	B						O				C		
21	Khaliajuri-2	S						O				C		
22	Khaliajuri-4	S						O				C		

Legend: Gates are kept open. ("O" means the timing of open.)
Gates are remained shut. ("C" means the timing of close.)
Note: * Type shows three categories; F = Full embankment; S = Submergible embankment; B = Both F and S
Source: Result of inventory survey conducted in the Data Collection Survey

Figure 7.4.3 Operation Rule of Existing Regulator

ii) Maintenance Works

The existing structures are regularly inspected by the sectional officer monthly and by the sub-division divisional engineer (SDE) quarterly. They normally judge the functional failures of structures based on their individual experience and not on any technical standards. If any failure of structure is found, repair cost is estimated for the next budgetary request.

Beneficiary Community Group:

A water management organization (WMO) is formed by local beneficiaries after projects are completed though its name is different depending on the project size, implementing agencies and so on. WMOs are registered under the Department of Cooperatives. In order to assist communities in formation of WMO, BWDB has PEO at zone level, AEO at division level and extension overseer (EO) at sub-division level, which are led by the CWM.

The mandatory formulation of WMO is not mentioned in any official document though it is encouraged to be formed in a relevant policy or guideline. Although BWDB is willing to form WMO for every subproject, not all subprojects have formed WMOs at present. In general, WMO is formed in FCDI subprojects associated with fare collection for water use. They partially contribute to the financing of O&M cost. However, such FCDI subprojects do not exist in the haor areas.

In order to understand the current situation of communities' activities and to identify their issues and needs, a community survey was conducted in the 15 proposed rehabilitation subproject areas between August and September 2013. The findings from the interviews are summarized below and detailed in Appendix 7.7.

- Out of 15 subprojects, 13 have one or more regulator (sluice) committees instead of a registered WMO, although some of them are not properly functioning at present. Most of them were formed before the formulation of the participatory guideline.
- Most members of committee are in charge of the operation of regulators; however, they are not involved in maintenance activities because all the facilities are under the control of BWDB.
- All the interviewed committees have no official operation rule with the exception of one committee. They operate the regulators based on their own rule or personal experience.
- Five committees have faced problems in operating regulators due to conflict between different groups, for instance, farmers and fisheries or upstream/downstream farmers.
- Most committees were given only a simple demonstration for regulator operation immediately after construction. After that, no guidance/trainings on O&M works have been provided. They desire proper trainings and manual for better O&M works.
- Although it is reported in many study documents that the malfunctioning of facilities were caused by poor O&M works, it was also revealed that there were many cases where O&M works have been terminated since facilities were broken down due to originally imperfect design.

The interview results are summed up that communities are willing to participate in O&M works for much higher benefit from farm products if a proper mechanism of participation could be provided. However, from a practical perspective, most communities are not in a financial position to cover the cost needed for O&M works at present.

7) Village Cooperative Society Trained by NGO:

Concern, an international NGO based in Ireland, implemented 21 subprojects in the haor areas for village protection from wave action under the project "Haor Initiatives for Sustainable Alternative Livelihood (HISAL)" from October 2006 to December 2011.

In this project, Concern organized a cooperative society in the target village and the society produced a maintenance fund upfront. The beneficiaries also contributed all labor for construction. After completion of the project, ownership was transferred to the society and they took over responsibility for all kinds of maintenance.

According to Concern, in the first five years after project completion, there were two cases of collapse out of the 21 subprojects; however, the villagers successfully reconstructed those without any assistance from Concern.

8) Ongoing Relevant Projects

From the aspect of O&M of flood management structures, the following projects are currently being implemented:

Water Management Improvement Project (WMIP):

The WMIP is an ongoing project and expected to be completed by 2015. One of the four components of WMIP is "O&M performance improvement". The project is basically designed to expand the role of communities in water resources management, empowering them to manage the infrastructure and providing a framework for participation of beneficiaries and stakeholders in rehabilitation and operation of the water management[6].

In WMIP, the following four-step "Participatory Scheme Management (PSM)" approach is applied; 1) selection of schemes, 2) mobilization and planning, 3) implementation of O&M, and 4) transfer of O&M. In this way, it is expected that the people will develop a sense of ownership of the project.

The core component of the participatory approach is formation of WMOs. In WMIP, two tiers of such organization have been considered, namely WMGs at the lowest level and WMAs by combining a number of WMGs in accordance with the Guidelines for Participatory Water Management.

The O&M activities are divided into three groups under WMIP, namely: 1) preventive maintenance, 2) periodic maintenance, and 3) emergency maintenance. It is proposed in WMIP that WMA will be responsible for preventive maintenance while BWDB will provide both periodic and emergency maintenance.

The implementation started in 2012. Out of the 35 target schemes, all schemes have achieved the formation of WMGs and WMAs by the end of June 2013. The total number of WMGs and WMAs formed for the 35 schemes are 386 and 37, respectively. The WMOs were formed through the activities of NGOs and consultants. Also, organizational management trainings for WMOs and tender process for rehabilitation works are ongoing as of September 2013.

It should be noted that schemes in the haor areas are not included in WMIP as they involve yearly high recurrent maintenance of submergible embankments after recession of monsoon flood[7] with the exception of full embankments in Netrokona and Kishoreganj.

Small-Scale Water Resources Development and Support (SSWRDS):

Although small-scale flood management structures of LGED are out of the scope of the survey, the LGED practice will serve as a useful reference for O&M works in BWDB.

The LGED has implemented the former Small Scale Water Resources Development Project (SSWRDP) since mid-2000. SSWRDP has a participatory approach for each stage, namely: Stage 1) identification and planning; Stage 2) feasibility, design and institutional establishment; Stage 3) construction and first year joint operation; and Stage 4) sustainable O&M. The implementation of SSWRDS will continue until 2017.

[6] Inception Report of Components 1 and 2, WMIP, November 2010
[7] Draft O&M Plan, WMIP, September 2011

The nature of infrastructure includes earthen embankments, khals (channels), gated regulators and other structures including culverts, bridges, pipeline network and rubber dam. The important criterion of subproject area selection is that the command area has to be less than 1,000 ha. By 2017, about 1,080 subprojects will have been developed and handed over to water management cooperative associations (WMCAs) for O&M works.

The SSWRDS prepared "Guideline on Subproject Operation and Maintenance (Draft)" in May 2013, which is used to clarify O&M requirements, duties, responsibilities and procedures for completed (or handed over) subprojects.

Table 7.4.2 shows the funding mechanism for three different maintenance works and additional (new) works in SSWRDS. As seen in the column "Funding", WMCAs contribute to funding for routine maintenance fully and periodic maintenance partially.

Table 7.4.2 Maintenance and Additional New Works Funding in SSWRDS

No.	Works / Maintenance Category	Funding	Criteria for Use	Remarks
A	Routine Maintenance	100% WMCA	Application by WMCA. Initial assessment by the LGED upazilla engineer, with checking by IWRMU staff	Routine maintenance (weed & water hyacinth removal from khals, etc) is not eligible for GOB funding assistance, and is fully the WMCA/beneficiaries' responsibility.
B	Periodic Maintenance	Matching fund[8]: GOB: --% WMCA:--%		Periodic maintenance (silt removal from khals, periodic replacement of gates, etc) is eligible for GOB funding support. Support for periodic maintenance to be given after preparation of maintenance strategy for the subproject.
C	Emergency Maintenance	Emergency fund: 100% GOB		To include: (i) infrastructure failure due to abnormal loading, such as major slip failure of embankments due to scouring by large flood; (ii) minor new works to improve O&M such as reference (lined) sections in khals; and (iii) essential subproject rectification works.
-	Additional (New) Works	New works: 100% GOB	Upfront contribution required. Justification required.	Additional (new) works to an established subproject may be identified as part of performance enhancement studies. The investment limit for new works would be decided from time to time by competent authorities, or as given in the loan documents for any project.

Source: Guideline on Subproject Operation and Maintenance (Draft), LGED, May 2013

Initially, the O&M fund of WMCA is collected during Stage 1 which is one of the criteria of subproject implementation, i.e., subprojects are not able to proceed to construction stage if WMCA was not able to collect required amount of O&M fund.

In general, contribution for O&M is collected once or twice a year after handover of the subproject. The collection from WMCA members based on landholding area is recommended by LGED as a method of contribution collection.

As it is likely that funding applications for GOB support will be oversubscribed, an assessment/grading will be carried out to determine those subprojects which will receive funding support. Subproject grading enables donors and GOB to know the success of the investments in SSWRDS, in order to inform changes to project design and to guide future investments.

[8] Percentages funded by GOB and the WMCA, as well as upfront WMCA contribution, would be decided by GOB from time to time.

9) Diagnosis of Current O&M Works

Identified Problems in O&M Works:

Through the interviews with relevant units of BWDB and communities in the haor areas as well as past study documents[9/10/11/12], the following problems/issues were identified:

a) Lack of clear policy and organized structure

- Poor preparation of annual O&M work and lack of transparent, rational policy of fund distribution is one of the major drawbacks. There is no policy on paper regarding O&M work planning and budget allocation. At present, funding is allocated to cope with immediate needs. As a result, optimum utilization of the allocated fund is not ensured.
- Comprehensive O&M plans/programs have not been prepared. The so-called "O&M Plan" in BWDB is a list of O&M projects for the purpose of securing annual budget to cope with immediate needs, which are carried out in a project style with tender process.

b) Inadequate and untimely fund allocation

- Inadequate and untimely fund availability can be identified as one of the major constraints to proper O&M works. As BWDB is a service providing organization, it has no own income; BWDB depends entirely on government funding for financing O&M works. It is alleged that in recent years such government funding is inadequate. Furthermore, in many cases, funding availability is always late. As a result, proper work planning and timely implementation are hindered.
- The work plan finalized by BWDB is forwarded to MoWR for approval. MoWR approves the work plan subject to concurrence of the Ministry of Finance. For the absence of conceptual uniformity, a large amount of time is spent at different stages in this procedure. Sometimes, the dry season is almost over before field level works can get started.
- Even if regulator gates are not functioning, BWDB regional offices have not been able to fix them over the years due to limited budget. The only activity BWDB division offices were able to do is carrying out regular inspection of structures.

c) Shortage of manpower

- Shortage of manpower at field offices is another major constraint to proper execution of O&M works. Due to restriction on new appointment for different reasons, the present manpower is even less than the approved quantity.
- The policy (BWDB, 2010) observed that there is a lack of awareness among the field level officers on the importance of proper execution of O&M works. The policy also observed that field level offices do not maintain detailed list of infrastructures and completed projects within their areas. There is no structured inspection formats and routine inspection timeframe to identify maintenance requirements. Thus, it is not possible to allocate funds rationally. There is also absence of framework for monitoring and evaluation of suitability and quality of O&M works undertaken, and effect of completed works.

[9] Master Plan of Haor Area, Annex 1: Water Resources (BHWDB , April 2012)
[10] JICA Preparatory Survey on Cooperation Program for Disaster Management in Bangladesh (JICA, July 2012)
[11] Policy on O&M of Permanent Structures of BWDB (BWDB, October 2010)
[12] Draft O&M Plan, WMIP (BWDB, September 2011)

d) Shortage of transport equipment

- Shortage of required logistics (particularly transports, speed boat, computers, etc.) at field offices is another major constraint to proper execution of O&M works. Transportation is particularly essential since the schemes of the haor area are normally located in remote and inconvenient places.

e) Damageable structures

- Due to the mighty disaster-causing forces of nature such as extremely heavy precipitation and wave actions in the haor areas, low-quality infrastructures that were constructed under poor supervision and corrupt practices, particularly for very small schemes, are easily damaged.

f) Difficulties in O&M works of submergible structures

- WMIP excluded haor areas from their schemes as they involve yearly recurrent maintenance of submergible embankments after recession of monsoon flood. This indicates that WMIP is skeptical about the success of participatory O&M management in haor areas.

g) Lack of participation of community

- There exist regulator committees formed by beneficiaries in the haor areas. Most of them are not functioning at present due to malfunctioning facilities. The committees are dependent on BWDB's initiative and have less incentive to execute O&M works at their own initiative.
- Under present circumstances, most communities are not in a financial position to cover the cost needed for O&M works.

Diagnosis Approach by Means of Fault Tree Analysis:

In order to systematically diagnose the current status of O&M works based on the problems identified in the previous clause, fault tree analysis (FTA) will be effective.

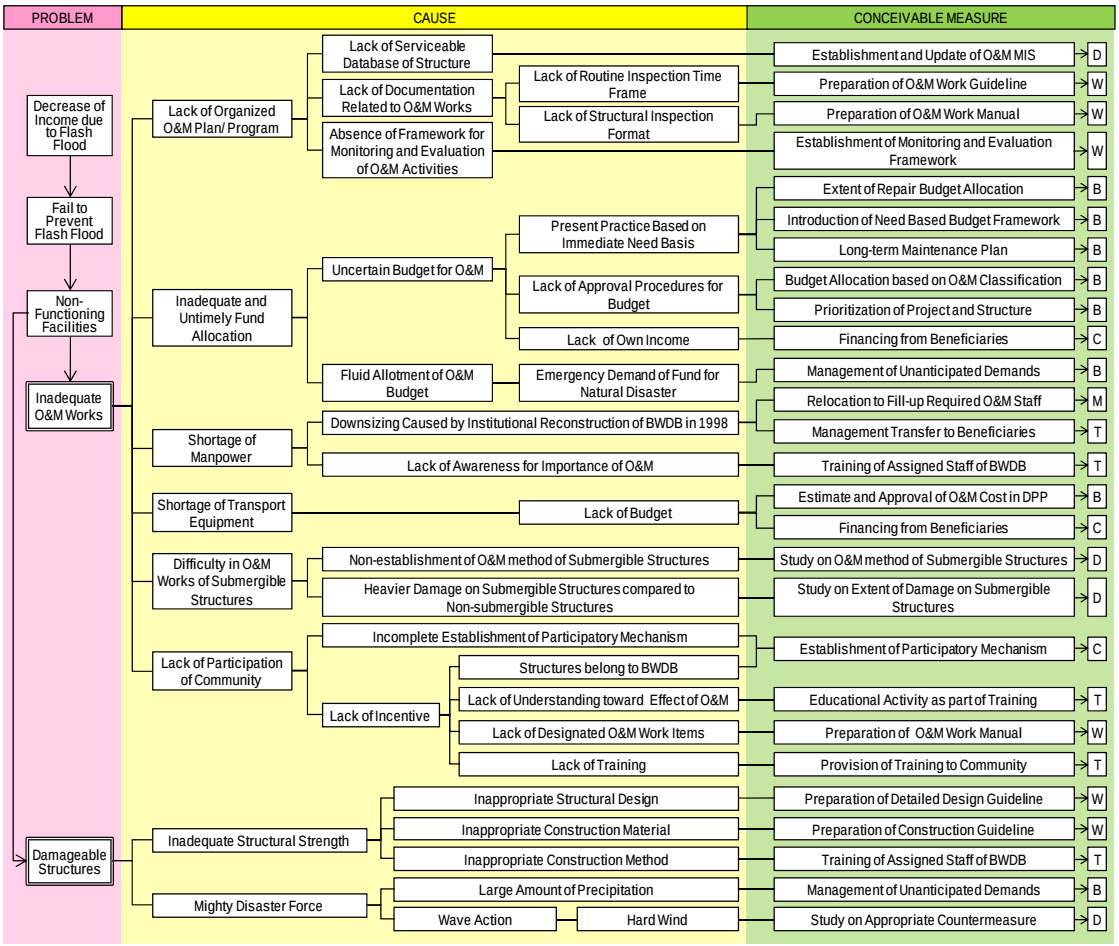
The FTA is a method developed by Self Control Technology to diagnose the status of electronic equipment automatically. The method stores information of problems that occur frequently in a memory unit mounted on the equipment in the form of a tree structure together with automatic diagnostic system. The memory unit files the conceivable causes that would possibly bring about the problems and countermeasures that could remove or alleviate the causes as well. Once a problem occurs in the equipment, the automatic diagnostic system is activated and accesses the file to identify the problem, detect causes of the problems, and select the relevant countermeasure that could remove or alleviate the causes to solve the problem.

A fault tree is some sort of "medical chart" which presents the summary of the diagnosis or examination results of the current O&M works. A countermeasure at the end of a tree is the proposed treatment which is expected to be effective to remedy the problem. It is, in other words, an intervention which is required in O&M works.

Diagnosis Result:

In accordance with the above approach, FTA was conducted by using the identified problems mentioned above. The results of FTA are shown in Figure 7.4.4 below. It also indicates some conceivable measures against the respective causes of problem.

Although sufficient information on the failure of regulator's operation were not collected this time because there were a lot of cases where the structures were broken before the accumulation of actual performance, more specific diagnosis using FTA will be expected if actual O&M work records are accumulated in the future.



Note: The letters written under the column conceivable measure such D, W, B, C, M and T are explained below.
Source: JICA Survey Team

Figure 7.4.4 FTA for O&M of BWDB Flood Management Structures

Incorporation of FTA Result into O&M Plan:

The above conceivable measures are broadly categorized into six key points. The O&M plan described in the following clauses were deliberated based on these points.

D) **D**ata and Information:
Sufficient data and information will make O&M plan more specific and effective. They will also be utilized for future study on maintenance method of submergible structures. Accumulation of data by updating database will be necessary.

W) **W**ork Description:
To perform proper O&M works, the documentation of guidelines, scheme-specific plans and manuals will surely be required. The preparation of these documents will be proposed in the following O&M plan.
Although measures regarding design and construction stages are out of the following O&M plan, design and construction manual will be prepared in the Project for Capacity Development of Management for Sustainable Water Related Infrastructure, which is being carried out with technical assistance from JICA from August 2013 to July 2016.

B) **B**udget:
O&M cost for prioritized subprojects will be estimated in the plan in consideration of O&M classification and annual work necessity.
Furthermore, in order to secure longer-term budgetary stability, periodic replacement of structures and long-term inspection for submergible structures will be considered in the O&M plan.

C) **C**ommunity Participation:
Clear mechanism of community participation including formation method of WMOs, implementation method of activities, training programs, future financing system from communities, etc., will be established.

M) **M**anpower:
Appropriate manpower for the proposed O&M works will be examined in view of the number and official position of BWDB officers.

T) **T**raining:
Necessary trainings to BWDB field officers and communities from both aspects of technical and administrative matters will be programmed.

(2) O&M Plan for Component 1 Structures

The objective of O&M plan is to ensure the sustainability of flood management subprojects to be proposed in the survey. The O&M plan for Component 1 is formulated based on the results of FTA and is outlined as follows:

1) Objective Structures for O&M Works for Component 1

Structures to be operated and maintained in Component 1 shall include all the structures proposed in Component 1, namely, embankment, regulator and intake/drainage canal.

2) Participatory Approach in O&M Activities

It has been reported in several relevant past study documents[9/10/11/12] that lack of local stakeholder participation is considered as one of the important factors for O&M issues.

When there is shortage in BWDB's manpower, it is impractical to conduct O&M works solely by means of BWDB's manpower. It is obvious that the cooperation of local stakeholders is absolutely necessary for regular and sustainable O&M activities to be carried out in the field where most beneficiaries reside.

The results of interview surveys with local communities in the haor areas revealed that regular and routine inspection and maintenance works have rarely been conducted in the

past. In consideration of the difficult accessibility to subproject sites in the haor areas, residents around the sites are most suitable for these kinds of works. Fortunately, local communities are also willing to participate in such O&M works.

For the purpose of sustainability of regular O&M works, a participatory approach is highly recommended. In this regard, it is desirable to make an O&M plan that is accessible to local communities, which would be the members of WMOs.

3) Preparation of O&M Guidelines

In line with the O&M policy formulated in 2010, the O&M Directorate of BWDB should prepare the overall O&M guidelines, which include routine inspection timeframe, structural inspection format, etc., to be applicable to the preparation of specific O&M plans and manuals for each subproject in the haor areas. In consideration of the schedule that initial O&M plan for each subproject is to be prepared at the D/D stage, the preparation of guidelines should be completed in the early part of D/D stage.

The Project for Capacity Development of Management for Sustainable Water Related Infrastructure, which is being carried out from August 2013 to July 2016, will prepare a draft O&M manual for river infrastructures by June 2014 and will revise the manual twice based on lessons from the model O&M activities by December 2015. Although it is not a specialized manual for haor areas, it will serve as a useful reference for the preparation of the overall O&M guidelines and contribute to shortening the time for preparation.

4) Maintenance Plan

The maintenance works for flood management structures are broadly classified into the following three categories:

i) Preventive Maintenance: This aims at maintaining the original design function of the structures based on the following three activities:
   a) *Routine Maintenance*, which includes all repetitive activities to be performed throughout the year such as lubrication of mechanical facilities and removal of garbage and sediment deposits;
   b) *Periodic Maintenance*, which includes all activities such as overhaul of mechanical facilities and repainting of substantial parts of metal components, to be performed at intermittent intervals in accordance with a predefined program; and
   c) *Small Repair Work*, which includes works of small scale necessary for restoration of a facility such as repairs of small cracks, holes or detachment on structures and replacement of damaged facilities.

ii) Corrective Maintenance: This aims at more substantial repair/replacement works (than preventive maintenance above) to restore a facility that has a considerably reduced function than its original design due to over-extended operation and/or destructive damage.

iii) Emergency Maintenance: This is executed to prevent imminent failure of infrastructures during extreme disasters such as floods, landslides and earthquakes.

Among these, preventive maintenance would be performed based on a definite and consistent maintenance plan. On the other hand, both corrective maintenance and emergency maintenance are ad-hoc, therefore it would be difficult to formulate a consistent annual plan in advance. From these viewpoints, standard maintenance works are defined as shown in Table 7.4.3.

Table 7.4.3 Proposed Work Items for Preventive Maintenance

Work Item	Objective Facility	Time Interval of Work	Standard Annual Work Volume
Removal of garbage twining around structures	Regulator	Once a month	As required
Removal of sediment deposit	Intake/ drainage canal	As required	The whole extent of canal
Removal of water hyacinth	Water surface around regulator	Once a year	100 m area from regulator
Small repair for earth embankment	Submergible embankment	As required	About 1% of the entire surface
	Full flood embankment	As required	About 0.5% of the entire surface
Small repair for structures other than earth embankment	Concrete structures around regulator	As required	About 0.1% of the entire surface
Lubrication of mechanical facilities	Submergible mechanical facilities	As required	As required
	Non-submergible mechanical facilities	As required	As required
Small-scale re-painting for detachable metal parts	Submergible mechanical facilities	As required	As required
	Non-submergible mechanical facilities	As required	As required
Overhaul of mechanical facilities	Submergible gate facilities	Once every five years	Whole mechanical parts
	Non-submergible gate facilities	Once every ten years	Whole mechanical parts
Greasing of whole movable part of mechanical facilities	Submergible movable parts of mechanical facilities	Once a year	Whole mechanical part
	Non-submergible movable parts of mechanical facilities	Once every three years	Whole mechanical parts

Source: JICA Survey Team

Although it will take time to clarify the damage mechanism of submergible structures by conducting further study, it is obvious that those structures require maintenance at higher frequency than others. In this regard, higher frequency of maintenance works for submergible structures are provided as shown in the table above.

Also, even if preventive maintenance is properly performed, corrective maintenance is generally required. However, as described in Chapter 3, large-scale rehabilitation works of embankment may not be needed for more than 50 years if 98% degree of compaction is specified during construction. In this regard, in addition to the above preventive maintenance works, detailed geotechnical inspections at an interval of ten years are proposed for the purpose of confirmation of the geotechnical strength of embankment. Tri-axial tests and unconfined compression tests will be conducted in the detailed inspection for comparative study with expected strength by dry-wet cycle test mentioned in Chapter 3.

5) Operation Plan

The operation rule of regulator for FCD project is generally prepared on a seasonal fixed basis, while the rule for FCDI project is provided on a water level basis. In fact, all the existing subprojects in the haor area have only seasonal operation rule regardless of FCD or FCDI as shown in Figure 7.4.4. However, this type of operation may increase flood damage because the timing of increase in water levels is variable every year. In this regard, it is necessary to develop an operation rule on a water level basis for the haor areas.

Regulator operation will be linked not only to agricultural requirement and on farm water management but also to the requirement of fisheries and navigation. The operation plan for the respective subproject is to be updated through the participation of beneficiaries at the C/S stage for efficient performance of the plan though the initial plan will be prepared at the D/D stage as explained in clause (3) 3) below.

The plan for each subproject will be jointly drawn up by BWDB division/sub-division offices and WMO in cooperation with the office of the CWM BWDB and DAE. The operation plan of FCD and FCDI will have some difference. In reference to WMIP's experiences, the respective plans will contain the following:

The operation plan for FCD subprojects will contain the following:

- Approved spatial distribution of the cropping pattern and cropping calendar,
- Maximum water level allowed in early monsoon to satisfy fisheries demand (before planting *Aman*[13] crops),
- Maximum water level targeted in beel during peak monsoon period: Aman crops above this level should be safe, and
- Critical water retention level at which the gate will be closed at the end of the wet season, for irrigation of *Rabi*[13] crop or reduced water requirement of land preparation for *Boro*[13] in *Rabi* season.

The operation plan for FCDI subprojects will contain the following:

- Approved spatial distribution of the cropping pattern and cropping calendar,
- Starting date of irrigation per channel reach, in concurrence with the approved cropping pattern and calendar (e.g. those located farther will be allowed to start irrigation earlier than those located nearer);
- Starting date of drainage, per channel reach, channel, section or scheme, which depends on rainfall, and the actual implementation of the water management plan, rotation schedule of canals (where applicable);
- Minimum water levels, or minimum water depths required in canals for (pumped) irrigation; and
- Decision schedule stipulating clearly under which conditions under-irrigation will start, or which areas will be excluded from irrigation first.

[13] Different varieties of rice grown in Bangladesh include Aus rice in kharif-1 season (April-July/August), Aman rice in kharif-2 season (July-December) and Boro rice in Rabi season (December-May). Source: UNESCAP website

The operation plan shall be a formal agreement between BWDB and WMO, ensuring that operational services will be provided. Manuals needed for daily use should be prepared for each subproject based on the above contents.

The operation plan for each subproject should also stipulate persons responsible for gate operation, information dissemination route in operation, management method of operation record, list of equipment, and emergency response method such as advance preparation of sandbags and wooden stop logs.

6) Updating of Database

The existing database is being updated through WMIP. In order to achieve effective inspection and maintenance, the database should be updated when the proposed subprojects are completed. The updating works will be executed by the office of Chief Monitoring. The respective division offices will be responsible for provision of updated information when required. The monthly activity reports to be submitted by WMOs will be a part of information source and it should be entered into the database if necessary.

7) Update of O&M Plan and Manual for Each Subproject

The O&M plans and manuals for each subproject will be initially prepared at the D/D stage and will then be updated through the participation of beneficiaries at the C/S stage. These plans and manuals should be continuously updated by division/sub-division offices in cooperation with the relevant bodies when required.

8) Measures against Human-induced Problem

To assure the sustainability of the project, the following human-induced problems should be settled as follows:

a) Cutting of embankment by the public
It is thought that the main reason for public cutting is that embankments are being cut to avoid overtopping caused by malfunctioning regulators or to drain retained water at the end of the monsoon season. Those necessities will be eliminated if regulators and drainage systems are properly constructed and well-maintained in the future. However, some repair cost for closing breach of embankment was estimated and incorporated into the annual O&M cost in case embankments need to be cut for emergency.

b) Conflict between different groups
Both parties of any conflict are to be incorporated in WMOs so that they can have a chance to discuss the problem. AEOs and EOs of BWDB shall facilitate consensus building of WMO in case the conflict may not be settled through internal discussion .

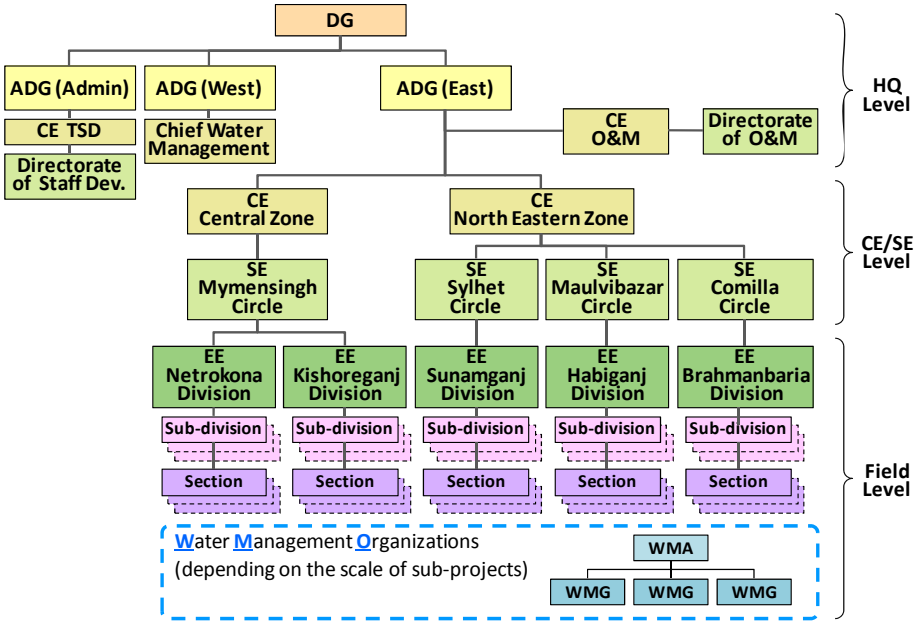
c) Theft of equipment:
One of the training programs to WMO will be to teach the importance of O&M works including the importance of equipment how they are used in the works. This kind of awareness building activities will be effective in fostering an awareness of the need to voluntarily protect equipment from theft. Also, it is

necessary to stipulate in O&M plan and manual for each subproject that removable parts should be stored in a safe place when not in use.

(3) Organizational Structures for O&M for Component 1

1) Organizational Structure

The organizational structure for O&M works for Component 1 is shown in Figure 7.4.5. The chart includes the concerned bodies to formation of WMO and provision of trainings.



Source: JICA Study Team based on discussion with BWDB

Figure 7.4.5 Organizational Structure for O&M Works

One additional sub-division office shall be newly established in Kishoreganj Division for the reason described in the following Clause 4).

2) Demarcation of Roles and Responsibilities

The implementing bodies for each type of field work are summarized in Table 7.4.4.

Table 7.4.4 Major Implementing Bodies by Work Type

Work Type		Major Implementing Bodies
Maintenance	Preventative Maintenance • Routine Maintenance • Periodic Maintenance • Small Repair Work	**BWDB** in cooperation with WMO * WMO shall contribute to in-kind (e.g. labor) as a part of maintenance works.
	Corrective Maintenance	**BWDB**
	Emergency Maintenance	**BWDB**
Operation		**WMO** under the technical guidance of BWDB

Source: JICA Survey Team

In consideration of the existing "Delegation of Financial Power for BWDB", the roles and responsibilities of BWDB's relevant offices and WMO shall be provided as follows:

a) Headquarters
- Overall financial arrangement in O&M works based on estimation by field offices,
- Formulation of overall O&M guideline to be applicable for preparation of specific O&M manual for each subproject,
- Technical assistance to BWDB field offices in forming WMO,
- Provision of training program for BWDB field officers.

b) CE/SE Levels
- Control and check of EE's work depending on the amount of project works,
- Technical assistance to BWDB field offices in forming WMO.

c) Division Offices
- Overall O&M works at field level including annual planning, tender process, selection of contractor, supervision of O&M works, preparation of bills, etc.;
- Management of operation, maintenance and inspection records;
- Inventory management;
- Training of site operators;
- Preparation/update of O&M plan and manual for each subproject;
- Periodic and emergency inspection and maintenance.

d) Sub-division/Section Offices
- Support for WMO in regular operations;
- Regular inspection and emergency maintenance;
- Logging of operation, maintenance and inspection;
- Management of inventory and logistics;
- Formation of WMO and provision of training to WMO.

e) WMO
- Operational works along with the provisions in the manual,
- Periodic preventive maintenance in cooperation with sub-division offices,
- Financial contribution at the future stage.

3) Formation of WMO

In principle, WMOs should be formed before the preparation of O&M plan for each subproject in order to incorporate their opinions into the plan. Normally, an O&M plan is prepared during the F/S and D/D stages. However, the time that elapses before commencement of O&M works would be too long for some late-started subprojects if WMOs are formed at the D/D stage. To avoid the passage of excessive time, it is desirable to form WMOs at the C/S stage. Accordingly, O&M plan for each subproject will be prepared at the D/D stage and should be updated with WMO's views taken into account after the formation of WMOs at the C/S stage.

The WMOs shall be basically formed and maintained in accordance with Guidelines for Participatory Water Management (GPWM). The details are as follows:

Method of Formation:

- WMOs shall be formed before the tendering process at the construction stage of each subproject. In this regard, the formation of WMOs is one of the preconditions to proceed to the tendering process.
- The formation process of WMOs will be facilitated by BWDB. The office of Chief Water Management is responsible for WMO matters at national level. AEOs at division level and EOs at sub-division level shall be in charge of WMO matters including the formation process and monitoring works after the completion of subprojects.
- Basically there will be two tiers of WMO for each subproject, namely WMG at the lowest level and WMA at the apex level.
- WMG will be formed for each smallest hydrological unit or social unit (para/village) of the subprojects. WMA will be formed when the number of WMG in a subproject is more than one.
- The number of WMG and WMA to be formed for 29 subprojects were estimated in accordance with GPWM and modified based on discussion with BWDB as shown in Table 7.4.5. Although the final decision will be made by BWDB and stakeholders at the formation process, basically 100 WMGs and 22 WMAs will be formed for the 29 subprojects.
- The number of membership of one WMG will be determined depending on the number of stakeholders in a subproject.
- Membership to WMG will be open to women and men belonging to households of farmers, fishermen, small traders, craftsmen, boatmen, aquaculturists, landless people, destitute women, project affected person, etc., within the subproject area who are influenced directly or indirectly and positively or negatively from the subproject and they will be treated as general members of WMG. In case a conflict between different groups such as farmers and fishermen is expected, it is desirable to incorporate both parties as members of WMO.
- Basically, the 12-member Executive Committee (EC) of each WMG (including the 30% women representatives) is formed by nominating and electing the members by the participating general members of that particular locality. The EC has one president, one vice president, one secretary, one joint secretary, one treasurer and seven other members.
- The membership of WMA is composed of representatives from respective WMGs in consideration of their coordinating function between WMGs.
- The farmers group and fisheries group to be formed in Components 3-1 and 3-2, respectively, as well as the existing regulator committees, shall be invited as candidate WMO members, though the members will be finally determined by BWDB and stakeholders at the formation process.
- It is essential that WMO is registered with the Department of Cooperatives and bylaws are drawn up for each WMO. The bylaws will be prepared by WMOs with the help of Deputy Chief Extension Officer and some Extension Overseers to be recruited under the Project.

Table 7.4.5 Number of WMOs to be Formed for 29 Subprojects

Sel. No.	Sub-project No.	Name of Subproject	Embankment Length (km)		Canal Length (km)	Nos. of Regulator	Area (ha)	Nos. of WMOs	
			Full	Submerge				WMG	WMA
1	R-1	Dampara Water Management Scheme	20.0	27.0	17.0	2	15,004	8	1
2	R-2	Kangsha River Scheme	20.0	-	-	7	11,337	6	1
3	R-3	Singer Beel Subproject	13.2	3.5	5.5	4	7,200	4	1
4	R-4	Boraikhali Khal Subproject	5.3	-	24.5	1	8,667	3	1
5	R-5	Alalia-Bahadia Subproject	-	-	8.0	1	2,464	1	-
6	R-6	Mothjola-Bairagir Char Subproject	10.8	-	-	1	2,060	1	-
7	R-7	Ganakkhali Subproject	-	-	-	2	2,652	1	-
8	R-8	Kair Dhala Ratna Subproject	-	26.0	40.0	3	11,900	6	1
9	R-9	Bashira River Re-excavation Subproject	-	15.0	20.0	2	4,521	3	1
10	R-10	Aralia Khal Subproject	-	-	2.4	2	1,501	1	-
11	R-11	Chandal Beel Subproject	2.7	-	1.5	1	1,012	1	-
12	R-12	Satdona Beel Scheme	-	-	-	2	5,049	2	1
13	R-13	Gangajuri Subproject	46.0	-	4.5	7	20,441	11	1
14	R-14	Khaliajuri FCD Polder-2	-	52.1	-	10	6,611	3	1
15	R-15	Khaliajuri FCD Polder-4	-	47.0	-	5	7,201	3	1
16	N-1	Naogaon Haor Project	-	31.2	20.0	4	9,104	4	1
17	N-2	Boro Haor Project (Nikli)	-	10.3	10.0	3	9,146	4	1
18	N-3	Jaliar Haor Project	-	12.4	8.0	2	2,466	2	1
19	N-4	Chandpur Haor Project	-	2.2	5.0	2	2,311	2	1
20	N-5	Dharmapasha Rui Beel Project	-	54.3	5.0	7	21,563	11	1
21	N-6	Suniar Haor Project	-	15.4	25.0	2	3,894	3	1
22	N-7	Badla Haor Project	-	9.7	2.0	2	1,504	1	-
23	N-8	Nunnir Haor Project	-	23.2	20.0	3	5,810	4	1
24	N-9	Dakhshiner Haor Project	-	16.8	10.0	2	2,482	2	1
25	N-10	Chatal Haor Project	-	5.8	11.0	2	816	1	-
26	N-11	Ganesh Haor Project	-	19.4	3.0	2	3,090	3	1
27	N-12	Dhakua Haor Project	-	32.9	30.0	3	4,425	3	1
28	N-13	Mokhar Haor Project	-	28.4	110.0	5	8,064	4	1
29	N-14	Noapara Haor Project	-	23.3	7.0	3	3,180	2	1
Total			118.0	455.9	389.4	92	185,475	100	22

Source: JICA Survey Team based on discussion with BWDB

Implementation Method of Activities:

- Mobilization of WMOs
  The WMO members will be trained about O&M activities including the roles and responsibilities, organizational operation, technical O&M works and awareness activities in the course of the formation process, training program and internal study meeting.
- Communication with BWDB
  The AEOs and EOs of BWDB shall be in charge of WMO matters at field level. WMO members shall report their activities to BWDB through EOs every month and will contact the EOs if any special situations arise.
- Decision making and consensus building within WMOs
  A president will be elected by the WMO members. The elected president will chair the discussion among the WMO members. The AEOs and EOs will facilitate the consensus building of WMO in case WMO's internal discussion has not settled the problem by themselves.
- Monitoring method of activities:
  A monitoring form for WMO's activities shall be prepared at the D/D stage when O&M plan for each subproject is prepared. WMO will report their O&M activities, issues encountered, solution to the issues, conditions of structures, etc., every month

to EOs. The brief report should be forwarded to the AEOs and EEs through EOs every month. Then, a summary of monitoring should be reported to zonal CEs quarterly.

4) Personnel Allocation Plan

Basically it is essential to fill in the current vacant posts because the number of approved posts can sufficiently perform the O&M works for the existing subprojects. However, out of 15 new subprojects, nine subprojects are located in Kishoreganj Division. In this regard, one sub-division office consisting three sections shall be newly established in Kishoreganj before the implementation of subprojects.

In addition to filling up, from the viewpoint of the official positions, two AEOs for each division office and several EOs for each sub-division office are necessary for the proper performance of O&M works. The AEOs and EOs will be assigned during the implementation stage and will be engaged in O&M works after the completion of subprojects. The number of EOs for each office are provided according to the number and scale of subprojects and agriculture promotion programs for Component 3-1 as shown in Appendix 7.8. Besides, the numbers of other official positions were determined based on the scale of subprojects.

It is assumed that additional manpower, including both the approved posts for five divisions and the new posts for an additional sub-division office in Kishoreganj, is reallocated within BWDB because such personnel relocation has been made flexibly in BWDB for a long time. Also, as mentioned in the subsection 7.3.2 (3) above, they will be allocated prior to the commencement of the construction works of subprojects.

The summary of manpower to be added for O&M works is shown in Table 7.4.6 below and its details are shown in Appendix 7.8.

Table 7.4.6 Summary of Manpower to be Added for O&M Works in BWDB

(Unit: person)

Name of Office	Netrokona			Kishoreganj			Habiganj			Brahmanbaria			Sunamganj		
	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro	Set	Exi	Pro
Division Office	1 DO			1 DO			1 DO			1 DO			1 DO		
	21	7	23	15	6	23	20	7	23	9	1	15	20	4	23
Sub-division Office	2 SDOs			2+ new1 SDOs			2 SDOs			1 SDO			2 SDOs		
	23	6	53	20	8	65	21	7	44	6	0	10	19	8	33
Section Office	5 SOs			5+ new3 SOs			6 SOs			3 SOs			6 SOs		
	20	10	20	20	9	32	20	9	20	9	0	9	24	10	24
Directorate of O&M	Set up: 24, Existing: 14, Proposed: 24														

Note: Set = Set up, Exi = Existing, Pro = Proposed,
DO = Division Office, SDO = Sub-division Office, SO = Section Office
Source: JICA Survey Team based on discussion with BWDB

(4) Capacity Strengthening and Training

The capabilities of BWDB personnel at headquarters level are considerably being improved owing to the contribution of the component for O&M performance improvement in WMIP. Also, the Project for Capacity Development of Management for Sustainable Water Related

Infrastructure will contribute to the improvement of capabilities of BWDB personnel at headquarters level and some select field office levels.

Meanwhile, field level capacity strengthening in the haor areas is out of the scope of WMIP. In this regard, similar types of training to WMIP and the above JICA project will be necessary for BWDB field offices and WMO in the proposed subproject areas. The conceivable training program is outlined in the table below.

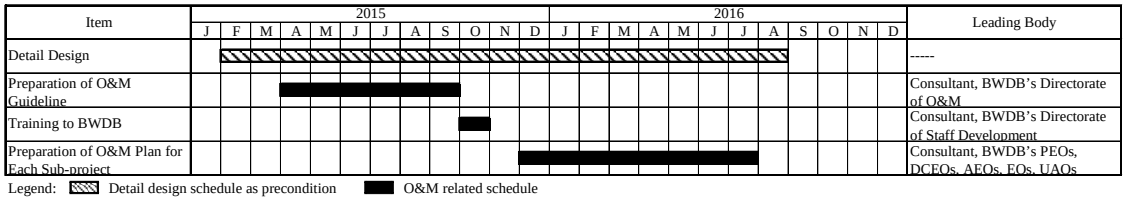
In particular, WMOs will receive follow-up training in addition to initial training for the purpose of regular and continuous follow-up even after completion of subproject. The trainer for the follow-up training will be BWDB's field officers for sustainability. Although only the first follow-up training is estimated as part of project cost, this will be continued if required.

Table 7.4.7 Conceivable Training Program

Program Type	Contents	Trainer	Quantity
Training to BWDB sub-division officers	• Formation method of WMO • Preparation of O&M plan and manual for each subproject • Monitoring of WMO's activities • Facilitation for consensus bulding • One year trial O&M works to be performed jointly with WMOs	Consultant, in coordination with BWDB's Directorate of Staff Development, Office of Chief of Water Management	• 1-day training • 14 sub-division offices (including the new sub-division office in Kishoreganj division)
Initial training to WMOs	• Formation of WMO including preparation of scheme- specific by-laws and registration procedure of WMO • Organizational and financial management • Technical training on O&M works to be executed by WMO • Participation in updating of O&M plan and manual • Awareness activities on the importance of O&M works • Precautions against public cut, theft of equipment, etc.	BWDB's PEOs, DCEOs, AEOs, EOs, UAOs, Cooperative Dept. officers, Revenue officers, Consultant, in coordination with BWDB's Directorate of Training, Office of Chief of Water Management	• 2-day training • 100 WMGs (including WMA members)
Follow-up training to WMOs	• Assessment of performance of WMO's O&M work • Solution to issues that WMO faced in the first one year of own activity	BWDB's PEOs, DCEOs, AEOs, EOs, UAOs	• 1-day training • 10-15 persons (representatives) from each WMG including WMA members • 1 training for two to three WMGs by subproject (30 persons in total per training) • 44 trainings in total for 100 WMGs

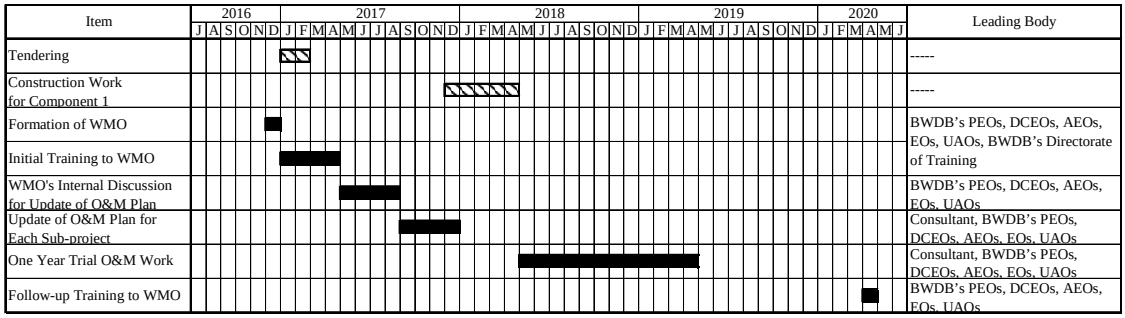
Source: JICA Survey Team

The training should be provided for BWDB field officers at the D/D stage and for WMOs at the C/S stage respectively for the reason mentioned in Clause (3) 3) above. The consultant services of the O&M specialist will be for 5 M/M during the D/D stage and 5 M/M during the C/S stage. The input of NGOs will not be indispensable since BWDB has accumulated sufficient experiences in forming and training WMOs through WMIP and other projects. The schedules of respective trainings are shown in Figures 7.4.6 and 7.4.7.



Legend: Detail design schedule as precondition O&M related schedule
Source: JICA Survey Team

Figure 7.4.6 Schedule of Training and Related Works for O&M in the D/D Stage



Legend: Construction schedule as precondition O&M related schedule
Note: Construction work will be implemented in the devided 5 cycles. The above chart show 1 cycle of them.
Source: JICA Survey Team

Figure 7.4.7 Schedule of Training and Related Works for O&M in the C/S Stage

(5) Cost Estimate

1) Annual O&M Cost

The annual O&M cost for all 29 proposed subprojects is estimated at BDT 67.0 million, as summarized in Table 7.4.8. The cost for gate operator is not included here because it is expected that WMOs contribute to the cost of operations.

Table 7.4.8 Summary of Annual O&M Cost for 29 Subprojects

(Unit: BDT/year)

Work Item	Annual Cost
Annual Cost of Routine and Periodical Inspection and Maintenance	46,927,481
Cost for Overhaul of Regulator	1,106,700
Annual Routine Operation Cost of Regulator	2,313,982
Overhead for O&M Works	16,614,000
Total	66,962,163

Source: JICA Survey Team

In particular, the percentages of embankment to be repaired annually were given as 1.0% for submergible and 0.5% for full embankment. These were determined based on the results of inventory survey, which focused on the current situation of existing structures. The calculated annual damage percentages were 0.81% for submergible and 0.51% for full embankment. Therefore it is considered that the percentages of 1.0% and 0.5% are reasonable values.

2) Training Cost

In accordance with the training program mentioned in Clause (4) above, the cost is estimated at BDT 8.0 million, as shown in Table 7.4.9.

Table 7.4.9 Training Cost for Field O&M

(Unit: BDT)

Item	Unit	Unit Price	Quantity		Cost	Remarks
			Training Days	Nos. of Group		
Training for BWDB Field Office	day	45,000	1	14	630,000	14 sub-division offices
Initial Training for WMO	day	30,000	2	100	6,000,000	100 WMGs (including WMA members)
Follow-up Training for WMO	day	30,000	1	44	1,320,000	• 10-15 persons (representatives) from each WMG including WMA members • One training for two to three WMGs by subproject (30 persons in total per training) • 44 trainings in total for 100 WMGs
Total					7,950,000	

Source: JICA Survey Team based on discussion with BWDB

3) Replacement Cost

The gates of regulators should be totally replaced after a certain period of time. The replacement interval was estimated at 25 years based on the result of the inventory survey conducted in the data collection survey, as follows:

- Out of the 60 existing regulators surveyed, 37 regulators (62%) are not functioning.
- The average elapsed year after completion of subproject is 15.7 years.
- From the above, it is estimated that all the regulators would become non-functional 25 years after completion of subproject.

Table 7.4.10 Replacement Cost for Regulator Gates

(Unit: BDT)

Item	Unit	Unit Cost	Work	Cost	Replacement Interval
Labor for removal of M.S. gates	each	1,582	314	496,767	Once 25 years
Installation of M.S. lift/flap gate	each	8,231	314	2,584,669	
Manufacture & supply, M.S. lift gate	each	90,149	314	28,306,918	
Total				31,388,354	

Source: BWDB Standard Schedule of Rates Manual (Volume II), Mymensingh O&M Circle

4) Cost for Periodical Geotechnical Inspection

As mentioned in Subsection 7.4.1 (2) 4), periodical inspection is necessary after a certain period in order to verify the strength of embankment. The cost of geotechnical inspection of the embankments of the 29 subprojects has been estimated at BDT 6.2 million/10 years based on the following unit costs:

- Detailed inspection for whole extent of embankment (10 MD) BDT 80,000
- Undisturbed sampling (ten sites) BDT 40,000
- Unconfined compression test (five pieces) BDT 30,000
- Tri-axial compression test (five pieces) BDT 45,000
- Analysis and reporting BDT 20,000
- Subtotal amount for one subproject BDT 215,000

5) Funding Source

As already stated, the necessary O&M budget has not been adequately allocated in the past decade due to the limited overall government budget. However, it is expected that the necessary amount would be reduced by completing all the rehabilitation works for each proposed subproject and by performing proper O&M works based on a definite and consistent plan in the future.

Regarding funding mechanism for O&M works of flood management facilities, WMIP and SSWRDS provided similar examples. However, SSWRDS is omitted here due to its smaller benefit area compared to BWDB's projects.

WMIP initially intended that funding from WMOs can be used as a part of O&M budget. However, WMIP realized immediately after the commencement of the project that it is difficult to collect money from WMOs because WMO members refused to contribute to funding even in non-haor areas. World Bank also agreed that the up-front financial contribution of WMOs was waived. Instead, the WMOs will take responsibility for regular routine maintenance and may contribute to in-kind (e.g. labor). The beneficiaries in the haor areas are poorer than the target group of WMIP. In this regard, it would be difficult to collect operational cost from beneficiaries from the early stage of the project. However, according to the interview survey, some communities indicated their intension to contribute to cost sharing in the future if they could realize that proper O&M works bring much benefit from farm products after completion of the subprojects.

For the first several years until communities actually feel the increase of benefits, all the cost shall be borne by BWDB. During this period, communities would contribute to labor works. After that, they shall start to contribute to funding gradually. The amount of cost sharing shall be discussed every year based on the benefits of the previous year.

7.4.2 O&M Arrangement for LGED

(1) Current O&M Situation of Rural Infrastructures

1) Relevant Policy Paper to O&M of Rural Infrastructures

The GOB, through its Gazette Notification No PC/TS/Classification Committee/06 dated November 6, 2003, followed by two subsequent notifications, reclassified the national road system into six categories, redefined them and re-delineated the ownership and responsibilities of the concerned organizations. These notifications endowed LGED with the sole ownership of all upazila roads and union roads. Besides, the responsibility of improving and maintaining village roads was given to the Local Government Institutions (LGIs).

The bulk of constructed rural roads require necessary maintenance, and the gap between maintenance need and funding is gradually widening. Time thus came to formulate and adopt a rational and sound new policy for rural road maintenance.

The LGED has formulated the Rural Road and Bridge Maintenance Policy. It was prepared by RMRSU and approved by the Minister of MLGRD&C in January 2013. The policy addresses the financial and other related issues being faced by LGED towards maintaining proper geometric and technical standards so as to sustain the benefits of improved rural access. Major features of the policy are summarized below.

a) Maintenance Needs Assessment

- The policy emphasizes that: i) establishing a reliable road inventory at planning and programming stages is a pre-requisite for road maintenance need assessment, and ii) a set of prioritization criteria should be developed. It indicates eight criteria to be included.

b) Road and Bridge Maintenance Standards

- The policy describes that rural road maintenance activities will be operated considering the threshold values determined under international standards while LGED standards will be considered for the appurtenant structures.

c) Environmental Considerations

- The policy states examples of both negative and positive impacts to be included in environmental considerations. Obviously, relevant laws enacted by the government should be strictly followed in implementing the maintenance program.

d) Implementation Management

- The policy stipulates the rural road maintenance responsibilities in accordance with gazettes regarding road classification, ownership and responsibilities.

e) Stakeholder Participation

- The policy encourages stakeholder participation. As a following action to this policy, it also describes that LGED shall develop a comprehensive but easily understandable guidelines on the roles of stakeholders at different stages of rural road maintenance.

f) Gender Equity and Involvement

- The policy says women should be involved at all stages of rural road maintenance right from planning to implementation.

g) Financing Mobilization

- To have a viable funding mechanism, the government will consider funding on an incremental basis. Parallel to this, funding from LGIs and the private sector is encouraged.
- The policy also states priority will be to protect and maintain the existing rural roads than to construct new roads.

h) Institutional Policy

- The policy expresses two points for institutional matters: i) LGED should streamline its institutional structure accordingly by employing an adequate number of qualified staff at its district, regional and headquarter level; and ii) LGED's Monitoring and Evaluation Unit should also establish a separate section for in depth monitoring and evaluation of the yearly rural road maintenance program implementation.

It is noted that the policy states in its Clause 9.0 that upazila roads, union roads, and any paved village roads linking the higher categories of roads above the village road shall be

maintained by LGED, and that the maintenance responsibilities of other village roads will lay upon the LGIs vis-à-vis the zila parishad, upazila parishad and union parishad. According to LGED Upazila Engineers to whom interviews were done, responsible organizations of the maintenance of the other village roads are union parishads.

It is further noted that the policy states in its Clause 12.2 that a list of existing upazila and union roads in the project area that will be reshaped by widening, overlay or periodic maintenance be proposed during the preparation of a development project to reduce backlog maintenance, and priority be given to such development project while allocating resources in the ADP. Although the amount of maintenance cost for the listed roads is not specified in the policy, the cost has been assumed to be around 10% of the development project cost, according to an LGED official.

Based on this policy, necessary manuals, guidelines, etc., will be prepared in RTIP-II, which is financed by the World Bank, as detailed in Item (7) below.

As for O&M of growth centers/rural markets (hats), the Guideline on Government Hat/Bazaar Management, Lease Procedures and Distribution of Income (LGD, 2011a) stipulates the roles and responsibilities of the lessee, market management committee (MMC) and upazila market management committee (UMMC), and financing of market operation and maintenance. The roles and responsibilities are summarized in Table 7.4.11.

Table 7.4.11 Roles of Lessee, MMC and UMMC for O&M of Hats

Lessee	MMC	UMMC
Daily cleaning of market/ erecting signboard displaying toll rates.	Preparing annual market development and maintenance plans/submitting market improvement and maintenance proposal to UMMC/supervising toll collection/ensuring facility is kept clean.	Overseeing market management/approving plans and proposals from MMC/submitting plans and proposals to upazila parishad/observing performance of MMC/reporting to deputy commissioner

Source: Preparatory Survey on the Northern Region Rural Development and Local Governance Improvement Project, Final Report (JICA, November 2012)

2) Preparation of O&M Work Plan

The existing nationwide rural road network, which is maintained by LGED and LGI, is summarized in Table 7.4.12 below. This table was prepared by RMRSU of LGED in October 2013, and submitted to MLGRD&C for approval.

Table 7.4.12 Existing Nationwide Rural Road Maintained by LGED and LGI

Agency Responsible for Maintenance	Road Type	Total Length (km)	Earthen Length (km)	Paved Length (km)
LGED	Upazila Road	37,257	6,568	30,689
	Union Road	44,007	19,861	24,146
	Important Village Road	37,041	22,953	14,088
	Subtotal	118,305	49,382	68,923
LGI	Village Road-A	81,578	68,320	13,258
	Village Road-B	103,389	94,792	8,597
	Subtotal	184,967	163,112	21,855
Total		303,272	212,494	90,778

Source: RMRSU, LGED

The LGED is responsible for construction of upazila, union and village roads, and maintenance of upazila and union roads and important village roads.

The LGED uses the following three maintenance implementation methods for rural roads and related structures:

i) Routine maintenance consisting of the following: a) off-pavement maintenance to be executed by LCS, and b) on-pavement maintenance to be carried out by Mobile Maintenance Team (MMT) stationed in the district office. The off-pavement routine maintenance includes activities of cutting/filling shoulders, cutting/clearing drains, filling ratholes/raincut, removing bushes, clearing inlet/outlet of culverts and weepholes, maintaining roadside vegetation, and replacing turf;

ii) Periodic maintenance including resealing, overlaying and rehabilitation of road pavement, and maintenance of structures such as bridges and culverts to be performed by contractors; and

iii) Emergency maintenance to be carried out by contractors.

Preparation of the annual maintenance plan and estimate of the costs for upazila, union and village roads are carried out by LGED annually in the following manner in principle:

i) Annual maintenance needs assessment. The assessment consists of: a) annual update of road and structure inventory stored in the road network database based on surveys on roughness, road surface condition, traffic volume, and bridge/culvert condition; b) classification of road surface into good, fair, poor and bad condition using international roughness index; and c) estimate of annual maintenance cost (plan) by applying unit costs of the respective maintenance methods and corresponding road surface conditions classified.

ii) District-wise weightage calculation of fund allocation. The calculation includes: a) calculation of percentages of paved length, vehicle km, and socioeconomic point for a district against country totals; and b) calculation of percentage of the annual maintenance cost for a district against country total as estimated in item (i)(c); and c) calculation of fund allocation for a district by applying average percentages of items (a) and (b) above.

iii) Finalization of the annual maintenance plan. The allocated fund in item (ii) above is adjusted by the approved total maintenance budget, and maintenance plan is finally decided within the approved budget.

In the finalization of the maintenance plan, budget for emergency maintenance is usually decided by applying 10% of the approved total maintenance budget.

The O&M work plan with cost estimate for rural infrastructures is prepared by the EE of the district offices and the proposal for fund requirement is sent to the SE (Maintenance Unit) for allocation of the fund.

With regards to maintenance activities carried out by LGIs, they have no officials working exclusively for rural road maintenance, and also have almost no maintenance budget supplied from GOB, according to officials of LGED. It is said that the almost sole source

of budget for LGI to do maintenance works is that from the Second Local Governance Support Project (LGSP-II) of the World Bank being paid directly to union parishads.

However, the budget of LGSP-II is marginal for each of the union parishads, and has been utilized for road construction, water supply and sanitation, education and agriculture, instead of road maintenance, according to interviews with some upazila offices of LGED.

Allocation of sufficient budget to LGIs to do maintenance of village roads-A and -B is essential to attain the targets of the road maintenance policy.

Regarding O&M of the growth centers and rural markets (hats), the upazila parishads are responsible for the annual leasing of all markets within their jurisdiction, and some percentages (15% to 25%) of the lease value shall be allocated to the maintenance of the markets. In addition to that amount, 10% of the annual lease value from all markets shall be deposited in the Upazila Development Fund for maintenance and development of the markets within the upazila.

The boat landing facilities (ghats) are, in many cases, constructed adjacent to the growth centers or rural markets. The O&M of such ghats then falls under the responsibility of the market lessee and MMC. Other ghats may be leased on the same basis as stipulated for leasing the markets.

3) Database on Existing Rural Roads

There is an LGED road network database covering all upazila, union, and village roads. The database consists of a road and structure inventory with items of average roughness, traffic volume indicated in annual average daily traffic (AADT) and commercial vehicle per day (CVD), total length, surface type, structures, construction year, maintenance operation records and so forth.

The road and structure inventory in the database is updated annually based on surveys on roughness, road surface condition, traffic volume, and bridge/culvert condition.

The database supplies the basic data to the road and structure database management system (RSDMS) running in 64 districts and 485 upazila offices.

4) Maintenance Activities for Existing Rural Roads

As described in the preceding section, LGED is responsible for the maintenance of upazila and union roads and important village roads in accordance with the maintenance policy (2013). Although maintenance responsibilities of all the village roads had laid upon the LGIs before the 2013 maintenance policy became effective and the LGI is currently responsible for the maintenance of village roads except for important village roads, maintenance works has been substantially carried out by LGED according to officials of LGED.

The RMRSU at the LGED headquarters is the unit in charge of road maintenance. The unit head is SE, supported by three EEs (maintenance), one EE (road safety), one

transport economist (EE), two AEs (maintenance), one senior AE (maintenance), one sub AE (estimator) and one programmer (maintenance).

The major responsibilities at different levels of LGED for road maintenance are summarized in Table 7.4.13.

Table 7.4.13 Major Responsibilities of Road Maintenance in LGED

Office	Staff	Mandate
Headquarters	ACE supported by SE, XEN (=EE), Sr.AE and AE	• Policy formulation • Fund allocation • Overall supervision of maintenance program
Region Office	SE supported by XEN (=EE), Sr.AE and AE	• Approve all type of routine maintenance scheme • Periodic maintenance schemes up to estimated cost of BDT 1.5 million • Monitoring and supervision of maintenance program • Coordination within the region
District Office	XEN (=EE) supported by Sr.AE and AE	• Formulate priority ranking • Preparation of annual maintenance plan • Operation of fund • Implementation of maintenance program
Upazila Office	UE supported by UAE and SAEs	• Conduct road condition and traffic survey • Update road database • Scheme preparation • Scheme implementation

Source: RMRSU, LGED

LGED has prepared the guidelines for maintenance of rural infrastructures. Based on the guidelines, a maintenance training manual has been prepared and training courses are conducted for district and upazila staff at the regional and district training centers.

5) O&M Activities for the Existing Markets/ Ghats

Development/improvement of growth centers and rural markets (hats) is the responsibility of LGED. However, O&M of the centers/markets are the responsibility of the lessee, the market management committee (MMC) and upazila market management committee (UMMC) as stipulated in the preceding section. The lessees, MMCs and UMMCs have operated and maintained the centers/markets by using 15% to 25% of the lease values managed by the upazila parishads

The O&M of boat landing facilities (ghats) is under the responsibility of MMC, the market lessee, or other lessee.

6) Ongoing Relevant Projects

The RTIP-II, with implementation period of 2012-2018, is an ongoing project relevant to O&M of rural infrastructure in this project. Its development objective is to improve rural accessibility in the project areas covering 26 districts including the haor areas and strengthen institutional capacity for sustainable rural road maintenance. RTIP-II has the following four components: i) accessibility improvement, ii) institutional development and enhancement, iii) rural transport safety, and iv) contingent emergency response.

One of the subcomponent elements of the second component mentioned above is implementing new LGED maintenance policy and operational strategy, which includes: a) capacity building at headquarters and field levels on road asset management policy, functions, systems and operations; and b) implementation of new technology and skills for road condition survey and axle-load limit monitoring and enforcement on roads. According to an LGED official, the preparation of guidelines and manuals relevant to this subcomponent is included in its activities.

(2) Maintenance Plan for Component 2 Structures

The LGED has prepared the Rural Road Maintenance Action Plan for the Northern Bangladesh Integrated Development Project (NOBIDEP) consistent with the draft rural road maintenance policy. The objective of the action plan is to contribute to improving sustainability of all-weather core rural road networks (upazila and union roads) in the project area. The outputs of the action plan are as follows:

1) Output 1: Project investments in rural road upgrading and rehabilitation sustained.
2) Output 2: Sustainability of the core rural road network in the project area increased.
3) Output 3: Rural roads maintenance policy adopted and implemented.
4) Output 4: Rural road network performance monitoring system developed, tested and applied.

The first output focuses on project investments in improved rural roads. The second output is broader, addressing rural road maintenance at the project area level. The third output has a national perspective. The fourth output is concerned with measuring LGED's performance as a service provider in sustaining access to the rural road network.

The abovementioned NOBIDEP maintenance action plan for rural roads is applicable to the project as well although there are some particular issues for the haor areas. The particular issues may include maintenance of turfing, pavement, and protection of shoulders from flow of water.

(3) Organizational Structures for O&M for Components 2 and 3-2 Structures

Maintenance activities for upazila, union and important village roads in Component 2 will be conducted by the existing LGED district offices and upazila offices using contractors and LCSs under supervision of LGED RMRSU and regional offices.

The maintenance activities for village roads except for important village roads in Component 2 will be carried out by upazila and union parishads with the technical guidance of LGED conforming to the maintenance policy. However, the parishads have no staff available for maintenance and no budget at present as mentioned in Sub-section 7.4.2 (1) 2). According to LGED, the following measures should be taken to ensure sustainable maintenance by LGIs such as upazila and union parishads:

1) Assignment of technical staff in LGI to work exclusively for road maintenance,

2) Allocation of budget for road maintenance in LGI to be subsidized from the national budget and/or allocated by using part of the provided maintenance budget given as 10% of the project costs of various projects as per the maintenance policy, and
3) Technical guidance by LGED upazila offices, which has been carried out and to be continued.

The O&M activities for the growth centers and rural markets (hats) and boat landing facilities (ghats) in Component 2 will be carried out by the lessee, MMC and UMMC by using part of the lease money as mentioned in Sub-section 7.4.2 (1) 2).

The O&M activities for the developed beels in Component 3-2 (fishery) will be made by the beel users groups (BUGs).

(4) Training

The LGED has a central training unit (CTU) at the headquarters and 14 decentralized regional training centers (RTCs) at regions set under revenue budget. The prime objective of the training unit is to develop the capacity of LGED officials and staff through various subjects. The training activities include assessment of training needs, development of training modules and implementation of training courses followed by evaluation of the courses. In addition to the revenue funded trainings, project funded trainings are carried out. In FY2013/14, the revenue fund is BDT 16.5 million and project fund is BDT 901.1 million.

The LGED training on road maintenance consists of not only the abovementioned training but also on-the-job training. Subjects of the on-the-job training include the following: i) construction procedure for base and subbase course, ii) bituminous carpeting, and iii) protection works by concrete and sand bags. In FY2012/13, about 40 on-the-job trainings were conducted in the district offices. Participants of the trainings are upazila engineers, sub-assistant engineers, work assistants, contractors and LCS people.

It is recommended that the present training system be maintained. Furthermore, a certain training to LCS people on their construction and maintenance activities of village roads would be necessary according to LGED. The features of the LCS training program are shown in Table 7.4.14.

Table 7.4.14 LCS Training Program

Items	Descriptions
Subjects of Training	Methods of construction and maintenance of village roads (by using implementation manuals for LCS prepared by LGED)
Trainee	LCS members, a total of 12,150 persons (= 135 km long village roads x 3 groups/km x 30 members/group)
Trainer	Upazila engineers or others having similar capability, (the training will be undertaken by project upazila offices under the instructions of district project coordinator of PIU.)
Number of Training	Two trainings per LCS group to be undertaken before and after construction
Training cost	Estimated cost of BDT 10,000,000 with the approximate unit cost of BDT 25,000 per LCS group

Source: JICA Survey Team based on discussion results with LGED

(5) Cost Estimate for Maintenance of Component 2 Structures

The expected annual costs for maintenance of the structures of Component 2, as summarized in Table 7.4.15, was estimated based on the percentages of the maintenance costs against the assumed direct construction costs based on the LGED data.

Table 7.4.15 Annual Maintenance Cost for Component 2 Structures

Items	Annual Maintenance Cost (BDT 1,000/year)
Rural Roads	
Upazila and Union Roads	132,956
Important Village Road	20,359
Other Village Roads	20,359
Bridges and Culverts	1,714
Subtotal of Rural Roads	175,388
Growth Centers/Rural Markets (Hats)	1,372
Boat Landing Facilities (Ghats)	143
Total	176,903

Source: JICA Survey Team based on LGED data

CHAPTER 8 ENVIRONMENTAL CONSIDERATION

8.1 Legal and Policy Framework related to Environmental Assessment in the Country

8.1.1 Relevant Legislations on Environmental Assessment

The Bangladesh Environment Conservation Act, 1995 (amended in 2010) provides the principal law on environmental protection in Bangladesh. An Environmental Clearance Certificate (ECC) is required for any project implementation. Under the act, the environmental assessment process is prescribed by the Environment Conservation Rules (the ECR, 1997) and its amendment. For the first step of the environmental application, information in the Initial Environmental Examination (IEE)-level is required even for projects requiring EIA (as stipulated in the ECR, 1997). Thereafter, other steps such as the preparation of the EIA terms of reference (TOR) and EIA submission and approval can continue within the process. The major legislations related to the currently proposed projects are shown in Table 8.1.1. With regard to the natural environment, there are no significant gaps between the legislations related to environmental assessment in Bangladesh (provided in the ECR, 1997 and others) and the JICA Environmental and Social Consideration Guidelines, 2010 in terms of the objectives of the EIA.

Table 8.1.1 Relevant Legislations on Environmental Assessment

Legislation	Contents
Environment Conservation Act (ECA),1995	The act is the principal law for the general environment in the country. The act, including 21 articles, stipulates the following: (1) conservation of the environment, (2) authority to regulate development and environmental pollution, (3) setting of ambient and discharge standards, (4) issuance of clearance certificates, (5) inspection of factories and production facilities, and (6) imposition of violation penalties.
Environment Conservation Rules (ECR),1997	These rules provide the detailed environmental process under the ECA and stipulate the following: (1) setting of national standards for air and water quality, discharges of gas and water for industries, and noise and vehicle exhaust; (2) process of IEE and EIA; and (3) designation of specific areas that are important for environment conservation.
EIA Guidelines for Industries, 1997	This is a handbook of guidelines outlining the procedures for preparing and reviewing EIAs. The handbook consists of the following: • EIA procedures, • Screening of industrial projects, • Application for Environmental Clearance • Review of EIA report, and • Methodology for the EIA process.
Environment Court Act, 2000	The aim and objective of the act is to materialize the Environmental Conservation Act, 1995 through judicial activities. The main features of this act are as follows: • Establishment one or more environmental courts by the government in every division, • Jurisdiction of the courts, • Procedure of activities and power of the courts, • Right of entry for judicial inspection, and • Appeal process and constitution of the environmental appeal court.

Legislation	Contents
Guidelines for Participatory Water Management (MoWR, 2001)	The document highlights the government's commitment to ensure participatory water management in Bangladesh. The guidelines indicate how the local stakeholders, representatives of local government institutions, private sector, and public sector agencies will work together for the participatory water management in Bangladesh. These provide only a broad outline for stakeholder participation and the concerned implementing agencies will develop their own procedures, manuals, formats, etc., as required, on how to apply these guidelines.
Guidelines for Environmental Assessment of Water Management (Flood Control, Drainage, and Irrigation: FCD/I) Projects, 2005	The updated guidelines are intended to be used in the planning of FCD/I projects, and are issued by WARPO and approved by the Ministry of Environment and Forest (MoEF). In due course, these will become a part of the set of sector environmental guidelines currently being prepared by the Department of Environment (DoE). Under these guidelines, the project reports and environmental annexes should be submitted to WARPO and DoE. • The Environment Section of WARPO, which was mandated under the NWP to act as a 'clearing house', will review the report and ensure that the interventions in the water resource sector comply with the NWP and the NWMP program. The procedure will also allow the addition of relevant information to the National Water Resource Database to assist in characterizing residual and cumulative impacts. • The DoE is the final environmental review authority prior the issuance of site and environmental clearance certificates. Particularly, the DoE's review is to confirm the screening categorization, to agree and approve the IEE and EIA conclusions, and, if these are satisfactory, to issue the project site and environmental clearance certificates.
Environmental Assessment Guidelines for LGED Projects (May 2008)	These are the guidelines for environmental assessment of LGED projects. The guideline was published in 2008, aiming to implement all of its development projects in an environmentally sound and sustainable manner. The guidelines provide necessary procedures and formats for the IEE and EIA of rural infrastructure development and urban sector projects in LGED.

Source: JICA Survey Team, Environmental Assessment Guidelines for LGED Projects, LGED

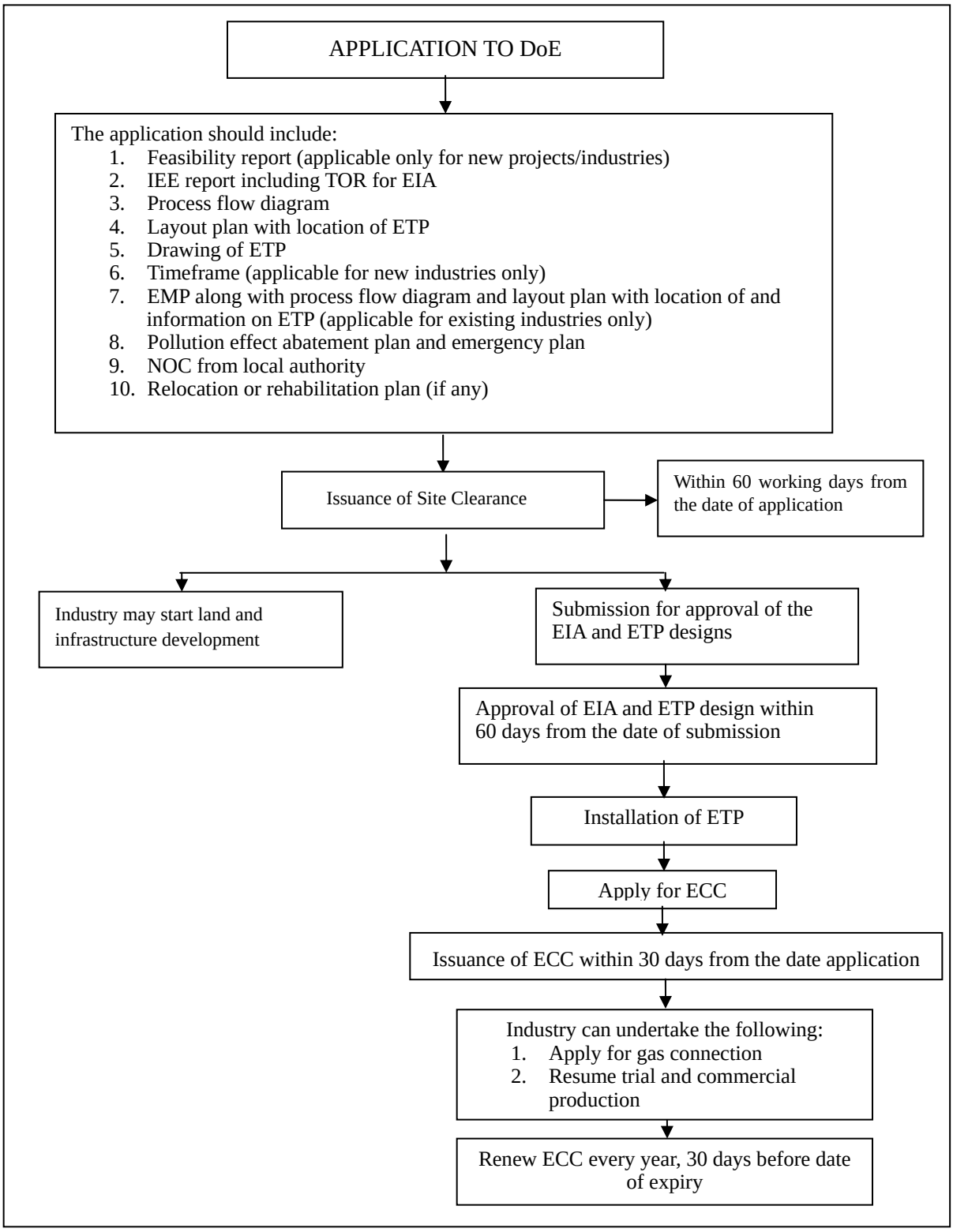
8.1.2 Environmental Assessment Process

The DoE, which is under the MOEF, is in charge of all the environmental processes in the country. The Environmental Clearance Certificate (ECC) application process should be implemented according to the category under which the proposed project falls, based on the schedules in the ECR, 1997 and its amendments. Industrial units and projects have been classified into four categories depending on their environmental impact and location. The DoE determines the category of the proposed project during project application. The categories and required information are shown in Table 8.1.2 and the flow of the process for the red category is shown in Figure 8.1.1. The flow for the other categories is shown in Appendix 8.1.

Table 8.1.2 Category and Requirement for Each Category based on ECR, 1997

Category	Required Information
(a) Green	General information, no objection certificate (NOC) from the local authority
(b) Orange A	General information, NOC, process flow diagram, layout plan showing effluent treatment plant (ETP), waste discharge arrangement, and relocation plan, if any
(c) Orange B	Feasibility study (F/S), IEE, EMP, NOC, and ETP
(d) Red	F/S, IEE including TOR for EIA, ETP, EIA, EMP, and NOC

Source: Environmental Conservation Rules 1997



Source: Environmental Assessment Guidelines for LGED Projects

Figure 8.1.1 Environmental Clearance Procedures in the Case of Red Category

8.2 Environmental Screening of Subprojects (Categorization)

8.2.1 Proposed Project Scheme

The subproject areas extend in haor areas in five districts (Brahmanbaria, Habiganj, Kishoreganj, Netrokona, and Sunamganj districts) as shown in Table 8.2.1 below. The project comprises three components. Component 1 of the project includes construction and/or rehabilitation of flood control infrastructures which are under the responsibility of BWDB. In particular, this includes the following insfrastructures: 1) submergible embankments, 2) fully flood embankments, 3) sluice gates and regulators, and 4) drainage canal construction and rehabilitation. Component 2 of the project includes construction, upgrading, and/or rehabilitation of the following infrastructures: 1) upazila and union roads (including bridges and culverts), 2) village roads, 3) growth centers and rural market infrastructure (hat), and 4) ship landing facilities (ghats). Component 3 of the project includes interventions to improve the living conditions of the people in the target areas such as agriculture or fishery production improvements or diversification, and other income-generating activities. The three project components are shown in Table 8.2.1.

Table 8.2.1 Project Components

Component 1: Construction and rehabilitation of flood management infrastructure
1) Submergible embankments construction
2) Full embankments rehabilitation
3) Sluice gates and regulators
4) Drainage canal
Component 2: Construction and rehabilitation of rural development infrastructure
1) Upgrading and/or rehabilitation of upazila, union, and community (village) roads (submergible and all-weather roads), including bridges and culverts
2) Improvement and development of growth centers and rural markets (including protection works)
3) Improvement of ship landing facility (including protection work of ghats and surrounding areas)
Component 3: Implementation of livelihood improvement activities
1) Agriculture production improvement
2) Fishery production improvement

Source: JICA Survey Team

Table 8.2.2 District-wise Number of Subproject Sites

District	Number of New Construction Candidate Sites	Number of Rehabilitation Candidate Sites	Total Number of Candidate Sites
Sunamganji	4	0	4
Habigonji	1	4	5
Netrokona	1	5	6
Kishoreganji	8	4	12
Brahmanbaria	0	2	2
Total	14	15	29

Source: JICA Survey Team, Note: Some haors are located across district borders. The haor is counted in the district where the majority of its area is located.

Table 8.2.3 Proposed Project Sites in Each District (New Embankment Construction Sites)

District	No.	ID	Name	Project (Haor) Area (ha)	Remarks
Sunamganj	1	N3	Jaliar Haor	2,465.51	
	2	N4	Dharmapasha Rui Beel	21,563.17	The area partly includes Netrokona
	3	N5	Chandpur Haor	2,310.52	
	4	N12	Dhakua Haor	4,425.37	
Habiganj	1	N13	Mokhar Haor	8,063.94	
Netrokona	1	N11	Ganesh Haor	3,089.65	
Kishoreganji	1	N1	Boro Haor (Nikli)	9,145.82	
	2	N2	Naogaon Haor	9,104.27	
	3	N6	Sunair Haor	3,894.38	The area partly includes Netrokona
	4	N7	Badla Project	1,504.18	
	5	N8	Nunnir Haor	5,810.01	
	6	N9	Dakhshiner Haor	2,482.35	
	7	N10	Chatal Haor	816.46	The area partly includes Netrokona
	8	N14	Noapara Haor	3,179.79	
Grand Total			14 sites	77,855.42	

Source: JICA Survey Team

Table8.2.4 Proposed Project Sites in Each District (Embankment Rehabilitation Sites)

District	No.	ID	Name	Project (Haor) Area (ha)	Remarks
Habiganji	1	R8	Kairdhala-Ratna	11,900.18	The area partly includes Sunamganj
	2	R9	Bashira River Re-excavation	4,520.91	The area partly includes Kishoreganj
	3	R10	Aralia Khal	1,500.92	
	4	R13	Gangajuri FCD Subproject	20,441.03	
Netrokona	1	R1	Dampara Water Management Project	15,004.10	The area partly includes Mymensingh
	2	R2	Kangsha River Scheme	11,337.41	
	3	R3	Singer Beel Scheme	7,200.36	The area partly includes Sunamganj
	4	R14	Khaliajuri FCD Project (Polder-2)	6,610.63	The area partly includes Sunamganj
	5	R15	Khaliajuri FCD Project (Polder-4)	7,200.84	The area partly includes Kishoreganj
Kishoreganji	1	R4	Baraikhali Khal Subproject	8,667.45	The area partly includes Mymensingh
	2	R5	Aladia Bahadia Subproject	2,463.98	
	3	R6	Modkhola Bhairagirchar Scheme	2,060.25	The area partly includes Narsingdi
	4	R7	Ganakkhali Subproject	2,652.01	
Bramanbaria	1	R11	Chandal Beel	1,012.19	
	2	R12	Satdona Beel Scheme	5,048.55	The area partly includes Comilla
Grand Total			15 sites	107,620.81	

Source: JICA Survey Team

Note: Some haors are located across the district border. The haors are counted in the district where the majority of its area is located.

8.2.2 Environmental Condition in the Project Area

The haor region, or the large bowl-shaped floodplain depressions, stretches in the northeastern region of Bangladesh covering seven districts, namely: Sunamganj, Sylhet, Habiganj, Maulvibazar, Netrokona, Kishoreganj, and Brahmanbaria. The total area is about 20,000 km^2. Present population of the region is estimated to be 19.4 million. Although around 16% of the national rice production is shared by the region, the livelihood condition of the people still

remains at the lower level in the country due to the lack of accessibility to public infrastructure and recurrent water flood damages (refer to Chapter 1 for the detailed socioeconomic and natural conditions).

8.2.3 Screening of the Project in line with the JICA's Guidelines for Environmental and Social Considerations (2010)

Prior to the current preparatory survey, JICA has classified the project under Category B, which has potential adverse impacts on the environment and society that are less adverse than those of Category A projects. Moreover, these site-specific impacts can be solved with normal mitigation measures. Table 8.2.5 and the Tentative Environmental Checklist in Appendix 8.3 are provided as references.

Table 8.2.5 Categorization of the Upper Meghna River Basin Watershed Improvement Project (JICA)

Country, Site	Bangladesh, Netrokona, Sunamganj, Kishoreganj Districts
Project Outline	The objective of the project is to mitigate flood damages and improve living environment by constructing flood management facilities and implementing income-generating activities in the haor area, thereby contributing to the economic development and poverty reduction of the project area.
Category	B
Reason of Categorization	The project is not considered to be a large-scale river/erosion control project; is not located in a sensitive area; has none of the sensitive characteristics under the JICA Guidelines for Environmental and Social Considerations (April, 2010); and is not likely to have significant adverse impact on the environment.

Source: JICA Website: http://www.jica.go.jp/english/our_work/social_environmental/id/asia/south/bangladesh_b06.html

The project has developed three components, i.e.: flood control project as Component 1; rural infrastructure project as Component 2; and livelihood improvement project as Component 3, within the 29 subproject areas in the five districts in the haor area. There is no legally protected environmental sensitive area involved that would cause large environmental impact (Table 8.2.6). Thus, there is no significant reason to revise the previously determined "Category B" rating regarding natural environment (Table 8.2.6).

Although the anticipated impact is not significant, careful planning should be conducted during the detailed design stage. In relation to social impacts, the scales of works are limited and the impacts are judged to be insignificant.

Table 8.2.6 Environmental Condition at Project Screening

No.	Environmental Items	Description
1	Permits, approvals, and explanations	• Official process should be conducted by implementing agencies after the JICA preparatory survey. Preliminary environmental study is ongoing under the survey. The tentative categorization is shown below.
3	Natural environment	• Protected areas: No protected area is located in the project site. Due to the significant environmental feature in the country, important natural environments have been legally assigned as protected areas. There are 17 National Parks and 34 Wildlife sanctuaries declared by the end of 2012. Among these areas in the target districts, Tanguar Haor in Sunamganj District is protected as Ramsar site and Tanguar Haor and Hakaluki Haor in Sylhet/Maulvibazar District are protected as ecologically critical areas (ECAs) in the haor area. No subproject sites are located within these two haors (Sylhet and Maulvibazar districts are excluded from the subproject sites). The Dharmapasha Rui Beel in Sunamganj and Netrokona, the nearest subproject site from the Tanguar Haor, is located approximately 3.5 km south from the haor. • Primeval forests, tropical natural forests: Generally, Component 1 will be designed for the seasonal wetland in the farmland. All road constructions in Component 2 were planned as improvement of the existing roads. The area has already been developed for use and no large impact on the natural environment such as forests is anticipated. • Ecologically important habitats and endangered species: Some protected fish species inhabit the region, i.e., freshwater areas in the northeast lowlands in Bangladesh. The species are monitored by the Department of Fisheries. The fish movement during the flood season may be slightly affected during the early rainy season (at flood protection works by newly constructed submergible embankment).
4	Social environment	• Resettlement (No physical displacement has been identified at the time of the study due to lack of information but some land acquisition may be required.) In Component 1, the embankments will basically be designed in farmlands. Based on the land survey, all resettlement should be avoided and area for land acquisition should be minimized during the detailed design stage. However, detailed information is not available (refer to social consideration). In Component 2, the road projects planned are only improvement works and the subsequent impacts is minimal. Details on situation of resettlement and land acquisition should be studied based on updated information during the detailed design stage (refer to social consideration). In Component 3, livelihood improvement activities through agriculture and fishery promotion are planned in the same project sites as for Component 1. No impact from the activities is anticipated.
5	Pollution	No large impact by pollution is anticipated. However, some earthworks during construction may increase water turbidity. Also, the construction works should be considered to minimize the impact on nearby residents.

Source: JICA Survey Team

8.2.4 Screening of the Project in line with the Environmental Conservation Rules, 1997

The proposed subprojects are tentatively categorized into four categories provided in the ECR, 1997 based on the required activities, as shown in Table 8.2.7 (details are presented in Appendix 8.2). The embankment rehabilitation works of Component 1 do not involve additional land acquisition and do not cause large impact in the area, as a design policy. Most of the road projects are comparatively small in scale. The activities in the ECR, 1997 are not limited to the scale of the activities in each category. The official confirmation of the DoE is recommended after the current JICA preparatory survey.

Table 8.2.7 Number of Subprojects in Each Component

Component	Number of Red Category Subprojects	Number of Orange B Category Subprojects	Number of Orange A Category Subprojects	Number of Green Category Subprojects	Number of Unidentified Subprojects
Component 1	25	0	0	0	4
Component 2	0	22	0	0	7
Component 3	0	0	0	0	29

Note: The subprojects proposed in the end of August 2013 were categorized tentatively in line with the ECR, 1997 and all projects and subprojects are subject to the categorization by DoE. Projects that are not listed in the ECR, 1997 were tentatively categorized as "unidentified". Number in the table shows the number of haors.

Source: JICA Survey Team

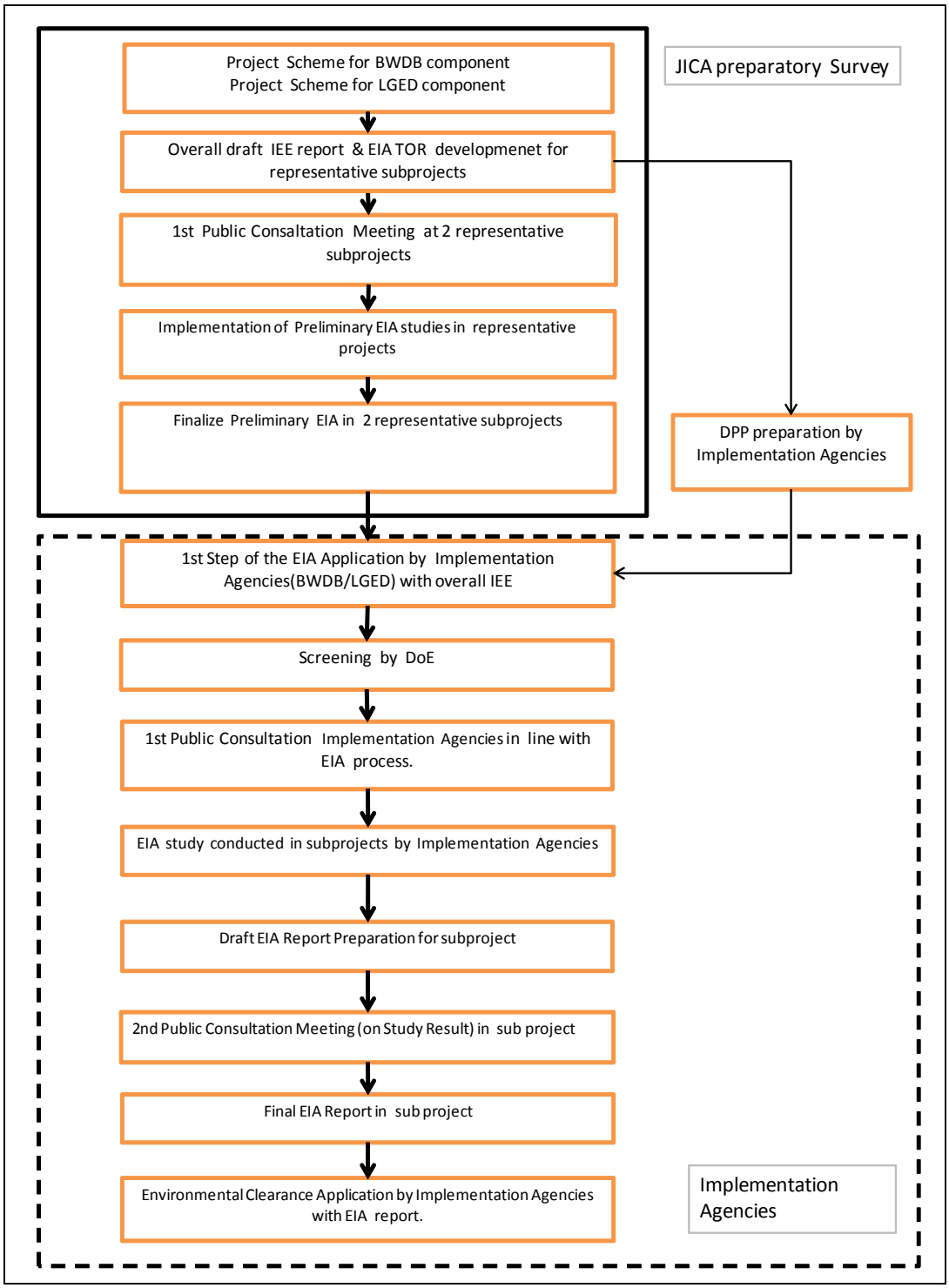
8.3 Environmental Study, Overall IEE Study, and Preliminary EIA Study through Local Subletting

8.3.1 Scope of the Environmental Study

An Environmental Clearance Certificate (ECC) obtained from the DoE is required for the implementation of projects under both BWDB and LGED schemes. The EIA is a legal procedure that should be implemented in line with the legislation of the country. In this respect, the environmental study under this survey should be considered as a preliminary environmental assessment, stressing its difference from the actual legal process in the country to avoid unnecessary misunderstanding of concerned project-affected persons (PAPs). The report is expected to include the draft IEE covering the overall information of the entire project area (not individual subprojects) and the draft EIA covering detailed information of the two representative projects.

Since JICA has tentatively classified the project as Category B under the JICA Guidelines 2010, an IEE-level information is required at the feasibility study stage. On the other hand, all governmental projects should prepare developing project profile (DPP) to obtain approval. The DPP requires IEE-level information as well.

The JICA Survey Team is expected to compile the information provided by the subletting consultant. As mentioned above, the actual EIA process in the country including adequate public consultation should be conducted by the implementation agencies. The tentative process of the environmental study is shown in Figure 8.1.2.



Source: JICA Survey Team

Figure 8.1.2 Tentative Steps for Environmental Study

8.3.2 Result of the Environmental Study

The environmental studies were conducted on the proposed projects in cooperation with the selected subletting companies. The overall IEE for the proposed project areas and preliminary EIA in the two representative subproject areas for BWDB and LGED schemes (Table 8.3.5) are conducted as below.

8.3.3 Overall Initial Environmental Examination

The impacts associated with the projects were predicted through the study as summarized in Table 8.3.1 below. All facilities in Component 1 are located in farmlands and any serious adverse impacts of the projects have not been predicted (Table 8.3.1). Also, most of the impacts predicted can be mitigated by applying some adequate measures (Table 8.3.2). Most subprojects of Component 2 are small scale and their predicted associated impacts are comparatively small (Table 8.3.3). Some small-scale resettlement, which can be less than 20 PAPs at the subprojects, and land acquisition are likely associated with the projects. Adequate study and resettlement action plan to meet the scale of impact should be conducted during the detailed design stage in order to minimize the impacts (Table 8.3.4).

Table 8.3.1 Potential Impacts of Component 1 (BWDB)

Important Environmental Components (IECs)		Rating	Reasons of Adverse Impacts
Natural Environment			
1	Topography	B-	The major physical components of the rehabilitation projects are resectioning of embankments, regulators, and re-excavation of canals. The major physical components of new submergible embankment projects are construction of new embankments, regulators, and excavation of canals. Improper excavation for the reconstruction/construction of embankments and canals may degrade the existing topography.
2	Soil Erosion and Siltation	C	It is unclear at this stage whether soil erosion at the borrow pits for the project will occur. Improper activities during construction work might cause soil erosion and consequent siltation on adjacent water bodies and agricultural land.
3	Regional Hydrology (Flooding, Drainage Congestion, and Water Logging)	C	It is not clear at this stage whether the projects would impose any negative impacts on the regional hydrology. However, in order to understand the impact of the interventions on regional hydrology, mathematical modeling can be suggested.
4	Landscape and Land Use	B-	The major physical components of the rehabilitation projects are resectioning of embankments, regulators, and re-excavation of canals. The major physical components of new submergible embankment projects are construction of new embankments, regulators, and excavation of canals. Improper excavation for the reconstruction/construction of embankments and canals may degrade the existing landscape and land use.
5	Sand Carpeting	B+	Sand carpeting is a problem in the haor areas that affects the fertility of agricultural lands. Some of the upstream rivers carry huge amounts of sand. When these rivers overspill, they deposit large amounts of sand on fertile land making them unsuitable for cultivation. It is expected that sand carpeting might be reduced due to the implementation of the project.
Agriculture			
6	Crop Production	B+	The project may create some flood-free areas which may ultimately be utilized as cultivable land by the farmers. As a result, crop production might increase.
7	Crop Damage	B+	Project will protect crops against damage from flash floods.
8	Irrigated Area	B+	People may cultivate more lands as the project will ensure less damage.
Ecological Parameters			
9	Fisheries	B-	Construction of new embankments and associated flood control structures such as regulators may affect the natural migration and spawning of fish. Fish may also laterally migrate toward adjacent floodplains for spawning during flood season. Moreover, disposal of wastes into nearby water bodies during construction may be harmful for fish. Filling up wetlands may extinct the fish culture area.

Important Environmental Components (IECs)		Rating	Reasons of Adverse Impacts
10	Wildlife	B-	Negative impact may occur due to loss of natural habitat caused the construction of new embankments. The impact on wildlife will be mainly during the construction activities arising from noise, vibration, and human activities.
11	Forest/Tree/Crop Loss	B-	Negative impact may occur due to loss of natural habitat caused by the construction of new embankments.
12	Wetlands Ecosystem/ Biodiversity	B-	Some negative impact may be anticipated as mostly agricultural land is used for construction of new embankments. Interventions can cause changes in wetland characteristics.
13	Endangered Species	C	No particular habitats of endangered species have been identified at this stage.
Environmental Pollution			
14	Air Pollution	B-	During construction, air pollution may occur through the use of vehicles and equipment, cleaning of materials, coating of construction materials, and dust from stone/brick crushing.
15	Ground and Surface Water Pollution	B-	During construction, accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water.
16	Noise and Vibration	B-	During construction, noise pollution will be generated by the use of vehicles, stone crushers, and generators.
17	Soil Contamination	B-	Accidental spillage of gasoline, chemicals, and liquid waste, and disposal of dredged spoils may pollute the soil quality.
18	Waste Disposal	B-	Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from the temporary labor camps during the construction period.
Social Environment			
19	Land Acquisition and/or Resettlement	B-	Rehabilitation projects do not involve any land acquisition and/or resettlement and thus have no associated impacts. However, new projects will primarily require acquiring agricultural land. Land acquisition will have impact on local income and social order.
20	Homestead Loss	C	Rehabilitation projects do not involve any homestead loss. For new projects, it is not clear at this stage whether any homestead loss will be involved. During the progress of the study, information on homestead loss is expected to be clear.
21	Income Loss	B-	For rehabilitation projects, there is no income loss. However, for new projects, land acquisition will have impacts on local income and social order.
22	Income Gain	B+	Implementation of the project will protect the crops from flash floods.
23	Employment	B+	Employment will be created during the construction stage. More agricultural labor force will also be required.
24	Food Intake	B+	Food intake will increase.
25	Historical and Cultural Loss	C	There is no historical and cultural loss to be incurred by rehabilitation projects. However, for new projects, it is not clear at this stage whether there is any historical and cultural loss.
26	Worker's Health and Safety	B-	During the construction period, health hazards may occur if occupational health and safety guidelines are not properly followed.
27	Accidents	B-	During construction and reconstruction activities, operation of heavy vehicles and machineries may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.
28	Ethnic Minorities and Indigenous People	C	This impact is not clear at this stage. With the progress of the study, the impacts will be become clearer.
29	Hazards (Risks) of Infectious Disease such as HIV/AIDS	B-	Construction and reconstruction activities may increase the risk of HIV/AIDS infection. During the construction period, a lot of employed laborers who will enter the project site may have contracted HIV/AIDS. The mixture of the laborers with the local people may spread HIV/AIDS.

Rating:
A : Serious impact is expected.
B- : Some negative impact is expected.
B^+ : Some positive impact is expected.
C : Extent of impact is unknown. (Further examination is needed. Impacts may become clearer as study progresses.)
- : No impact is expected.

Table 8.3.2 Potential Impacts of Component 2 (LGED)

Important Environmental Components (IECs)		Rating	Reasons of Adverse Impacts
Natural Environment			
1	Topography	B-	The LGED schemes have project components of upazila road, union road, and village road constructions. The project interventions may degrade the existing topography. However, other components like construction of ghats, growth centers, and rural markets in existing facilities might not affect the topography.
Agriculture			
2	Crop Transportation	B+	Haor area transportation is very bad and farmers have difficulties transporting their crops during harvest time and marketing. Improvement of road conditions will help provide easier access for goods, which generate have enormous positive impacts on their lives.
3	Marketing of Crops	B+	One of the project components of the LGED scheme is construction/ reconstruction/improvement of the existing growth centers and markets in the selected project sites. These interventions will provide facilities where farmers can easily market their harvested crops and gain profit at a good price.
Ecological Parameters			
4	Fisheries	B+	With improved growth centers and markets, people will have opportunities to sell their fish in the nearby market.
5	Wildlife	-	No impact is expected.
6	Forest/Tree/Crop Loss	-	No impact is expected.
7	Endangered Species	-	No impact is expected.
Environmental Pollution			
8	Air Pollution	B-	During construction, air pollution may occur through the use of vehicles and equipment, cleaning of materials, coating of construction materials, dust from stone/brick crushers, etc.
9	Ground and Surface Water Pollution	B-	During construction, accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water. During operation, waste from hats (market) and growth centers may cause water pollution.
10	Noise and Vibration	B-	If the improvement works are conducted near the houses, then these could create a significant impact.
11	Soil Contamination	B-	Accidental spillage of gasoline, chemicals, and liquid waste, and disposal of dredged spoils may contaminate the soil quality.
12	Waste Disposal	-	Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from temporary labor camps during the construction period. During operation, waste from hats, growth centers, and ghats may cause the contamination of residential areas.
13	Public Nuisance	B-	During the operation of hats and growth centers, the increase of wastes at the surrounding areas may produce offensive odor and water contamination at the site.
Social Environment			
14	Land Acquisition and/or Resettlement	B-	Construction/reconstruction/widening of upazila, union, and village roads might require land acquisition and/or resettlement, which will have impacts on local income and social order. Details should be further investigated during the EIA study. Construction of new hats and ghats may involve some resettlement of less than 20 PAPs at the site.
15	Homestead Loss	B-	Reconstruction of ghats, growth centers, and markets in existing facilities might not involve any homestead loss. However, construction/reconstruction/widening of upazila, union, and village roads might cause homestead loss. It is not clear at this stage whether any homestead loss is involved. New hat and ghat construction may involve some resettlement of less than 20 PAPs at the site. Information on possible homestead loss will become clearer during the progress of the study. Details should be further investigated during the EIA study.
16	Employment	B+	Employment will be created for the residents in the area as an income opportunity during the construction stage.

Important Environmental Components (IECs)		Rating	Reasons of Adverse Impacts
17	Historical and Cultural Loss	C	Whether the road construction projects require any historical and cultural loss is not clear at this stage.
18	Worker's Health and Safety	B-	During the construction period, health hazards may occur if occupational health and safety guidelines are not properly followed.
19	Accidents	B-	During construction and reconstruction activities, operation of heavy vehicles and machineries may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.
20	Ethnic Minorities and Indigenous People	C	This impact is not clear. With the progress of the study, it will be clearer. No particular community of ethnic minorities and indigenous people has been identified at the moment.
21	Hazards (Risks) of Infectious Diseases such as HIV/AIDS	B-	May have very little impact.

Rating:
A : Serious impact is expected.
B- : Some negative impact is expected.
B^+ : Some positive impact is expected.
C : Extent of impact is unknown. (Futher examination is needed. Impacts may become clear as study progresses.)
- : No impact is expected.

Table 8.3.3 Assumed Mitigation Measures for the Predicted Negative Impacts (BWDB)

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
Natural Environment				
1	Topography	B-	The major physical components of the rehabilitation projects are resectioning of embankments and re-excavation of canals. The major physical components of new submergible embankment projects are construction of new embankments and excavation of canals. Improper excavation for the reconstruction/construction of embankments and canals may degrade existing topography.	During Planning (Design): - New embankments should be designed in such a way that they may have minimum impacts on topography. - Selected borrow pits should have less environmental impacts and generate less pollution. During Construction: - Regulatory measures should be undertaken to prevent uncontrolled land use adjacent to the embankments and canals' right of way (ROW). - Proper plan for earthwork is necessary during construction activities in order to minimize the impacts on topography. - Proper construction guidelines can be prepared and contractors must be ensured to follow them during construction to prevent uncontrolled land use adjacent to the embankments and canals' ROW. Thus, impacts on topography can be minimized.
2	Soil Erosion and Siltation	C	It is not clear at this stage whether soil erosion at the borrow pits for the project will occur. Improper activities during construction work might cause soil erosion and consequent siltation on adjacent water bodies and agricultural land.	During Construction: - Prompt grass sodding/plantation (locally adapted). - Perform the construction work during the dry season, if possible. - Ensure adequate compaction and slope protection works. - Avoid uncontrolled earth cutting from surrounding areas. - Careful hydrological planning should be considered.

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
3	Regional Hydrology (Flooding, Drainage Congestion, and Water Logging)	C	It is not clear at this stage whether the projects impose any negative impact on the regional hydrology. However, in order to clarify the impact of the interventions on regional hydrology, mathematical modeling will be required.	During Planning (Design): - Adequate waterway opening for bridges/culverts/sluice gates on the new embankments should be considered. It is recommended to conduct both mathematical and physical modeling to confirm the hydrologic and flood impacts during the detailed design stage. During Construction: - Careful construction planning is required so as not to disturb the natural flooding pattern.
4	Landscape and Land Use	B-	The major physical components of the rehabilitation projects are resectioning of embankments and re-excavation of canals. The major physical components of new submergible embankment projects are construction of new embankments and excavation of canals. Improper excavation for the reconstruction/construction of embankments and canals may degrade existing landscape/ land use.	During Planning (Designing): - New embankments should be designed in such a way that they may have minimum impact on existing landscape and land use pattern. - Selected borrow pits should have less environmental impacts and generate less pollution. During Construction: - Regulatory measures should be undertaken to prevent uncontrolled land use adjacent to the embankments and canals' ROW. - Construction work should be regulated within the planned ROW without prior permission of the land. - Proper plan is necessary during construction activities by minimizing the impact on landscape and land use pattern.
Ecological Parameters				
5	Fisheries	B-	Construction of new embankments and associated flood control structures such as regulators may have impacts on natural migration and spawning of fish. Fish may also laterally migrate toward adjacent floodplains for spawning during flood season. Moreover, disposal of waste into nearby water bodies during construction may be harmful to the fish. Filling up wetlands may reduce the water body and fish culture area.	During Planning (Designing): -Adequate openings on new submergible embankments are recommended to lessen the impact of lateral fish migration During Construction: -No disposal of waste products from construction sites to the water bodies during construction should be ensured. After Construction: -Regulator should be adequately operated as planned, i.e.; immediately after crop harvest time, so as not to affect fish migration. -The loss of fish production can be compensated by strengthening fishery extension effects in the nearby villages (especially new borrow pit ponds). -The borrow pits can be designed for fish culture.
6	Wildlife	B-	Negative impact may occur due to loss of natural habitat from the construction of new embankments. The impact on wildlife will mainly occur during the construction activities arising from noise, vibration, and human activities.	During Planning (Design): -Avoid habitat of important wildlife under the land survey during the planning stage with confirmation from villagers/forestry officer, if any. During Construction: -During construction activities, the noise level must be managed so that these activities result in least disruption to the wildlife.
7	Forest/Tree /Crop Loss	B-	Negative impact may occur due to loss of natural habitat from construction of new embankments.	During Construction: -In order to compensate for the loss of trees, the project should provide opportunities for new plantation.

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
8	Wetlands Ecosystem/ Biodiversity	B-	Some negative impact may anticipate as mostly agricultural land is used for the construction of new embankments. Interventions can cause change in wetland characteristics.	During Construction: -Ensure that no waste products from construction site will be disposed to the nearby water bodies during construction. -Use machineries that minimize water turbidity and pollution. Set sludge fences.
9	Endangered Species	C	No particular habitats of endangered species have been identified at this stage.	During Planning (Design): -Avoid habitats of endangered species specified under the land survey during the planning stage with confirmation from villagers/fishery officers, if any. During Construction: -Avoid habitat of endangered species, if any.
Environmental Pollution				
10	Air Pollution	B-	During construction, air pollution may occur through the use of vehicles and equipment, cleaning of materials, coating of construction materials, and dust from stone/brick crushing.	During Construction: -In order to keep the pollution level within acceptable limit, construction-related emissions should be regulated, e.g., maintaining machinery and avoiding unnecessary idling. -Regular water sprinkling on dry surfaces to reduce dust generation must be practiced.
11	Ground and Surface Water Pollution	B-	During construction, accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water.	During Construction: -Handling, storage and spillage of potential contaminants must be organized under strict conditions in order to avoid water pollution on embankments during construction.
12	Noise and Vibration	B-	During the construction period, noise pollution will be generated by the use of vehicles, stone crushing, generators, etc.	During Construction: -Strict measures for noise pollution control need to be undertaken during construction activities if the sites are close to communities. -Restrict construction works during daytime to avoid community disturbance. -Prior notice of construction work should be given to the nearby communities
13	Soil Contamination	B-	Accidental spillage of gasoline, chemicals, and liquid waste, and disposal of dredged spoils may pollute the soil quality.	During Construction: -Adequate precaution should be taken in order to minimize the scope of accidental spillage.
14	Waste Disposal	B-	Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from the temporary labor camp during the construction period.	During Construction: -A waste management plan should be prepared and followed.
Social Environment				
15	Land Acquisition and/or Resettlement	B-	Rehabilitation projects do not involve any land acquisition and/or resettlement and thus have no associated impact. However, new projects will primarily require acquiring agricultural land. Land acquisition will have impact on local income and social order.	During Construction: -Land acquisition plan will have to be prepared for the proper compensation of land loss and rehabilitation of PAPs. Compensation should be given as per the related laws and regulations.
16	Homestead Loss	C	Rehabilitation projects do not involve any homestead loss. For new projects, it is not clear at this stage whether any homestead loss is involved. During the progress of the study, information on homestead loss will be further clarified.	During Construction: - A resettlement action plan (RAP) will be needed for the proper displacement of the PAPs, if any. RAP will be prepared for the proper compensation of land loss and rehabilitation of the PAPs according to GOB rules and regulations as well as good practice adopted in other projects.

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
17	Income Loss	B-	No income loss will result from rehabilitation projects. However, for new projects, land acquisition will have impacts on local income and social order.	During Planning (Design) /Construction: -Any direct income loss must be adequately compensated within LAP/RAP, if it will occur.
18	Historical and Cultural Loss	C	No historical and cultural loss will result from rehabilitation projects. However, for new projects, it is not clear at this stage whether there is any historical and cultural loss.	During Planning (Design) /Construction: -Alternative locations and facilities should be provided for cultural infrastructures such as family graves/graveyards, educational institutes, mosques/temples, burying yards, and eidgahs. As much as possible, graves/graveyards must be avoided using alternative design, but where proven impossible, negotiations should be held in order to have agreed relocation arrangements. This work should be included as part of the RAP if there is impact.
19	Worker's Health and Safety	B-	During the construction period, health hazards may occur if proper occupational health and safety guidelines are not maintained.	During Construction: -Proper occupational health and safety (OHS) guidelines should be prepared and training should be provided to construction workers according to the OHS guidelines. During construction activities, workers should properly follow the guidelines.
20	Accidents	B-	During the construction and reconstruction activities, operation of heavy vehicles and machineries may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.	During Construction: -BRTA rules and regulations must be strictly followed in order to minimize the risk of traffic accidents during construction activities.
21	Ethnic Minorities and Indigenous People	C	This impact is not clear. With the progress of the study, it will be clearer.	During Planning (Design): -Conduct a socioeconomic survey to understand whether such groups are affected by the projects. They should be incorporated in the RAP/LAP for proper compensation. -Plan should also include strategy for improving the people's living standards that should be similar with the previous one.
22	Hazards (Risks) of Infectious Diseases such as HIV/AIDS	B-	Construction and reconstruction activities may increase HIV/AIDS infection. During construction period, a lot of employed laborer who will enter the project site may have contracted HIV/AIDS. The mixture of the labor with the local people may spread HIV/AIDS.	During Construction: -Proper instruction to workers should be adopted as countermeasure during the construction activities.

Rating:
A : Serious impact is expected.
B- : Some negative impact is expected.
B^+ : Some positive impact is expected.
C : Extent of impact is unknown. (Further examination is needed. Impacts may become clear as study progresses.)
- : No impact is expected.

Table 8.3.4 Assumed Mitigation Measures for the Predicted Negative Impacts (LGED)

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
Natural Environment				
1	Topography	B-	The LGED schemes have project components of upazila, union, and village road constructions. The project interventions may degrade existing topography. However, other components like construction of ghats, growth centers, and rural markets in existing facilities might not have impacts on the topography.	During Construction: -Regulatory measures should be undertaken to prevent uncontrolled land use adjacent to the roads. -Proper plan is necessary during construction activities in order to minimize the impacts on topography.
Ecological Parameters				
2	Wildlife	B-	Negative impacts may occur due to loss of natural habitat from road construction. The impact on wildlife will be mainly during the construction activities arising from noise, vibration, and human activities.	During Construction: -During construction activities, the noise level must be managed so that these activities would result in least disruption to the wildlife.
3	Forest/Tree/Crop Loss	B-	Negative impact may occur due to loss of natural habitat from the construction of roads.	During Construction: -In order to compensate for the loss of trees, the project should provide opportunities for new plantations.
4	Endangered Species	C	It is not clear at this stage whether the projects will affect endangered species. It will be clear when the study progresses in the field.	During Construction: -Avoid habitat of endangered species, if any.
Environmental Pollution				
5	Air Pollution	B-	During construction, air pollution may occur through the use of vehicles and equipment, cleaning of materials, coating of construction materials, and dust from stone/brick crushers.	During Construction: -In order to keep the pollution level within acceptable limit, construction-related emissions should be regulated. -Regular water sprinkling on dry surfaces to reduce dust generation must be practiced.
6	Ground and Surface Water Pollution	B-	During construction, accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water. During operation, waste from hats (market) and growth centers may cause water pollution	During Construction: -Handling, storage, and spillage of potential contaminants have to be strictly organized to avoid water pollution during construction. During Operation: -With a proper operation plan, waste from hat (market) and growth center should be properly treated. -Surrounding area of the ghat should be kept in clean condition with routine cleaning.
7	Noise and Vibration	B-	During the construction period, noise pollution will be generated by the use of vehicles, stone crushers, generators, etc.	During Construction: -Strict measures for noise pollution control must be undertaken during construction activities if the sites are close to communities. -Restrict construction works during daytime to avoid disturbing the community. -Prior notice of construction work should be given to the nearby communities.
8	Soil Contamination	B-	Accidental spillage of gasoline, chemicals, and liquid waste, and disposal of dredged spoils may pollute the soil quality.	During Construction: -Adequate precaution should be taken in order to minimize the scope of accidental spillage.

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
9	Waste Disposal	B-	Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from the temporary labor camps during the construction period. During operation, waste from hats, growth centers, and ghats may cause contamination of the residential area	During Construction: -A waste management plan should be prepared and properly followed. During Operation: -With a proper operation plan, waste from hats (market) and growth centers should be properly treated.
10	Public Nuisance	B-	Operation Phase: During the operation of hats and growth centers, the increase of wastes at the surrounding area may generate offensive odor and water contamination at the site, even.	During Operation: -Waste management plan should be prepared. -Waste from hats (market) and growth centers should be properly treated. -Maintenance of the ghats, hats, and growth centers including planned public toilet should be kept in hygienic condition.
Social Environment				
11	Land Acquisition and/or Resettlement	B-	Construction/reconstruction/widening of upazila, union, and village roads might require land acquisition and/or resettlement and these will have impacts on local income and social order. During the EIA study, detail needs to be further investigated. Construction of new hats and ghats may involve some resettlement of less than 20 PAPs at the site.	During Planning (Design): -During the land survey in the planning/design stage, the resettlement and land acquisition area should be minimized when considering the alignment and structure. -Land acquisition plan will have to be prepared for the proper compensation of land loss and rehabilitation of PAPs. Compensation should be given as per related laws and regulations.
12	Homestead Loss	C	Reconstruction of ghats, growth centers, and markets in existing facilities might not involve any homestead loss. However, construction/reconstruction/widening of upazila, union and village roads might cause homestead loss. It is not clear at this stage whether any homestead loss will be involved. During the progress of the study, information will become clearer. During the EIA study, details on homestead loss must be further investigated. Construction of new hats and ghats may involve some resettlement of less than 20 PAPs at the site.	During Planning (Designing): -During the land survey in the planning/design stage, the resettlement and land acquisition area should be minimized when considering the alignment and structure. - RAP will be needed for the proper rehabilitation of the displaced persons, if any. RAP will be prepared for the proper compensation of land loss and rehabilitation of PAPs according to GOB rules and regulations as well as good practices adopted in other projects.
13	Historical and Cultural Loss	C	It is not clear at this stage whether the road construction projects will involve any historical and cultural loss.	During Construction: -Alternative locations and facilities should be provided for the cultural infrastructures such as family graves/graveyards, educational institutes, mosques/temples, burying yards, and eidgahs. As much as possible, graves/graveyards must be avoided through implementation alternative designs, but when proven impossible, negotiations should be held to provide the agreed relocation arrangements. This work should be included as part of the RAP, if there is impact.

Important Environmental Components (IECs)		Rating	Impacts	Assumed Mitigation Measures
14	Worker's Health and Safety	B-	During construction period, health hazards may occur if proper occupational health and safety(OHS) guidelines are not maintained.	During Construction: -Proper OHS guidelines should be prepared. Training in accordance to the OHS guidelines should be provided to construction workers. During construction activities, workers should properly follow the OHS guidelines.
15	Accidents	B-	During the construction and reconstruction activities, operation of heavy vehicles and machineries may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.	During Construction: -BRTA rules and regulations will need to be strictly followed to minimize the risk of traffic accidents during construction activities.
16	Ethnic Minorities and Indigenous People	C	This impact is not clear. With the progress of the study, details will become clearer. No particular community of ethnic minorities and indigenous people has been identified at the moment.	During Planning (Designing): -Socioeconomic survey should be conducted in order to understand whether such groups are affected by the projects. They should be incorporated in the RAP/LAP for proper compensation. -Plan should also include strategy for improving the people's living standards similar with the previous condition.
17	Hazards (Risks) of Infectious Diseases such as HIV/AIDS	B-	Construction and reconstruction activities may increase HIV/AIDS infection. During the construction period, a lot of employed laborers who will enter the project site may have contracted HIV/AIDS. The mixture of the laborer with the local people may spread HIV/AIDS.	During Construction: -Proper instruction to workers should be adopted as countermeasures during the construction activities. During Operation: -Waste from hats and growth center should be properly treated. -Maintenance of the ghat, hats, and growth centers including planned public toilet should be kept in hygienic condition.

Rating:
A : Serious impact is expected.
B- : Some negative impact is expected.
B^+ : Some positive impact is expected.
C : Extent of impact is unknown. (Further examination is needed. Impacts may become clear as study progress.)
- : No impact is expected.

8.3.4 Preliminary EIA for Two Representative Project Areas

Based on the result of the IEE study, the preliminary EIA was conducted in the two representative project sites, namely, Boro Haor in Kishorganj District and Ganesh Haor in Netrokona District. The area and the project components are shown in Table 8.3.5 below. Following the TOR developed in the IEE study, the field surveys were conducted after the public consultation meetings.

Table 8.3.5 Location and Project Component for the Preliminary Environmental Impact Assessment

No.	Name of Project	Location	Component	Category in BD.	Description of Works	Remarks
N-1	Boro Haor Project (Nikli)	Kishorganj District Upazila: Karimganj, Katiadi, Kishoreganj Sadar, Nikli	**Component 1** Embankment (Submergible) =10.3 km Re-excavation of canal = 10 km 9-vent Regulator = 2 nos. 3-vent Regulator = 1 no.	Red	The project includes construction of 10.3 km of submergible embankments which is categorized under No. 66 of Schedule 1 in ECR, 1997.	New lands may be required.
			Component 2 Road improvement (1 union road: 2.61 km, 1 village road: 2.0 km): 2 nos. = 4.61 km Hat/bazaar (2 rural markets and 1 growth center): 3 nos. Ghat new construction: 3 nos.	Orange B	Approximately 5 km of local road improvement, which can be categorized under No. 63 of Schedule 1 in the ECR, 1997.	
			Component 3 Livelihood improvement through agriculture and fishery	N/A	N/A	
N-11	Ganesh Haor Project	Netrokona District Upazila: Madan, Atpara	**Component 1** Embankment (Submergible) =19.4 km Re-excavation of canal = 3 km 3-vent Regulator = 1 no. 2-vent Regulator = 1 no.	Red	The project includes construction of 19.4 km of submergible embankments which is categorized under No. 66 of Schedule 1 in ECR, 1997.	New land may be required.
			Component 2 Road improvement (6 village roads: 10.75 km): 6 nos. = 10.75 km Culvert, new construction: 3 nos. = 20 m Bridge, new construction: 3 nos. = 40 m	Orange B	Approximately 11 km of local road improvement with total bridge length of 20 m, which can be categorized under No. 63 and No. 64 of Schedule 1 in the ECR, 1997.	
			Component 3 Livelihood improvement through agriculture and fishery	N/A	N/A	

Source: JICA Survey Team

8.3.5 Public Consultation Meeting at Haor Level

To disseminate the information on the proposed project, public consultation meetings during the scoping stage were held in the two haor sites, namely, at Ganesh Haor on 16 September 2013 and at Boro (Nikli) Haor on 18 September 2013, where the preliminary Environmental Impact Study was conducted. Representatives of the relevant haor communities were invited to the meetings. Approximately 70 participants were invited. The meeting also presented the context of the JICA study, findings and progress of the IEE and EIA studies, benefits of the projects, and description of the project features. The results together with the relevant comments, feedbacks, and recommendations from the participants were incorporated in the environmental study reports in order to share the information for better and effective implementation of the project.

The participants from relevant upazilas positively accepted the projects in general. However, they expressed their major concerns regarding smooth navigation as well as fisheries migration and movement due to regulator obstacle.

Table 8.3.6 Main Feedback from the Public Consultation Meeting at Ganesh Haor (16 September 2013)

- The participants generally accepted the project implementation upon understanding of the advantages of union road, upazila road, and village roads; growth center, market, and rural market improvement; and canal re-excavation.
- The participants from Atpara Upazila gave their positive opinions and expressed their satisfaction regarding the submergible embankment proposed under this subproject. They expressed that many boro cultivation areas will be saved from early flash floods while boro crop production will significantly increase.
- The participants from Madan Upazila were confused about the benefit and utility of the embankment and regulators. They suspected about the poor management of the proposed water regulator and were also concerned that the present year's water level is very low so that it will have no immediate result.
- The participants proposed to carefully design the embankment in order to minimize the negative impact on two upazilas. They also gave their individual opinions on the selection of sites of the submergible embankment.
- Some participants commented that some new roads must be included in the proposed subproject along with some dead canal excavation.

Source: Preliminary EIA, JICA Survey Team

Table 8.3.7 Main Feedback from the Public Consultation Meeting at Boro (Nikli) Haor (18 September 2013)

- The participants generally accepted the project implementation upon understanding of the advantages of union, upazila, and village roads; growth center, market, and rural market improvement; and canal re-excavation.
- Few participants, along with the agriculture officer, DAE, and Nikli, expressed concerns regarding smooth navigation as well as fisheries migration and movement due to regulator obstacle.
- Many participants from Nikli area gave their opinions regarding the urgent need of submergible embankment. They expressed that many boro areas will be saved from early flash floods while boro crop production will significantly increase.
- The participants were able to identify the proposed location of submergible embankment in the map and expressed that there is no harm by the submergible embankment.
- Some participants commented that some new roads must be included in the proposed sub-project along with some already dead canals and rivers (such as Norsunda) re-excavation.

Source: Preliminary EIA, JICA Survey Team

8.3.6 Result of the Preliminary Environmental Assessment

The preliminary environmental assessment for the two representative subproject areas was conducted as a sample study to develop a tentative environmental management plan based on the field conditions (TOR is in Appendix 8.5). Based on the results, no serious environmental impacts were found in the field survey under both BWDB and LGED schemes (Table 8.3.8 and Table 8.3.9) besides those already described in the overall initial environmental examination (IEE). However, in terms of social impact, interruption of navigation and water transport by the installation of new regulators in major canal were of great concern to the local residents and should be avoided or minimized as agreed upon during the detailed design stage. Also, the mitigation measure should be updated based on the information at the detailed design stage.

Table 8.3.8 Major Impacts based on Preliminary EIA in Boro Haor and Ganesh Haor Areas and Their Mitigation Measures, BWDB Scheme (Component 1)

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
Natural Environment				
1	Topography	B-	During Construction: The construction of two new embankments, i.e., N1: Boro Haor Project and N11: Ganesh Haor Project, including existing canal excavations will impact the existing topography and geographic features to some extent. Both project alignments pass through agricultural vacant lands along with some moderately deep swampy ditches and beels. However, the impact will not be serious. Improper digging and construction activities during excavation of canals might also degrade the topography but these will be temporary and can be minimized.	During Detailed Design: The project components should be designed and the construction plan should be prepared in such a way that possible degradation can be minimized. To do so, options of selecting existing borrow pits which have less environmental impacts and generate less pollution can be considered. To avoid unnecessary earthworks that affect topography, the soil from the canal excavations can be used for the construction of the two new embankments, if appropriate. During the preparation of bid documents, a detailed EMP should be included in the contractor's bid incorporating the strategy for proper monitoring of construction activities. During Construction: Proper construction guidelines should be prepared and it must be ensured that contractors follow them during construction to prevent uncontrolled land use adjacent to the embankments and canals ROW. Thus, impact on topography can be minimized. EMP should be followed by the contractor properly.
2	Soil Erosion and Siltation	B-	During Construction: Improper activities during construction work might cause soil erosion and consequent siltation on adjacent water bodies and agricultural land.	During Construction: All earthworks should be carried out during the dry season. Soil materials from the excavations of canals in both projects, if appropriate, are expected to be used for the construction of the two embankments. Adequate compaction and appropriate slope protection should be ensured. In this case, Durba Grass should be planted for slope protection. Contractors must properly follow the EMP and should avoid any earth cut works from surrounding areas.

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
	Regional Hydrology (Flooding, Drainage Congestion, and Water Logging)	B-	During Construction: Most of the project activities such as construction of embankments, excavation of canals, and construction of regulators will be carried out during the dry season. These interventions will cause minor impact on flooding. After Construction: The confinement effect of embankments may increase flood level of rivers and adjacent water bodies. Such higher water level may disrupt the regional hydrology in the study area, which is located in a deeply flooded region.	During Construction: Careful construction planning is required so as not to disturb the natural flooding pattern. After Construction: Adequate waterway openings will be provided along the embankments through the construction of two units of 9-vent regulators and one unit of 3-vent regulator for the N1: Boro Haor Project as well as one unit of 3-vent regulator and one unit of 2-vent regulator for N11: Ganesh Haor Project. These regulators will remain open to allow floodwater inside the catchment confined by the embankments before monsoon flood starts, and also to release the floodwater outward water bodies when floodwater starts to recede. However, it is recommended to conduct both mathematical and physical modeling to confirm the hydrologic and flood impact during the detailed design stage.
	Drainage Congestion and Water Logging	B-	During Construction: Some localized drainage problems can happen due to unplanned construction activities. After Construction: Some impacts on drainage may be anticipated by the proposed embankment with a length of 10.3 km for N1: Boro Haor Project and 19.4 km for N11: Ganesh Haor Project as both embankments will be constructed on floodplain agricultural land. These two embankments will cross some khals and also some low-lying swampy ditches.	During Construction: Proper construction planning can eliminate local drainage congestion. After Construction: Adequate waterway openings will be provided along the embankments through the construction of two units of 9-vent regulators and one unit of 3-vent regulator for the N1: Boro Haor Project as well as one unit of 3-vent regulator and one unit of 2-vent regulator for N11: Ganesh Haor Project. These regulators will remain open to allow release of floodwater outward water bodies when floodwater starts to recede. In addition, under N1: Boro Haor Project and N11: Ganesh Haor Project, 10 km and 3 km of existing canals will be excavated, respectively. The conveyance and retention capacity of these canals will increase through these excavation programs. Therefore, drainage and water logging problems will be minimized. However, it is recommended to conduct both mathematical and physical modeling to confirm the drainage congestion impact on the floodplain during the detailed design stage.
	Landscape and Land Use	B-	During Construction: As both embankments will pass through mostly agricultural land, the projects will be required to acquire these lands from private owners. This is why there will be a moderate impact on existing land use. The construction activities might considerably degrade the local landscape. Improper excavations of borrow pits for the construction of the embankments and other infrastructures may degrade the existing land use and landscape. There is no particular area legally protected by the government in the project area. The impact will be moderate.	During Construction: It is recommended to design new embankments in such a way that they may have minimum impacts on existing landscape and land use pattern. Suitable borrow pits which have less environmental impacts and generate less pollution during construction should be selected. Regulatory measures should be undertaken to prevent uncontrolled land use adjacent to the embankments and canals' ROW. Proper plan is necessary during construction activities to minimize the impact on landscape and land use pattern.

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
Ecological Parameters				
6	Fisheries	B-	During Construction: Construction activities on the water bodies may create some disturbance to fishes. However, this impact is minimal. Disposal of waste into nearby water bodies during construction may be harmful to fishes. Excavated soil from canals should not be dumped into adjacent water bodies, if any, during construction. After Construction: The pattern of migration of riverine fish is controlled by seasonal flooding following monsoon rains. Longitudinal, upstream, or downstream fish movement and migration occur at various times of the year. Any barrier to the normal movement will affect the life and reproductive cycles. Fish which migrate laterally toward the floodplain may be affected by the embankment. The floodplain is an important fisheries ground. Construction of new embankments will have impacts on natural fish migration and spawning. Lateral migration of fish will be obstructed which will affect their spawning behavior.	During Construction: No disposal of waste products from the construction site to the river during construction should be ensured. After Construction: The loss of fish production can be compensated by strengthening the extension effect in the nearby villages (especially by new borrow pit ponds). As mentioned earlier, under these two embankment projects, 10 km of khals will be excavated under N1: Boro Haor Project and 3 km of khals will be constructed under N11: Ganesh Haor Project. These two newly excavated khals can be used as fish culture grounds and which will indeed compensate for the loss of fish reproduction. Another good way to minimize the problem of lateral movement of fishes is to provide adequate opening on the embankments. Under these schemes, a number of regulators will be constructed such as two units of 9-vent regulators, one unit of 3-vent regulator for the N1: Boro Haor Project, and one unit of 3-vent regulators and one unit of 2-vent regulator for N11: Ganesh Haor Project. These regulators will help reduce the problems on fish movement.
7	Wildlife	B-	During Construction: The impact on wildlife will be mainly due to noise, vibration, and activities that would arise during construction. After Construction: After construction, insignificant impact on wildlife is anticipated.	During Construction: Noise level must be managed so that the activities result in least disruption to wildlife. After Construction: No negative impact is expected.
8	Forest/Tree/Crop Loss	B-	During Construction: Improper movement of construction-related heavy equipment and inappropriate human activities during construction may damage trees, crops, and vegetation along the ROW during construction. After Construction: There is no major impact on tree cutting and plantation after construction.	During Construction: Careful construction activities are recommended so that damages on trees, crops and vegetation on the side of the ROW are minimized during construction. The project should prompt tree plantation under the projects.

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
9	Wetlands Ecosystem/ Biodiversity	B-	During Construction and Operation: New embankment construction may affect the water flow between main rivers and adjacent wetland during the early rainy season. However, this impact will not be so adverse. During the construction phase, mainly during embankment construction, turbidity of water at adjacent rivers and water bodies, particularly at the downstream, may be increased which may pose problems on the aquatic flora and fauna. However, the impact is not adverse. There is no legally protected sensitive area designated by the government in the proposed project sites. Sometimes, the migration of the aquatic fauna between rivers and adjacent wetlands may be affected during the early rainy season if the embankment is constructed without consideration of the current water flow.	During Construction: No disposal of waste products from the construction site to the nearby water bodies during construction should be ensured. It is preferred to use machineries that can minimize water turbidity and pollution. It is also strongly recommended to set sludge fences wherever necessary. During the detailed design, the current flow should be carefully considered.
Environmental Pollution				
10	Air Pollution	B-	During Construction: It is expected that air pollution will occur in and around the construction site through the use of vehicles and machinery, asphalt and aggregate plants, and other materials. Dust generated by the movement of construction vehicles, crushing and handling of aggregates, and earthworks will also be sources of localized air pollution.	During Construction: In order to keep the pollution level within acceptable limit, construction-related emissions should be regulated. Regular water sprinkling on dry surfaces that reduce dust generation must be practiced.
11	Ground and Surface Water Pollution	B-	During Construction Phase: Associated with the embankment construction, the turbidity of the water at the downstream will be likely increased.	During Operation Phase: Upon the operation of the new embankment, passengers may litter some garbage into rivers and around the project sites.
12	Noise and Vibration	B-	During Construction: Due to construction activities, the noise and vibration levels are likely to be increased in the project area. Sources of noise include stone/brick crushing, dredging, electricity generation, and transportation. Sources of existing noise pollution include passing vehicles using hydraulic horns, ferries, and speed boats.	During Construction: Strict measures for noise pollution control must be undertaken during construction activities if the sites are close to the communities. Restricting construction works during daytime will help avoid disturbing the local communities. Prior notice of construction work should be given to the nearby communities.
13	Soil Contamination	B-	During Construction: Deterioration of soil quality at the construction site is possible through accidental spillage of chemicals, bituminous materials, and fuel, as well as prolonged storage of such materials. Another potential source of soil contamination is the disposal of solid and liquid wastes. Huge quantities of sand will be dredged and will be used for the construction of embankments and excavation of canals. However, no major impacts on soil contamination is expected if the EMP guidelines are strictly followed.	During Construction: Adequate precaution should be taken in order to minimize the scope of accidental spillage.

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
14	Waste Disposal	B-	During Construction: Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from temporary labor camps during the construction period. However, the impact is not so serious.	During Construction: A waste management plan should be prepared and properly followed during the construction stage.
Social Environment				
15	Land Acquisition and/or Resettlement	B-	During Construction: Land acquisition has been kept to a minimum. Total area to be acquired stands at 13.9 ha as per the ARP study. Most of the land to be acquired is mainly under agricultural practices. Details of land acquisition have been given in the ARP study report. After Construction: No major impact from land acquisition is expected after construction.	During Construction: A land acquisition plan will must be prepared for the proper compensation of land loss according to GOB rules and regulations as well as other relevant guidelines. After Construction: No major impact is anticipated.
16	Income Loss	B-	During Construction: Both embankment projects require agricultural land which is very important for PAPs as it is their only major source of income. There are some swampy ditches and beels where some people carry out their limited fishery activities, and these lands must be acquired under these projects. Therefore, some people will lose their source of income.	During Construction: All direct income loss must be adequately compensated in the RAP.
17	Worker's Health and Safety	B-	During Construction: A range of heavy equipment will be used during the construction period. Workers should be trained in the safe operation of these equipment and machineries. During the construction period, health hazards may occur if proper OHS measures are not followed.	During Construction: Proper OHS guidelines should be prepared. Proper training in accordance to the OHS guidelines must be provided to construction workers. During construction activities, workers should properly follow the guidelines.
18	Accidents	B-	During Construction: During mobilization and demobilization and even in the time of construction activities, movements of heavy vehicles are expected in the project sites. These vehicles will transport construction materials and machineries, which may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.	During Construction: BRTA rules and regulations will need to be strictly followed to minimize the risk of traffic accidents during construction activities.
19	Navigation and Water Transport	B-	After Construction: The people's mobility will be affected significantly.	During Detailed Design: During detailed design, careful thought should be given to minimize the impact on people's mobility.

Source: Preliminary EIA in Boro and Ganesh Haors under the BWDB Scheme, JICA Preparatory Survey

Rating:
A : Serious impact is expected.
B- : Some negative impact is expected.

Table 8.3.9 Major Impacts based on Preliminary EIA in Boro Haor and Ganesh Haor Areas and Their Mitigation Measures, LGED Scheme (Component 2)

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
Natural Environment				
1	Topography	B-	During Construction: The activities in Component 2 of N1: Boro Haor Project under the LGED schemes are: (i) improvement of two union and village roads (including bridges and culverts), (ii) improvement of three rural hats/bazaars and growth centers, and (iii) new construction of three landing ghats. The roads and hat/bazaar/growth centers are the existing facilities which will be improved and remodeled under this project. However, the landing ghats involve new construction. Although the roads are relatively in good shape, some portions are damaged and overall earthwork will be required to make the surface even. Thus, soils from adjacent lands will be needed which might be done by digging the existing surface. Unplanned and improper digging activities can impact on the existing topography. However, the impact will not be serious and the scale of impact is minor. The other two activities will not harm the existing setting of the topography.	Design Phase: During detailed design, the project components should be designed smartly and the construction plan should be prepared in such a way that possible degradation can be minimized. To do so, options of selecting existing borrow pits which have less environmental impacts and generate less pollution can be considered. During the preparation of bid documents, a detailed EMP should be part of the contractor's bid, incorporating the strategy for proper monitoring of construction activities. During Construction: Proper construction guidelines should be prepared and it must be ensured that contractors follow them during construction to prevent uncontrolled land use along the ROW. Thus, impact on topography can be minimized. EMP should be followed by the contractor properly.
Ecological Parameters				
2	Wildlife	B-	During Construction: The impact on wildlife will be mainly during construction activities arising from noise, vibration, and human activities.	During Construction: The noise level will must be managed so that these activities result in least disruption to the wildlife.
3	Forest/Tree/Crop Loss	B-	During Construction: Improper movement of construction-related heavy equipment and inappropriate human activities during construction may damage trees, crops, and vegetation along the ROW during construction.	During Construction: Careful construction activities are recommended so that the damages of trees, crops, and vegetation alongside the ROW are minimized during construction. It is recommended that during the detailed design stage, a full-scale survey is launched to prepare tree cutting census. After Construction: After road improvement is finished, the planned and organized plantation of more than double of the affected numbers of trees will minimize the impact significantly.
Environmental Pollution				
4	Air Pollution	B-	During Construction: It is expected that air pollution in and around the construction site will occur through the use of vehicles and machinery, asphalt and aggregate plants, and other materials. Dust generated by the movement of construction vehicles, crushing and handling of aggregates, and earthworks will also be sources of localized air pollution.	During Construction: In order to keep the pollution level within acceptable limit, construction-related emissions should be regulated. Regular water sprinkling on dry surfaces to reduce dust generation must be practiced.

Important Environmental Components (IECs)		Rating	Impact	Mitigation Measure
5	Ground and Surface Water Pollution	B-	Construction Phase: During the road improvement works and construction of ghats and hats/bazaars/growth centers, there might be little possibility to pollute the adjacent water bodies from the construction activities. Crushing of concrete and earthworks may increase the turbidity of the ambient surface water bodies. However, the impact will be minimal. Operation Phase: Upon the operation of these facilities, particularly the hat/bazaar/growth center and landing ghat, people may litter some garbage into the rivers and around the project sites.	During Construction: Handling and storage of the potential contaminants have to be strictly organized to avoid water pollution during the construction of the projects.
6	Noise and Vibration	B-	During Construction: Due to construction activities, the noise and vibration levels are likely to be increased in the project area. Sources of noise include stone/brick crushing, electricity generation, and transportation. Sources of existing noise pollution include passing vehicles using hydraulic horns, ferries, and speedboats.	During Construction: Strict measures of noise pollution control need to be undertaken during construction activities if the sites are close to the communities. Restrict the construction works during daytime to avoid community disturbance. Prior notice of construction work should be given to the nearby community.
7	Soil Contamination	B-	During Construction: Deterioration of soil quality at the construction site is a possibility through accidental spillage of chemicals, bituminous materials, and fuel, and prolonged storage of such materials. Another potential source of soil contamination is the disposal of solid and liquid wastes. However, no major impact on soil contamination is expected if the EMP guidelines are strictly followed.	During Construction: Adequate precaution should be taken in order to minimize the scope of accidental spillage.
8	Waste Disposal	B-	During Construction: Accidental spillage of toxic chemicals such as fuel, lubricants, and solvents may pollute the water and soil. Pollution may also occur from the temporary labor camp during the construction period. However, the scale of impact is minor.	During Construction: A waste management plan should be prepared and followed during the construction stage.
Social Environment				
9	Worker's Health and Safety	B-	During Construction: During construction period, a range of heavy equipment will be used. Workers should be trained in safely using these equipment and machineries. During construction period, health hazards may occur if proper occupational health and safety measures are not followed.	During Construction: Proper OHS guidelines should be prepared. Training needs to be provided to the construction workers according to the OHS guidelines. During construction activities, workers should follow the guidelines properly.
10	Accidents		During Construction: During mobilization and demobilization and even in the time of the construction activities, movements of heavy vehicles are expected in the project sites. These vehicles will transport construction materials and machineries which may cause traffic accidents in and around the proposed project sites. Also, accidents may occur toward the workers during construction.	During Construction: BRTA rules and regulations will need to be strictly followed to minimize the risk of traffic accidents during construction activities.

Source: Preliminary EIA in Boro and Ganesh Haors under BWDB Scheme, JICA Preparatory Survey

Rating:

A : Serious impact is expected.

B- : Some negative impact is expected.

8.3.7 Environmental Monitoring Plan

Adequate monitoring by the implementation agencies shall be conducted during actual project implementation. The tentative environmental monitoring plan is shown in Table 8.3.10 below. The contents should be updated to reflect the results of the environmental and social consideration study covering the EIA process and land acquisition process in the country, which will be officially conducted after this JICA preparatory survey. The tentative monitoring forms are attached in Appendix 8.4.

Table 8.3.10 Environmental and Social Items Recommended for Monitoring

Monitoring Items	Contents for Monitoring	Method of Confirmation	Implemented by	Frequency and Expected Time
Design and Pre-construction Phase				
Environmental license	1. Obtaining the environmental license certificate 2. Conditions for obtaining the license	Submission of relevant documents (photocopy of license, application documents)	BWDB LGED	Once after completion of the process (before construction)
Documentation of RAP and LAP	1. Census survey 2. Land and asset value survey 3. Entitlement matrix 4. Budget and implementation plan	Submission of necessary documents	BWDB LGED	Once before the construction works (after JICA preparatory survey)
Implementation of RAP and LAP	1. Budget and timeframe 2. Delivery of entitlement	Periodic monitoring report	RAP implementing agency, BWDB LGED	Quarterly (during RAP implementation)
Grievance redress	Grievance redress records	Periodic monitoring report	RAP implementing agency, BWDB LGED	Quarterly (during RAP implementation)
Information disclosure to the local residents	Information about the results of the project scheme	Monitoring report	BWDB LGED	Once before construction works (after JICA preparatory survey)
Construction Phase				
Adequate project implementation following legislation/ instruction of DoE and contents in the approved EMP/ EMoP	Achievement of the condition in the environmental license or other instructions from DoE Achievement of the contents of EMP/EMoP approved by DoE	Relevant documents	Consultant/ Contractor/ BWDB LGED	During construction, as requested by DoE
RAP benefit monitoring	Change in socioeconomic condition	Periodic monitoring report	External monitoring agency, LGED, BWDB	Semiannually (twice), after RAP implementation
Grievance handling during construction	Grievance from the nearby PAP/residents	Occasional record of contractors/consultant/Project Management Unit in BWDB and LGED	BWDB LGED	Quarterly (during construction)
Operation Phase				
Grievance handling during operation	Grievance from the nearby PAP/residents	Project Management Unit in BWDB and LGED	BWDB LGED	At the time of post evaluation

Source: JICA Survey Team
Note: EMP: Environmental Management Plan; EMoP: Environmental Monitoring Plan, RAP: Resettlement Action Plan, LAP: land Acquisition Plan

CHAPTER 9 SOCIAL CONSIDERATIONS

9.1 Scope and Approach for Social Considerations Study

This JICA Preparatory Survey formulates the scope and examines the viability of the project that includes flood management components like embankments and regulators and their related synergic components like rural infrastructures and agricultural and fisheries development interventions. Since the major economic activity of the haor area is boro cultivation, the area will not only experience less pre-monsoon flood damages but also be able to open up other commercial activities as a result of the improved flood management infrastructures. All these factors will contribute direct benefits to the living standards, income levels, and overall social texture.

However, similar to many other large infrastructure projects, this Project is also expected to require land acquisition and in some rare cases, involuntary resettlement. Thus, it is important to ensure that proper compensation and assistance are paid to the Project Affected Persons (PAP) so that the living conditions of these people do not deteriorate. It is generally considered that a Resettlement Action Plan (RAP) is the best instrument to implement a successful resettlement/ compensation program. However, RAP preparation and execution are the sole responsibility of the Bangladesh side. The JICA Survey Team provided advice and support so that the RAP can be prepared in a timely manner complying with both JICA and Bangladesh regulations and requirements.

In this regard, the JICA Survey Team carried out the following activities:

- Review of the general socioeconomic conditions of the Project area;
- Review of the relevant laws of Bangladesh;
- Compilation of lessons learned from RAP of similar projects in Bangladesh;
- Review of the relevant JICA guidelines;
- Assessment of the gap between Bangladesh laws and international norms;
- Recommendation of harmonized policy;
- Review of the RAP implementation procedures of BWDB and LGED;
- Identification of the social impacts of the Project;
- Assessment of the socioeconomic situation of the PAPs (through sublet work);
- Conduct consultation with PAPs to obtain their view on resettlement process (through sublet work);
- Preparation of Resettlement and Compensation framework (RCF) (through sublet work);
- Preparation of sample Abbreviated Resettlement Plan (ARP) for two subprojects (through sublet work) following the prepared RCF, which will serve as an example to BWDB and LGED during their preparation of RAP (ARP was prepared at this stage instead of RAP because the exact locations of the facilities to be constructed are yet to be fixed); and
- Recommendation on the RAP preparation and implementation.

9.2 Socioeconomic Setting of the Project Area

The haor region stretches over seven districts, namely: Sunamganj, Sylhet, Habiganj, Maulvibazar, Netrokona, Kishoreganj, and Brahmanbaria. The total area is about 20,000 km^2. The population of the seven districts in 2011 was 17.9 million. (Community Report, BBS, 2012, http://www.bbs.gov.bd/home.aspx)

Agriculture, especially paddy cultivation, is the main economic activity in the region. The rice production in the haor region is about 5.3 million tons, grown in 710,000 ha, resulting to almost 16% of the national rice production. Farmers plant boro rice in December when the haor is drained up. Generally, the harvesting period spans from mid-April to mid-May. However, due to the natural setting and terrain characteristics, flash floods often occur in this region during the pre-monsoon period. The timing of the flash flood clashes with the boro harvesting period. The annual damage caused by the flash floods was estimated at BDT 3,486 million (Haor Master Plan, Haor Board, 2012). Thus, flash flood damage control in the haor area has been a major concern.

Since the haor area usually has only one crop, the job opportunities in the agriculture sector is very limited and less than compared to the other part of the country which has multiple agricultural crops and different types of businesses over the year.

Although agriculture is the main economic activity, the haor area is also famous for open water fisheries. Much of the haors remain under water until November and these areas are used for open water fisheries.

People in haor areas reside in raised/elevated lands which are not submerged throughout the year. However, the wave action of the huge lake-like haor causes erosion at the banks of these elevated lands. Therefore, loss of land due to erosion is another serious problem to the hoar people and erosion protection/control is an important measure that they need.

Roads and embankments in the haor area get inundated during the monsoon season (June-October) and therefore, the only means of communication in the haor area is waterway/boat communication. However, during the dry season, communication is equally difficult as there are only few intra-haor roads. The year-round poor communication system has adverse impact on socioeconomic aspects including education and health, jobs and income, and produce storage and marketing.

Table 9.2.1 presents the statistics for some key social parameters of the seven haor districts. It can be seen from the table that:

- All seven districts except Kishoreganj and Brahmanbaria have a population density which is less than the national average. Also, all districts except Sylhet have an urbanization rate which is less than the national average indicating that much of the areas of these districts remain in their rural/natural form and thus, the human settlements are scattered leaving vast lands for agricultural cultivation.
- The literacy rate in these districts is less than the national average except in Sylhet and Maulvibazar. School attendance is also less than the national average. Perhaps, the poor communication system during the rainy/wet season is the reason behind this.

- Except for Netrokona and Kishoreganj, the average population growth rate per annum in these districts is higher than the national average, which is assumed to be due to the lack of awareness in family planning among the people.
- Ethnic population mainly lives in Habiganj and Maulvibazar.

Table 9.2.1 Statistics (2011) for Some Key Social Parameters of Seven Haor Districts

Parameter	National	Sunamganj	Sylhet	Habiganj	Maulvibazar	Netrokona	Kishoreganj	Brahmanbaria	Total for 7 Districts
Area (km^2)	147,569	3,747	3,452	2,636	2,799	2,794	2,688	1,881	19,999
Population (million)	144	2.467	3.434	2.089	1.919	2.229	2.911	2.840	17.89
Population density (no./ km^2)	976	659	995	792	686	798	1,083	1,510	895
Urbanization (%)	23.30	10.38	21.94	11.73	10.84	11.09	16.79	15.79	
Annual population growth rate per year (%)	1.47	2.02	2.95	1.72	1.73	1.13	1.14	1.68	1.99
Literacy, both sex (%)	51.8	35.0	51.2	40.5	51.1	39.4	40.9	45.3	
School attendance (5-24 years) (%)	52.7	44.5	50.6	46.0	50	49.4	52.8	50.8	
Ethnic population (no.)	--	6,911	12,781	65,802	63,466	25,247	433	118	174,758

Source: Compiled by the JICA Survey Team based on information from Community Report, BBS, 2012, http://www.bbs.gov.bd/home.aspx

9.3 Legal Framework for Resettlement/Compensation

This section reviews the legal framework for land acquisition and resettlement in Bangladesh, and JICA's safeguard policies and requirements. A comparative study between the two has been made aimed at finding the gaps between them. Then, a harmonized resettlement and compensation policy has been prepared. In addition, experiences related to the resettlement and compensation from previous projects in Bangladesh have been analyzed to find the good practices/lessons that can be incorporated in the development of resettlement and compensation policy for application in the present project.

9.3.1 GOB Laws on Land Acquisition

The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance II (1982) and its subsequent amendments in 1989, 1993, and 1994. The 1982 Ordinance requires that compensation be paid for the following: (i) land and assets permanently acquired (including houses, trees, and standing crops,); and (ii) any other impacts caused by such acquisition.

The Ministry of Land (MOL) is the legal authority for land acquisition and has delegated some of its authority to the Commissioner at the divisional level and to the Deputy Commissioner at the district level. The Deputy Commissioners (DCs) have authority over land acquisition and

payment of compensation to legal landowners for a land parcel of up to a maximum of 50 standard *bighas* (or 16.7 acre).

The DC determines (i) the official market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (ii) up to 50% premium on the assessed value (other than crops) due to compulsory acquisition. The 1994 amendment provides for payment of crop compensation to tenant cultivators (share cropper).

The law specifies the methods for the calculation of the official market value of property based on recorded prices obtained from relevant government departments, such as the Land Registrar (for land), the Public Works Department (for structures), the Divisional Forest Offices (for trees), the Department of Agricultural Extension (for crops yield), the Department of Agricultural Marketing (for crop prices), and the Department of Fisheries (for fish stock).

The East Bengal State Acquisition and Tenancy Act, 1951 defines the ownership and right of use of alluvial and diluvial land in the country. This law might also be relevant to the Project for the acquisition of lands within the river bank line for river bank protection works. Legally, the GOB owns the bank line and eroded land (submerged) in the river. However, the original owner(s) may claim the land if it reemerges under a natural process within 30 years from the date of erosion.

9.3.2 Limitations of the GOB Legislation

The major limitations of the GOB law are as follows:

(a) All compensation is restricted to legal owners /users of property, supported by records of ownership such as deeds, titles, or agreements. The Ordinance does not cover PAPs without titles such as informal settlers (squatters), occupiers, and informal tenants and leaseholders (without registration document).

(b) The value paid based on sales price record is invariably less than the “market value” as it is often common to undervalue the land transaction prices in order to pay lower stamp duty and registration fees. As a result, compensation for land paid by DC including the premium remains less than the real market price or replacement value (RV).

(c) Further, the Ordinance has no provision of resettlement assistance for affected households and businesses or any assistance for the restoration of livelihoods of the affected persons.

9.3.3 Draft National Policy on Involuntary Resettlement and Rehabilitation, 2008

To overcome the current limitations, a policy was drafted in 2008 under ADB TA 4517-BAN: Development of a National Policy on Involuntary Resettlement in Bangladesh. The MOL was the implementing agency of the technical assistance. MOL is in the process of finalizing the policy for submission to the Cabinet. Although this has not been approved yet, many of the current ODA projects follow the essence of this draft regulation.

Improvements over the current law proposed in this draft policy include the following: (i) a socioeconomic survey by an NGO and a social impact assessment; (ii) information campaigns

and public consultations; (iii) minimizing resettlement effects during project implementation; (iv) entitlement policy covering all categories of PAPs; (v) comprehensive resettlement plan; (vi) special attention to women and other vulnerable groups; (vii) civic amenities in relocated sites; (viii) strong and innovative resettlement organization in collaboration with NGOs; (ix) computerized land acquisition and resettlement data management, use of automated tools for payment processing, and effective supervision and monitoring using a computerized Management Information System (MIS); (x) two-time market surveys in the project area to determine the average market price of land to ensure correct replacement value; (xi) protection of cultural and customary rights of ethnic minorities; and (xi) attention to the mitigation of post-construction impacts.

9.3.4 Resettlement Experience in Bangladesh

At present, there is no national policy for resettlement of PAPs in Bangladesh. However, many donor and multi-donor funded projects – particularly large bridge projects such as the Jamuna, Bhairab, Paksey, and Rupsa – implemented satisfactory resettlement programs. The Jamuna Resettlement is considered a model with many good practices. It is important to mention here that the good practices of the Jamuna Bridge Project have influenced many other projects since its completion in 1998, including the development of the national policy, which is awaiting approval by the government. Both LGED and BWDB also applied the Jamuna good practices in some of their donor funded projects. Thus, it is recommended to apply some of the Jamuna good practices in this Project.

Table 9.3.1 presents the good practices of the Jamuna Bridge Project and rationale for their application or rejection in this Project.

Table 9.3.1 Good Practices in Jamuna and their Applicability to this Project

Good Practice in Jamuna	Apply?	Rationale for Replication or Rejection in this Project
i. Identification of all affected persons	Yes	All PAPs are required to be identified for the provision of compensation and benefit package under the Project.
ii. Cut-off date established	Yes	Establishing cut-off date is important to set the number of PAPs who will get benefits; no illegal persons are entertained.
iii. Video-filming of project right-of-way	Partial	This should be done only for subprojects where resettlement is involved.
iv. ID cards for affected persons	Partial	PAPs will be given ID cards from the project to ensure that right persons have the benefit and compensation package; no fraud applications are entertained. This should be done only for subprojects where resettlement is involved.
v. Compensation for losses irrespective of titles	Yes	Many poor and illiterate farmers might not have all the updated papers. However, entitlement should be confirmed by other ways.
vi. Replacement value of land and other assets	Yes	Giving replacement value of land and assets to the PAPs has been the common practice now in Bangladesh for all major donor funded projects.

Good Practice in Jamuna	Apply?	Rationale for Replication or Rejection in this Project
vii. Resettlement to relocation area	No	To avoid complications; as it is expected that only few people may lose their households.
viii. Special provisions for assistance to poor women and vulnerable groups	Yes	Vulnerable groups of people should get additional importance and privileges.
ix. Training/livelihood programs for income restoration	Partial	To avoid complications. As very few resettlements are expected, change in profession is not expected to occur on a wide scale. However, skills development for the same occupation can be considered.
x. Management information system for processing resettlement benefits, monitoring, and evaluation	Yes	Both LGED and BWDB should develop MIS and use it effectively for processing resettlement benefits, monitoring, and evaluation.
xi. Involvement of NGOs in RAP implementation	Yes/No	In case the number of resettled persons is more, assistance from NGOs in the implementation of the RAPs will be required. Otherwise, it is not required; BWDB and LGED's local set up in the field can handle the implementation.

Source: JICA Survey Team

9.3.5 JICA's Environmental and Social Safeguard Requirements

Like other major development partners, JICA also encourages environmentally and socially sound and sustainable development and hence, insist the project proponent to identify the adverse environmental and social impacts and formulate mitigation measures against them at the early stage of the projects. While project proponents are ultimately responsible for the environmental and social considerations of the projects, JICA supports them through activities similar to this Preparatory Survey to avoid or minimize impacts on the environment and local communities.

In principle, JICA confirms that projects meet the requirements for environmental and social considerations stated in the Guidelines for Environmental and Social Considerations, April, 2010 through the following ways:

(a) JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities.

(b) JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate.

(c) JICA takes note of the importance of good governance surrounding projects in order that measures for appropriate environmental and social considerations are implemented.

(d) JICA discloses information with reference to the relevant laws of project proponents and of the Government of Japan.

9.3.6 Harmonization with JICA Policies

The JICA Guidelines of 2010 suggests following the World Bank's Operational Procedures, i.e., OP 4.12 (Resettlement) and OP 4.10 (Indigenous People), as minimum standards to be maintained in the formulation of resettlement and compensation packages for use in their projects. The primary objective of the World Bank's policy on involuntary resettlement is to explore all alternatives to avoid or at least minimize involuntary resettlement. Where resettlement is unavoidable, the resettlement activities should be conceived and executed as sustainable development programs, providing sufficient resources to enable affected persons to share project benefits and assist in their efforts to improve their livelihood and standard of living, or at least to restore them to pre-project level. The World Bank policy (and in turn, the JICA guidelines) also requires that the affected population is meaningfully consulted and should have opportunities to participate in the planning and implementation of the resettlement programs.

Since the GOB's 1982 Ordinance falls short of JICA as well as World Bank requirements on safeguard policies, the Project's land acquisition and resettlement policy should be harmonized with JICA's safeguard requirements.

Table 9.3.2 Development of Harmonization Policy for Application in the Project

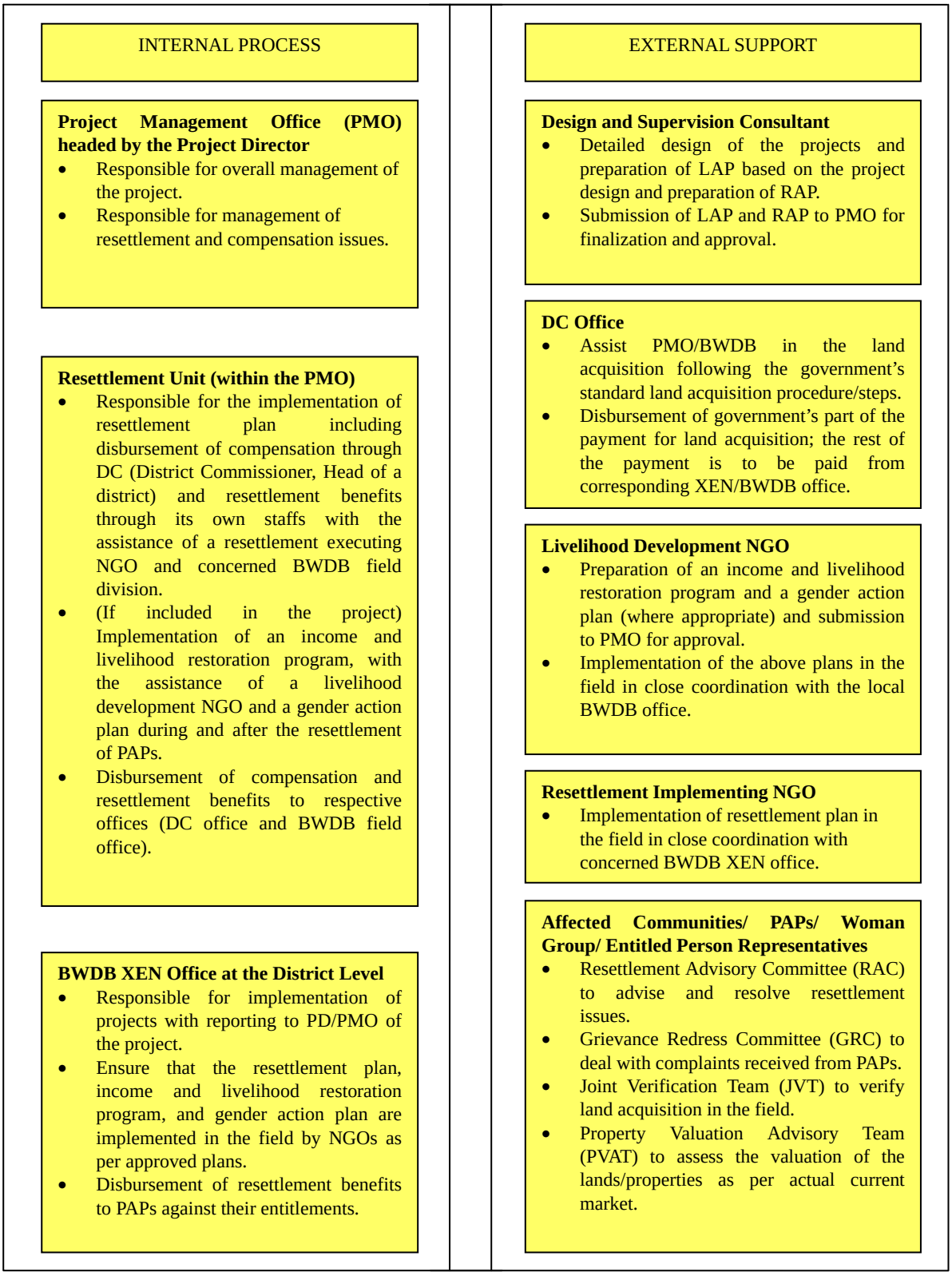
Aspect	Compliance Coverage		Harmonized Policy
	GOB	JICA	
Objectives			
1. Avoid resettlement /loss of livelihood	No provision	Provision	Avoid involuntary resettlement, adverse impacts on people and communities, and loss of livelihood, wherever feasible.
2. Minimize resettlement	Discourages unnecessary and excessive acquisition	Provision	If displacement is unavoidable, minimize involuntary resettlement by exploring alternative viable project options.
3. Compensate properly and mitigate adverse social impacts	Partial provision	Provision	Where involuntary resettlement is unavoidable, effective measures to mitigate adverse social and economic impacts should be taken by: (a) providing compensation for loss of assets at replacement cost; (b) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected, and (c) improve or at least keep the living conditions of displaced persons at a state prevailing before the resettlement.
Core principles			
1. Identify, assess, and address the potential social and economic impacts	Covered in GOB environmental rules/guidelines (1997)	Covered	Assess at an early stage of the project cycle the potential social and economic impacts caused by the involuntary taking of land (e.g., relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood).
2. Prepare mitigation plans for affected persons	No mention of RAP preparation, DC carries out joint verification of assets	Covered	Preparation of Resettlement Plan or Resettlement Framework during Project processing to mitigate the negative impacts of displacement. The plan will provide an estimate of the total population affected and establish entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the poor and the vulnerable.

Aspect	Compliance Coverage		Harmonized Policy
	GOB	JICA	
3. Consider alternative project design	Not covered	Covered	Multiple alternative proposals must be examined to avoid or minimize involuntary resettlement and physical, or economic displacement and to choose a better project option while balancing environmental, social, and financial costs and benefits.
4. Involve and consult with stakeholders	Not covered	Covered	Consult PAPs, host communities, and local NGOs, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, indigenous peoples, ethnic minorities, or other displaced persons who may not be protected through the national land compensation legislation.
5. Disclose and inform PAPs of RAP and mitigation measures	Only a notice to be published (under Section 3)	Covered	Disclose the resettlement plan including documentation of the consultation process, in a form and language(s) accessible to key stakeholders, civil society, particularly affected groups, and the general public in an accessible place for a reasonable minimum period.
6. Support existing social and cultural institutions of the affected persons	Not covered	Covered	Ensure that the existing social and cultural institutions of the resettled persons and any host communities are supported and used to the extent possible, including legal, policy, and institutional framework of the country to the extent that the intent and spirit of the involuntary resettlement policy is maintained. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the Project is planned.
Implementation			
1. Supervision	Not covered	Covered	Implementation of the resettlement plan will be supervised. The project owner or its nominated entity will supervise the entire RAP implementation.
2. Monitoring	DC will report annually (not project specific)	Covered	Periodic monitoring on resettlement implementation to determine compliance with the resettlement instrument. Preferable to be done by independent external entity.
3. Evaluation	Not covered	Covered	The borrower is responsible for adequate evaluation of the post resettlement situation. The evaluation reports must be made public and additional steps should be taken, if required.

Source: Compiled by the JICA Survey Team from various sources

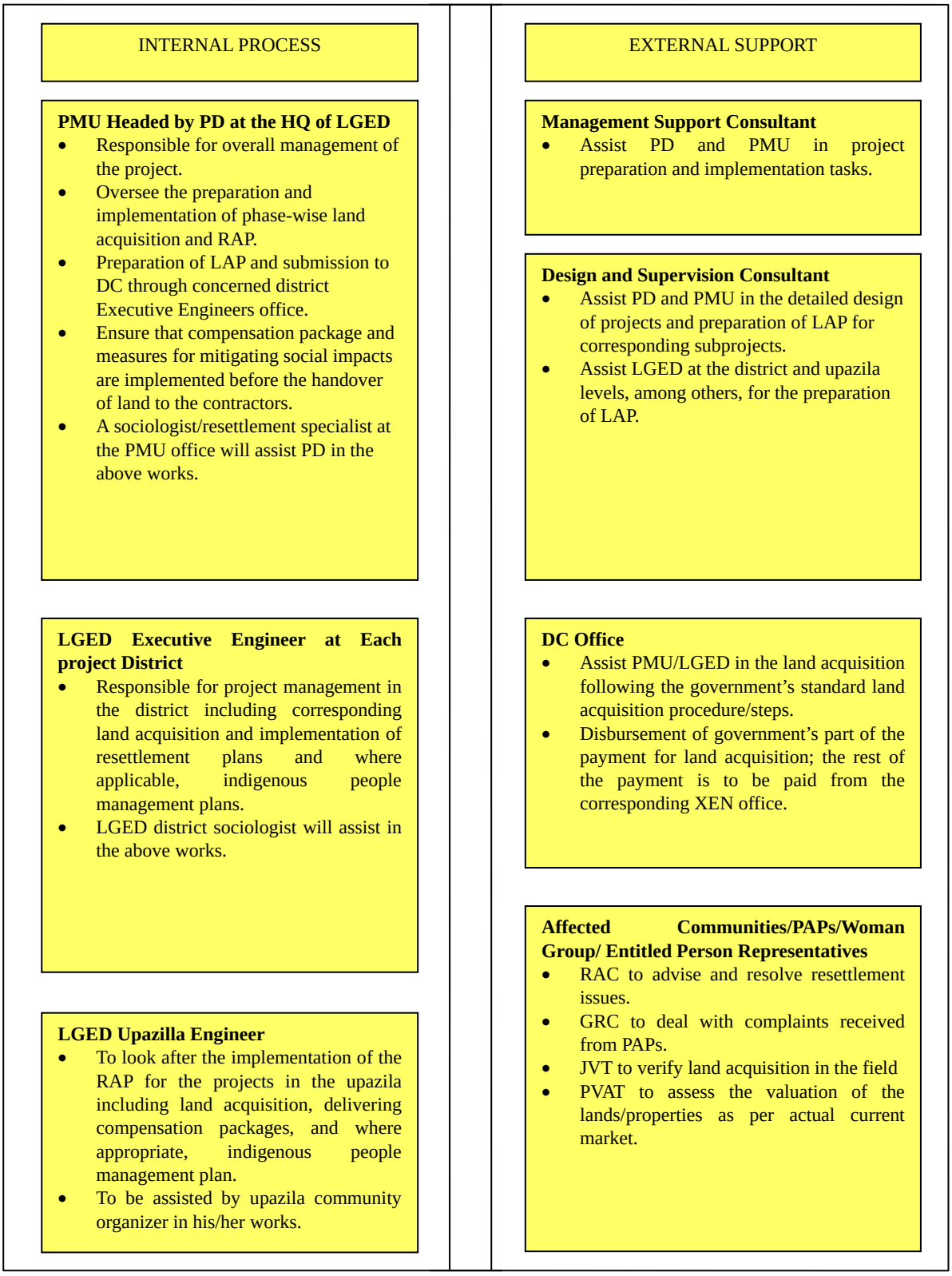
9.4 LAP/RAP Implementation Procedure and Institutional Arrangement of BWDB and LGED

The BWDB and LGED are the implementing agencies of the Project. They implement the land acquisition plan (LAP)/resettlement action plan (RAP) for their projects in accordance with their existing implementing procedure and instructional frame as presented in Figures 9.4.1 and 9.4.2. It is to be noted that the figures show a typical and generalized flow, but there can be some exceptions in some special cases.



Source: Compiled by the JICA Survey Team based on "Resettlement Plan of Chenchuri Beel, SAIWRPM, DHV, BWDB, July, 2011" and "Resettlement Framework, MRFBERMP, NHC, BWDB, June 2013"

Figure 9.4.1 Existing LAP/RAP Management Framework of BWDB



Source: Compiled by the JICA Survey Team based on "Social Impact Management Framework, RTIP-II, Hifab, LGED, March, 2012" and "Resettlement Plan for Santoshpara-Chatra Canal/Khal Subproject, PSSWRSP, CCDB, LGED, November 2012"

Figure 9.4.2 Existing LAP/RAP Management Framework of LGED

The following can be seen from the above figures:

- LGED has a strong presence in the field, with its human resource set up, for dealing with social issues and hence, it is in a position to implement RAP for its projects without the assistance of NGOs; however, if the project demands and the social issues are diverse with complexities, it can hire NGOs to implement the prepared RAP.
- On the other hand, BWDB does not have strong presence in the field for handling social issues and implementing RAP for its projects. Therefore, it requires exclusive support from potential NGOs for providing compensation packages to PAPs and other things within the prepared RAP for its projects.

9.5 Preparation of RCF and ARP

The implementation of the proposed Project will be carried out by BWDB and LGED, and there will be a number of subprojects under both BWDB and LGED components. Land acquisition and resettlement plan will be prepared by the respective implementing agencies during the detailed design stage. In order to assist the implementing agencies, the JICA Preparatory Survey Team has prepared a preliminary Resettlement and Compensation Framework (RCF) which can be updated and used by the agencies as a project specific guideline to prepare RAP. In addition, the JICA Survey Team has also prepared two preliminary Abbreviated Resettlement Plans (ARPs) for two subprojects using the prepared RCF. These will serve as examples when the agencies prepare the formal RAP.

The preparation of RCF and ARP was carried out by subcontracting a local consultant. The contract was concluded in the end of July. The draft RCF was prepared in mid-September and was shared with BWDB and LGED for their comments and observation. It was then finalized in mid-November. The preliminary ARP was also completed in mid-November and shared with BWDB and LGED for their comments and observation. The important features of the preliminary RCF and ARP were presented in the final report. The details can be found in RCF/ARP reports.

Under this JICA Survey, two public consultation meetings (PCMs) were carried out as part of the ARP preparation, one for each subproject. All stakeholders were present in the PCMs including local-elected leaders and representatives from the executing agencies. In the PCM, the explanation and discussion items included the project components, possible impacts, policy of compensation, entitlements, grievance redress, and compensation options, among others. More details are given in Section 9.7.

9.6 Principal Features of Preliminary RCF

As mentioned above, the preliminary RCFs have been prepared as the basis of future RAP preparation by the implementing agencies. These had been prepared following the harmonized policies of Bangladesh laws and JICA guidelines. Two separate RCFs were prepared for LGED and BWDB; however, both of these follow the same basic principle. The reason of preparing two separate RCFs is that there will be two separate PMOs and each PMO (one for BWDB and one for LGED) will independently carry out different components. The agencies

are also expected to separately prepare RAP; thus, in this JICA Survey, separate RCFs were prepared.

In this section, the principal features of RCF are illustrated briefly. The details can be found in the RCF report.

9.6.1 Scope of Land Acquisition

The Project has three main components. The estimated land acquisition is summarized in Table 9.6.1 below. Details can be found in the respective project design chapters of this report.

Table 9.6.1 Scope of Land Acquisition

Component	Estimated Land Acquisition*	Estimated Resettlement
Component 1: Flood Management		Nil Layout is proposed not to cause any resettlement. In the detailed design stage, further adjustment is recommended so that no resettlement takes place.
Rehabilitation of existing flood control facilities	Nil	
Construction of new submerged embankment	4,048,385 m^2	
Construction of new regulators	Nil (all constructions are expected to be within existing canals)	
Re-excavation of canals	Nil (all constructions are expected to be within existing canals)	
Subtotal, Component 1	*4,048,385*	*Nil*
Component 2: Rural Infrastructures		
Rehabilitation and upgrading of rural roads	506,733 m^2	139
Rural hats	44,352 m^2	67
Rural ghats	252 m^2	34
Subtotal, Component 2	*551,337*	*240*
Component 3-1 Agricultural Development	Nil	
Component 3-2 Fisheries Development	Nil	
TOTAL	**4,599,722**	**240****

Note: * = Based on respective Project design as outlined in previous chapters. Design of facilities and their actual locations are not yet finalized; thus, the land acquisition values are preliminary.
** = Indicative value only, estimated by LGED

9.6.2 Eligibility and Entitlement

Types of losses considered in this RCF are as follows: (i) residential/business structures, (ii) homestead/agricultural lands, (iii) crops/business, (iv) employment/income, and (v) community assets.

Categories of project affected persons (PAPs) considered in this RCF are as follows: (i) households/farmers, (ii) business enterprises, (iii) non-title holder occupants, (iv) vulnerable groups, (v) employees of affected business/share croppers, and (vi) PAPs losing access to common property resources.

Cut-off date (COD): Eligibility to receive compensation and other assistance will be limited by the COD. The COD for compensation under law (CUL) is considered for those identified on the project right of way (ROW) proposed for acquisition at the time of serving of notice under Section 3 or joint verification by DC, whichever is earlier. The COD of eligibility for resettlement assistance is the commencement date of the census and inventory of losses by the RAP Executing Agency (REA) upon completion of LAP/RAP, but after the PAP identification. Those who encroach into the Project area after COD will not be entitled to compensation and any resettlement benefits. The PMO (through the REA) will take video and photo documentation to identify PAPs. The absence of legal title will, however, not bar PAPs from compensation and assistance, as specified in the entitlement matrix.

Valuation of land and other asset: The Deputy Commissioner (DC), the head of the district administration, has the authority to fix the valuation as per the rules laid down in the 1982 Ordinance with assistance from relevant departments. The land compensation under law (CUL) is determined based on government land registration prices. For valuation of other assets, the DC office will take assistance from the Public Works Department (PWD) for structures, Divisional Forest Office for trees, Department of Agricultural Extension (DAE) for crop yields, and Department of Agriculture Marketing for crop prices. The line ministry will form a Joint Verification team (JVT) to compare and review the loss of physical assets and their owners collected by the REA with the DC's assessment. The JVT will be constituted with representatives from implementing agency, concerned DC office, and the REA.

Additional compensation: The assessed land values are typically lower than the replacement costs. To ensure that the PAPs can replace the lost property, the provision of Property Valuation Advisory Team (PVAT) is proposed to determine the replacement cost of the lost assets. The PVAT will be constituted by the line ministry with representatives from implementing agency, concerned DC office, and the REA.

Entitlement matrix: The entitlement matrix given in Table 9.6.2 below was prepared based on the harmonized policy proposed in Section 9.3.6. It may be mentioned here that the recent RAP and Frameworks of BWDB and LGED projects were also duly consulted during the preparation of the entitlement.

Table 9.6.2 Entitlement Matrix

Sl#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible Organization
1	Loss of agricultural land, pond, ditches, and orchards	Legal owner(s) of land	• Replacement value of land (government land value plus 50% premium as per law and additional grant to cover the market value of land to be determined by PVAT). • Refund of stamp duty and registration cost incurred for the replacement land purchase at the replacement value.	a. Assessment of quantity and quality of land by JVT survey. b. Assessment of cash compensation under law (CCL). c. Assessment of market value by land market survey (LMS). d. Updating of title of the affected persons. e. Payment of CCL plus 50% premium. f. PAPs will be fully informed of the entitlements and procedures regarding payments. g. Additional cash grant to be paid to cover the current market price of land. h. Stamp duty and registration fees will be paid to an PAP in case land is purchased within one year from the date of receiving full compensation for land.	a. DC, JVT b. DC c. PVAT d. PAP/REA e. DC f. DC/IA/REA g. IA/REA h. REA/IA
2	Crop damage to cultivable land by owner cultivator/ tenant/ sharecroppe r	Tenants/ sharecropper/ legal owner/ grower/ socially recognized owner/ lessee/ unauthorized occupant of land	a) Crop compensation will be equal to the yield multiplied by the crop price. Yield per acre will be determined by DAE and crop price by PVAT but not less than the price determined by the government at the time of procurement of rice/paddy. b) Compensation for crops other than rice to be determined by PVAT.	a. All the individuals identified by the JVT as tenants of sharecroppers/ owner/users of landowner. b. Price of crops will be determined by PVAT and yield by DAE.	a. DC, JVT b. DAE, PVAT
3	Loss of homestead/ residential/ commercial/ CPR plots by owners/ authorities	Legal owner(s) of the land	• Replacement value of land (CCL plus 50% premium as per law) and additional grant to cover the market value of land to be determined by PVAT. • Refund of stamp duty and registration cost incurred for the replacement land purchase at the replacement value.	a.Assessment of quantity and quality of land by JVT survey. b. Assessment of CCL. c.Assessment of market value by LMS. d. Updating of title of the PAPs. e.Payment of CCL plus 50% premium. f. PAPs will be fully informed of the entitlements and procedures regarding payments. g. Additional cash grant to be paid to owner/ authorized member of the management committee to cover the current market price of land. h. Stamp duty and registration fees will be due to an PAP in case of land purchase.	a. DC, JVT/PVAT b. DC c. PVAT d. AP/REA e. DC f. DC/REA g. REA/IA h. REA/IA

Sl#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible Organization
4	Loss of trees/ fish stocks	1. Persons with legal ownership of the land 2. Socially recognized owner/ unauthorized occupant of the trees/ fishes	• Cash compensation at market rates for replacement of trees and additional cash grant to cover replacement value. • For fruit bearing trees- compensation for fruits at 30% of timber value. • Compensation for fish stock at BDT 600 per decimal. • 5 saplings will be distributed among each affected household. • Owners will be allowed to cut and take away their trees.	a. Assessment of loss and market value of affected trees. b. Payment of CCL for trees. c. Payment of additional cash grant and compensation for fruits. d. Payment of compensation for fish stock. e. Distribution of saplings to affected households.	a. DC, JVT/PVAT b. DC c. REA/IA d. REA/IA e. REA/IA
5	Loss of residential /commercial structure by owner(s)	Owner(s) of structures (with title)	• Replacement value of structure at market price determined by PVAT. • Transfer grant at 12.50% of the replacement value of structure assessed by PVAT. • Reconstruction grant at 12.50% of the replacement value of structure assessed by PVAT. • Owners to take away all salvage materials, free of cost. • Additional assistance for female-headed and vulnerable households by PVAT.	a. Payment of CCL for the structure loss. b. Verification of structures (residential/ commercial) and their owners by JVT and PVAT. c. PAPs will be fully informed about their entitlements and assisted to obtain them. d. Payment of transfer grant, reconstruction grant, and additional assistance for female-headed and vulnerable households.	a. DC b. JVT/PVAT c. REA/DC d. REA/IA
6	Loss of residential /commercial structure by squatters and unauthorize d occupants	Owner(s) of structures (without title)	• Replacement value of structure at market price determined by PVAT. • Transfer grant at 12.50% of the replacement value of structure assessed by PVAT. • Reconstruction grant at 12.50% of the replacement value of structure assessed by PVAT. • Owners to take away all salvage materials, free of cost. • Additional assistance for female-headed and vulnerable households assessed by PVAT	a. Verification of structure (residential/ commercial) and their owners by JVT and PVAT. b. PAPs will be fully informed about their entitlements and assisted to obtain them. c. Payment of replacement of structure. d. Payment of transfer grant, reconstruction grant and additional assistance for female-headed and vulnerable households.	a. DC, REA, IA b. REA, IA c. REA, IA d. REA, IA
7	Loss of occupancy of residential houses/ commercial structures (owners/ rented or leased)	Tenants of rented/ leased properties	• One time cash grant for facilitating alternative housing, BDT 6,000 per household or entity. • Shifting allowance per household based on family members at BDT 2,000 per member with minimum of BDT 6,000 and maximum of BDT 10,000 per household.	a. Verification of joint verification survey records. b. Shifting allowance will be paid on relocation.	a. JVT b. REA/IA
8	Loss of business due to dislocation	Owner/operator of the business as recorded by joint verification survey	• Business restoration grants of BDT 15,000 and BDT 10,000 for large and small owners/operators, respectively.	a. All entitled persons recorded by the joint verification survey. b. Payment of cash grant to the owners/operators.	a. JVT b. REA/IA

Sl#	Type of Loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible Organization
9	Loss of income and workdays due to displacement	Household head / employees identified by the JVT	• Cash grant to the affected employees/wage earners equivalent to 90 days wage at BDT 400.00 for unskilled and BDT 500.00 for skilled laborers. • Preferential employment in the project construction work, if available. • Additional cash grant of BDT 4,000 for female-headed and vulnerable households.	a. All entitled persons recorded by the joint verification survey. b. Cash grant to be paid to household head / employees. c. Involvement of the incumbents in project civil works. d. Involvement in job/ fishing/ livestock and poultry/ horticulture/ welding/ mechanics/ plant cultivation/ social forestry on roadside land.	a. JVT b. REA, IA c. IA/Contractor d. REA/IA
10	Poor and vulnerable households	Poor and vulnerable households including informal settlers, squatters /women-headed households identified by JVT	• Additional cash grant of BDT 10,000 for affected women-headed households and other vulnerable households. • Training and cash grant for PAP/persons nominated by PAP for income generating activities as determined by PVAT.	a. Identification of vulnerable households as per guidelines stipulated in RCF. b. Income restoration schemes as outlined separately for vulnerable households in RCF. c. Arrangement of training on income generating activities.	a. REA b. IA/REA c. REA/IA
11	Displacement of common properties resources (CPR)	Duly constituted management committee (MC) of CPR identified by JVT or MC authenticated by UP Chairman	• Replacement value of structure at market price determined by PVAT. • Replacement value of structure at market price determined by PVAT. • Transfer grant at 12.50% of the replacement value of structure assessed by PVAT. • Reconstruction grant at 12.50% of the replacement value of structure assessed by PVAT. • Cash grant of BDT 40,000 per CPR for facilitating the establishment of a better CPR. • Owners to take away all salvage materials, free of cost.	a. Payment of CCL. b. Payment of additional cash grant for reconstruction or improvement to match the replacement value of CPR and transfer/ shifting grant.	a. DC b. REA/IA
12	Temporary impact during construction	Community / individual	• The contractor shall bear the cost of any impact on structure or land due to movement of machinery and in connection with the collection and transportation of borrow materials. • All temporary use of lands outside the proposed ROW to be done by contractor with written approval of the landowner and contractor. • Land will be returned to owner, rehabilitated to its original or preferably better condition by the contractor.	a. Community people should be consulted regarding air and noise pollution and other environmental impacts before the start of construction. b. The laborers in the camp would be trained about health and safety measures during construction. The contractor shall ensure first aid box and other safety measures at the construction site. c. Child labor will not be employed. d. Compensation for adverse impact during construction will be determined by authorized representative of BWDB and UP Chairman.	a. Contractor b. Contractor c. Contractor /IA d. IA, UP Chairman and Contractor
13	Adverse impact on the host community	Host community/host people	• Provision for additional civic amenities.	a. Conduct a need-based survey in the host community regarding availability of such community facility. b. Project should keep a provision to provide additional civic amenities.	a. REA b. IA

9.6.3 Consultation and Disclosure

Consultation and information disclosure are essential elements of resettlement planning. These include the following: (i) disclosure of project components, (ii) information on potential impacts, (iii) consultation on compensation options and entitlements, (iv) grievance redress mechanism, and (v) stakeholder's participation throughout the planning and implementation of the Project.

There are various ways of information sharing including leaflets, public notice, stakeholders meeting, Focus Group Discussion, etc. At least two consultation meetings were proposed for each subproject area, one during compensation planning and one during implementation. The scope and responsibilities for consultation and disclosure were elaborated in the RCF.

For effective consultation process, it was proposed to form a Resettlement Advisory Committee (RAC). The RACs will comprise one representative each from the implementing agency and REA, two local key public representatives (male-1 and female-1), and representatives of various stakeholders and PAPs. The committees will seek local inputs from the affected people and communities in the implementation process and assist the implementing agency in all matters related to resettlement. The RACs will ensure local participation in the implementation of the resettlement plan. However, it is noted that RAC is neither a legal body nor a mandatory body. Thus, depending on local situation, the implementing agency might opt not to form RAC.

9.6.4 Grievance Redress Mechanism

Grievance Redress Committees (GRCs) will be established to ensure stakeholders rights during the implementation process. The GRCs will be formed and activated during the land acquisition process to allow PAPs sufficient time to lodge complaints and safeguard their recognized interests. A gazette notification on the formation and scope of the GRCs will be required from the line ministry. The GRC will consist of representatives of implementing agency, REA, local government (e.g., union council chairman), and PAPs.

Other than disputes relating to ownership right under the court of law, GRCs will review grievances involving all resettlement assistances, relocation, and other supports. Grievances will be heard within a month from the date of lodging the complaints and redressed within 90 days. The PAPs can also call upon the support of the REA engaged to assist them in presenting their grievances or queries to the GRC. The grievance redress procedure, appeal procedure, and conflict resolution are explained in the RCF.

9.6.5 Implementation Arrangements

The outline of implementation arrangements of the resettlement plan is elaborated in the RCF. Essentially, this follows the current practice of BWDB and LGED as given in Figures 9.4.1 and 9.4.2.

A PMO will be established each in BWDB and LGED headed by the respective Project Director (PD). The PMO will appoint a RAP Executing Agency (REA, an NGO or social consulting firm) to execute the RAP. Field-level resettlement plan implementation will be controlled by district-level Project Implementation Unit (PIU). District PIU will propose the composition of GRC, JVT, PVAT, and optional RAC. These have to be approved by the line ministry and notified by gazette (except for the RAC). The proposed formation of these teams/committees and their terms of reference are illustrated in the RCF. The district-level PIU will hand over the money to DC for payment under the Compensation under Law (CUL). Additional compensation will be paid by district PIU through the REA.

An Engineering Services Consultant (ESC) will be engaged by the Implementing Agency (IA, LGED and BWDB) for design, supervision, and other management support. The scope of ESC will also include assisting the IA to carry out a range of activities including the preparation, implementation, and monitoring of the safeguards aspects of the Project. It is proposed that the ESC will assist IA to prepare the LAP/RAP during the detailed design stage and then monitor the implementation of LAP/RAP which will be executed by the REA.

9.6.6 Institutional Capacity Building

There is no established unit within BWDB and LGED in charge of resettlement and land acquisition. The PMO will, therefore, need technical support in preparing and implementing the resettlement plan. As part of the institutional development program, the implementing agencies may establish an optional resettlement unit RU at the PMO. The ESC, in that case, will provide necessary on-the-job training to the designated staffs.

9.6.7 Budget and Financial Planning

All land acquisition/resettlement funds will be provided by the implementing agencies based on the financing plan agreed between the government and JICA. The budget shall include the following:

(a) Detailed costs of land acquisition, structure, trees, relocation and livelihood, and income restoration and improvement,
(b) Administrative costs,
(c) LAP/RAP preparation cost,
(d) LAP/RAP implementation cost,
(e) Training costs for the PAPs,
(f) Capacity building costs for implementing agency personnel, and
(g) Monitoring costs.

All costs associated with land acquisition and resettlement except for the LAP/RAP preparation, LAP/RAP implementation, and monitoring costs will be funded through the non-eligible GOB portion. The LAP/RAP preparation, LAP/RAP implementation, and monitoring costs are proposed to be included in the eligible portion of the JICA loan. There

will be opportunity to monitor the actual costs and funding requirements annually. The estimate for land acquisition by the DC will be prepared by his/her land acquisition section and lodged to the PIU for arranging and transferring the fund to the account of DC. The additional benefits entitled to the PAPs as per entitlement policy will be paid directly by the implementing agency through the appointed REA. The REA will assess the quantity of losses and the eligible persons for resettlement benefits and submit to the implementing agency for approval after verification by JVT. The PVAT will make the valuation of losses and submit it to the implementing agency for approval. PMO will ensure that the funds for compensation and entitlement under LAP/RAP are fully disbursed to PAPs prior to the award of the civil work to the contractor.

9.6.8 Implementation Schedule

A time-bound implementation schedule for LAP/RAP is prepared in harmony with project construction schedule. The overall schedule of implementation is based on the principle that resettlement benefits are paid to PAPs before they are displaced or their land is taken over. The implementation of LAP/ RAP will include the following:

(a) Identification of cut-off date and notification,
(b) Verification of losses and extent of impacts,
(c) Finalization of entitlements and distribution of ID cards,
(d) Consultations with PAPs on their needs and priorities, and
(e) Resettlement, provision of compensation and assistance, and income restoration of PAPs.

A tentative implementation schedule is given in the RCF but it has to be adjusted based on the final Project implementation plan. It is proposed that during the detailed design stage, the ESC will assist the implementing agency to prepare the LAP/RAP in six months. After the approval of LAP/RAP, the implementing agency will appoint REA for carrying out the LAP/RAP. It is also proposed that the REA will complete the LAP/RAP in two years.

9.6.9 Supervision, Monitoring, and Evaluation

Supervision, monitoring, and evaluation are of critical importance to the management of resettlement implementation. Supervision is a periodic exercise usually undertaken as a routine work on a weekly, monthly, or quarterly basis to check the progress, review the documented papers and aspirations of the PAPs, and give the needed advice and opinion for the resettlement implementation. Monitoring and follow up provide periodic checks to ascertain whether resettlement activities are working as planned. The project management will need this feedback to be able to ensure that the planned activities are on the right track. Evaluation, on the other hand, is an exercise usually undertaken towards the end of the projects to assess whether the plan achieved its goals and objectives.

The supervision is to be carried out by the implementing agency through the district PIU with assistance from the ESC and REA. The implementing agency will inform JICA about the land acquisition, resettlement, and related activities through quarterly reports, including the identification of significant issues.

Two types of monitoring are exercised during the LAP/RAP implementation, namely, internal and external. However, since there are few resettlements anticipated, external monitoring is not proposed in the Project. The proposed internal monitoring will be carried out by the implementing agency through the district PIU with assistance from ESC and REA. Internal monitoring report will be provided to JICA on a quarterly basis. Monitoring issues and monitoring indicators are illustrated in the RCF. Issues should cover budget, timeframe, delivery of entitlements, consultation, grievance, and benefits.

9.6.10 Supporting Annexes

The draft RCF also contains some supporting annexes as follows:

(a) Outline of Resettlement Plan: This is a terms of reference for RAP preparation. It is expected that the implementing agency will prepare the RAP based on this terms of reference during the detailed design stage.

(b) Census and Socioeconomic Survey Guidelines: This will help the implementing agency to design the census and socioeconomic survey to be conducted during RAP preparation.

(c) Administrative Guidelines for Payments of Compensation and Resettlement Benefits: This clearly explains the method and process of budget preparation, budget approval, fund placement, process of payment, placement of fund to DC, and audit of financial documents. This guideline is made from administrative perspective elaborating the works to be done by the implementing agency.

9.7 Principal Features of ARP

Under this JICA Survey, two ARPs have been prepared, one each for two executing agencies, namely, BWDB and LGED. These will serve as examples for future RAP preparation by the implementing agencies. These ARPs have been prepared following the proposed preliminary RCF as explained in Section 9.6. Although two separate ARPs were prepared for LGED and BWDB, both follow the same basic principle. The reason of preparing two separate ARPs is because there will be two separate PMOs and each PMO (one for BWDB and one for LGED) will independently carry out different components. The agencies are also expected to prepare RAP separately; thus, in this JICA Survey, separate ARPs were prepared.

For the preparation of ARP, two representative subprojects were selected, namely, Ganesh Haor and Boro Haor, which are spread over Atpara and Madan Thana of Netrokona District and Katiadi, Nikli, Karimganj and Sadar Upazila of Kishoreganj District, respectively.

In this section, the principal features of the ARP are illustrated briefly.

9.7.1 Scope of Land Acquisition

The Project has three main components. The scope of land acquisition is summarized in Table 9.7.1 below. Details can be found in the respective project design chapters of this report.

Table 9.7.1 Scope of Land Acquisition

Component	Boro Haor	Ganesh Haor
Component 1: Flood Management		
- Rehabilitation of existing flood control facilities	Nil	Nil
- Construction of new submerged embankment	Length = 9.6 km	Length = 22.5 km
- Construction of new regulators	There are 2 regulators, one 13-vent at Indachulli, Upazila- Karimganj, and one 18-vent at Nikli, Upazila-Nikli. All constructions are expected to be within the existing canals.	There 2 regulators, one 2-vent Gridan Tenga, Upazila - Atpara, and one 3-vent at Debasshree, Upazila - Atpara. All constructions are expected to be within the existing canals.
- Re-excavation of canals	Total of 10.0 km. All constructions are expected to be within the existing canals.	Total of 3.0 km. All constructions are expected to be within the existing canals.
Component 2: Rural Infrastructures		
- Rehabilitation and upgrading of rural roads	One union road, length = 2.61 km. One village road (A), length = 2.0 km.	Three village roads (B), total length = 5.25 km
- Rural hats	One rehabilitation work which does not require land acquisition. Two new works, each requiring 2,464 m^2; Total area = 4,928 m^2.	Nil
- Rural ghats	Total of three, each requiring 12 m^2 area; Total = 36 m^2.	Nil
Component 3-1: Agricultural Development	Proposed activities do not require land acquisition.	Proposed activities do not require land acquisition.
Component 3-2: Fisheries Development	Proposed activities do not require land acquisition.	Proposed activities do not require land acquisition.

9.7.2 Census for Asset Inventory and Assessment of Losses

Methodology:

The census was carried out from August to October 2013 to provide the requisite details on the project-affected units in order to assess the magnitude of likely impacts and to identify measures for mitigation of adverse impacts. The survey covered the full census of households and other physical units (shops, community units, etc.). The survey identified the households and land belonging to common property resources (CPR) on the Project ROW.

The alignment/ROW of submergible embankments was placed on Google Map and the latitude and longitude of 20 points for each subproject were identified in the field using GPS. Using these latitude and longitude, specific *mouza* sheets (land record maps) related to the proposed embankments were identified. Accordingly, all the required *mouza* sheets were collected and scanned from Netrokona/Kishoreganj DC Office and Director General of the Survey and Land Record Office Dhaka. In order to superimpose the alignment of embankments prepared on Google Map, the field staff, using GPS, collected the latitude and

longitude of a minimum of two corners of two specific plots at the two extremes of each *mouza* sheet. In this process, scanned maps of 23 *mouza* sheets of Ganesh Haor and 11 *mouza* sheets of Boro Haor were joined. The alignment of submergible embankments was then superimposed on the joined *mouza* sheets, identifying the specific plot numbers and quantum of land in each plot. Thus, alignments were overlaid on *mouza* maps to identify the affected land, trees, and properties. All households and CRPs (formal or informal, legal or illegal) generally located in the intervention area and in the component were covered under the census.

For the LGED components, a similar approach was adopted.

Inventory of Expected Losses:

Census revealed that a total of 23.076 ha land need to be acquired to implement the project in Ganesh Haor. The major portion of 20.015 ha (86.74%) is in Atpara Upazila, spreading over 21 *mouzas*, and the remaining 3.061 ha is in two *mouzas* of Madan Upazila, Netrokona District. In the Boro Haor, a total of 12.188 ha land will require acquisition to implement the project. The major portion of 6.078 ha (49.87%) is in Nikli Upazila, spreading over six *mouzas*, and the remaining 3.020 ha and 3.090 will be affected in Katiadi Upazila and Karimganj Upazila, respectively. Details are shown in the ARP.

The total households impacted due to the BWDB projects is 852. Details are summarized in the following Table 9.7.2. It should be noted that there is no resettlement caused by the BWDB project. Also, it is stated that although mosque and schools are affected as common properties, only agricultural land of such organization and no structure will be affected.

Table 9.7.2 Project Impact by Upazila

Project	Ganesh Haor			Boro Haor			
Impact	Madan	Atpara	Total	Katiadi	Nikli	Karimganj	Total
	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.
Agricultural Land (households)	65	403	468	190	96	87	373
Common Property	3	1	4	4	1	2	7
Total Households	68	404	472	194	97	89	380

Source: ARP conducted by the JICA Survey Team through sublet.

For LGED components, the land acquisition for Boro Haor consists of 2,904 m^2 for road, 4,928 m^2 for hat, and 36 m^2 for ghat, while for Ganesh Haor, the required land acquisition is 8,018 m^2 for road. (There is no ghat and hat proposed in Ganesh Haor). Thus, the total land acquisition is 15,886 m^2.

In Ganesh Haor, 126 households will lose land, three households will lose land with trees and three CPRs will lose agricultural land, while in Boro Haor, 151 households will lose land, 142 households will lose land with trees, 27 households will lose business structure, seven households will lose rented business facility, 40 households will lose floating business facility, and 13 CPRs will lose agriculture land. The Project will also require the removal of 51 trees owned by three households in Ganesh Haor. In Boro Haor, 4,101 ft^2 tin-made and 1,146 ft^2 semi-pucca commercial structure of 27 households will be displaced. About 2,190 trees of

various sizes belonging to 142 households will require removal from the ROW. The details can be found in the ARP.

9.7.3 Socioeconomic Survey of PAPs

Methodology:

A socioeconomic survey was carried out from August to October 2013 for the affected households. The survey collected a wide range of data, e.g., demography, age/sex distribution, education, occupation, income/poverty data, types of businesses, and types and ownership status of affected land and other assets. For each of the identified settlement, stratified random sampling of households was done under the socioeconomic survey. The survey covered 50 households in Boro Haor and 70 households in Ganesh Haor with stratified occupation groups (farmer, service holder, businessman/vendor, hawker, fisherman etc.).

Important Findings:

The details of the socioeconomic survey can be found in the ARP reports. Some of the major findings are as follows:

- In the Ganesh Haor project, 13 households (2.77%) are headed by women and in the Boro Haor project, 17 households (4.56%) are headed by women.
- A total of 2,873 people belonging to 468 households will be affected in the Ganesh Haor project while 2,279 people belonging to 373 households will be affected in the Boro Haor project.
- There are no indigenous people in the two subprojects.
- The major occupation was found to be agriculture.
- In Ganesh Haor, considering population aged 7 years and above, 26.90% male and 28.00% female are illiterate, while in Boro Haor, 6.72% male and 14.15% female are illiterate.
- Household income distribution shows that the major income bracket is BDT 10,000 to 20,000. Percentage-wise, 48% of households in Ganesh and 36% in Boro Haor subproject fall within this range.
- Using the BBS poverty definitions (2010) for lower poverty (less than BDT 1,106/capita) and upper poverty (less than BDT 1,237/capita) levels, it was found that 85 (18%) and 33 (9%) households are below the lower poverty line in Ganesh Haor and Boro Haor, respectively. The figures are 18 (4%) and 12 (3%) for the upper poverty level in these haors, respectively. The rest are non-poor.

9.7.4 Stakeholders Meeting

Under the ARP, two consultation meetings were conducted, one each in the two selected subprojects.

In the first week of October 2013, community-based stakeholders disclosure meetings were held to disseminate the objectives and interventions of the project and to seek the opinions of the different stakeholders on the project. One stakeholders meeting was held at Nikli Union Parisad, Kishoregonj on October 6, 2013 (Boro Haor subproject) and the other at Douj Union

Parisad, Atpara, Netrokona (Ganesh Haor subproject) on October 7, 2013. The concerned Union Parisad Chairman presided over the sessions. Different types of stakeholders, i.e.: teacher, imam, local community leader, businessman, Union Parisad male and female members, retired government officials, freedom fighters, and affected people attended the meeting. Representatives of BWDB/LGED also attended and participated during the discussion in the meeting.

The meetings were divided into two sessions. In the first session, the representative of the JICA Survey Team and sublet consultants described the goal and objective and interventions of the project and also disclosed the process of land acquisition, payment procedure, donor's policy on involuntary resettlement, and the draft policy matrix under the ARP. The second session was dedicated for open discussion. Local participants provided suggestions/recommendations for the betterment of the project. They also came up with questions on various aspects and policy guidelines of the project which were then replied to/ explained by the representatives of the JICA Survey Team and sublet team. The summary of the stakeholders meeting can be found in ARP.

CHAPTER 10 ECONOMIC AND FINANCIAL ANALYSIS

10.1 Objectives of the Economic and Financial Analysis

Firstly, the economic analysis of the project was carried out to evaluate the economic viability of the project from the viewpoint of whole society. The Economic Internal Rate of Return (EIRR), Benefit/Cost ratio (B/C) and Economic Net Present Value (ENPV) were calculated under the base case scenario as well as several assumed cases in the sensitivity analysis.

Secondly, the indirect benefits which could not be quantified in monetary values were briefly reviewed to perceive the whole impact of the Project implementation.

Lastly, the financial conditions of farmers and fishermen were evaluated to see if local households have the financial capacity to invest on new crops and other necessary assets for future income generation.

10.2 Methodology of the Economic Analysis

For the economic analysis, to evaluate the impact of the project in the whole society, the cost and benefit were calculated based on various assumptions. In conclusion, the EIRR, B/C ratio and ENPV were calculated to justify project implementation. A sensitivity analysis was also conducted to evaluate the sustainability of the project against possible changes in project costs and benefits.

10.2.1 Applied Guidelines

The methodology of economic analysis is regulated by each organization based on their published guidelines so that the values of the economic viability of several projects can be easily compared.

This economic analysis was conducted using two different guidelines issued by two agencies, i.e., the guideline of Water Resource Planning Organization (WARPO) made for the Bangladesh Water Development Board (BWDB) and that by the Local Government Engineering Department (LGED).

For projects implemented by BWDB, the economic analysis has been carried out on the basis of the Guidelines of Project Assessment (GPA), modified in May 1992 and provided by WARPO under the Ministry of Water Resources. .

The other guideline used is based on the Guidelines for Effect Monitoring and Evaluation (EME) of Rural Road and Market Improvement issued by LGED in 1999. The projects on roads and market construction were carried out by applying the Vehicle Operating Cost (VOC) savings and the Spoilage Reduction (SR) methods, respectively. These are the standard methods used for rural road and market development projects in Bangladesh.

The applied guidelines and major assumptions are shown in Table 10.2.1.

Table 10.2.1 Applied Guideline and Basic Assumptions

	Component 1, 3-1	Component 2, 3-2
Implementing Organization	BWDB	LGED
Project Component	Flood Damage Reduction, and Livelihood Improvement of Farmers	Rural Road, Market, and Ghat, and Livelihood Improvement of Fishermen
Guideline	Guidelines for Project Assessment, WARPO 1992	Guidelines for Effect Monitoring and Evaluation (EME) of Rural Road and Market Improvement, LGED 1999
Applied Method, Benefit	- Reduction of damage in boro crop	Road: VOCs Market: SR
Project Year	30 years from the start of project construction	No description in the guideline (20 years in general)
Expected Rate of Return	More than 12%	

Source: Compiled by the JICA Survey Team

10.3 Economic Benefit

Below are the economic benefits calculated in the analysis which the JICA Survey Team has quantified in financial value. Other intangible benefits are also reviewed in the latter Chapter 10.5. Due to difficulty in quantifying the economic value, the benefit of the agriculture program is not included in the calculation.

(1) BWDB Part

- Damage Reduction on Boro Crop induced by Flood Protection.

(2) LGED Part

- Reduction of VOCs induced in Road Pavement works;
- Spoilage Reduction in Perishable Products caused by Rural Market Improvement; and
- Increase in Income of Fishermen by the Project Activities.

10.3.1 Economic Benefits of BWDB Part

The benefits of the project can be estimated by assessing the possible savings resulting from the actions taken in response to damage mitigation or protection of agricultural production against flood.

(1) Damage Reduction on Boro Crop

The quantity of flood damages varies with the extent of flood or is related to the recurrence interval (return period) of the flood.

The damage curve of the project area is assumed to be the same to the results analyzed in the “Kalni-Kushiyara River Management (KKRM) Project (1998, BWDB/CIDA)”. The JICA Survey Team members considered it as the most reliable data among existing analyses and selected it as basis of estimates.

The relationship between damage rate of Boro Rice and Return Period is summarized below in Table 10.3.1.

Table 10.3.1 Damage Rate of Boro Rice

Return Period (Years)	2	5	10	20
Estimated Damage Rate of Boro Rice	6.4%	26.4%	36.1%	55.5%

Source: Kalni-Kushiyara River Management Project

The annual benefit of the Damage Reduction on Boro Rice was calculated using the formula below.

Economic Benefit of Damage Reduction on Boro Rice =
"(i)Benefit Factor" x "(ii)Average Yield of Boro Rice" x "(iii) Economic Price of Boro Rice"

(i) Benefit Factor

In Chapter 3, Section 3.2 (Selection of Subprojects), the benefit factor was calculated by multiplying the "Production Area of Boro Rice (ha) in the Project Site" and "Damage Rate in Pre-Monsoon Period (%)". Damage Rate was calculated by the former mentioned damage rate referring to the KKRM report.

(ii) Average Yield of Boro Rice

The present average yield in each project area was estimated by calculating the average yield obtained from district offices for the three latest seasons (2010/11–2012/13). The average yield is calculated at 4.1 ton/ha (detailed data is shown in Table 10.3.4).

Based on the historical data of the Bangladesh Rice Research Institute (BRRI), the average yield of boro rice in the whole of Bangladesh increased to 23% from 2000 to 2010. In the future, it is assumed that the yield will increase to at least 15% for ten years from 2013 to 2023 (or 1.5%/year). The yield after 2023 is assumed to be constant until 2045.

Table 10.3.2 Historical Average Yield of Boro MV in Bangladesh

(unit: t/ha)

Year	1990/91	1995/96	2000/01	2005/06	2010/11	2011/12
Average Yield	2.49	2.62	3.17	3.44	3.90	3.91
Annual Increase Rate	1.02%	3.88%	1.65%	2.54%	2.56%	-

Source: HP of Bangladesh Rice Research Institute, October 2013

(iii) Economic Price of Boro Rice

The economic price of Boro rice was estimated based on the World Bank's Global Commodity Price Projections at BDT 20.4/kg (BDT 20,400/ton) through the computation process shown in Appendix 10.1. The projected price in 2025 was converted into the constant price in 2013 adopting the latest manufactures unit value (MUV) index published by the World Bank in July 2013.

The expected economic benefit of each subproject area is shown in Table 10.3.3.

Table 10.3.3 Annual Benefit of Damage Reduction on Boro Rice in 2013

No.	Name of Project	Annualized Benefit (B)	Average Yield (t/ha)	Annual Benefit of Damage Reduction on Boro Rice (BDT 1,000)
R-1	Dampara Water Management Scheme	1,167	4.0	95,227
R-2	Kangsa River Scheme	1,149	4.0	93,758
R-3	Singer Beel Scheme	360	3.9	28,642
R-4	Baraikhali Khal Scheme	768	4.0	62,669
R-5	Alalia-Bahadia Scheme	135	4.0	11,016
R-6	Modkhola Bhairagirchar Sub-project Scheme	167	4.1	13,968
R-7	Ganakkhalli Sub-scheme	154	4.1	12,881
R-8	Kairdhala Ratna Scheme	758	4.6	71,131
R-9	Bahira River Scheme	273	4.5	25,061
R-10	Aralia Khal Scheme	100	4.4	8,976
R-11	Chandal Beel Scheme	104	4.0	8,486
R-12	Satdona Beel Scheme	188	4.0	15,341
R-13	Gangajuri FCD sub-project	1,368	4.1	114,420
R-14	Kaliajuri polder #02 scheme	411	4.4	36,891
R-15	Kaliakjuri polder #04 scheme	399	4.3	35,000
	Subtotal			**633,467**
No.	**Name of Project**	**Annualized Benefit (B)**	**Average Yield (t/ha)**	**Annual Saved Boro Rice Value (BDT 1,000)**
N-1	Boro Haor Project (Nikli)	479	4.2	41,041
N-2	Naogaon Haor Project	667	4.4	59,870
N-3	Jaliar Haor Project	114	***4.1**	9,535
N-4	Dharmapasha Rui Beel Project	1,286	**3.5**	91,820
N-5	Chandpur Haor Project	70	4.1	5,855
N-6	Suniar Haor Project	118	4.2	10,110
N-7	Badla Haor Project	85	4.5	7,803
N-8	Nunnir Haor Project	207	4.3	18,158
N-9	Dakhshiner Haor Project	180	4.5	16,524
N-10	Chatal Haor Project	43	4.5	3,947
N-11	Ganesh Haor Project	117	4.1	9,786
N-12	Dhakua Haor Project	228	**2.5**	11,628
N-13	Mokhar Haor Project	451	4.2	38,642
N-14	Noapara Haor Project	141	4.4	12,656
	Subtotal			**337,375**
	Total			**970,842**

Note: * As the current yield data was not available in N-3, Jalia Haor Project area, the average yield of the whole area is adopted.

Source: JICA Survey Team

It is assumed that the benefit will start from 2016 and gradually magnify until 2023, when 100% of the above benefit amount has been achieved. The occurrence rate of benefit increases as construction work progresses. The occurrence rate of benefit from damage reduction as shown in Table 10.3.4 is assumed similar to what was adopted for that of O&M cost as shown in Table 10.3.3.

Table 10.3.4 Occurrence Rate of Benefit of Damage Reduction on Boro Rice

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023-47
Occurrence Rate of Total Benefit	0%	2%	10%	20%	40%	61%	81%	95%	100%

Source: JICA Survey Team

10.3.2 Economic Benefits of LGED Part

(1) Road

According to the LGED guidelines, there are three methods used in calculating the economic benefits of road improvement projects, namely, VOCs approach, user's cost saving (UCS) approach, and agricultural produces surplus (APS) approach. The VOCs approach is selected as it has been utilized in recent major projects and the availability of the data during the survey period.

The VOCs approach is based on the quantification of savings in financial and economic VOCs accrued by vehicles before and after the implementation of road upgrading projects. The method is explained in detail in the Guidelines for EME of Rural Road and Market Improvement (LGED, 1999)

The economic evaluation using VOCs approach involves the following three steps:

1) Calculate the Annual Average Daily Traffic (AADT);
2) Calculate the present VOCs; and
3) Calculate the future VOCs after the project.

VOCs, as shown in Table10.3.5, were calculated and subtracted to obtain the benefits.

1) Calculate the AADT

First, the pre-development AADT was determined for each road using the survey results of the traffic count.

Traffic was counted based on the following categories of vehicles: namely motorized vehicles (auto-rickshaw, jeep/taxi/car, motorcycle, pick-up/microbus, bus/minibus, and truck/tractor), non-motorized vehicles (bicycle, bullock cart, rickshaw, and rickshaw van), and pedestrians. As traffic count surveys were conducted during the daytime, once on a *hat* (market) day and once on a non-*hat* (non-market) day, the assumptions stated below are made to derive the AADT.

- The number of *hat* and non-*hat* days per week is assumed to be two and five, respectively, and the average daily traffic was calculated.
- The daytime 12-hour (8:00 a.m. to 8:00 p.m.) data is converted to 24-hour data using coefficient factors. The coefficient factors were determined to be from 110% to 115% depending on the vehicle type based on past studies of LGED.
- The coefficient factor determined for each month was multiplied to the above 24-hour traffic data to avoid seasonal bias. The coefficient factor was determined by past studies. For instance, the coefficient factor for July is ranges from 1.02 to 2.04 based on vehicle type.

As for this survey, the Maintenance Team of LGED assisted in providing the latest AADT data of project road routes (82 routes in total) since the survey period is limited. The Maintenance Team obtained AADT data of 42 out of the 82 project road routes for analysis (details are presented in Appendix 10.2).

Table 10.3.5 Available AADT Data and VOC

	Route Number	Total Length	Available AADT Data from Maintenance Team of LGED	Share of Data Availability	Average Annual Saved VOCs in Constant Price in 2013 (BDT 1000/km)
Upazila Road	13	121. 73 km	11	85%	1,156
Union Road	25	158.12 km	23	92%	970
Village Road	44	135.99 km	14	32%	371
Total	**82**	**415.84 km**	**48**	**59%**	**824**

Source: JICA Survey Team

2) Calculation of Present VOCs

Second, the data set on unit VOCs for various vehicle types and surface roughness surveyed by the "Rural Infrastructure Improvement Project (RIIP) RDP-25 (2009, LGED, GTZ)" were employed in order to calculate the VOCs before and after the development of each road, as this is the best available data at present. In this data, unit VOCs were given for different surface conditions classified by the international roughness index (IRI).

For the analysis, IRI of 16, which represents the surface condition of a typical earthen road, and IRI of 4, which represents the surface condition of a well-paved surface, were employed in calculating the pre- and post-development VOCs for each road.

Since the VOCs used by RDP-25 were expressed in 2009 monetary values, they were converted to 2013 constant prices by multiplying a factor of 1.20, which represents the rate of inflation during the period of 2009 to 2013. The factor was derived from the MUV index issued by the World Bank and the exchange rates in 2009 and 2013. The unit data of all vehicle types is summarized in Appendix 10.3-4.

The difference of VOCs between IRR 4 and IRR 16 per each vehicle type was multiplied by AADT data in order to identify the daily saved VOCs benefits of the road by improved road pavement. Then, the daily amount was converted to annual amount by multiplying the former by 365. Categorized according to road type, the average annual VOC benefits of AADT available roads were computed at BDT 1,156,000/km for upazila road, BDT 970,000/km for union roads, and BDT 371,000/km for village roads.

3) Prediction of Future Traffic after the Project

Third, the change of traffic volume after the project implementation is assumed.

In the past survey of the "Impact Survey of Five Roads on Sunamganj Community Based Resource Management Project (2010, LGED)" shows the household survey data of 196 samples about the change in transportation mode before and after the project. The respondents' answers on the modes of vehicle used on the improved road before and after the project are summarized in Table 10.3.6. The traffic volume was estimated assuming that the 196 respondents used their chosen vehicle twice a day. The total traffic volume after the project is 38% higher than the one before the project.

Table 10.3.6 Mode of Vehicle Used Before and After the Project

Mode of Vehicle Used		Used vehicle Mode		Assumed Traffic Volume	
		Before	After	Before	After
Non-Motorized	Pedestrians	63%	6%	248	24
	Bicycle	65%	63%	256	248
	Rickshaw/Van	39%	95%	154	374
	Cart	34%	6%	134	24
	Boat (in flood)	22%	6%	87	24
Motorized	Mortor-cycle	5%	54%	20	213
	Light motor*	1%	48%	4	189
	Tractor	0%	36%	0	142
	Bus/Truck	0%	1%	0	4
Total				**903**	**1,242** (+38%)

Source: Impact Survey of Five Roads on Sunamganj Community Based Resource Management Project

Furthermore, the economic analysis of the Haor Infrastructure and Livelihood Improvement Project (HILIP), 2011, LGED report, assumed that traffic volume will increase to 40% as compared with the present level and based on the past experiences.

Taking the above assumptions into account, the traffic amount after the project was assumed to increase to 40% of the present average traffic volume due to the improved pavement and better connection with the surrounding road networks. Based on the guidelines discussed in Section 7.5.2.3, half of the VOC savings of newly generated traffic was considered as economic benefit of the Project.

In conclusion, the total calculated annual benefit of VOCs is at BDT 413.5 million by accumulating the VOCs of each route based on 2013 prices.

In addition, through the development of the surrounding economy, the traffic volume is assumed to naturally increase by 6.1% each year. The increase rate is set based on the average gross domestic product (GDP) increased rate of 6.1% during 2001-2011.

The estimated benefit amount was assumed to gradually increase in accordance with the construction work progress from 2018 to 2024. The applied benefit on the occurrence rate from road improvement (as shown in Table 10.3.7) is similar to the O&M cost of LGED part.

Table 10.3.7 Occurrence Rate of Benefit of Road Improvement

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023-37
Occurrence Rate of Total Benefit	0%	5%	26%	48%	69%	89%	97%	99%	100%

(2) Market

The SR method was used in the economic analysis on the development of the growth center and rural market. Of the various indicators that represent the economic effects of market improvement, the SR method is the most preferred because it focuses on the reduction of physical waste of traded products.

Due to lack of existing information on the 20 target rural markets and four target growth centers, the calculated benefit in the previous study was adopted for the Project. The “Market

Infrastructure Development Project in Charland Regions, Impact Assessment of Rural Markets (IFAD, 2011)", the mid-term review mission assessed the project impact of 18 rural markets. The annual economic benefit of "loss reduction" was calculated at BDT 2,247,000 for each market based on the surveyed result.

In the calculation, the incremental revenues from the increased volume of sold products were estimated first, then a loss reduction index of 6% (average between dry and rainy seasons) was applied. Maintenance cost was set at 4% of the initial investment cost.

The JICA Survey Team considered the above surveyed benefit amount as the most reliable data as it is the latest available data used for the economic analysis. Furthermore, the JICA Survey Team adopted the calculated benefit value in the economic analysis for the development of growth center and rural market component of the Project. The benefit value in April 2011 constant prices is converted to the 2013 price by multiplying the former by 1.20, which represents the consumer price index (CPI) increase in Bangladesh during the period. The annual economic benefit of each market is computed at BDT 2,696,400.

The annual increase in trading volume is assumed at 6.1%.The increase rate is set based on the average GDP increase rate of 6.1% during 2001-2011.

(3) Fisheries

The benefits of beels and floodplain aquaculture were estimated assuming the incremental increase in fish catch.

Under the review of the fisheries expert, the fish catch in the project was estimated for 150 beels as shown in Table 10.3.8. The target fish catch of beels was assumed based on the data provided by the Ministry of Fisheries and the ongoing Sunamganji project data. The fish catch was assumed to increase matching to the project progress from 4th to 8th year. The financial value of fishes was determined at BDT 100/kg for beels development, as it consists of small indigenous fish species which are popular among the rural poor, based on the information of the Ministry of Fisheries.

SCF of 0.8 was multiplied to the financial value to obtain the economic value for both cost and benefit.

Table 10.3.8 Economic Benefit of Beel Development

(BDT 1,000/year)

Item	Unit	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)	Year 8-23 (2023-2038)
Incremental Number of Beels Developed	beel	0	0	30	60	90	120	150	150
Incremental Impact Area through Beel Development	Ac	0	0	0	1,125	2,250	3,375	4,500	5,625
Fish Catch	kg/ac	140	140	140	154	169	186	205	226
Incremental Revenue	BDT 1,000/year	0	0	0	17,325	38,025	62,775	92,250	127,125
Incremental Economic Benefit	BDT 1,000/year	0	0	0	13,860	30,420	50,220	73,800	101,700

Source: JICA Survey Team

Similarly, the economic benefit of the aquaculture is estimated by predicting the net fish catch (cultured) of each project type. The detailed predicted value of each type is shown in Appendix 10.5-8. The financial value of fishes was calculated at BDT 110/kg, which was slightly higher than the beel fish based on the data issued by the Ministry of Fisheries.

In calculating the economic benefit, the incremental fish value was estimated, and the SCF was multiplied on the said value. The "operating cost borne by group" is added to the economic cost, which is not counted in the Project cost as presented in Table 10.2.2. In conclusion, the calculated incremental benefits of each system are as shown in Table 10.3.9.

Table 10.3.9 Economic Benefit of Aquaculture

(BDT 1,000/year)

Item	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)	Year 8-23 (2023-2038)
Net Pen Culture	0	2,112	3,608	6,495	9,329	8,700	8,700	8,700
Individual Cages	0	669	954	904	2,252	2,252	2,252	2,252
Backyard Pond Culture	0	880	1,712	2,093	2,108	2,375	2,375	2,375
Seasonal Floodplain Aquaculture - Daudkandi Model	0	1,430	2,746	2,661	3,007	3,387	3,387	3,387
Incremental Economic Benefit	**0**	**5,091**	**9,020**	**12,153**	**16,696**	**16,714**	**16,714**	**16,714**

Source: JICA Survey Team

10.4 Results of the Economic Analysis

In order to calculate the values of EIRR, B/C, and ENPV as shown in Table 10.4.1, the annual cost and benefit flow is predicted. The EIRR of the project was computed at 15.6%, while the B/C and ENPV with a discount rate of 12% resulted to 1.26 and BDT 2,164 million, respectively. The results indicated a high project economic viability.

Table 10.4.1 Results of the Economic Analysis of the Project

Project	EIRR	B/C	ENPV
BWDB part	16.1%	1.29	BDT 1,153 million
LGED part	15.2%	1.23	BDT 1,011 million
Whole Project	**15.6%**	**1.26**	**BDT 2,164 million**

Source: JICA Survey Team

(1) Sensitivity Analysis

The project sensitivity with respect to the changes in benefit and cost is evaluated to analyze the sustainability of the project. Three alternative cases of (i)10% cost increase, (ii)10% benefit decrease, and (iii) worst case (both 10% cost increase and 10% benefit decrease), were assumed. The EIRR, B/C, and ENPV are summarized in Table 10.4.2.

The EIRR and B/C are 12.4% and 1.03, respectively under the "(iii) worst case", which is 10% cost increase and 10% of benefit decrease. The EIRR is higher than the criteria (EIRR=12%) even under the worst case. Therefore, the project is justified to be economically feasible.

Table 10.4.2 Results of the Sensitivity Analysis

	EIRR	B/C	ENPV
Base Case	15.6%	1.26	BDT 2,164 million
a) Capital cost of the project: +10%	14.0%	1.14	BDT1,327 million
b) Benefit -10% point	13.9%	1.13	BDT 1,111million
c) a) + b)	12.4%	1.03	BDT 273 million

Source: JICA Survey Team

10.5 Intangible Benefit

There are some important benefits which are difficult to be quantified in economic value, but have significant impacts to the society. The potential intangible benefits are briefly reviewed and summarized below.

Job opportunity in the area

According to the past project impact assessment in Sunamganj District, about 94% of the respondents said that job opportunities was improved after the Project. The construction of facilities and operation and maintenance (O&M) works in the project under the Project implementation create a direct impact to the local community. Furthermore, some dwellers living around the road development project have better access to the city center where more jobs are available. They also have a chance to work as rickshaw drivers along the developed road.

< BWDB Part >

Damage reduction on private and public owned assets

The damage on private and public owned assets caused by floods could be alleviated by the project. However, the benefit is not included in the Economic Analysis due to lack of reliable information. Referring to the household survey conducted by the JICA Survey Team, the average respondents reported that the damage cuased by floods amounted to BDT 10,000 in 2000 and 2004. The significant amount of damage loss is expected to be saved with the Project.

Damage reduction on Fisheries Output

Not only the agricultural crops, but also the fishery production could be saved from the flood damage after the project implementation.

Reduction in human dislocation

The economic cost of dis-location of dwellers can be reduced as the flooding will be reduced by the Project. The beneficiaries can utilize their saved cost and time to other economic activities such as agriculture or own business.

< LGED part >

Increase in trade activity

Trade and businesses along the project area would be accelerated because of better road networks. The farm and fishery beneficiaries can save time and cost in transporting fertilizers, crops, and laborers outside of the area. Furthermore, businesses will flourish and will increase land prices within the project site, as expected, due to the influence of improved economic atmosphere.

Better access to social services such as NGOs, farmers organizations, schools, and hospitals

The project beneficiaries can now have easier access to several social services. Several non-government organizations (NGOs) and farmers organizations are providing trainings and educational opportunities as well as micro-credit scheme in the area. The improvement of access to these services will surely contribute to the development of rural society. Referring to other published project reports, better access to these social services will create more impacts on women and children who are facing severe conditions in the society. Thus, this may result in effective poverty reduction.

Electricity access escalated

Access to modern and reliable energy supply is the key to sustainable socioeconomic development, bringing major benefits to public health, social welfare, and economic productivity. However, the lack of roads has hindered the distribution of the electricity supply grid as power lines tend to follow road alignments.

<Livelihood Improvement>

Increase in income of farmer's and fisherman's household.

The variety and higher yield of crops resulted in the increase of household income in the long term. The saved cash can spend on the food, saving for emergency use, preparation for flood damage, education, further investment of their house business etc., thus, contributing to poverty reduction in the Project area.

10.6 Financial Analysis of the Project

In order to evaluate the profit improvement of farmers and fishermen, the additional O&M cost and expected revenue accrued by the Project implementation were analyzed. The main project scheme, Small-scale Income Generation Subproject (SIGS) for agriculture, beels and floodplain aquaculture development for fisheries part, were evaluated.

The result of crop budget analysis of SIGS on the agriculture sector is summarized in Table 10.6.1. The amount of cost items and their prices has been reviewed by the JICA Survey Team and local experts. Detailed information is attached in Appendix 10.10. Except for the "Fruit Production Support Scheme", the net revenue of the project becomes positive even in the first

year while the net profit increases after the second year for every scheme. The schemes are then considered to be financially feasible.

Regarding the "Fruit Production Support Scheme", the maturation of fruit trees takes longer time. The whole spent cost is recovered in the 4th–5th year by the presumed revenue, and the stable net revenue (BDT 4,500–12,500/year) is expected after the 5th year. The scheme is considered feasible in the long term.

From the aspect of household expenditure, the cost to be incurred by farmers is limited at BDT 1,020 to 13,000/year/scheme. Referring to the household survey result (Table 2.1.23), the average income of farmers is estimated at BDT 160,914/year, and the mentioned annual cost for SIGS scheme ranges from 0.6% to 8.1%, and the cost will be recovered in the short term. Hence, it is concluded that farmers can afford to pay the said amount for the enhancement of their own income generation.

Table 10.6.1 Results of Crop Budget Analysis of SIGS

(unit: BDT)

Scheme	Item	1st year	2nd year and after
Floating Bed Vegetable Culture Scheme	Cost	(3,000)	1,020
	Return	3,150-4,200	3,150-4,200
	Net Return	3,150-4,200	2,130-3,180
Small-scale Vegetable Production Support Scheme	Cost	(3,200)	2,500
	Return	4,200-7,000	4,200-7,000
	Net Return	4,200-7,000	1,700-4,500
Fruit Production Support Scheme *	Cost	(2,769)	2,500
	Return	0	0-11,500 (2nd to 4th year) 7,000–15,000 (5th year and beyond)
	Net Return	0	-2,500-9,000 (2nd-4th year) 4,500-12,500 (5th year and beyond)
Micro Poultry Raising Scheme	Cost	(17,000)	13,000
	Return	16,000-24,000	16,000-24,000
	Net Return	16,000-24,000	3,000-11,000
Small-scale Mushroom Culture Scheme	Cost	(4,500)	4,000
	Return	7,200-14,400	10,200-20,400
	Net Return	7,200-14,400	6,200-16,400

Note: The cost in the 1st year in ( ) is assumed to be family labor cost, and its expenditure is not considered in the net return.
* Detailed cost and revenue prediction of Fruit Production Support Scheme from 2nd year to 5th year is shown in Appendix 10.10.

Source: JICA Survey Team

The cost and net revenue of each scheme in fisheries activities were estimated based on the experience of the JICA Survey Team and local experts. The fish catch of Cage Culture is assumed to be at the same value. In case of other schemes, the fish catch value is assumed to gradually increase as the project progresses until the 6th year, and remains the same afterward. The fish value of the whole scheme was assumed at BDT 110/kg considering the data provided by the Ministry of Fisheries.

The cost and expected return is summarized in Table 10.6.2. The "Net Pen Culture" and "Seasonal Floodplain Aquaculture" activities generate positive net revenues even from the second year of the program. The other schemes show positive net value starting from the third year and gradually increases due to the increase in the amount of fish catch. The assumed

recovery period of the project cost of each scheme is set at 4-6 years. Hence, all activities will contribute to the increase in household income generation in the Haor area in the long term.

Table 10.6.2 Anticipated Cost and Revenue of Beels and Floodplain Development

Scheme	Size	Item	2nd Year (BDT)	3rd Year and Beyond (BDT)
Net Pen Culture	20 acres	Cost	917,000	517,000
		Return	1,166,000	1,232,000-1,383,800
		Net Return	249,000	715,000-866,800
Cage Culture (Individual Cages)	20 cages	Cost	100,000	20,000
		Return	33,000	33,000
		Net Return	-67,000	13,000
Cage Culture (Joint Cages)	10 joint cages	Cost	400,000	220,000
		Return	385,000	385,000
		Net Return	-15,000	165,000
Backyard Pond Culture	2.5 acres/group	Cost	450,000	70,000
		Return	275,000	302,500-366,850
		Net Return	-175,000	232,500-296,850
Seasonal Floodplain Aquaculture - Daudkandi Model	25 acres per model site	Cost	1,000,000	500,000
		Return	1,787,500	1,966,250-2,618,000
		Net Return	787,500	1,466,250-2,118,000

Source: JICA Survey Team

10.7 Evaluation Indicators of the Project

Regarding the evaluation of the project impact, the JICA Survey Team and local counterparts, BWDB and LGED, have agreed to utilize the evaluation indicators below. The methodology and target figure will be determined after the discussion among stakeholders. The ex-post evaluation could be conducted after two years of the project completion. The present condition and draft target value of the evaluation is set as follows:

(1) BWDB

- Decrease in frequency and area of inundation inside the subproject areas (Effect Indicator)

  Frequency and area of inundation in the past ten years (before the project) inside the embankment of the project area during the pre-monsoon season for submergible embankment and monsoon for full embankment will be investigated during the baseline survey for representative subprojects near the existing water level observation stations.

  Frequency and area of inundation can be estimated from the comparison between ground elevation inside the project area and records of adjacent water level observation stations. The survey also refer to conduct interviews with local people.

  Inundation will be expected to be prevented after the project.

- Accruing of difference of water levels between riverside and inside of embankment (Operation Indicator)

  Water level at riverside, where embankment will be built, will be monitored during the pre-monsoon season for the submergible embankment, and the monsoon season or the full embankment project for representative subprojects near the existing water level observation stations.

Time series of water level will be recorded in the adjacent water level observation stations and the water levels outside and inside the embankment at representative points will be also monitored once a day.

Difference of water levels between outside and inside of the embankment will be expected to be accrue after project.

- Evaluation of WMO formulation and activities (Operation Indicator)

  A subproject for each district (total 5 subprojects) will be selected through the baseline survey. Current issues of each subproject area before the project will be investigated such as problems of gate operation, public cut and so on.

  Situations of subproject area after the project will be investigated to evaluate

  - WMOs will be established or not,
  - WMOs will play their roles stipulated in their scopes or not, and
  - Problems mentioned above will be resolved or not.

- Increase in yield of boro rice and crop diversification (Effect Indicator)

  In the field trial area of agriculture promotion activities, ten sampling places will be selected for evaluation during the baseline survey in the target areas of both APSS and SIGS.

  - Increase in yield of boro rice

  The yield of boro rice of the sampling locations in the target area of APSS and the neighboring area with similar environment conditions but out of the target area of APSS will be compared to evaluate the effect of APSS without yearly yield fluctuation of boro rice influenced by the climate.

  - Crop diversification

  Number of crop species including vegetable, fruit, and mushroom before the project will be investigated through the baseline survey at the sampling places in the target area of SIGS. Increase in crop species will be investigated after the project at the same places.The number of production crops of target households of SIGS scheme will be also compared before and after the project.

- Increase in household income and asset (Effect Indicator)

  The household income and asset before the project will be investigated during the baseline survey. Increase after the project will be estimated by the same method. Tentative values are as follows:

  - Present income: BDT 162,663/year (average household income by household survey in 2013), the asset before the project has to be investigated in the baseline survey.
  - Target: increase in income and asset

(2) LGED

- Increase in traffic volume per vehicle mode (car, motorcycle, CNG, rickshaw, walking, etc.) (Operation Indicator)

The traffic volume before the project will be investigated during the baseline survey. Increase of traffic volume after the project will be estimated by the same method. Tentative values are as follows:

- Present: AADT data of 48 routes is available.
- Target: 40% increase in traffic volume (expected value in benefit calculation)

- Decrease in travel time (Effect Indicator)

  The baseline survey will sample some representative roads for each road type (Upazila, Union, Village) and each district, which will be upgraded in the project and investigate the travel times between two selected points along a road by transportation (car, motorcycle, CNG, rickshaw). The travel times will be also investigated after the project. The travel times will be expected to decrease.

- Increase in sales, handling, and business in markets per Upazila (Effect Indicator)

  The number of shops per kind, sales amount and price of each product, and average daily revenue in the markets before the project will be investigated during the baseline survey. Increase of the said figures after the project will be estimated by the same method. Tentative values are as follows:

  - Present: No available data.
  - Target: Increase in number of shops per kind, sales amount and average value of sold products, and average daily revenue

- Increase in household income and asset (Effect Indicator)

  The household income and asset before the project will be investigated during the baseline survey. Increase after the project will be estimated by the same method. Tentative values are as follows:

  - Present: BDT 162,663/year (average household income by household survey in 2013)
  - Target: Increase in income and asset

- Increase in fish catch (Effect Indicator)

  The fish catch before the project will be investigated during the baseline survey. Increase in fish catch after the project will be estimated by the same method. Tentative values are as follows:

  - Present: No available data.
  - Target: Increase in fish catch

- Improvement in biodiversity (Effect Indicator)

  Improvement in biodiversity will be evaluated by the number of species of caught fishes in representative beels, which will be selected during the baseline survey. Monitoring of the number of species will be carried out after the project commences.