Performance Evaluation of the Participatory Water Management of Some Selected Small-Scale Water Resources Projects of LGED

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Declaration

It is hereby declared that this Project Report or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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ABBREVIATIONS/ ACRONYMS

ADB	Asian Development Bank
AGM	Annual General Meeting
BADC	The Bangladesh Agricultural Development Corporation
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CAD	Command Area Development
DAE	Department of Agriculture Extension
DLIPEC	District Level Inter-Agency Project Evaluation Committee
DOC	Department of Cooperative
DoE	Department of Environment
DOF	Department of Fisheries
FCD	Flood Control , Drainage Improvement
FCDI	Flood Control , Drainage Improvement and Irrigation
GOB	Government of Bangladesh
GPWM	Guidelines for Participatory Water Management
Ha	Hectare
HT	HYV Transplanted
HYV	High Yielding Variety
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
LGI	Local Government Institution
LT	Land Transplanted
MoA	Ministry of Agriculture
MOU	Memorandum of Understanding
MoWR	The ministry of Water Resources
NGOs	Non Government Organization
NWMP	National Water Management Plan
O & M	Operation and Maintenance
PRA	Participatory Rural Appraisal
PWM	Participatory Water Management
PWMA	Participatory Water Management Approach
SSWRDSP	Small Scale Water Resources Development Sector Project
UP	Union Parishads
WMCA	Water Management Cooperative Association
WU	Water Users
WUA	Water Users' Association
WUC	Water Users' Committee

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ABSTRACT

During the period from April 1996 to December 2002, LGED implemented the Phase-1 of the Small-Scale Water Resources Development Sector Project (SSWRDSP-I). The purpose was to rehabilitate and/or upgrade 280 small-scale water control systems, called sub-projects, in western part of Bangladesh with much emphasis on people's participation. The sub-projects comprised of flood control, drainage improvement, water conservation and command area development schemes. The Project was implemented with the aims of agricultural development, floodplain fisheries, environmental mitigation measures, stakeholder and beneficiaries' participation, poverty reduction and gender development as core elements. Based on its achievement, the second phase SSWRDSP-II has been undertaken for implementation in the period from November 2001 through 2009.

The performance of existing FCD projects can be significantly improved by developing a participatory approach. This study deals with the evaluating performance of such participatory water management system. The SSWRDSP has developed an approach to ensure sustainable O&M by establishing Water Management Cooperative Associations (WMCA). WMCA was supposed to assume O&M responsibilities of all the successfully implemented sub-projects of the LGED. In addition they facilitated community development activities via micro-credit among the stakeholders and beneficiaries.

The study was conducted on three selected sub-projects of SSWRDSP of LGED. Of the selected sub-projects, two are from Phase-I and one from Phase-II. Out of those two sub-projects from Phase-I, one was selected on the basis of performance rated above average (Brazamul-Bhitikhal Sub-project) and the other one was selected as performance rated below average (Fuleswari Sub-project). These performances are reported by LGED officials and previous field investigations of different researchers. The third one was selected as a new sub-project from Phase-II (Alamkhali Sub-project). The study was carried out with mainly three objectives: i) to analyze the pre- and post-project conditions of the selected sub-projects, ii) to determine the factors affecting the performance and (iii) to assess the performance of the WMCAs. Relevant literatures were studied and questionnaire survey through field investigation was conducted for this purpose. In course of investigating the performance of the management system, socio-institutional, financial and environmental aspects have been considered for evaluation.

All three selected WMCAs were found registered duly under cooperative laws. The WMCA formation processes, meeting attendance, conflict resolution, etc Brazamul-Bhitikhal sub-project and Alamkhali sub-project were found to be appropriate. Crop production and cropping intensity have increased remarkably in those two sub-projects. But those increases were nominal in Fuleswari sub-project. Due to lack of beneficiaries' participation and O&M of the infrastructure by WMCA, Fuleswari sub-project was not functioning well. There was no appreciable environmental change related to water quality and natural vegetation for pre- to post-project conditions. Natural fish migration hampered due to construction of embankment and regulators. But culture fish production has increased after implementation of the sub-project and better training. In Fuleswari sub-project, navigation has been obstructed due to inadequate implementation of facility for boat-passage across the embankment. There ware four public-cuts found at that embankment. The financial viability as per beneficiaries' contribution collection for cooperatives in all the three sub-projects is good (above 100%) but as per O&M fund collection Fuleswari sub-project shows very poor performance.

Lack of beneficiaries' participation and lack of proper infrastructure maintenance by WMCA ware found to be the main reasons behind lesser success of those water schemes. The performance can be improved by increasing beneficiaries' involvement in local levels. Executive members of WMCA should be formed with dedicated stakeholders of the sub-projects and their activities should be monitored regularly. Linkage with WMCA and LGED project level authority must be further improved.

Chapter 1
Introduction

বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়
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1.1 Water Resources Projects in Bangladesh

Many areas in Bangladesh are confronted with decline in quantity and quality of existing water resources. In fact, water resources in Bangladesh face immense challenges for resolving diverse problems and issues. With increasing population and demand for food, sustainable water management system has to be achieved. With limited freshwater and land resources, and increasing competition for these resources, water-managed and irrigated agriculture must improve its utilization of these resources.

Water management is the intervention of humans in the manner in which surface and/or groundwater is captured, conveyed, utilized and drained in a certain area. Moreover, it is a process of social interaction between different stakeholders, each employing different methods, resources and strategies, around the issue of water control. This management of water resources may be done through the development of water management systems where participation of all stakeholders is ensured.

Flood and water-logging in monsoon and water scarcity in dry season are the crucial factors for water management in Bangladesh. It has been widely recognized that water should no longer be considered as a totally free resource, and plans must be developed for its efficient use through better management and rules that preserve everybody's access to it and interest in its development especially in case of flood control, drainage and irrigation (FCDI) systems (Faruqee and Choudhry, 1996).

Water sector projects have been categorized based on its size, such as, small-scale projects < 1000 ha, medium-scale projects 1000-5000 ha, and large-scale projects > 5000 ha (GPWM 2000). Initially water sector development schemes were implemented in Bangladesh through Bangladesh Water Development Board

(BWDB). After passing of the Union Parishad Act (1998) in the Parliament, power has been given to the Local Government Engineering Department (LGED) to plan, design and implement the water resources schemes up to 1000 ha. It was also suggested in the National Water Policy to hand over the water schemes up to 5000 ha to LGED (NWPo, 1999).

During the period from April 1996 to December 2002, LGED implemented the first phase of Small Scale Water Resources Development Sector Projects (SSWRDSP-I). The Project was to rehabilitate and/or upgrade 280 small-scale water control systems, called sub-projects, in western part of Bangladesh. The sub-projects were comprised of flood control, drainage improvement, water conservation and command area development schemes. The Project was implemented with aims of agricultural development, floodplain fisheries, environmental mitigation measures, stakeholder and beneficiaries' participation, poverty reduction and gender development as core elements. Based on its achievement, the second phase SSWRDSP-II has been planned and undertaken for implementation in the period from November 2001 through 2009.

A large number of evaluations (e.g., Khan and Romm 1978, Zhi 1989, Faruqee and Choudhry 1996, Molden et al. 1998, Samad and Vermillion 1999, Datta et al. 1999, Mukherjee 2004, Rahman 2005) have concluded that the intended benefits from water management systems are not materializing, partly due to institutional weakness. People's participation at all stages of water resources development, is widely believed to be a key requirement, for tackling those institutional weaknesses. The SSWRDSP has developed an approach to ensure sustainable O&M by establishing Water Management Cooperative Associations (WMCA). WMCAs were supposed to assume O&M responsibilities of all the successfully implemented small-scale projects of the LGED. In addition they facilitated community development activities via micro-credit facility, to enhance the conditions for poverty reduction by a strong and effective organization of stakeholders and beneficiaries (LGED 2003).

1.2 Rationale of the Study

BWDB and LGED are the main implementing agencies for water resources projects in Bangladesh. By this time they have implemented a lot of projects but maximum of those projects are not sustainable because of lack of beneficiaries' participation in water management and O&M. A little success can be found in LGED managed small-scale project. A huge amount of foreign money of total investment cost, technology and expertise was involved in this project. Thus an evaluation of this project will be helpful in understanding the implications of involving those investments in FCD projects of Bangladesh

Participatory management often has a number of competing alternatives and is assessed by interest groups with differing values and perspectives. Furthermore, indicators with some weightage or within some pre-defined range sometimes do not show the complete picture of a project (Molden et al., 1998). Thus some qualitative factors may be used to identify the different criteria or indicators for performance evaluation of a project.

This research focuses on the evaluation of agro-socio-institutional performances of the schemes. Thus it has become necessary to conduct a systematic research to find out the key contributory factors that are behind the success or failure of small-scale projects and to appreciate an approach for the success of participatory management. Review of relevant literatures and questionnaire survey through field visits are conducted for the purpose.

1.3 Objectives

The present study is carried out with the following objectives:

- To investigate the pre-project and post-project conditions of the selected sub-projects of the SSWRDSP-I and II of LGED.
- To determine the factors affecting the performances of those sub-projects.
- To assess the performance of the Water Management Cooperative Associations (WMCA) of the selected sub-projects.

Three sub-projects of SSWRDSP of LGED are selected as study areas. Of selected sub-projects, two are selected from Phase-I and one from Phase-II of SSWRDSP. Out of those two sub-projects from Phase-I, one is selected on the basis of performance rated above average and the other one is selected as performance rated below average.

The study is provide an insight into the physical and institutional interventions carried out in SSWRDSP-I and II and their impacts on the performance of the participatory water management of the projects.

1.4 Organization of Report

In Chapter I, Introduction, the preface, significance and the objectives are presented. The management of Water Resources project is one of the prime objectives in a land like Bangladesh. From an assessment of past performance of water sector projects in Bangladesh it is found that the performance of that project has often remained below expectations due to lack of peoples' participation, inadequate planning, improper operation and maintenance.

In Chapter II, Literature Review, some relevant literature is reviewed in this section and detailed background information about present practice of participatory small scale water management is presented. Small Scale projects are managed by Water Management Cooperative Association (WMCA) in field level.

In Chapter III, Methodology, major criteria for performance evaluation is identified (including the selection criteria of study area) and data collection procedure is presented. At first all relevant stakeholders of the project is identified and their objectives are listed. Find out pre-project and post-project conditions of the selected sub-projects Analyze the projects by several indicators considering infrastructural, agricultural, socioeconomics, environmental and institutional (i.e performance of WMCA) aspects and identified to quantify factors affecting project performance. Questionnaire investigation through several field visits to small scale project is the main source of data for analysis.

In Chapter IV, Study Area, a short description about study area/sub-project is presented. In this part; location of the study area/sub-project, sub-project development concept and objectives, geographical characteristics, population and household status, major structural components and an overview of WMCA of each sub-project is described.

In Chapter V, Analysis and Evaluation of performance of selected sub-projects are presented in respect to agricultural, socio-institutional, environmental etc.

In Chapter VI, Result and Discussion, performance evaluations are presented and revolutionize the project areas are identified. It was done on the basis of agriculture production, economic effects, and social and environmental effects and finally it has to draw a comparative summary among the study areas of this project.

Several conclusions from the study have been drawn and are presented in chapter VII. One major conclusion is that without peoples' participation there is less likelihood of total success of the projects.

Chapter 2

Literature Review

2.1 Assessment of Performance of Water Sector Projects

The National Water Policy has emphasized the establishment of stakeholders' participation for ensuring direct input from people at all levels. Lack of stakeholders' participation is considered as one of the most important factors for inefficient output. Hence, to improve the performance of Flood control, Drainage and Irrigation (FCDI) projects, beneficiaries should share the responsibilities of O&M and it is essential to have their direct participation right from the project planning and/or rehabilitation stage (World Bank, 1987).

An assessment of past performance of water sector projects is presented in Table 2.1.

Table 2.1 Assessment of past performance of water sector projects and interventions

Project type	Performance/Impact (1)				Relative GoB O & M Burden (2)	Ease of Implementation and Management (3)
	Technical	Social	Environmental	Economic		
Rural FCD						
Inland embankments and polders	M	L	L	L	H	M
Coastal embankments and polders	M	M	L	M	H	
Compartmentalization Pilot Project	M	L	M	L	H	L
Small–scale FCD	H	M	L	H	L	M
River training and bank protection	M	H	M	M	H	M
Urban FCD	H	H	M	H	M	M
Small-scale Irrigation						
Barind DTWs	H	H	M	M	L	M
Rubber Dams	H	M	L	M	L	M
Khal Re-excavation	M	M	H	M	L	L
Large-scale Irrigation (3)						
Primary pumping	L/M	M	M	L	H	M
Gravity supply	M	M	M	L	M	M
Flood Proofing						
Structural	H	H	H	H	L	M
Non-structural	H	-	-	-	M	M

(Source : NWMP,2001)

Note : (1) L = Low Performance/Negative Impact, M = Medium Performance/Neutral Impact, H = High Performance/Positive Impact. Two letters together (e.g M/H indicates a high degree of variability in performance.

(2) Taking account of the degree of recovery of O & M costs from beneficiaries

(3) Net benefits are higher where there is little STW irrigation potential.

It is stated that large and medium scale FCD project performance varies from medium success to failure. It is due to poor economic returns, complexity of operation and management and uncertainties regarding the beneficiaries' willingness to accept full responsibility for O&M. Moreover, they have several major negative impacts, such as the loss of fisheries, navigation and soil fertility, and the exacerbation of drainage problems.

While the small-scale projects of LGED appear to be more attractive and sustainable than large-scale projects. Apart from its low costs, it has the merit of being highly participatory, with beneficiaries' ability to take over the O&M fully. But long-term sustainability is still unproven, because not much time has elapsed for the O&M arrangement to be properly tested.

Some related literatures are reviewed in the following section

Hamid et al. (1978) also evaluated the performance of the GK project from the viewpoints of technical, economical and organizational aspects. Among the technical points they have mentioned irregular and inadequate power supply to the pump house, unsatisfactory arrangements for repair and servicing of infrastructure; and inadequate technically trained staff. It has been stated that the project has significant positive impact on crop yields but produced no favorable effect on benefit distribution. They have noticed the organizational problem like lack of co-operation among organizations, lack of control at the lower level in water distribution, lack of power in taking independent decision, etc.

Ahmed (1987) evaluated the performance of Chandpur Irrigation Project (CIP) of BWDB in the Chandpur district on agriculture sectors (cropping pattern, cropping intensity, crop yield and production, agriculture inputs use, population and food balance, impact on fisheries) and socio-environmental aspects (employment

opportunities, transportation and navigation, water logging and drainage problem, water hyacinth problem, cooperatives and credits). The study revealed that radical positive change in cropping pattern has taken place in CIP. The cropping intensity has also jumped from 160-170% in pre-project stage to 225% after project implementation. Yields for individual crops have also increased (for T. Aman HYV, yield increased 64.6%). Consequently the total production of rice and others crops has increased significantly. Employment opportunity has increased in agricultural sector, but the project has also reduced the seasonal under-employment, which was a chronic problem in other flood prone areas. Direct benefits were also obvious in case of road transport. Fish production from the open water resources declined 35%. The impact of CIP on fisheries was *a* glaring example of the ecological consequences of water development projects in Bangladesh. But at the same time it showed how successfully the adverse impacts were overcome by taking proper remedial measures.

Hifaf International (1989) evaluated the performance of thirty-nine small-scale water resources projects of LGED in certain localized areas in Kurigram and Faridpur districts. This study included comparison of agricultural regime during pre and post-scheme periods, potentiality of more intensive cropping through modern agricultural practices and feasibility of irrigation farming through STW or LLP. The adoption of flood control, drainage and irrigation measures has changed the land type from high to mid-high and from low to mid-low. The possibility of flood and drainage congestion resulting crop damage has eliminated. Irrigation technology has been adopted in the project areas in limited scale after implementing the projects. But a noticeable change has taken place in respect of adoption of HYV crop cultivation. No change was observed in respect of credit after the project.

Azad (1990) evaluated the performance of three selected small-scale flood control, drainage and irrigation projects (Sonail Embankment, Naldanga and Chatlar-Fukurhati Beel Project). These are located in Gaibandha and Faridpur districts in Bangladesh. This study evaluated the performance selected project in terns of crop yield, cropped area, cropping intensity, land use pattern, income distribution and labour force by occupation in pre and post project condition. The technical and

management problems in proper operation and maintenance of the projects were also identified through field observations and questionnaire survey. Cropping pattern of the project areas has been changed from low yielding varieties to high yielding verities. The income of household in the project has been increased but the per capita income has not been increased due to growth population. The existing problems identified were improper operation of gates, lack of maintenance of the physical components and absence of standard water management practices in the project areas. This study recommended for the improvement of utilization of the existing facilities in the project area. A standard operation procedure of structures should be followed and gates should be operated by permanent and trained operators. Embankment and structures should be repaired and maintained properly. A standard water management practice should be followed in the project areas.

Rahman (1990) evaluated the performance of three selected small-scale projects such as Mahajan-Lauhajong project, Polder 65/A-3 project and Mondakini Khal Irrigation project f BWDB. This study visualized the level of their performance from the viewpoints of technical and ago-socio-economic aspects. This study revealed that Mondakini khal irrigation project is a successful one. It's success in respect of different aspect of national development through increased agricultural production and also through socio-economic well-being. Mahajan-Lauhajang project was an incomplete one and Polder 65/A-3 project was in serious state of disrepair; but the result of this study showed their potentiality in obtaining the desired goal if rehabilitated properly. This study revealed that the need for completing the excavation of the drainage canals up to the design requirement in Mahajan-Lauhajong project and rising of embankment height by another meter with reconstruction of breached portion of embankment in polder 65/A-3 project for their proper functioning. It was also felt that completed project should be supported with adequate maintenance fund and fostered by a local project maintenance committee formed of the member from the beneficiaries and backed by BWDB.

Faruquee and Choudhry (1996) made an effort for improving the water resource management in Bangladesh by suggesting an analytical framework for an improved

water management system. They suggested to treat water as an economic good and also gave suggestions to decentralize the Water management and delivery systems. In addition they highly emphasized on the formulation of the national water sector policy, policy on water pricing and cost recovery public sector management and investment strategy.

BUET, BIDS and WL/delft hydraulics (2003) evaluated the performance of thirty sub-projects of Small-Scale Water Resources Development Sector Project Phase I (SSW-I) during the period from April 1996 to December 2002. The Local Government Engineering Department (LGED) implemented these projects. Selected 30 sub-projects (randomly) located in the western half of Bangladesh. The performance of these projects was evaluated from the viewpoints of technical, social-economic, institutional and environmental aspects. The evaluation focused on the project framework ensuring sustainable operation and maintenance (0&M) of small-scale water resources interventions, with special reference to the (i) institutional set-up through Water Management Co-operative Associations (WMCAs) (ii) quality of the infrastructure and its social acceptability (iii) poverty reduction issues (iv) institutional strengthening of LGED and other agencies involved. Distinction was made between the number of projects scoring more than 70%, regarded as good, the number of projects score between 50% and 70%, requiring continuous supports and attention, and the number of projects with a score below 50% considered as insufficient. It was found that about 47% of the sampled sub-projects showed a good score on technical issues and 17% score below the expected acceptable standard. For the remaining criteria only one out of the thirty projects reach a good score. The valuation of the socio-economic output was highly dependent on the perception of the respondents to the questionnaires in the field. The valuation of these sub-criteria therefore were made based on theoretical relations between the direct socio-economic outcomes such as agriculture, fisheries and employment and the expected distribution of such benefits between the poor and landless people and women. When considering the institutional criteria only one of the thirty sub-projects qualifies with a score above 70%, and about 20% of the sub-projects rank with a score above 60%. For the improvement of project performance the study recommended that (i) enhance involvement and participation of beneficiaries and stakeholders. (ii) focus on

enhancement of the Water Management Unit's capacity and capability for identification, formulation, data collection, appraisal preparation, design, construction and supervision of small-scale water resources schemes; (iii) more attention to the identification and determination of the expected socio-economic outcome of the sub-project, including a through baseline survey and study; (iv) specify measures should be taken to ensure that poor people, small farmers and destitute women get benefit from the sub-projects.

Mukherjee (2004) evaluated the performance of three-selected small scale water resources development sector sub-project of LGED (Brazamul FCD, Agrani CAD and Gangarampur FCD sub-projects) and one medium scale water sector development project (Narayanganj-Narsingdi Irrigation Project) of BWDB. The evaluation focused on hydraulic, agriculture, socio-economic and environmental aspects. The problems encountered in these schemes were: no clear operational instruction, which lead to conflicts between the technicians and the farmers; no equitable water distribution at field level; no cost recovery; no proper conflict-handling etc. Improper system Maintenance and lack of beneficiary participation was found, which was the main reason behind the lesser success of the water schemes. This study revealed that partial decentralization in LGED schemes helps in sustainable agricultural and overall financial development, but almost in every case the rate of farmer's involvement or beneficiary participation in system management was found not satisfactory. This study recommended that the performance of existing FCDI projects can be improved significantly by enabling increased people's participation in local level and by developing a suitable management approach that will have a strong institutional setting. In Bangladesh it is a prime need to develop water management system through participatory approach especially in case of irrigation, drainage and flood control systems.

Rana (2004) evaluated the Participatory Water Management Approach (PWMA) following GPWM systematically in Narayanganj-Narsingdi Irrigation Project (NNIP) and necessary modification was made to this approach with the help of BUET-DUT Project and BWDB. For better performance of the PWM intervention work, various

aspects of the research were supervised and monitored. Check list and questionnaires were prepared for systematic recording of the information. Coordination were maintained both for (i) functional activities of various institutions and (ii) various components of intervention work to ensure better performance through improve participatory water management. The impact of the applied PWM intervention work in NNIP was evaluated in terms of parameters chosen as indicators of the project's goals and achievement. Technical, Institutional, Agricultural, Socio-economic, Financial and economical all aspects were considered for performing the impact assessment. The evaluation involved comparison of the values of the indicators for pre and post intervention conditions. The intervention work in NNIP produced significant positive results in terms of crop productivity, agricultural returns, household income, supply and distribution of irrigation water and farmers willingness to participate in operation and maintenance of the project. Hydraulic assessment shows that overall reliability of the canal systems has been improved and the average relative water supply at agricultural plot was higher compare pre intervention condition. Another most positive aspect of the intervention work in NNIP was that the coverage of irrigated area was increased significantly which was from 64.29% to 90.55% resulting irrigation systems performance better. But in institutional improvement, limited success has been achieved. Though all WMGs and one WMA were formed in NNIP area, their activities in all cases were not remarkable. Still lack of linkage with BWDB project level authority and also be late for service charge collection. Considering all those aspect, a modified PWM framework has been proposed for NNIP in this study which may result better system management and the beneficiaries could reach remarkable success from this project in future.

Bhuiyan et al. (2006) evaluated the PWM application by the LGED in SSWRDSP and other BWDB in large-scale FCDI projects. As such an attempt has been made to evaluate 4 small-scale projects of LGED and 3 large-scale projects of BWDB externally through a set of questionnaire survey, extensive field visit and group discussion. Subsequently this research is designed to evolve a suitable operation and maintenance (O&M) management practice for BWDB existing projects in particular and other similar existing projects in general, in line with government policy and

guidelines. As such the findings obtained with pilot and external/field evaluations are in use to workout the above stated water management practice. At NNIP, a two-tier water management organization (WMO) comprising 40 Water Management Groups (WMGs) at the lowest tertiary canal level and one Water Management Association (WMA) as an apex body of the local stakeholders has been institutionalized since 2003-04 in order to assume the everyday water management of the project from the BWDB. Three aims have been identified for the establishment of PWM approach: to ensure beneficiaries' participation, self-control of the management, and O&M cost reduction and its effective use. As such, three seasons' data (pre-PWM: 2002-03, post-PWM: 2003-04 and 2004-05) have been collected in order to evaluate the performances and suggest further modification that might be necessary for PWM practice. Under this research, a group of technical and extension staff of BWDB have been engaged, to work with the local beneficiaries in the field related to irrigation and O&M activities and at the same time to help in setting the local institution. The extension staff was involved in motivating the local beneficiaries for organizing meetings, decision-making, electing/selecting of the EC members, helping in preparation of irrigation plan and schedule, service charge collection and put in the bank account, training the beneficiaries (for technical, agricultural and institutional), etc. The research team was in touch with the field staff of the NNIP, to monitor their everyday activities. This deal was being arranged in consultation with higher BWDB officials to implement the PWM. At the same time the research team was involved in monitoring the impacts of the PWM approach at NNIP, so that it can be used as a lesson learning event and may eventually evolve a model for the future implementation of the management practice throughout the country. A number of performance evaluations are described based on pilot-scale PWM application at NNIP such as technical, agricultural, financial and economic, environmental and socio-institutional performance. In socio-institutional performance the following matters were considered: formation process of the institution, effectiveness, beneficiaries' involvement and sustainability of the institution. Based on the pilot-scale experience at NNIP and other external/field evaluations of LGED and BWDB water resources projects, a range of modifications of GPWM has been proposed for application under PWM in the existing water resources projects of Bangladesh.

2.2 Participatory Approach in Water Management in Bangladesh

The cultivable lands of the country are increasingly coming under water management system. However, the declining groundwater level and poor performance of many water management systems indicate the necessity of improvement of the management (Datta et al., 1999; Jordans, 1998). Government of Bangladesh trying to conserve and use surface water more efficiently and effectively through different organizations (e.g., BWDB, LGED, etc) introducing participatory water management.

The concept of water institutions with beneficiaries' participation came first in late 1970s, through two Dutch assisted projects, Land Reclamation Project and Delta Development Project (Quassem, 2001). Beneficiaries were supposed to be involved in planning, execution and operation and maintenance of the infrastructure of the system. The initiative was in isolation, not linked to the mainstream activities of the sector and did not obtain enough support due to resistance from local elites. Both Land Reclamation Project and Delta Development Project finally lost their drive by the mid-1980s. However, since early 1990s, the issue has set off again by the NGOs and the donor communities. Peoples' participation in the water sector management has been greatly influenced as a strategy for poverty alleviation of the country.

In 1994, Ministry of Water Resources issued a set of Guidelines for People's Participation (GPP) in Water Development Projects, which marked a major advancement in water management policies, and envisaged setting up institutions of local people along with officials of agencies. In 1999, a revised guidelines — Institutionalizing Local Participation: Proposal for Guidelines for Participatory Water Management were issued, which has particularly addressed the rights, duties and responsibilities of all those involved in the processes of water development and system management rather than only the procedures to involve people in the processes. In the meantime Local Government and Engineering Department has also prepared a number of reports as: Guidelines and Manual for Operation and Maintenance of Small-Scale Water Resources Schemes (1984), Guidelines for Operation and Maintenance of Small-Scale Flood Control and

Drainage Schemes (1986), and Guidelines for Participatory Process of Small-Scale Water Resources Development (revised draft —1999). In the admittance of too many guidelines and as a consequence upon the declaration of the National Water Policy in 1999, an Inter-Agency Taskforce Committee reviewed all the approaches in this consideration and prepared the current Guidelines for Participatory Water Management (GPWM, 2000) in the sector. The current guidelines have tried to avoid conflicts, removed duplications, accommodated flexibility, integrity and complementarities of participatory water management in the country.

The main purposes of the new guidelines are as follows:

- Elaborate the provisions incorporated in NWPo (1999) in respect of stakeholders' participation.
- Make available harmonized GPWM for application in the field.
- Increase stakeholders' involvement in water management.
- Give local stakeholders a decisive voice at all stages of water management.
- Raise environmental awareness among local stakeholders and the implementing agencies involved with PWM, etc.

The ultimate targets of the guidelines are:

- Develop capacity of the local stakeholders in PWM.
- Gradually establish ownership of local stakeholders in water resources management.
- Achieve sustainable PWM, etc.

2.3 Small Scale Sub-projects of LGED

As mentioned earlier that LGED is the authorized for implementing and maintenance the small-scale projects in Bangladesh. Currently, LGED develops water bodies/areas up to 1000 ha as subprojects under the 'Small Scale Water Resources Development Sector Project (SSWRDSP)'. The aims of this Project include sustainable agricultural growth and poverty alleviation by developing water resources, with main emphasis on people's participation.

The SSWRDS Project of the first phase commenced in 1995 -96 and originally it extended over the 37 districts of the western half of Bangladesh. 280 subprojects have been completed with a total benefited area of about 165,000 ha In 2002 the Project extended, as a Second Small Scale Water Resources Development Sector Project (SSWRDSP-2), to include the eastern half of Bangladesh. About 300 subprojects improving agriculture over an aggregate 190,000 ha benefited area will be implemented under the SSWRDSP-2 (LGED, 2002).

2.3.1 Sub-project Development Process

Components of SSWRDSP Sub-projects

The project activities are grouped into two components: Participatory Water Resources Development and Institutional Strengthening of the Small-Scale Water Resources Sector.

Participatory approach to Sub-project development:

In support of participatory development of the anticipated 300 subproject, the Project utilizes a process of selection, appraisal, and design involving area stakeholders throughout its implementation. To this effect, Water Management Cooperative Associations (WMCAs) are being established and provided with substantial institutional support for 3.5 years before and during construction. Extensive training is provided for mobilizing beneficiaries to participate in subproject selection, planning, implementation and O&M.

The following activities are carried out to ensure participation of the stakeholders in the subproject development process:

- Subprojects are identified by Union Parishads
- Social feasibility is checked by independent Participatory Rural Appraisal(PRA)
- Peoples' participation is institutionalized in Water Management Cooperative Associations (WMCAs)

- Close interaction between technical designers and WMCAs
- WMCA observes construction
- WMCA is fully responsible for O&M of the subproject
- WMCA monitors and evaluates activities which results in future developments.

Institutional strengthening for Small Scale Water Resources Development

Institutional strengthening is to enhance the capacity of concerned organizations to effectively participate in small-scale water resources development. This program includes (i) the advisory services of and international consulting firms in association with national firms, and (ii) training of organizations (other than WMCAs) involved in the Project's implementation.

Co-ordination with other agencies

SSWRDSP has mobilized several agencies, which provide support to subproject beneficiaries. These includes: Department of Agriculture Extension (DAE), Bangladesh Agricultural Development Corporation (BADC) under the Ministry of Agriculture, Department of Fisheries (DoF) under the Ministry of Livestock and Fishery, Department of Cooperative (DoC) under the Ministry of Local Government, Rural Development and Cooperatives, Forest Department (FD), Department of Environment (DoE), Bangladesh Rural Development Board (BRDB), Department of Livestock Services (DLS), Ministry of Land (MoL), Ministry of Women & Children Affairs (MoWCA), etc. The role of these agencies in relation to water sector interventions is to deliver services in their respective field of activity within the participatory framework set out in these guidelines. To legalize the support of these agencies, LGED entered into agreements with each agency through Memorandum of Understanding (MOU). In addition, it is recognized that there is need for close cooperation and coordination of the works with the Bangladesh Water Development Board (BWDB) since they are the major agency for implementing the water management interventions.

2.3.2 Subproject Development Cycle

Each subproject has three distinct stages:

(i) Identification and feasibility
(ii) Design and Institutional establishment
(iii) Construction and first year operation and maintenance

Identification and Feasibility

According with the LGED procedures, the local people first identify a potential subproject by recognizing water related problem(s) in their area. With identified possible solutions, they approach their elected representatives at grassroots level, the Union Parishad members with request for subproject. The Upazila Engineer (UE) would present the proposed sub-project to the Upazila Development Coordination Committee (UDCC). Following the approval of UDCC, UE would enter the sub-project in the Upazila Plan Book and forward the same to the Executive Engineer (XEN). The XEN would review the proposal and forward it to Project Management Office (PMO).

All Union Parishads and many local NGOs have also been briefed on the Project and instructed to encourage their target groups to take the opportunity offered by the SSWRDSP. After it is proposed to LGED via the Union Parishad, and Upazila Engineer, LGED develops a technical and socio-economic information base and starts developing the subproject. As part of the subproject proposal processing, the LGED Project staff assesses/pre-screened the technical feasibilities of the proposed subproject undertaking reconnaissance visits. Where the outcome of the field reconnaissance was positive, the proposed sub-project was assigned to a Participatory Rural Appraisal (PRA) team. PRA methodology is used to determine its social and environmental feasibility with the following objectives:

- To determine if there is broad -based support for the proposed sub-project.
- To determine if there is opposition and, if so, to quantify the extent of opposition.

- To assess the willingness of potential beneficiaries to organize themselves into a Water Management Association and to take responsibility for O&M.

Proposed subprojects that pass all the feasibility tests are basically declared feasible and sent to the District Level Inter-Agency Project Evaluation Committee (DLIPEC) for discussion, approval and inclusion in District Work Plan.

Design and Institutional establishment

After the Project Management Office of LGED approves the proposed subproject, a parallel process of detailed designs and institutionalization of people's participation start. The infrastructure design by the feasibility consultant is preceded by field data collection and analysis. In both, the engineering analysis and detail design the consultants use the existing computer based software and the LGED Design Catalogue.

The subproject institutional development is accomplished through organizing various local stakeholders under a Water Management Cooperative Association (WMCA), within the legal framework of the Co- operatives Act. The first step in this process is fielding the NGO facilitator. His involvement is for the duration of the subproject implementation cycle during which he works closely with the Upazila based LGED Community Organizer (CO). The facilitator's main task is to assist the subproject population in all phases of the subproject. His brief is "to be on the side of the people".

At district level, the SSWRDSP employs a Socio-Economist, who assists the LGED staff in responding appropriately to the active involvement of all stakeholders. The Socio-Economist also assists the WMCA in getting registered with the Co-operative Department, and helps them to establish contacts with other Upazila level GOB staff (agriculture, fisheries, social welfare, women affairs etc.). A district level Assistant Engineer, a Surveyor and a Draftsman assists the regular LGED staff in all technical matters.

The facilitator's first task is to start a broad information campaign at village level. Following that he makes a total inventory of all households inside the subproject area and those living outside it, but project-affected. In the process he identifies existing stakeholders groups and respected local leaders. From among the latter, a small number of men and women are asked to form a "Bylaw drafting Committee". When they have completed the draft bylaws, they are transferred into a "First Management Committee" by adding representatives of farmers, fishermen, landless and women.

The First Managing Committee is involved in a variety of institutional activities such as:

- formation of village or occupation based groups
- membership enrolment
- conflict mediation and resolution
- formation of the Water Management Cooperative Association (WMCA)
- applying for registration of the WMCA
- preparing the WMCA's first annual general meeting.

The main aim of these institutional activities is to create a strong and broad-based water management organization. It is the platform for all decisions on the management of water resources. This includes resolving the inevitable conflicts of interest between the various stakeholders.

Shortly after the first management committee is operational, the design engineers present a draft of the subproject concept and preliminary designs for review by the first management committee. Based on the outcome of the discussions with the stakeholders, the designer makes the necessary adjustments, if necessary, and includes possible mitigation measures in a "draft final design". The "draft final design" is presented for discussion and approval at the first annual general meeting of the WMCA.

It is at this general meeting that all the WMCA members have the final say in whether or not the subproject should go ahead as designed. To ensure sustainability a near unanimous acceptance of the design is needed. After the first Annual General meeting at which the WMCA has accepted the design, and when the first elected Managing Committee is in place, a formal agreement is signed

between LGED and the WMCA for implementation of the subproject. This agreement includes the agreed design drawings as well as the responsibilities and rights of both parties.

In the first phase of the SSWRDSP the role of Local Government Institutions has been limited to subproject identification and conflict resolution. Since the start of the SSWRDSP-2, the government has issued new instructions to the Union Parishad on its role in development activities, including water. As a result, the Union Parishad will be given an advisory status towards WMCAs. The project is now arranging trainings for Union Parishad members regarding participatory water management issues and their involvement in subprojects is likely to grow in the years to come.

Construction and First Year Operation and Maintenance

During the construction and first year's operation and maintenance stage, the parallel technical and institutional processes continue.

People's participation in this stage is mainly in three areas:

(1) Contributing the required "beneficiary contribution"
(2) Ensuring right of access of the contractor to all building sites, and
(3) Observing the construction work.

The beneficiary contribution is a crucial part of the SSWRDSP methodology to ensure subproject sustainability. Therefore, after signing the Implementation Agreement and before tendering is started, the WMA has to collect the first year O&M contribution. This contribution is designed to test the commitment of the direct beneficiaries of the subproject, which in most cases are farmers and fishermen. It is calculated to be equivalent to the cost of operating and maintaining the infrastructure for a year (3% of earthwork and 1.5% of structures cost) (SSWRDSP, 1998).

The WMCA is involved in observing construction. The implementation Agreement includes detailed procedures, which allow only the Upazila Engineer to issue instruction to the contractor. The WMCA and Union Parishad members have the right

to lodge written complaints to LGED. To ensure their independence, the WMCA managing committee members cannot work as contractors in any of the construction works under the subproject.

To channel project benefits to the landless, much of the earth moving work is done by Labor Contracting Societies (LCS). Their members are trained by the project retained NG0s. Destitute women and Widows are given preference in joining the LCS.

After the construction work is completed and the contractor's liability period is over, LGED assists the WMCA for at least one season and up to a full year in operating and maintaining subprojects. During this period LGED has to prove that the infrastructure delivers the promised results. After that year, the WMCA formally leases the subproject infrastructure from LGED.

During the first and subsequent years of operation the WMCA is likely to spend a considerable time resolving conflicts of interests between various stakeholders. If the WMA is not able to resolve a conflict it would invite others to mediate. Normally this would start with the Union Parishad Chairman, then the Upazila Engineer and in extreme cases the LGED District Executive Engineer.

Depending on the complexity of the subproject, the construction and first year O&M may last between two and three years. After taking over the subproject, all aspects of operation and maintenance become the sole responsibility of the WMCA.

The subproject O&M includes:

- Preparation and updating annually operation plan and budget
- Preparation and updating maintenance plan and budget
- Preparation and updating fund collection plan
- Establishing systems for monitoring, evaluation and follow-up action.

The beneficiaries are responsible for conducting operation and maintenance and for 100% of its cost. Normally, the necessary local resources will be collected from the direct beneficiaries in proportion to the benefit they receive. In addition joint activities such as tree plantation, fisheries activities and poultry farming may generate

resources for the O&M. Destitute women are given preference when it comes to preventative maintenance work on embankments.

Once the subproject is operational the people in the area are likely to change their agricultural practices, fisheries and other production systems to make the most of the new environment. The project assists the people in linking up with other government and non-government resources that will facilitate these changes. For that reason a number of memorandums of understanding have been signed between LGED and other agencies.

2.3.3 Subproject Management System

WMCA Management

WMCAs have been formed in all 280 subprojects (SSWRDSP, 2002). These are legal bodies that are registered under the cooperative law and self managed through a Managing Committee that operates in accordance with a set of bylaws prepared by a Bylaw Drafting Committee and ratified by the WMCA General Membership. Sound management of the WMCA by the Management Committee is of critical importance to ensure the participation of the beneficiaries and ultimately to achieve the goals of the investment.

To promote sound management, each WMCA Management committee, through an initial orientation course, is instructed to undertake the following:

- Establish a physical location that will become the office where meetings can be held, where day-to-day cooperative business can be carried out, and where records and documents kept available for general access.
- Appoint at least one staff person as a manager to maintain records and undertake other tasks on behalf of the WMCA management committee. Usually this individual is paid a normal salary or allowance by the WMCA.
- Conduct weekly membership meetings, the primary focus of which is to increase membership and mobilize capital.

- Conduct monthly management committee meetings to deal with the business of the cooperative.
- Conduct elections within the time frame stipulated by the cooperative law.
- Organize meaningful economic/business activities for the membership.

In addition, the management committees are systematically being provided with in-depth training by the cooperative department, which is designed to provide them with additional skills to assist them in fulfilling their roles.

Desk study has showed that many WMCAs have adopted sound management practices and comply with the activities described above. However, in some of the WMCAs, the management is far from satisfactory. Where the management is unsatisfactory, the WMCA exhibit some of the following characteristics of inadequate management:

- Office accommodation is not established. As a result, records and other management documents are not accessible to the general membership and will, in time, to be lost to the cooperative. This reduces transparency and also affects the ability operative to conduct regular meetings.
- No staff or manager has been appointed to carry out day-to-day tasks on behalf of the cooperative. As a result, records are not properly maintained, meetings are not held, and when they are held, proceedings are not documented. Without regular meetings, capital is not mobilized and membership enrolment at WMCA stagnates and little or no meaningful business is conducted.
- Elections are not held. The WMCA is a democratic organization that requires election of the management committee at regular intervals. In some cases, after the date for elections has elapsed, the District Cooperative Officers in accordance with the law, have permitted the formation of ad-hoc management committees to continue running the business of the WMCA in lieu of an elected committee.
- Management committees are generally not giving enough attention to organizing meaningful economic/business activities for the membership.

2.3.4 The Cooperative Institutional Framework

The Cooperative Institutional Framework was selected during Project Appraisal to accommodate the perceived need to have a registered organization that could collect funds, operate bank accounts and be subject to external audit. In the course of implementing this, a number of concerns were raised. The most serious of these are (i) that the cooperative structure is unnecessarily complicated for a water management organization, and (ii) that the multipurpose cooperatives dilute the focus on operation and maintenance (LGED, 2000).

The project goals are to ensure sustainable agricultural growth as well as poverty reduction. With the inclusion of the poverty agenda, it becomes necessary to promote heterogeneous membership in the cooperative and, by extension the cooperatives need to address the needs of clientele beyond beneficiary farmers. Membership in a cooperative association is open to any adult member from within the geographical boundary of a subproject that wishes to join the association. The expenses of the SSWRDSP to large extent accepted the cooperative as a credible institution for water management and poverty alleviation together at the local stakeholder level.

2.3.5 Operation and Maintenance of Small-Scale Project

It is assumed that small-scale water resource programs are simple, so no major inputs are required for their implementation and O&M. Depending on foundation, hydrologic and hydraulic conditions, planning, design and implementation of even a very small structure may pose great difficulties. In addition, on the social side, in water resources projects there are conflicts among the users of lands at various elevations, between fishers and farmers, between navigation and water conservation, which make the assessment of surface water projects complicated. Because of its complicated nature stakeholder participation is essential for developing and maintenance different type surface water subprojects. In-depth training and on-the-job experience is required to develop capability for planning, design, implementation and O&M of subprojects, which would be acceptable to the stakeholders.

After implementation the subproject, LGED transfers the ownership of the subproject to the WMCA, which, from now on, is responsible for the entire infrastructure within the subproject area. WMCA prepares O&M Plans, Agricultural Plans, Fisheries Plans, and Resource Mobilization Plan etc.

If the local stakeholders face any problem, first they would try to solve it by consulting their WMCA members. If WMCA members cannot solve the problem, they would inform the LGI associating with the Executive Committee members of WMCA and finally the LGED.

The general institutional framework for participatory water management of small-scale subprojects of LGED is shown in Figure 2.1.

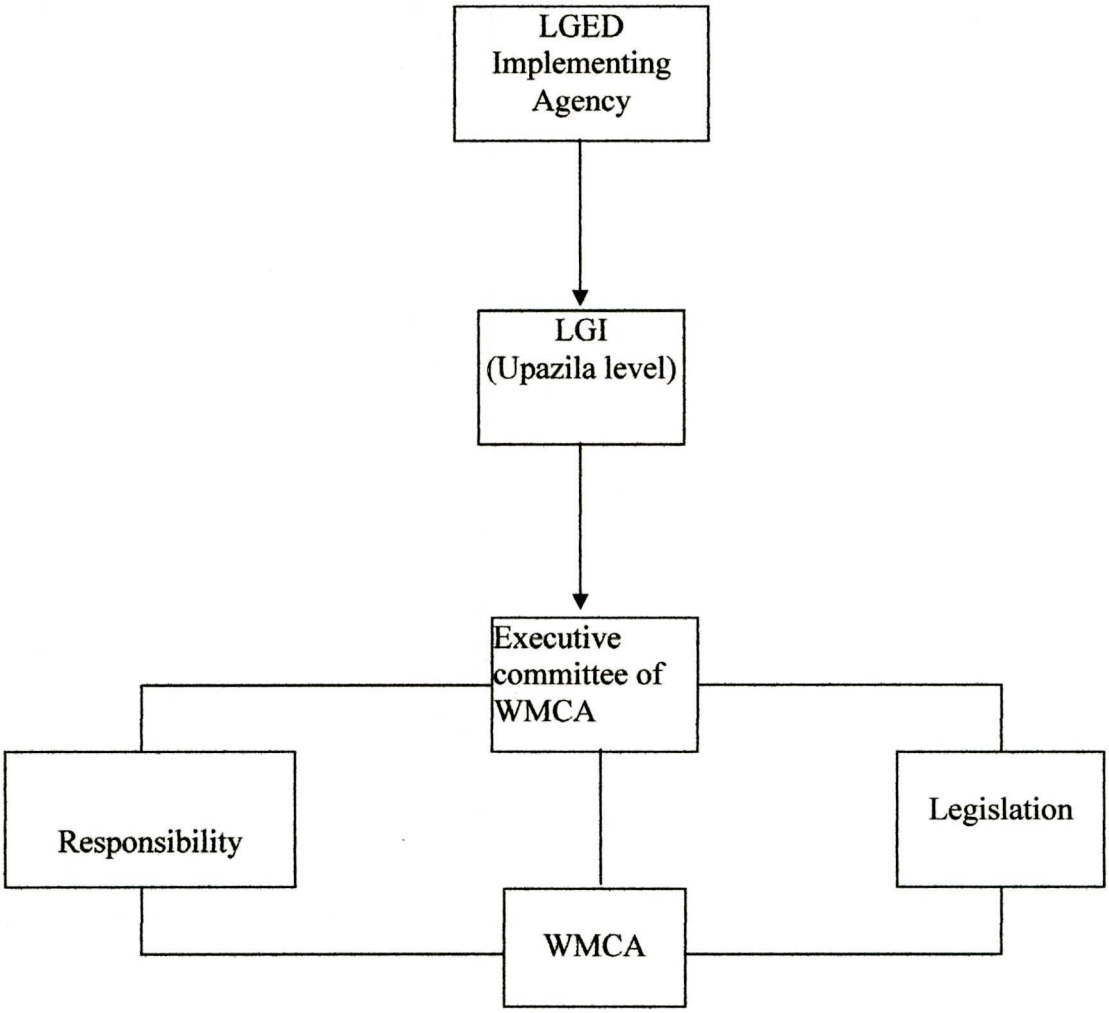

Figure 2.1 The institutional framework for O&M of small-scale project of LGED

2.3.6 Legal Framework of WMCA

In SSWRDSP subproject, Water Management Co-operative Association (WMCA) means a co-operative society which is formed to accommodate the project goals and to improved the socio economic & institutional conditions of its member by way of providing various facilities and services and the members of which are beneficiaries of a subproject. Sound management of the WMCA by the management committee is of critical importance to ensure the participation of the beneficiaries and ultimately to achieve the goals.

Registration of water management organization is done within the framework of the Cooperative Societies Ordinance, 2001 and the Cooperative Societies Rules, 2004 as amended from time to time. The registration of an organization gives them the power to hold property, to enter into contracts to institute and defend suits and other legal proceedings and to do all things necessary for the purposes for which it was constituted. So the organization registered will dictate them to form managing committee (already stated above) constituted in accordance with the Cooperative Societies Ordinance, Rules and the bye-laws to be framed there under. This system of registration will prevail till the government frame separate rules for registration of the water management organization for PWM. The terms and conditions of the sample agreements for ownership transfer, taking over of management, private management through leasing management contract under competitive bidding procedure or joint management for projects schemes of different sizes are also given in GPWM (2000).

Chapter 3
Methodology

3.1 General

The performances of the PWM at the selected study areas are planned to be represented by its measured levels of achievements in terms of one or several parameters, which are chosen as indicators of the project's goals or objectives. It is the measure of effectiveness with respect to the achievement of the desired objectives of the project. In most water management systems five categories of goals or objectives are generally present, either explicitly or implicitly. The relative importance ascribed to each of these goals is: productivity, profitability, equity, sustainability and quality of life. Here the quality of life is a relative matter, may vary and are often a matter of social and political judgment.

The process of performance evaluation consists of measuring the extent to which targets are being met at the end of a given time, and thus requires that all relevant input and output are quantified or evaluated. This evaluation is done through performance indicators. The quantitative and in some cases qualitative values of the selected indicators should serve as the degree of achievement for each of the goals or objectives of the system.

3.2 Sub-project Selection Criteria

In this study, three sub-projects of SSWRDSP of LGED are selected as study areas. Of these selected sub-projects, two are from Phase-I and one from Phase-II of SSWRDSP. Out of those two sub-projects from Phase-I, one is selected on the basis of performance rated above average and the other one is selected as performance rated below average. These performances are reported by LGED officials and previous field investigations of different researchers. On the other hand, selection of these sub-projects is based on availability of data and its accessibility to the study areas.

The three sub-projects are: (i) Brazamul-Bhitikhal Sub-project at Pangsha Upazila of Rajbari District, (ii) Fuleswari Sub-project at Madhukhali Upazila of Faridpur District, and (iii) Alamkhali Sub-project at Dhamrai Upazila of Dhaka District. The first two are selected from Phase-I and the third one from Phase-II of SSWRDSP.

3.3 Selection of Performance Indicators

An efficient indicator of performance must satisfy certain standards. It must be quantifiable at sufficient level of accuracy. It must also be easily perceivable and cost of measurements related to the indicator must not be very high. A good performance indicator should also have both an actual value and a target value that enables the user to quickly assess the deviation.

The set of indicators is used to allow for individual and cross-system performances. Different indicators suggested in the literatures (Abernathy 1989, Bos and Nugteren 1993, BUET 1992, Levine 1982, Zhi 1989, Rao 1993, Small and Svendsen 1990) are used for the analysis. For performance evaluation of FCDI system, the criteria for selecting the important indicators are as follows:

- The indicators are based on a relative comparison of absolute values within pre- or post-project conditions, rather than being referenced to standards or targets.
- The indicators related to phenomena that are common to FCDI supported agricultural systems.
- The set of indicators is small, yet reveals sufficient information about the output of the system.
- Data collection procedures are not too complicated or expensive.
- The indicators related to output and are bulk measures of irrigation and FCDI supported systems, and thus provide limited information about internal processes.

Participatory management is an essential prerequisite for improving the performance of FCDI system. Precisely because there is so much water management going on in

FCDI system and there are so many local initiatives to control water, participatory water management is needed to coordinate all the different water management objectives.

The following indicators are considered for performance evaluation of the three selected sub-projects of LGED:

- Agricultural Indicators
- Infrastructural Indicators
- Environmental Indicators
- Socio-institutional Indicators , and
- Sustainability of O&M.

3.3.1 Agricultural Indicators

Even though it is generally understood that water management system increases crop yield, quantitative assessment of this increased yield is essential to understand the performance.

The analysis of agricultural impacts of the selected sub-project has been focused mainly on the changes of agricultural production (tons) and yield (tons/ha) of crops, changes of cultivated areas and changes of cropping intensity. This analysis is done according to different land types. A comparison has been drawn for pre- and post-project conditions

$$\text{Cropping Intensity} = \frac{\text{Cropped Area}}{\text{Total Potential Area}} \text{ X } 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \text{Eq.(3.1)}$$

3.3.2 Infrastructural Indicators

The following matters have been checked to evaluate the performance of the infrastructure:

The vent size, number of vents, location, sill and crest level of the water retention structures have been checked. Conditions of the gate, concrete work, and earth work have been checked to assess the quality of work and maintenance of the

infrastructure. It is important to check/review the alignment of embankment, its crest level, width, side slopes, piping/leakage/rat-hole/rain-cut/man-made cut, quality of the filling materials, tree plantation, etc. In case of canals it has been observed its siltation along with its cleanings of weeds and water hyacinths.

3.3.3 Environmental Indicators

In recent years, there is an increasing demand for paying attention to the impact of the development projects to the environment. There is an ever increasing threat of environmental degradation and subsequent ecological imbalance. Therefore few selected environmental parameters have been considered to indicate the pre- and post-project environmental status.

The major selected parameters of concern are as follows:

i. Impeded drainage and water logging and/or flooding
ii. Impact on land use pattern
iii. Increase in sedimentation in the project area
iv. Decrease in land fertility
v. Effect on public health and sanitation, water born disease etc
vi. Effect on fisheries and livestock
vii. Effect of pesticides and fertilizers
viii. Effect on navigation

3.3.4 Socio-institutional Indicators

The socio-institutional indicators related to long-term impacts of pursuing a particular set of operational and agricultural strategies. Social impacts refer to the effects on people, their well-being, social organization, and livelihoods of any intervention. The sub-projects are organized under an organization named Water Management Co-operative Associations (WMCA). WMCA should play a significant role on the performance of a sub-project. Performances of the existing WMCAs of the selected sub-projects have been assessed considering their registration status, membership, number of female members, election of executive committee, training,

regularity of meeting and its attendance, conflict resolution, beneficiary's awareness, participation in O&M and others activities related to cooperatives. A detailed questionnaire survey has been conducted at each of the sub-projects to evaluate these factors.

As evaluation of participatory water management (PWM) is the main focus of this study, WMCA's performance is the central consideration. However, PWM performance of those WMCA's will also be reflected through their achievements in agricultural productions, environmental status etc.

3.3.5 O&M Execution, Capital Funding & Micro-credit Activities

Long back water is delivered free of charge to the farmers of our country. The government supports the entire cost of the system including the operation and maintenance costs. Only recently water charge is collected from the farmers to cover part of the O&M costs. An evaluation of the system based on financial and economic principles, will give the benefit-cost ratio in order to understand the system performance.

The indicator which will be used for the impact assessment is Financial Self Sufficiency of the sub-project (based on beneficiaries' contribution for O&M, share and savings collection for capital funding, employment generation/wage rate, land value, etc).

$$\text{Financial Self Sufficiency} = \frac{\text{Fee collected}}{\text{Fee due or targeted}} \quad \text{..... Eq.(3.2)}$$

3.4 Data Collection

The necessary data has been collected through two important means – primary sources and secondary sources. Primary data has been collected by field visits, household survey through questionnaires; focus group discussions (FGDs) including interviews with local LGED officials, WMCA executives, and other stakeholders in the considered sub-project areas. For household survey a set of questionnaire has been prepared in line with logical framework for the performance evaluation of the project. Secondary data are comprised of existing project documents and records, information available from various agencies, project benefit monitoring evaluation reports, external evaluation reports, theses, journals and other sources.

The collection procedure of these two categories data is briefly discussed below:

3.4.1 Data Collection through Primary Sources

Primary data have been collected from the selcted sub-project areas by physical investigation through personal observation, focus group discussion (FGD) and questionnaire survey. Fifteen days (5 days in each sub-project) field visits and reconnaissance have been made at sub-project areas under this study to collect the data on flood, drainage, irrigation, agricultural activities and WMCA activities. A checklist has been used for helping systematic data collection.

Field data collection procedure is discussed below:

a. Personal observation and reconnaissance

Detailed data collection sheets have been prepared to collect physical properties of different infrastructures of the sub-projects, to check O&M performance, institutional activities and records of the technical information.

Special emphasis has given to note the following:

- Provision of the physical facilities and its existing conditions (sluice gate, regulator, canal system, embankment, etc) for effective flood control, drainage and irrigation in the project area

- Adequacy of the following of the water retention structure: vent size, number of vents, location, sill and crest level
- Operation and Maintenance of these facilities
- Reasons for failure and engineering problem and constrain with the operation of the project facilities
- Awareness of beneficiaries

b. Investigation through questionnaire survey and Focus Group Discussion

A set of structured questionnaire for systematic data collection has been prepared to collect agro-socio-institutional information. A total of 35~40 households have been selected randomly for investigation in each sub-project areas. In determining the sample size, considerations were given to: the time limit within which the field investigation is to be completed, the area of the project, and the degree of reliability and biasness. Households were selected randomly (all classes of villagers) to avoid biasness. Focus Group Discussion (FGD) has been conducted with different classes of peoples (beneficiaries, officials, executives, etc) in the project area.

The distribution of interviewers among different categories is as follows:

A. Project officials and executives of WMCA
B. Farmers
   Landless (<0.5 acres)
   Small and Marginal (0.51-2.5 acres)
   Medium and Large (>2.5 acres)
C. Women
D. Fisherman and Boatman
E. Traders
F. Local Inhabitants (Teachers, peoples of the areas who are not the member of WMCA)

The following points were given emphasis in this part:

- Project personnel who are directly involved with the operation of the sub-project
- Agricultural data (number of crops, cropped area, cropping intensity, total production, yield, etc) related to pre- and post-projects
- Adequacy of agricultural support services (extension and training, credit, etc)
- Farmer's organizations and their role in O&M
- A chronological record of O&M budget and expenditure

- Yearly and monthly meeting details
- O&M personnel working in the field, and their response to field demand
- Status of WMCA, etc.

3.4.2 Data Collection through Secondary Sources

The following points have been given emphasis for these studies:

- Agricultural production
- Institutional arrangement for O&M of the facilities
- Technological details of the sub-projects
- Financial details of the project investment and O&M cost
- Involvement of beneficiaries in O&M
- Provision for training of officials and beneficiaries
- Provision for institutional development
- Various organization involved and their constitution
- Legislation and transparency

As such desk studies are divided into two major categories:

a. Relevant office documents and records

Data regarding agricultural and socio-institutional aspects have been collected from review of various reports such as pre-feasibility, feasibility, appraisal, detailed engineering design, project benefit monitoring evaluation reports, combined summary appraisal and summary IEE. These reports have been collected basically from LGED's Integrated Water Resource Management (IWRM) Unit, Advisory Technical Assistance (ADTA) of SSWRDSP and different field offices in Upazila levels. Besides, some data have been collected from DAE, Fisheries Department and Department of Cooperatives for further checking and analysis of those collected from LGED's offices.

b. Various published literature

Various published information, external evaluation reports, theses, research and journals, have been studied/collected from different libraries.

Figure 3.1 Discussion with WMCA executive at Brazamul Sub-project.

Chapter 4

Study Area

4.1 Selected Study Area

Three sub-projects of SSWRDSP of LGED are selected for this study purpose. Of these three sub-projects, two are from Phase-I and one from Phase-II of SSWRDSP. The three sub-projects are: (i) Brazamul-Bhitikhal Sub-project (SP13068, area = 504 ha) at Pangsha Upazila of Rajbari District, (ii) Fuleswari Sub-project (SP13057, area = 745 ha) at Madhukhali Upazila of Faridpur District, and (iii) Alamkhali Sub-project (SP23060, area = 442 ha) at Dhamrai Upazila of Dhaka District. The first two are selected from Phase-I and the third one from Phase-II of SSWRDSP.

Brief descriptions of these sub-projects are given in the following sections.

4.2 Brazamul Bhitikhal Sub-project

Brazamul-Bhitikha sub-project is one of the model projects under the first phase of Small Scale Water Resources Development Sector Projects (SSWRDSP-I) of LGED. The project has handed over to WMCA in 2000 as a lease for twenty years. Its performance has been considered as above average by the rating of the LGED officials.

4.2.1 Location and Map

Brazamul-Bhitikhal sub-project is located between 23°39′N to 23°42′N and 89°25′E to 89°28′E in the Pangsha Upazila of the Rajbari District. The sub-project comprises seven villages under Shaorail union. The villages are: Paturia, Jatubpachbari, Bhiti, Laribari, Ghatora, Boro Bila and Brazamul Banagram. A map of the sub-project area is provided in Figure-4.1

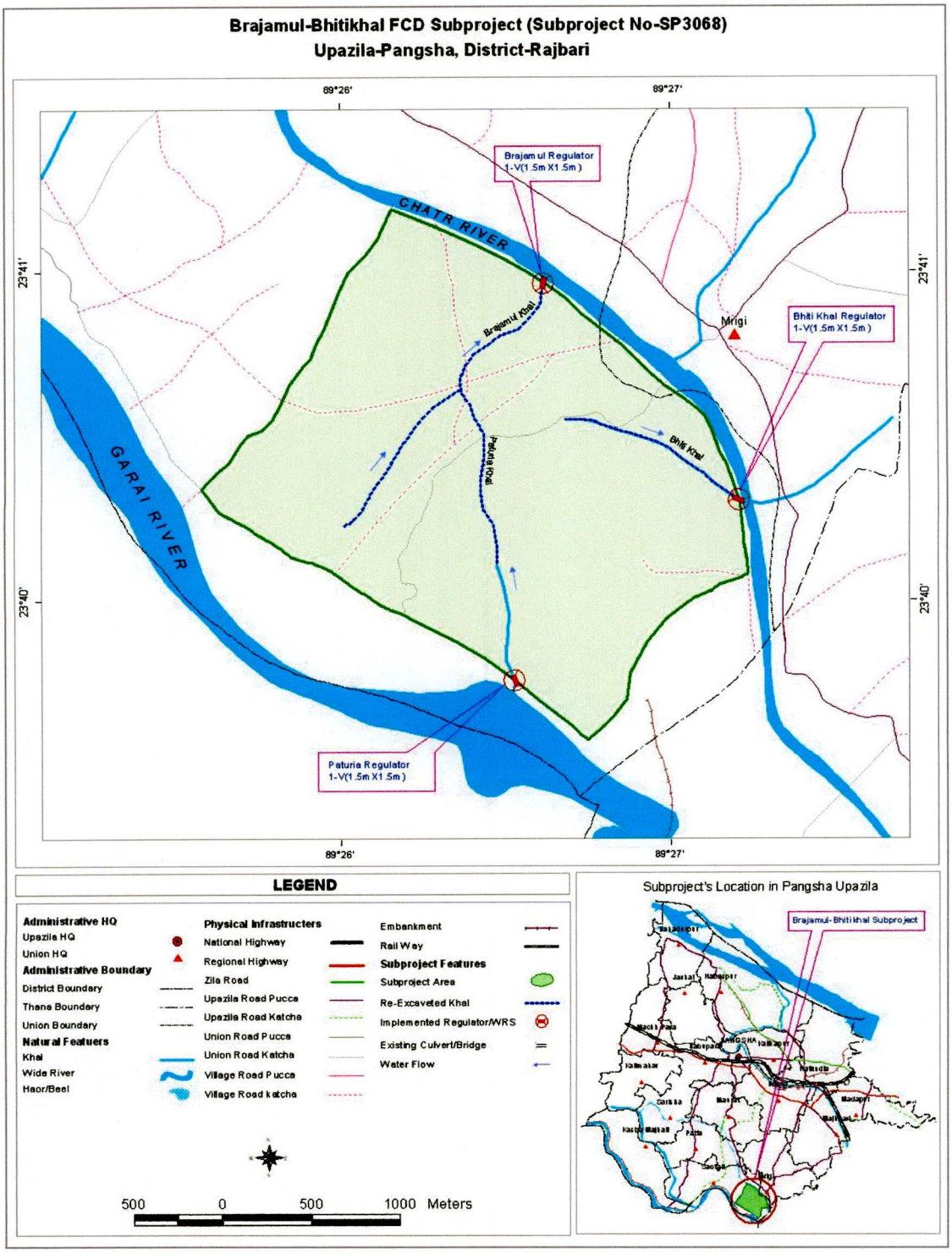

Figure 4.1 Map of Brazamul Bhitikhal Sub-project

4.2.2 Sub-project Development Concept and Objectives

The original proposal for a flood control, improved drainage, and water retention (FCD) sub-project from the local community transmitted by the Upazila Engineer of LGED (Pangsha, Rajbari) on 26-Feb-97. The sub-project component was (i) provide two regulators on the drainage channels falling into the Chatra River and, (ii) re-excavating the channels.
The gross area of the sub-project was 600 ha, and later corrected to 560ha and net benefited area 504 ha.

The proposed sub-project concept was reviewed and revised by the Beneficiary Participation and Project Management (BPPM) team of SSWRDSP based on information supplied from the field and on the results of standard social/technical analyses.

The main objectives of this sub-project are:

- Protection against rainfall flooding from Chatra and Garai River
- Improved drainage capacity development
- Provision of supplementary irrigation.
- Facilities for jute rotting.

Interaction with BWDB projects

This proposed sub-project interacted BWDB interventions. The LGED Executive Engineer discussed this with BWDB engineering staff in Faridpur and it was agreed that (i) this was a minor structure, and (ii) if people desired it, BWDB would not object.

4.2.3 Geographical Characteristics

The sub-project is situated in a flat delta bounded by the river Chatra in the north-east and by Gorai to the south-west and high land and village roads to the west. There are three canals in this sub-project.

The area is formed on recent alluvium. Soils are predominantly clay, have slow internal drainage; moderate but well sustained fertility; and are suitable for growing spices, rice and vegetables

During the monsoon rainfall, the rivers swell from rainfall run-off and the water enters the sub-project area via the Brazamul, Bhiti and Paturia Khals. To prevent inundation of their Aman crops, farmers historically constructed cross-dams but while this usually excludes the floods it does not provide a means for farmers to introduce water into the sub-project area in a controlled manner during drought periods. Due to the sub-project development, the low-lying flood plain lands (F1 and F2) have converted into F0 type lands for greater cultivation practice. Table 4.1 has reflected the overall impact on sub-project land types (flood depths on agricultural land).

Table 4.1 Land use and land types of Brazamul-Bhitikhal Sub-project

Land use/Land type	Flooding depth, d	Pre-project area (ha)	Post-project area (ha)	Change (ha)	Change (%)
Non-cultivated highland		56	56	0	0%
F0	d<0.3m	98	428	330	337%
F1	0.3m<d<0.9m	277	76	-201	-73%
F2	0.9m<d<1.8m	129	0	-129	-100%
F3	d>1.8m	0	0	0	
Non-cultivated lowland		0	0	0	
Of which perm water body		0	0	0	
Floodplain fish habitat (F2+F3)		129	0	-129	-100%
Net area (F0+F1+F2+F3)		504	504	0	0%
GROSS AREA		**560**	**560**	**0**	**0%**

Source: Sub-project Appraisal Report, LGED

* F0, F1, F2 and F3 depends on flooding depth, d

4.2.4 Population and Household Status

The sub-project boundary comprises seven villages with more than 9000 people. The total beneficiary household within the project locality is 616. Table 4.2 reflects the population status and Table 4.3 reflects household farm size distribution and occupation distribution.

Table 4.2 Population status of Brazamul-Bhitikhal Sub-project

Name of the village	Population		Total
	Male	Female	
Paturia	1442	1369	2811
Brazamul Banagram	712	673	1385
Bhiti	909	878	1787
Laribari	876	789	1665
Ghatora	543	565	1108
Boro Bila	56	61	117
Jatub Panchbaria	88	94	182
Total	4626	4429	9055

Source: Pangsha Upazila Statistics Department

Table 4.3 Household farm size and occupation distributions of Brazamul-Bhitikhal Sub-project

Area – Occupation	Percent
Farm size distribution according to farmers	
0.0 to 0.5 acres – landless	30%
0.51 to 1.5 acres – marginal	20%
1.51 to 2.5 acres – small	18%
2.51 to 5.0 acres – medium	17%
5.01+ acres – large	15%
Household occupation according to land ownership	
Farmers > 0.51 acres	68%
Day laborers	19%
Fishers and navigators – professional	1%
Trade transport etc service	7%
Others	5%

Source: LGED, Pangsha, Rajbari

4.2.5 Major Structural Components

Table 4.4 lists the SSWRDSP financed major cost components; typically, the major physical works such as structures, and channel re-excavation.

Table 4.4 Major structural components of Brazamul-Bhitikhal Sub-project

Items	Size/Length	Cost (Tk)
Brazamul Khal re-excavation	2.78 km	66,712
Bhiti Khal re-excavation	1.22 km	42,002
Paturia Khal re-excavation	1.83 km	1,87,573
Bhiti Khal regulator	1 V(1.5m × 1.5 m)	11,03,204
Brazamul regulator	1 V(1.5m × 1.5 m)	14,17,622
Paturia regulator	1 V(1.5m × 1.5 m)	13,57,902
O&M shed		2,65,062
TOTAL		**44,40,077**

Source: LGED, Pangsha, Rajbari.

4.2.6 Water Management Organization

In Brazamul-Bhitikhal Sub-project, Water Management Co-operative association (WMCA) is responsible for day-to-day operation and maintenance of the structures and rural development. WMCA is registered under cooperative in 1998 and since then the activities carried out. A short summary of the membership status and other information are given in Table 4.5

Table 4.5 Institutional Development Status of Brazamul-Bhitikhal Sub-project

Name of the organization:	Brazamul Bhitikhal Water Management Cooperative Association (WMCA)
Formation of 1st Executive committee:	21/11/1997
Registration No and date:	05, 10/02/1998
Beneficiary household:	616
Executive committee member:	12 (male: 7, female: 5, including President and Secretary of WMCA)
General membership:	777 (male: 545, female: 232)
Beneficiary contribution target:	Tk 79,107
Beneficiary contribution collected:	Tk 93,107
Share money collected:	Tk 84,370 (each share Tk.10)
Savings collected:	Tk 6, 31,010
Own capital collection:	Tk 7, 15,380
O&M fund collection:	Tk. 3, 09,024 (Expenditure: Tk.2, 50,850, Balance: Tk. 58,174
Micro-credit:	Total loaners: 327 (male: 259, female: 68); Amount: Tk 11,71,540
Bank operation	Krishi Bank, Mrigi branch, A/C-3554.
Date of last election:	01/02/06
Date of last AGM:	30/06/06
Date of last Audit:	22/12/06-05-06
Own business:	(i) Micro-credit (ii) Fish culture (iii) Nakshi Khatha

Source: LGED, Pangsha, Rajbari and WMCA of Brazamul-Bhitikhal Sub-project.

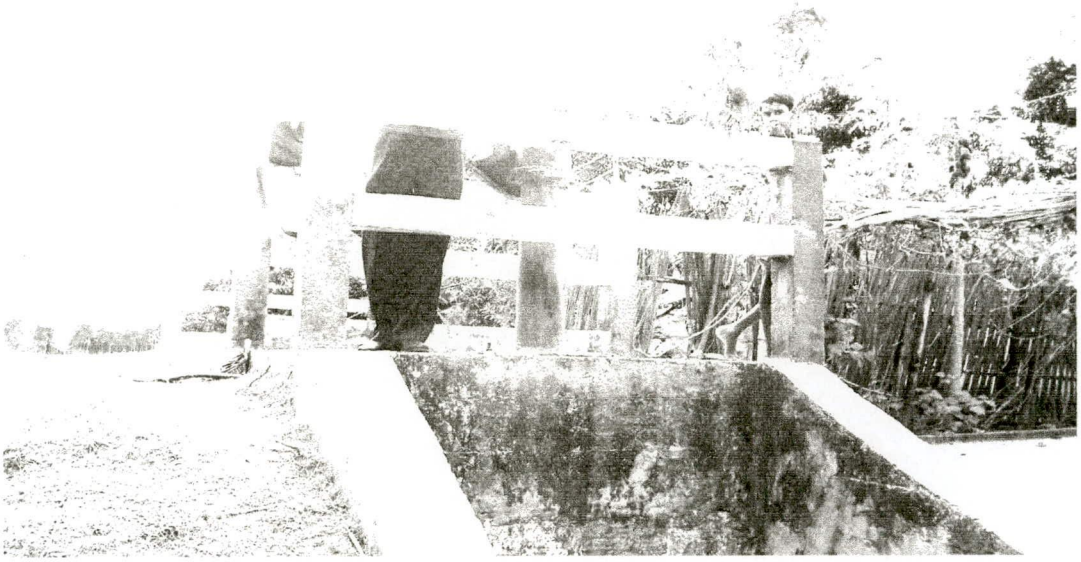

Figure 4.2 A Regulator at Brazamul-Bhitikhal Sub-project.

Figure 4.3 Own Office complex of WMCA at Brazamul-Bhitikhal Sub-project

4.3 Fuleswari Sub-project

4.3.1 Location and Map

Fuleswari Sub-project is located between 23°32′N to 23°36′N and 89°25′E to 89°29′E in the Modhukhali Upazila of the Faridpur District. The sub-project comprises seven villages under Megchami union. The villages are: Korokdi, Panch Korokdi, Kalagachi, Gaburdia, Ghorachula, Norkona and Shantipur.

A map of the sub-project area is provided in Figure-4.2.

4.3.2 Sub-project Development Concept and Objectives

The original proposal by Executive Engineer, Faridpur on 30-Jun-97 was for a FCD and WR sub-project, intended to control flooding from Fuleswari River by embankment and regulators and improve drainage by channel re-excavation.
The gross area of the sub-project was 1000 ha, and later corrected to 800 ha.and net benefited area is 745 ha.

The proposed sub-project concept was reviewed and revised by the Beneficiary Participation and Project Management (BPPM) team of SSWRDSP based on information supplied from the field and on the results of standard social/technical analyses.

The main objectives of this sub-project are:

- Protection against rainfall flooding from Fuleswari River
- Improved drainage capacity development
- Provision of supplementary irrigation.

Interaction with BWDB projects

The sub-project is within BWDB Madhukhali - Baliadanga FCDI Sub-project with a gross area of about 9450 ha. The BWDB Sub-project was designed to exclude flooding from the Gorai and the Chandana River. This purpose of flood protection has been achieved, but the farmers are facing problem due to local accumulation of rain water which enters the area through the internal river system (Fuleswari River and

Vati Khal). The Fuleswari sub-project was conceived to solve this localized flooding problem and to conserve water in the re-excavated internal drainage channel. Fuleswari sub-project infrastructure does not interfere with the BWDB infrastructure. This was discussed with BWDB and they would no objection.

4.3.3 Geographical Characteristics

The sub-project bounded by the river Fuleswari on the north and by Vati Khal to the south-west and by village roads on the west, southwest and southeast. The area is criss-crossed by several fresh water canals and linked with the river.

The subproject monsoon water level is influenced by the adjacent Fuleswari River. The mean monsoon water level in the Fuleswari River is 6.0 m PWD. The land levels in the subproject area vary between 4.50 and 7.50 in PWD. Flood water enters into the area via the Fuleswari River causing heavy damage to Aman crops. Flood normally peaks in late August or early September. Flooding restricts crop production, delays Aman transplantation, and prevents the use of modern high yielding varieties. Table 4.6 has reflected the overall impact on sub-project land types (flood depths on agricultural land).

Table 4.6 Land use and land types of Fuleswari Sub-project

Land use/Land type	Flooding depth d	Pre-project area (ha)	Post-project area(ha)	Change (ha)	Change (%)
Non-cultivated highland		49	49	0	0%
F0	d<0.3m	1	467	466	46600%
F1	0.3m<d<0.9m	76	139	63	83%
F2	0.9m<d<1.8m	373	139	-234	-63%
F3	d>1.8m	295	0	-295	-100%
Non-cultivated lowland		6	6	0	0%
Of which perm water body		6	6	0	0%
Floodplain fish habitat (F2+F3)		668	139	-529	-79%
Net area (F0+FI+F2+F3)		745	745	0	0%
GROSS AREA		**800**	**800**	**0**	**0%**

Source: Sub-project Appraisal Report, LGED

* F0, F1, F2 and F3 depends on flooding depth, d

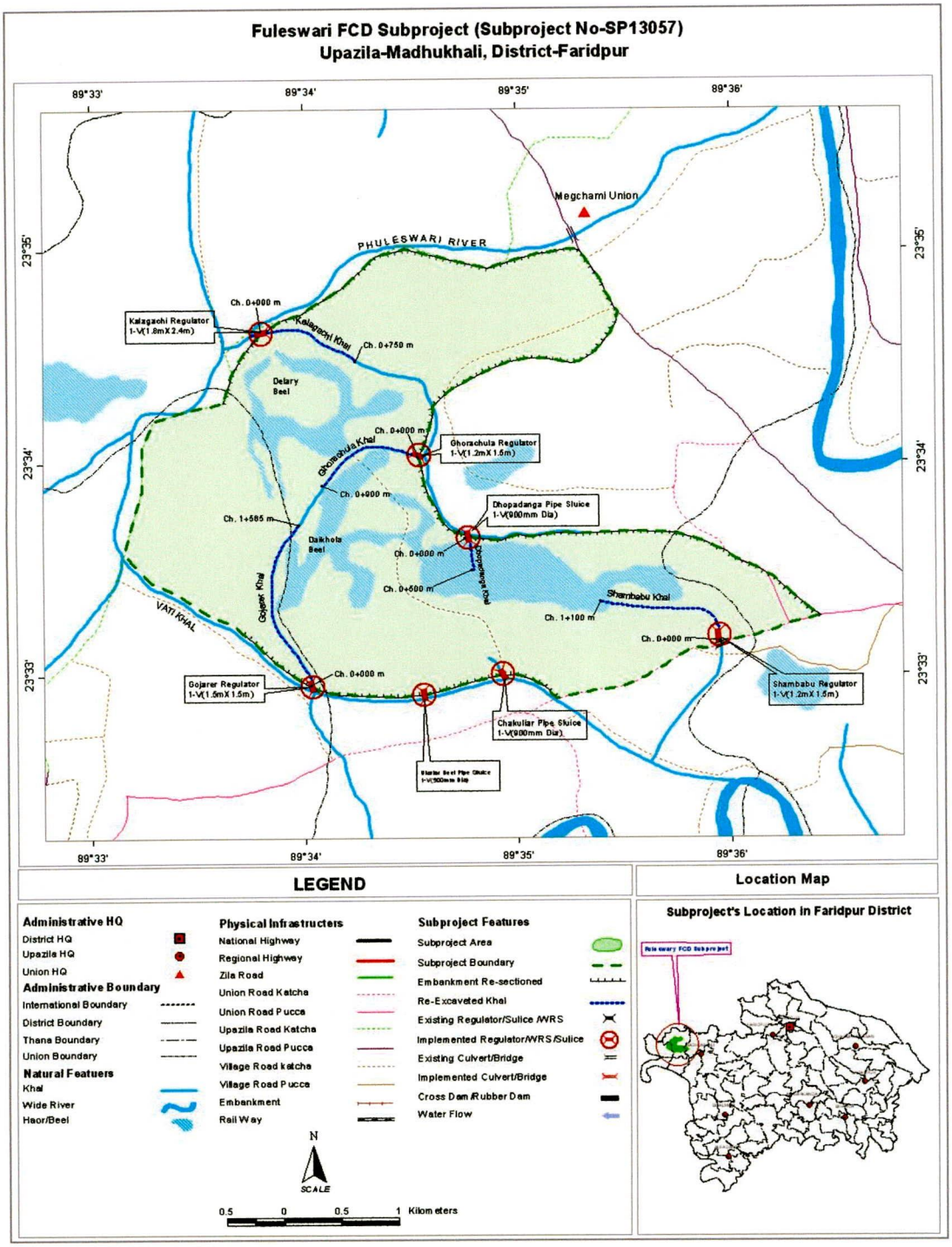

Figure 4.4 Map of Fuleswari Sub-project.

4.3.4 Population and Household Status

The sub-project boundary comprises seven villages with more than 6000 people. The total beneficiary household within the project locality is 721.Table 4.7 reflect the population status and Table 4.8 reflects household farm size distribution and occupation distribution

Table 4.7 Population status of Fuleswari Sub-project

Name of the village	Population		Total
	Male	Female	
Korokdi	509	471	980
Panch Korokdi	1254	1206	2460
Kalagachi	254	266	520
Gaburdia	249	231	480
Ghorachula	274	286	560
Norkona	556	494	1050
Shantipur	153	147	300
Total	**3249**	**3101**	**6350**

Source: LGED, Modhukhali, Faridpur and WMCA of Fuleswari Sub-project

Table 4.8 Household farm size distribution and occupation distribution of Fuleswari Sub-project

Area – Occupation	Percent
Farm size distribution according to farmers inside the subproject	
0.0 to 0.5 acres	38%
0.51 to 1.5 acres	24%
1.51 to 2.50 acres	16%
2.51 to 5.0 acres	12%
5.01+ acres	10%
Household occupation according to landless inside the subproject	
Farmers >0.51 acres	61%
Day laborers	22%
Fishers and navigators – professional	9%
Trade transport etc. service	6%
Others	2%

Source: Combined Summary Appraisal Report, LGED.

4.3.5 Major Structural Components

Table 4.9 list the SSWRDSP -financed major cost components; typically, the major physical works such as structures, embankments, and channel re-excavation.

Table 4.9 Major structural components of Fuleswari Sub-project

Items	Size/Length/Quantity	Cost (Tk.)
Regulator	I-V(1.2mX 1.5m), 3 Nos.	4,500,000
Khal Re-excavation	3.0 km	80,000
Embankment	5.8 km	5,000,000
Boat pass	1 V(1.8m × 2.4 m), 1 No.	1,500,000
TOTAL		**11,080,000**

Source: Combined Summary Appraisal Report, LGED.

4.3.6 Water Management Organization

In Fuleswari sub-project, Water Management Co-operative association (WMCA) was formed on 3 November 1997 and the activities carried out are not satisfactory. A short summary of the membership status and other information are given in Table 4. 10

Table 4.10 Institutional Development Status of Fuleswari Sub-project

Name of the organization:	Fuleswari Water Management Cooperative Association (WMCA)
Registration No and date:	07, 29/04/1998
Beneficiary household:	721
Executive committee member:	12 (male: 9, female: 3)
General membership:	1033 (male: 791, female: 242)
Beneficiary contribution target:	Tk 2, 80,206
Beneficiary contribution collected:	Tk 2, 86,634
Share money collected:	Tk 22,400 (each share Tk.10)
Savings collected:	Tk 2, 12,985
Own capital collection:	Tk 2, 35,385
O&M fund collection:	Tk. 61,054 (Expenditure: Tk.7, 506, Balance: Tk. 53,548)
Micro-credit:	Total loaners: 104 Amount: Tk 1, 31,500
Bank operation	Krishi Bank, Bagut branch (for savings), Sonali Bank, Modhukhali (for O&M fund) A/C No-8628/82.
Date of last election:	September, 2007
Date of last Audit:	31/06/05
Own business:	Micro-credit

Source: LGED, Madhukhali, Faridpur and WMCA of Fuleswari Sub-project.

4.4 Alamkhali Sub-project

4.4.1 Location and Map

The Alamkhali Sub-project is situated between latitudes 23°'58'45"N and 23°5940 N and longitudes 90°3.2 E and 90°5.6"E in Dhamrai upazila of Dhaka district. The sub-project comprises nine villages under Balia union. The villages are: Nayercher, Indara, Teligaon, Dunigram, Sutrapur, Jangalia, Kamar para, Sundhar Kathalia and Maderpur .

A map of the subproject area is provided in Fig. 4.3

4.4.2 Sub-project Development Concept and Objectives

The original proposal of the local people forwarded to Project Management Office (PMO) by the Executive Engineer, Dhaka for a Drainage and Water conservation sub-project on 16-Oct-03, intended to improve drainage by re-excavating internal Khals and a water retention structure at the Alamkhali khal to conserve post monsoon water.

The gross area of the sub-project was 980 ha.and later corrected to 519 ha The proposed sub-project concept was reviewed and revised by the technical team based on: an independent Participatory Rural Appraisal (PRA), information and data collected from the field, and on the results of standard social/technical analysis.

The major objectives of the sub-project are:

- Remove drainage congestion in the sub-project area by re-excavation of main and sub-khals.
- Conserve water in the khals by a regulator.
- Provide scope for fish culture.

Interaction with BWDB projects

The sub-project area is not within the BWDB projects and BWDB has no programme of works there.

Alam Khali Subproject (Subproject No-SP23060)
Upazila-Dhamrai, District-Dhaka

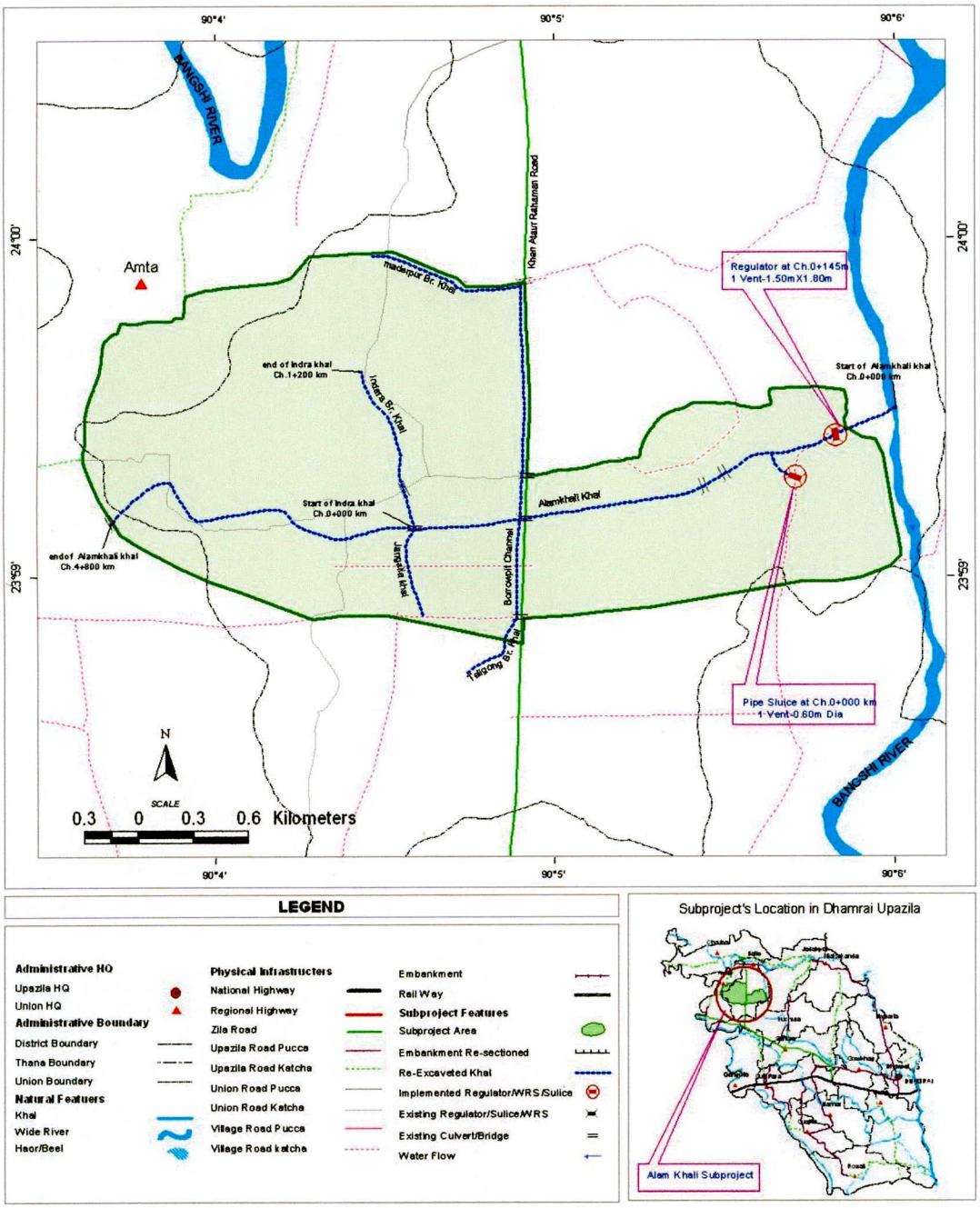

Figure- 4.5 Map of Alamkhali Sub-project.

4.4.3 Geographical Characteristics

The main internal drainage canal is the Alamkhali Khal passing from the west to the east and falls to Bangshi River. There are six sub-khals in the sub-project area. Such as Indara sub-khal, Madarpur sub-khal. Teligaon sub-khal, a link khal and Baichal sub-khal (Fig. 4.3). The sub-project also covers some beel, borrow pits and some low-lying areas. The main problem is the pre and post monsoon drainage congestion and flooding in the monsoon. During June to December water logging affect Aman and Boro paddy.

Floodwater inundates about 75% of land of the areas. Major flooding in the area occurred in 1988, 1991 and 1998 when depth of floodwater varied from 4 to 8 ft (1.22 to 3.05 m.).

For drainage improvement, Union Parishad re-excavated the Alamkhali khal during 1977, 1986 and, 2002. But the interventions were not enough to solve the problems.

The area belongs to AEZ 8 having soil texture red to brown, friable dark gray clay, highly potential for producing high yielding upland crops through out the year. The area falls under Young Brahmaputra and Jamuna flood plains.

Land elevation of the sub-project area varies between 5.57m PWD and 8.68m PWD.

Table 4.11 has reflected the overall impact on sub-project land types (flood depths on agricultural land).

Table 4.11 Land use and land types of Alamkhali Sub-project

Land use/Land type	Flooding depth, d	Pre-project area (ha)	Post-project area (ha)	Change (ha)	Change (%)
Non-cultivated highland		64	64	0	0%
F0	d<0.3m	178	178	0	0%
F1	0.3m<d<0.9m	177	177	0	0%
F2	0.9m<d<1.8m	78	78	0	0%
F3	d>1.8m	9	9	0	0%
Non-cultivated lowland		13	13	0	0%
Of which perm water body		13	13	0	0%
Floodplain fish habitat (F2+F3)		87	87	0	0%
Net area (F0+F1+F2+F3)		142	142	0	0%
GROSS AREA		**519**	**519**	**0**	**0%**

Source: Sub-project Appraisal Report, LGED

* F0, F1, F2 and F3 depends on flooding depth, d

4.4.4 Population and Household Status

The sub-project boundary comprises nine villages with more than 6000 people. The total household is 767 and beneficiary household within the project locality is 490. Table 4.12 reflects the population status and Table 4.13 reflects household farm size distribution and occupation distribution.

Table 4.12 Population status of Alamkhali Sub-project

Name of the village	Population		Total
	Male	Female	
Nayercher	405	426	831
Indara	390	380	770
Teligaon	218	221	439
Dunigram	770	774	1544
Sutrapur	478	474	952
Jangalia	233	236	469
Kamar para	300	298	598
Sundhar Kathalia	154	146	300
Mader pur	461	466	927
Total	**3409**	**3421**	**6830**

Source: Upazila Statistics Department and field survey.

Table 4.13 Household farm size and occupation distributions of Alamkhali Sub-project

Area – Occupation	Percent
Farm size distribution according to farmers	
0.0 to 0.5 acres – landless	33%
0.51 to 1.5 acres – marginal	32%
1.51 to 2.5 acres – small	21%
2.51 to 5.0 acres – medium	13%
5.01+ acres – large	1%
Household occupation according to land ownership	
Farmers > 0.51 acres	50%
Day laborers	40%
Fishers and navigators – professional	2%
Trade transport etc service	7%
Others	1%

Source: LGED, Dhamrai, Dhaka

5.4.5 Major Structural Components

Table 4.14 lists the SSWRDSP financed major cost components; typically, the major physical works such as structures and channel re-excavation.

Table 4.14 Major structural components of Alamkhali Sub-project

Items	Size/Length	Cost (Tk)
Alamkhali Khal Re-excavation	4. 80 km	1,395,668
Borrowpit Khal Re-excavation	2.07 km	601,335
Indora Branch Khal Re-excavation	0.85 km	396,680
Maderpur Branch Khal Re-excavation	0.80 km	232,400
Jangalia Khal Re-excavation	0.50 km	145,250
Link Khal Re-excavation	0.18 km	29,327
Regulator at Ch.0+145m on Alamkhali Khal	1 Vent- 1.50mX 1.80m	1,400,000
Pipe Sluice at Ch.0+000 km on Link Khal	1 Vent-0.60m Dia	800,000
O&M Shed	9.00mX5.00m	300,000
Others		212,459
Total		**5,513,119**

Source: LGED, Dhamrai, Dhaka.

4.4.6 Water Management Organization

In Alamkhali Sub-project, Water Management Co-operative association (WMCA) is responsible for day-to-day operation and maintenance of the structures and rural development. WMCA is registered under cooperative in 2003. A short summary of the membership status and other information are given in Table 4.15

Table 4.15 Institutional Development Status of Alamkhali Sub-project

Name of the organization:	Alamkhali Water Management Cooperative Association (WMCA)
Formation of 1st Executive committee:	03/10/2003
Registration No and date:	118, 15/04/2004
Beneficiary household:	490
Executive committee member:	12 (male: 9, female: 3)
General membership:	401 (male: 272, female: 129)
Beneficiary contribution target:	Tk 1,50,461
Beneficiary contribution collected:	Tk 1,59,620
Share money collected:	Tk 60,475 (each share Tk.10)
Savings collected:	Tk 6,85,978
Own capital collection:	Tk 7,46,453
O&M fund collection:	Tk. 14,165 (Expenditure: Tk.5,100, Balance: Tk. 9,065)
Micro-credit:	Total loaners: 279 (male: 194, female: 85) Amount: Tk 19,16,120
Bank operation	Krishi Bank, Balia branch, A/C-3779.
Date of last election:	24/06/07 (Selection)
Date of last AGM:	23/10/07
Date of last Audit:	02/09/07
Own business:	(i) Micro-credit (ii) Fish culture

Source: LGED, Dhamrai, Dhaka and WMCA of Alamkhali Sub-project.

Chapter 5

Analysis and Evaluation

The performances of the selected sub-projects have been evaluated in terms of institutional, agricultural, infrastructural, financial and environmental aspects.

5.1 Institutional Aspects

The institutional aspects deal with the performance of the WMCA in terms of their formation, regularity of meeting, involvement in sub-project activities, effectiveness and legitimacy, gender relations etc.

A detail questionnaire survey through field visits has been conducted to investigate these aspects.

Formation of WMCA

The responses from questionnaire survey on WMCA in terms of their membership status and process of election of the executive members are presented in Table 5.1. The beneficiaries' perception on the way of WMCA formation is presented in Table 5.2.

Table 5.1 Status of the surveyed WMCAs

Name of the WMCA*	Membership			Election held for EC
	Total member	Male member	Female member (% of total)	Yes/ No
Brazamul Bhitikhal	777	545	232 (30)	Yes
Fuleshwari	1033	791	242 (23)	Yes
Alamkhali	401	272	129 (32)	No

Source: WMCAs, UE Office of LGED; * all the WMCAs are registered under Cooperative laws

Table 5.2 Beneficiaries' perception on the formation of WMCAs

Particulars	Frequency (percent)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
Democratically elected	39 (90.8)	10 (25)	---
The committee formed with elite people	---	15 (37.5)	2 (5)
LGED officials formed the committee	1(2.3)	4 (10)	3 (7.5)
UP chairman formed the committee with consultation	----	---	33 (82.5)
Not known / not aware	3(6.9)	11 (27.5)	2 (5)

Source: Field investigation & WMCA

Regularity of WMCA Meeting

LGED and donor agencies have been given emphasized on meeting attendance and discussion of WMCA members. Table 5.3 shows the distribution of respondents in terms of weekly meeting attendance and Table 5.4 shows the reasons for not attending meeting.

Table 5.3 Meeting attendance of WMCA general members

Meeting attendance per month	Frequency (% of total sample)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
None	9 (21)	28 (70)	7 (17.5)
One – Two	23 (53.4)	7 (17.5)	21 (52.5)
Three – Four	11 (25.6)	5 (12.5)	12 (30)

Source: Field investigation & WMCA

Table 5.4 Beneficiaries' reasons for not attending meeting

Particulars	Frequency (%)		
	Brazamul-Bhitikhal (N=9)	Fuleswari (N=28)	Alamkhali (N=7)
Not informed	2 (22)	3 (10.7)	3 (42.8)
Busy	5 (56)	3 (10.7)	4 (57.2)
Meeting were dominated by local elites	1 (11)	7 (25)	---
Meeting had no importance	1 (11)	15 (53.6)	---

Source: Field investigation & WMCA

Table 5.5 represents the description of the meeting topics as stated by some of the meeting attending surveyed members.

Table 5.5 Beneficiaries' perception on the focus of the meeting topics

Meeting topics	Frequency (%)		
	Brazamul-Bhitikhal (N=34)	Fuleswari (N=12)	Alamkhali (N=33)
O&M	11 (32.4)	3 (25)	9 (27.3)
Beneficiary's contribution	13 (38.3)	6 (50)	16 (48.5)
Conflict resolution	8 (23.5)	3 (25)	6 (18.2)
Others	2 (5.8)	---	2 (6)

Source: Field investigation

WMCA's Involvement in Sub-project Activities

Beneficiaries' perception related to objectives of WMCA formation was examined and the findings have been presented in the Table 5.6. Table 5.7 shows the beneficiaries perception on the factors why WMCA failed to solve conflicts of the sub-projects.

The overalls performance of WMCA can be summarized by the beneficiaries' perception regarding WMCAs' overall activities that reveal in the tables 5.8 and 5.9.

Table 5.6 Beneficiaries' perception regarding objectives of the WMCA formation

Objectives	Frequency (%)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
O&M	12 (28)	1 (2.5)	10 (25)
Poverty alleviation	8 (18.6)	2 (5)	4 (10)
Social development	3 (7)	1 (2.5)	6 (15)
Micro-credit	14 (32.5)	11 (27.5)	12 (30)
Capital formation	5 (11.6)	14 (35)	8 (20)
To complete embankment	0	5 (12.5)	0
Do not know	1 (2.3)	6 (15)	--

Source: Field investigation

Table 5.7 Beneficiaries' perception on why WMCA did not try to solve conflicts

Particulars	Frequency (%)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
No financial benefit	12 (28)	2 (5)	16 (40)
Not aware of their responsibility	0	6 (15)	3 (7.5)
Only aware of micro-credit & collecting contributions	19 (44.2)	8 (20)	12 (30)
Infrequent in the field	8 (18.6)	3 (7.5)	7 (17.5)
WMCA do not composed of genuine stakeholder	2 (4.7)	16(40)	1 (2.5)
WMCA members are not dedicated	----	5 (12.5)	----
Others	2 (4.6)	----	1 (2.5)

Source: Field investigation

Table 5.8 Beneficiaries' perception why WMCA is effective

Particulars	Frequency (%)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
Problem solution	10 (23.2)	6 (15)	11 (27.5)
Regularly held meeting	14 (32.6)	7 (17.5)	10 (25)
Reflection of all opinion	8 (18.6)	9 (22.5)	12 (30)
Proper O&M	11 (25.6)	4 (10)	4 (10)
Other	----	14 (35)	----

Source: Field investigation

Table 5.9 Performance of WMCA Executive Committee

Particulars	Frequency (%)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
Satisfied (this year)	7 (16.3)	1 (2.5)	21(52.5)
Always satisfied	22 (57.2)	--	9(22.5)
Somewhat satisfied	9 (20.9)	3 (7.5)	7(17.5)
Dissatisfied	3 (6.9)	19 (47.5)	3(7.5)
No Comments	2 (4.7)	17(42.5)	---

Source: Field investigation

Effectiveness and Legitimacy of WMCA

In this study the effectiveness of the WMCA is recorded by the beneficiary response from the project area. From Table 5.10 a picture can be drawn about the WMCA and their effectiveness.

Responses of beneficiaries of the sub-project are listed in Table 5.11. A chart was used for systematic data collection to know the beneficiaries perception (Annex-A). Responses (yes or no) are presented in percentage taking the sample size equal to 43 for Brazamul-Bhitikhal Sub-project and 40 for Fuleswari Sub-project and Alamkhali Sub-project each. In Table 5.11, response "Yes" means the beneficiaries responded affirmative or positive and response "No" means the beneficiaries responded negative on the findings.

Table 5.10 WMCA- some common findings/General information

Indicator	Brazamul-Bhitikhal	Fuleswari	Alamkhali
1. Village sub-committee for O&M	Yes	No	No
2. Monthly EC meetings – regular	Yes	No	No
3. Weekly village committee meetings – regular	No	No	No
4. Annual General Meeting – regular	Yes	Yes	Yes
5. Own office for WMCA	Yes	No	Yes
6. Staff appointed for WMCA activities	Yes	Yes	Yes
7. Training for O&M and other activities	Yes	No	No
8. Maintenance of records:			
a. Membership register	Yes	No	Yes
b. Resolution book	Yes	No	Yes
c. Cash book	Yes	Yes	Yes
d. Share register	Yes	Yes	Yes
e. Savings register	Yes	Yes	Yes
f. Loan register	Yes	Yes	Yes
g. O&M plan prepared	Yes	No	Yes
9. Micro-credit	Yes	Yes	Yes
10. Share and savings activities	Yes	Yes	Yes
11. Own business of WMCA	Yes	No	Yes

Source: Field investigation

Table 5.11 WMCA performance according to beneficiaries' response

Questions	Response (%)		
	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Is sub-project benefits clear to the beneficiaries?	Yes 41 (95) No 2 (5)	Yes 23 (57.5) No 17 (42.5)	Yes 34 (85) No 6 (15)
Have the members already been benefited by the sub-project?	Yes 40 (93) No 3 (7)	Yes 20 (50) No 20 (50)	Yes 35 (87.5) No 5 (12.5)
Is there any complain against WMCA activities and officials?	Yes 7 (16) No 36 (84)	Yes 27 (67.5) No 13 (32.5)	Yes 7 (17.5) No 33 (82.5)
Is the WMCA well organized?	Yes 37 (86) No 6 (14)	Yes 13 (32.5) No 27 (67.5)	Yes 31 (77.5) No 9 (22.5)
Is the WMCA controlled by few influential people?	Yes 18 (42) No 25 (58)	Yes 27 (67.5) No 13 (32.5)	Yes 15 (42) No 25 (58)
Is there any internal conflict within WMCA executives?	Yes 17 (39.5) No 26 (60.5)	Yes 22 (55) No 18 (45)	Yes 17 (42.5) No 23 (53.5)
Is there good leadership?	Yes 24 (56) No 19 (44)	Yes 14 (35) No 26 (65)	Yes 24 (56) No 16 (46)
Is the managing committee active?	Yes 36 (84) No 7 (16)	Yes 19 (47.5) No 21 (52.5)	Yes 36 (90) No 4 (10)
Are general members aware of their responsibilities in day to day management?	Yes 26 (60.5) No17 (39.5)	Yes 21 (52.5) No 19 (47.5)	Yes 26 (60.5) No 14 (39.5)
Whether general members aware of decision-making & activities by WMCA?	Yes 23 (53) No 20 (47)	Yes18 (45) No 22 (55)	Yes 23 (53) No 17(47)
Is the WMCA likely to function well in future?	Yes 22 (51) No 21 (49)	Yes 12 (30) No 28 (70)	Yes 22 (51) No 18 (49)

Source: Field survey.

Gender Relations

Table 5.12 present the male-female ratio in WMCA executive committee. Women Participation Index (WPI) is calculated as the percentage of the average number of women present in the monthly general meeting for each project and shown in Table 5.13.

Table 5.12 Male-Female ratio between members of WMCA

Membership	Brazamul-Bhitikhal		Fuleswari		Alamkhali		Male-Female ratio		
	Male	Female	Male	Female	Male	Female	Brazamul-Bhitikhal	Fuleswari	Alamkhali
EC Member	7	5	9	3	9	3	1.4 : 1	3 : 1	3 : 1

Source: Field survey, WMCA and LGED.

Table 5.13 Women's Participation Index

Indicator	Average participants in meeting			Total No. of women members			Women's participation index		
	Brazamul-Bhitikhal	Fuleswari	Alamkhali	Brazamul-Bhitikhal	Fuleswari	Alamkhali	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Participation of women member in meeting	24	9	7	232	242	129	10.3%	3.7%	5.4%

Source: Field survey, WMCA and LGED

5.2 Agricultural Analysis

The analysis of agricultural impacts of the selected sub-project was focused mainly on the changes of agricultural production (tons) of crops, cultivated areas, cropping intensity and yield (tons/ha) of crops. This analysis is done according to different land types. A comparison has been drawn for pre- and post-project conditions.

Cropped area, yield, and production by land type for pre- and post-project situations of Brazamul-Bhitikhal Sub-project, Fuleswari Sub-project and Alamkhali Sub-project are presented in Table 5.14, Table 5.15 and Table 5.16 respectively.

Brazamul-Bhitikhal Sub-project

Table 5.14 Area, yield, and production of crops by land type for pre- and post-project situations (Brazamul-Bhitikhal)

Crop (according to land type)	Pre-Subproject			Post-Subproject		
	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
F0	98			428		
B. Aus	22	2.1	46.2	136	2.1	285.6
Jute	27	2.3	62.1	191	2.3	439.3
LT Aman	58	3.3	191.4	51	3.3	168.3
HYV Aman	0	0	0	254	4.8	1219.2

Wheat	18	2.4	43.2	98	2.4	235.2
Pulses	12	1.8	21.6	86	1.8	154.8
Oilseeds	11	1.0	11	109	1.0	109
Vegetables	17	7.5	127.5	17	7.5	127.5
Onion	41	8.7	356.7	104	8.9	925.6
Spices	29	7.0	203	64	7.0	448
Sugarcane	10	69.2	692	10	69.2	692
Total	245		1754.7	1120		4804.5
F1	277			76		
B.Aus	65	2.1	136.5	14	2.1	29.4
Jute	84	2.3	193.2	0	0	0
LT Aman	122	3.3	402.6	32	3.3	105.6
HYV Aman	71	4.8	340.8	13	4.8	62.4
Wheat	60	2.4	144	8	2.4	19.2
Pulses	76	1.8	136.8	28	1.8	50.4
Oilseeds	84	1.0	84	3	1.0	3
Onion	63	8.7	548.1	107	9.0	963
Spices	36	7.0	252	9	7.0	63
Total	661		2238	214		1296
F2	129			0		
B.Aus	16	1.7	27.2	0	0	0
Mix B.Aus	20	1.5	30	0	0	0
Mix B Aman	20	0.9	18	0	0	0
B Aman	22	1.2	26.4	0	0	0
Jute	22	2.1	46.2	0	0	0
LT Aman	65	2.3	149.5	0	0	0
HYV Aman	22	4.0	88	0	0	0
Wheat	39	2.0	78	0	0	0
Pulses	17	1.6	27.2	0	0	0
Oilseeds	19	0.9	17.1	0	0	0
Onion	9	8.3	74.7	0	0	0

Spices	12	6.3	75.6	0	0	0
Total	283		657.9	0	0	0
F3	0			0		0.0
Total	0		0.0	0		0.0
Grand Total	1189		4650.6	1334		6100.5

Source: LGED

Fuleswari Sub-project

Table 5.15 Area, yield, and production of crops by land type for pre- and post-project situations (Fuleswari)

Crop (according to land type)	Pre-Subproject			Post-Subproject		
	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
F0	**1**			**467**		
B.Aus	1	2.7	2.7	12	2.7	32.7
Jute	0	0	0	186	2.5	459.4
LT Aman	0	0	0	65	3.1	201.5
HYV Aman	0	0	0	35	4.3	150.5
Wheat	0	0	0	110	2.8	308
Pulses	1	1.2	1.2	138	1.2	164.2
Oilseeds	0	0	0	64	1.0	60.8
Vegetables	0	0	0	33	11.1	367.0
Spices	0	0	0	16	8.2	131.2

Sugarcane	0	0	0	23	61.8	1420.3
Total	2		3.9	682		3295.6
F1	**76**			**139**		
B.Aus	15	2.7	40.8	139	2.72	378.1
Jute	19	2.5	46.9	0	0	0
LT Aman	0	0	0	115	3.06	351.9
HYV Aman	0	0	0	24	4.4	105.6
Wheat	69	2.8	193.2	24	2.8	66.7
Pulses	7	1.2	8.3	0	0	0
Oilseeds	8	1.0	7.6	0	0	0
Spices	16	8.2	131.2	0	0	0
Sugarcane	23	61.8	1420.3	0	0	0
Vegetables	33	11.1	367.0	0	0	0
Total	190		2215.3	302.0		902.3
F2	**373**			**139**		
B.Aus	131	2.5	321.0	109	2.72	296.48
B.DWR	75	3.0	225.0	30	3	90.0
Jute	167	2.2	370.7	0	0	0
LT Aman	0	0	0	75	3.06	229.5
Wheat	112	2.5	280.0	0	0	0
Pulses	130	1.0	128.7	0	0	0
Oilseeds	56	0.8	44.2	0	0	0
Total	671		1369.6	214		615.98

F3	**295**			**0**		
B.Aus	132	2.45	323.4	0	0	0
B.DWR	148	3.0	444.0	0	0	0
Fellow	15	15	0.0	0	0	0
Totals	**295**		**767.4**			
Grand Total	**1158**		**4355.8**	**1198.0**		**4813.88**

Source: LGED

Alamkhali Sub-project

Table 5.16 Area, yield, and production of crops by land type for pre- and post-project situations (Alamkhali)

Crop (according to landtype)	Pre-Subproject			Post-Subproject		
	Area (ha)	Yield (t/ha)	Production (t)	Area (ha)	Yield (t/ha)	Production (t)
F0	**178**			**178**		
HYV T Aman (normal)	125	4.2	525.0	125	4.2	525.0
HYV Boro (flooded)	45	5.5	247.5	45	5.5	247.5
Wheat (normal)	0	2.7	0.0	35	2.7	94.5
Wheat (droughty)	25	1.9	47.5	0	1.9	0.0
Potato	20	15.7	314.0	20	15.7	314.0
Oilseeds	10	1.2	12.6	10	1.2	42.0
Spices	25	4.8	120.0	25	4.8	120.0
Vegetables	48	9.2	441.6	58	9.2	533.6

Jute	88	2.4	211.2	88	2.4	211.2
Total	386		1919.4	406		2087.8
F1	**177**			**177**		
HYV T Aman (normal)	105	4.2	441.0	105	4.2	441.0
HYV T Aman (flooded)	72	2.8	201.0	72	2.8	201.6
HYV Boro	42	5.5	231.0	152	5.5	836.6
Wheat (droughty)	10	1.9	19.0	0	1.9	0.0
Wheat (normal)	9	2.7	0.0	25	2.7	67.5
Total	238		1497.6	354		1546.7
F2	**78**			**78**		
HYV Boro	78	5.5	429.0	78	5.5	429.0
B Aman	30	2.1	63.0	30	2.1	63.0
T Aman	20	2.1	42.0	20	2.1	42.0
Oilseeds	0	1.2	0.0	18	1.2	21.6
Total	128		534.0	146		555.6
F3	**9**			**9**		
HYV Boro	0	5.5	0.0	9	5.5	49.5
HYV Boro (flooded)	9	2.9	26.1	0	2.9	0.0
Total	9		26.1	9		49.5
Grand Total	**761**		**3345.4**	**915**		**4239.6**

Source: LGED.

Cropping intensity

Table 5.17 presents the cropping intensity of the three selected sub-projects. This calculation is done on the basis of pre- and post project situation.

Table 5.17 Changes in cropping intensity of the three selected sub-projects

Brazamul-Bhitikhal Sub-project		Fuleswari Sub-project		Alamkhali Sub-project	
Pre--project	Post-project	Pre--project	Post-project	Pre--project	Post-project
236%	265%	155%	161%	172%	207%

5.3 O&M Execution, Capital Funding and Micro-credit Activities

5.3.1 O&M Execution

The following Tables present year wise (2000-`06) O&M execution (budgeting, funding & expenditure) of the three selected subprojects.

Table 5.18 O&M execution of Brazamul-Bhitikhal Sub-project

Year	Budget estimated	Fund in O&M account	GoB allocation	Expenditure by WMCA	GoB expenditure
2002	25,000	1,18,000	0	25,000	0
2003	46,707	94,000	15,000	37,000	15,000
2004	1,46,000	51,286	1,35,136	38,255	1,35,136
2005	4,62,980	2,216	2,00,000	1,92,784	2,00,000
2006	3,38,200	58,174	1,24,000	1,26,850	1,24,000

Source: LGED & WMCA of Brazamul-Bhitikhal Sub-project

Table 5.19 O&M execution of Fuleswari Sub-project

Year	Budget estimated	Fund in O&M account	GoB allocation	Expenditure by WMCA	GoB expenditure
2002	3,480	300	0	2005	0
2003	1,21,338	0	50,000	300	50,000
2004	2,96,770	400	3,92,000	7,000	0
2005	5,67,294	27,600	1,00,000	9,500	82,296
2006	6,21,000	53,548	0	7,506	0

Source: LGED & WMCA of Fuleswari Sub-project

O&M execution of Alamkhali Sub-project

Alamkhali is a new sub-project of Phase-II of SSWRDSP (Date of WMCA formation is 24-June-2007).

O&M fund collection of this sub-project is Tk.14,165, expenditure is Tk.5,100 and balance in hand is Tk. 9,065.

5.3.2 Capital Funding and Beneficiary Contribution

Shares, Savings and Beneficiary contribution collection are considered as important activities in Small Scale Sub-project of LGED. By lows, every WMCA member has to buy at least one share (Tk.10) and to deposit the same amount of money as savings

for first month. From the nest month he/she has to continue his saving deposit (Tk.10). A WMCA member can buy one-fifth of total share as maximum.

Table 5.20 show shares and savings collection as capital funding as also show beneficiaries' target and collection of the three selected sub-project.

Table 5.20 Capital Funding and Beneficiary Contribution of the three Sub-projects (Status on June-2007)

Name of the Sub-project	Capital Funds			Beneficiary Contribution	
	Shares	Savings	Others	Target	Collected
Brazamul-Bhitikhal	84,370	6,31,010	---	79,107	93,107
Fuleswari	22,400	2,12,985	---	2,80,206	2,86,634
Alamkhali	60,475	6,85,978	37,560	1,50,461	1,59620

Source: LGED & WMCA

5.3.3 Micro-credit Activities

Loan distribution to the male/female members of WMCA of the three selected sub-projects are presented in Table 5.21.

Table 5.21 Micro-credit activities of the three Sub-projects (Status on June-2007)

Name of the Sub-project	Loan Information (Tk.)			Borrower(nos.)			Borrower (%)	
	Total Disbursed	Total Realized	Percentage Realized	Male	Female	Total	Male	Female
Brazamul-Bhitikhal	11,71,540	10, 84,100	92.54	259	68	327	79.2	20.8
Fuleswari	1,31,500	44,185	33.6	82	22	104	78.8	21.2
Alamkhali	19,16,120	15,27,249	79.7	194	85	279	69.5	30.5

5.3.4 Sustainability of O&M

Sustainability of O&M is an important factor for smooth running of a water resource scheme. Sustainability can be calculated on the basis of beneficiary contribution and O&M fund collection (Eq.-3.2).

The following Tables present financial viability of the three selected Sub-projects

Table 6.22 Financial viability of the Sub-projects on the basis of beneficiary contribution

Item	Beneficiary contribution (Tk); Year-2006		
	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Target	79,107	280,206	150,461
Collected	93,107	286,634	159,620
Financial Viability	117.7%	102.3%	106.0%

Source: LGED & WMCA of the respective Sub-projects

Table 6.23 Financial viability of the Sub-projects on the basis of O&M fund collection

Item	O&M Fund (Tk), Year-2006		
	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Budget estimated	3,38,200	6,21,000	15,000
Fund collected	3,09,024	61,054	14,165
Financial Self Sufficiency	91.4%	9.8%	94.5%

Source: LGED & WMCA of the respective Sub-projects

5.4 Others Analysis

Some factors are also change directly or indirectly for the implementation of the sub-projects such as land value, wage rate, communication development, flooding, water logging etc. These changes are expressed in the following Tables.

Table 6.24 Beneficiaries' perception on the initial problems of sub-projects

Type of problem	Beneficiaries' perception (%)		
	Brazamul-Bhitikhal (N=43)	Fuleswari (N=40)	Alamkhali (N=40)
Flooding (1)	60.5	57	53.5
Water logging (2)	7	14	19
Poor agricultural production	2.3	4	3.5
Poor Irrigation	2.3	3	2
1, 2 & less cropping intensity	27.9	17	22
Poor transportation	0	5	0

Source: Field Visit

Table 6.25 Changes of Land value

Type of changes	Pre-project condition	Post-project condition
Land value(Tk./Decimal)		
Brazamul-Bhitikhal	600~900(1997)	3500~4500 (2007)
Fuleswari Sub-project	300~400(1997)	3000~4000(2007)
Alamkhali Sub-project	2500~3000(2002)	7000~10000(2007)

Source: Field investigation.

Table 6.26 Wage rate in Slack and Peak season in Pre and Post Project Condition

Study Areas	Average wage rate in slack season (Tk./ day)			Average wage rate in peak season (Tk./ day)		
	Pre-project	Post-project	% Change	Pre-project	Post-project	% Change
Brazamul-Bhitikhal	45	75	66.7%	65	100	53.8%
Fuleswari Sub-project	40	55	37.5%	55	75	36.4%
Alamkhali	40	60	50.0%	55	80	45.5%

Source: Field investigation.

Chapter 6

Results and Discussion

The performances of the selected sub-projects have been evaluated in terms of institutional, agricultural, infrastructural, financial and environmental aspects. The institutional aspects deal with the performance of the WMCA. Agricultural aspects include cultivated area, agricultural production and cropping intensity. These analyses consider pre- and post-project data to evaluate the agricultural impact on sub-project implementation. Infrastructural condition focuses on physical condition of infrastructure in relation to its vent size, number, location, sill and crest level, etc. It is essential to observe the condition of embankment, in terms of alignment, its crest level, width, side slopes, piping, etc. In case of canals, it would be appropriate to observe its siltation. Financial aspects focus on O&M execution, financial self-sufficiency for O&M and capital funding, micro-credit activities etc. Environmental aspects look for impeded drainage and water logging and/or flooding, impacts on land use pattern, fisheries and livestock, effect of pesticides and fertilizers etc.

6.1 Performance of Water Management Cooperative Association (WMCA)

The performances of the WMCAs in terms of some selected indicators have been discussed in the following sub-sections.

6.1.1 Formation of WMCA

As per LGED's Guidelines, WMCA must be registered under the law of cooperatives. All the peoples (adult) within the sub-project area are entitled to become members of the WMCA. The responses from questionnaire survey on WMCA in terms of their membership status, process of election of the executive member and the beneficiaries' perception on the way of WMCA formation are analyzed in the preceding chapter (Table 5.1 and Table 5.2)

The performances of the selected WMCAs from those tables are as follows:

- WMCAs were registered;

- The EC members of the Brazamul-Bhitikhal Sub-project were properly elected by the WMCA members and it was found that the EC members of Fuleswari Sub-project were selected from elites without due election process. In Alamkhali Sub-project due to time constraint election could not held and so the committee was formed by the UP Chainman in consultation with Cooperative Officer and local villagers.
- It also reveals that a big number of respondents in Fuleswari Sub-project are not aware of the WMCA formation activities.

6.1.2 Regularity of WMCA Meeting

In Brazamul-Bhitikhal Sub-project, about 54% of the members attended one to two meetings per month. About 26% attended three to four meetings and 21% of the respondents did not attend any meeting (Table 5.3). Out of non attending member, 56% of the respondents show the causes of not attended any meeting as they were busy, 22% were not informed about meeting and 11% think meeting were dominated by local elites and rest 11% think meeting had no importance (Table 5.4).

In terms of meeting attendance, Alamkhali Sub-project being a new sub-project shows a very promising picture of achievement of WMCA. Brazamul-Bhitikhal Sub-project though an old sub-project also shows a very good percentage of attendance. The result of Fuleswari Sub-project is not appreciative at all. The participants in the meeting are not regular and in most of the cases they think that the meeting had no importance. They are not informed properly about the meetings also.

It is found that the meetings are more-or-less regular only during flood or irrigation seasons. As there is no provision of incentive to attend the meeting, people wants to do their own work instead of attending the meeting. Moreover, it was apparent during the survey that the procedure for meeting organization is not clear to WMCA general members. Awareness should be developed among the beneficiaries so they attend the meeting and participate in decision making for O&M and other important activities of the sub-project.

It is found that most of the meeting discussions were dominated with beneficiaries' contribution for their cooperatives and loan giving affairs (Table 5.5).

6.1.3 WMCA's Involvement in Sub-project Activities

One of the major objectives of the participatory water management work in small-scale projects is to involve the beneficiaries in the operation and maintenance (O&M) of the infrastructure. This was planned to be accomplished through the formation of Water Management Cooperative Association (WMCA). Therefore beneficiaries' perception related to objectives of WMCA formation was examined and the findings have been presented in the Table 5.6. It shows that a good number of respondents have perception that WMCAs' were formed for micro-credit disbursement. O&M has received less priority with respect to their other societal activities. Respondents in Fuleswari Sub-project have great bias towards capital formation. On the other hand it has found split attitude with bias towards O&M and micro-credit activities for Alamkhali Sub-project.

Table 5.7 shows the beneficiaries perception on the factors why WMCA failed to solve conflicts of the sub-projects. It shows that WMCA do not function properly as because the EC members are not getting any financial benefits for their time and contribution. Most of the functions of the WMCAs are limited to collecting contributions and micro-credit disbursement activities. In Fuleswari Sub-project many of the EC members are not genuine stakeholder and not much dedicated to their responsibilities.

6.1.4 Effectiveness and Legitimacy of WMCA

In this study the effectiveness of the WMCA is recorded by the beneficiary response from the project area. From Table 5.10 a picture can be drawn about the WMCA and their effectiveness.

In this study, two of the small scale sub-projects executive committee members are democratically elected, one is selected and they have formed registered committee for water management. Document keeping and maintenance of records in Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project are found adequate and in Fuleswari Sub-project found inadequate. Among the sub-projects Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project have become a self income

generating organization through micro-credit, share and savings, and other business activities. Water management activities in Brazamul-Bhitikhal and Alamkhali Sub-project are found well organized. The monthly meetings and annual meetings are regular in Brazamul-Bhitikhal and Alamkhali Sub-project. They have office and appointed staffs for managing the activities. But village sub-committee for O&M is found effective only in Brazamul-Bhitikhal Sub-project.

Response Capacity

Response capacity refers to the institutional (as distinguished from physical, biological, or economical) capacity and perception of beneficiaries on O&M and organizations for managing small-scale water resources system. Responses of beneficiaries of the sub-project are listed in Table 5.11.

Results from the respondents revealed that most of the beneficiaries in the small-scale sub-projects have already been benefited by the sub-projects but they are not sure about its extent. They have affirmative response about formation, leadership and activities of WMCA. In Fuleswari Sub-project beneficiaries are not serious about O&M, do not understand or failed to understand the breadth of their responsibility in day-to-day O&M. Local inhabitants are not concerned in decision-making and other O&M activities done by WMCA. In Fuleswari Sub-project, people also not interested in participating day-to-day management activities as they were not properly motivated or aware to participate.

6.1.5 Gender Relations or Women Aspects

The impact of sub-project development on women within the project area is not significant except micro-credit gaining. The male-female ratio in the EC of WMCA is 3:1 for both Fuleswari Sub-project and Alamkhali Sub-project and 1.4:1 in Brazamul-Bhitikhal Sub-project (Table 5.12). As per the guideline of LGED, male-female ratio should be at least 3:1 in every WMCA. Government and donor agencies encourage woman participation in all forms of decision-making bodies. It is found that the woman members are not very much aware of day-to-day management activities except Brazamul-Bhitikhal Sub-project. However, woman members are

trying to emphasize on micro-credit facility for them and particularly for landless women of the project area. It was found during field survey that males have taken loan in the name of landless women in Fuleswari Sub-project.

Women Participation Index (WPI) is calculated as the percentage of the average number of women present in the monthly general meeting for each project (Table 5.13). It is found from the analysis that WPI is not good in any of the sub-projects; however, in Brazamul-Bhitikhal Sub-project it is comparatively better than others because of its awareness towards WMCA activities.

Form the field visit it was found that the women in the every sub-project are not interested in manual labor works in the field due to social and religious taboo.
In Fuleswari Sub-project, the female members complained that the male members got salary of about Tk.130/day, but the women members got only Tk.70/day. This is a typical picture of disparity that exists in Bangladesh. However in other two surveyed projects the disparity was substantially narrow.

6.2 Agricultural Impact

The agricultural analysis of the selected sub-projects is focused mainly on the changes of agricultural production (tons) of crops, cultivated areas and cropping intensity.

6.2.1 Changes of Agricultural Production

The changes of production of major crops (cereals and non- cereals) for pre- and post-project situations of the selected sub-projects have been analyzed in the following sections.
A comparative summary has been drawn for pre- and post-project conditions for the selected three sub-projects in the following Tables.

Brazamul-Bhitikhal Sub-project

This shift in cropping pattern in Brazamul-Bhitikhal Sub-project has been reflected in the form of increase in the production of onion and decrease of Aman (local).

Farmers are very much interested to cultivate onion instead of Rice as it needs less labor and also it is more profitable. In Brazamul-Bhitikhal Sub-project, much of the single and double cropped areas have been shifted to triple cropped areas to show its overall increase of production.

Table 6.1 illustrates summary of the changes of production of major crops for pre- and post-project situations of Brazamul-Bhitikhal Sub-project.

Table 6.1 Summary of the changes of production of major crops for pre- and post-project situations (Brazamul-Bhitikhal Sub-project)

Main crops produced	Production (tons)		% change
	Pre-project	Post-project	
Cereals			
B.Aus (local)	209.9	315	50
B.Aman	22	0	-100
T Aman (local)	743.5	273.9	-63.2
T Aman (HYV)	428.8	1281.6	198.9
Mix.B.Aman	18	0	-100
Wheat	265.2	254.4	-4
Total for cereals	1687.4	2124.9	26
Others crops			
Jute	301.5	439.3	45.7
Pulses	185.6	205.2	10.5
Oilseeds	112.1	112	-0.1
Sugarcane	692	692	0
Vegetables	127.5	127.5	0
Onion	979.5	1888.6	92.8
Spices	503.6	511	1.5
Total for others	2901.8	3975.6	37

Source: LGED

The main benefit (positive impact) derived for sub-project development is increased agricultural production (Table 6.1). Total increase of 437 tons (26%) for

cereals and 1074 tons (37%) for non-cereals is observed. Onion has shown a huge increase in production 909 tons (93%). On the other hand jute, vegetables, sugarcane, and oilseed production have not increased significantly with subproject implementation. Production of pulse has increase by 20 tons (10.5%) mainly because of an increase in area suitable for this crop.

An overall increase of cropped area is 12.2% and crop production is 31.2% (Table-5.14) after the implementation of this sub-project.

Fuleshwari Sub-project

Table 6.2 illustrates summary of the changes of production of major crops for pre- and post-project situations of Fuleswari Sub-project.

Table 6.2 Summary of the Changes of Production of major crops for pre- and post-project situations (Fuleswari)

Main crops produced	Production (tons)		% change
	Pre-project	Post-project	
Cereals			
B.Aus	688	707.3	2.65
LT Aman	0	782.9	---
HYV Aman	0	256.1	---
B.DWR	669	90	-87
Wheat	473.2	478	1.02
Total for cereals	1830.2	2314.3	26.5
Others crops			
Jute	417.6	459.4	10
Pulses	138	164	19
Oilseeds	52	61	17
Sugarcane	1420	1420	0
Vegetables	367	367	0
Spice	131	131	0
Total for others	2525.6	2602.4	3

Source: LGED

The increase in agricultural production in this sub-project is 26.5% for cereals and only 3% for non-cereals crops (Table 6.2). An overall increase of cropped area is only 3.5% and crop production is 10.5% (Table-5.15) after the implementation of this sub-project.

The effectiveness of most of the structures in this sub-project has decreased due to lack of proper O&M. As a result, this sub-project area can not be fully drainage free.

Alamkhali Sub-project

Table 6.3 illustrates crop area, yield, and production by land type under both pre- and post sub-project conditions of Alamkhali Sub-project.

Table 6.3 Summary of the changes of production of major crops for pre- and post-project situations (Alamkhali)

Main crops produced	Production(tons)		% change
	Pre-project	Post-project	
Cereals			
HYV T Aman (normal)	966	966	0
HYV T Aman(flooded)	201	201.6	0.3
B. Aman	63	63	0
T. Aman	42	42	0
HYV Boro	907.5	1562.6	72
Wheat (normal)	0	162	
Wheat (droughty)	66.5	0	-100
Total for cereals	2246	2997.2	33.5
Others crops			
Potato	314	314	0
Oilseeds	12.6	63.6	404
Spices	120	120	0
Vegetables	441.6	533.6	21
Jute	211.2	211.2	0
Total for others	1099.4	1242.4	13

Source: Field survey and LGED.

The main benefit is increased of 751 tons (33%) for cereals and 143 tons (13%) for non-cereals are observed (Table-6.3). On the other hand production of HYV Boro is increased by 655 tons (72%), production of oilseeds is increased by 51 tons (404%) and vegetables are increased by 92 tons (21%).

An overall increase of cropped area is 20.3% and crop production is 26.7% (Table-5.16) after the implementation of this sub-project.

6.2.2 Changes of Cropping Intensity

The change in cropping pattern in the study area may be compared for pre- and post-project conditions. Cropping intensity has been calculated by using Eq (3.1) and the results are shown in the Table 5.17.

From the result, it is seen that the cropping pattern have changed substantially in Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project. It shows that at post-project the cropping intensity has been increased in Brazamul-Bhitikhal Sub-project by 29% and in Alamkhali Sub-project by 35% but it has been increased in Fuleswari Sub-project by only 6%. The usefulness of most of the structures in Fuleswari Sub-project has decreased due to lack of proper O&M. As a result, this sub-project could not achieve its target.

6.3 Condition of the Infrastructure

Condition of the infrastructure is a measure of physical condition of the structures within an FCD system. Usefulness of the infrastructure was observed from the field investigation, stakeholders' response and also by studying literature and project documents. Common findings are shown in Table 6.4 and 6.5 for all of the study sub-projects.

In Fuleswari Sub-project, one regulator is found at improper location. There are three regulators and one boat- pass in this Sub-project. All the regulators are one vent with inadequate size (1mx1m). As the sub-project area is comparatively big, these regulators should be of 3 vents. Moreover there should be at least two additional regulators (two-vent) and two extra boat-passes. LGED officials admitted the

occurrences of these drawbacks due to improper feedback/information from the villagers before implementation. Regulator is improperly located due to weak soil condition.

Three of the regulators of Fuleswari Sub-project found inactive due to non-availability of shaft, gate plate and gear-box. This is really an example of improper management of WMCA. Gates were not painted and weeds were not cleaned. WMCA president informed that they have no fund, on the other hand, LGED do not sanction any fund.

In rest of the two sub-projects (Brazamul and Alamkhali), the vent sizes of regulators and sluices are found adequate (on the basis of physical observation and discussion with local people). Sill/ crest level and Gate heights of regulators and sluices are found appropriate, as reported by the respondents in the field.

Figure 6.1 A regulator at Fuleswari Sub-project without Shaft (stolen)

Figure 6.2 A regulator at Fuleswari Sub-project without gate.

Figure 6.3 A Public cut at the embankment at Fuleswari Sub-project (near Norkona village).

Table 6.4 Usefulness of the infrastructure

Infrastructure	Indicator/ Parameters	Name of the sub-project			Comments
		Brazamul-Bhitikhal	Fuleswari	Alamkhali	
Regulator/ Sluices					
	Location	++	-	+++	Brazamul-
	Vent Size	+++	---	+++	Bhitikhal and
	Sill/ Crest level	+++	+	++	Alamkhali Sub-project are Satisfactory
	Gate Height	+++	-	+++	Fuleswari is not Satisfactory
Embankment					
	Alignment	NA	-	NA	
	Crest level	NA	---	NA	Fuleswari is
	Crest width	NA	--	NA	not
	Side slopes	NA	-	NA	Satisfactory
	Physical damage	NA	---	NA	
Khals					
	Alignment	+++	-	+++	Brazamul-
	Width	++	---	++	Bhitikhal and
	Conveyance	+	--	+	Alamkhali Sub-project Satisfactory
	Physical damage	NA	-	NA	Fuleswari is not Satisfactory

Source: Field Investigation

Legends:

+++	Very Positive	-	Insufficient
++	Positive	--	Negative
+	Sufficient	---	Very Negative

Table 6.5 Condition of the infrastructure

O&M activities	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Siltation and sliding in canals	medium	high	low
Seedbed, obstruction, water hyacinth and weeds in canals	low	medium	low
Breach, public/rain-cut, rat-hole, goghs, and erosion in embankments	n/a	high	n/a
Protection blocks and approach road damaged	no	high	no
Rusting grease and paint given in gates	yes	no	yes
Damaged/missing rubber seals	no	yes	no
Gear box damaged/stolen, and missing keys	no	yes	no

Source: Field Investigation

In Fuleswari Sub-project, there observed four public cuts at the embankment due to inadequate boat passage. The width of the embankment was also found decreased in some places due to illegal use of bank area as private property by the beneficiaries. There was huge siltation in most of the canals of the three sub-projects specially the canals of Fuleswari Sub-projec.

6.3.1 Operation and Maintenance (O&M)

In Small Scale Projects, the implementing authority (LGED), in the project document very specifically addressed the issue of O&M by involving local beneficiaries. Subsequently, WMCA are established to (a) conduct routine operation of the structure, (b) conduct annual inspection to review the performance of water control system, (c) identify maintenance needs, (d) conduct necessary maintenance works, and (e) plan for O&M in the coming years.

However, all the sub-projects have been encountered with maintenance problems to some extent, but within a limitation, that can easily be addressed. Some of the common maintenance problems that were found in the sub-projects are as follows:

Siltation of khals of Brazamul-Bhitikhal Sub-project and Fuleswari Sub-project need to be re-excavated immediately.

Water hyacinth and weeds created huge obstruction in khals of Fuleswari Sub-project. No periodic maintenance is recorded here and executive committee members of WMCA reported about lacking in O&M fund in this abject.
Breach, public/rain-cut, rat-hole, goghs, and erosion in embankments are most common in Fuleswari Sub-project.

Table 6.6 O&M activities

O&M activities	Response	Brazamul-Bhitikhal	Fuleswari	Alamkhali
Basis of operation	1. Clear instruction 2. Operators judgment 3. Wish of influential	Clear instruction	Wish of influential	Operators judgment
Appointed operator	yes / no	Yes (Treasurer responsible as operator)	No	No
Conflict in operation	Yes/No	Yes (24%) No (76%)	Yes (73%) No (27%)	Yes (33%) No (67%)
Direct involvement on decision making of the O&M activities	Yes/No	Yes (35%) No (65%)	Yes (6%) No (94%)	Yes (42%) No (58%)
Complain about the infrastructure	Yes/No	Yes (3%) No (97%)	Yes (98%) No (2%)	Yes (2.5%) No (97.5%)

Note: Brazamul-Bhitikhal Sub-project beneficiaries have additional demand to construct another Regulator which is under processing by LGED.

6.4 Environmental Impact

In the past, emphasis was not given on the possible subsequent impact of the water development programs on the environment. Recently, there is an urgent need for giving attention to the environmental impact of water development projects because of increasing threat. In evaluating the performance of any intervention work, environmental parameters are considered as the performance indicators, although they are not the direct performance parameters.

In the study areas, actually there was no remarkable change compared to pre-project condition. The important environmental indicators were assessed and tabulated in Table 6.7 and the parameters are qualitative in nature and in most of the cases the judgment from the field visit and questionnaire investigation is used for the assessment.

Table 6.7 Impact of sub-projects on various parameters

Indicators	Impact		
	Brazamul-Bhitikhal	Fuleswari	Alamkhali
1. Incidence of flood	++	+	++
2. Drainage & water logging	+++	+	+++
3. Siltation	-	-	+
4. Fish catch	++	+	+
5. Fish migration	-	--	-
6. Fertilizer use	++	+	+
7. Pesticide use	++	+	+
8. Disease	+	No change	+
9. Land fertility	No change	--	No change
10. Public health & sanitation	+	No change	+

Interpretation:	Positive Impact:	Negative Impact:
	High +++	High ---
	Moderate ++	Moderate --
	Low +	Low -

6.5 Socio-economical impact

Socio-economic impact of the project has been analyzed mainly in terms of sustainability of O&M, capital funding and beneficiary contribution, micro-credit activities etc.

Sustainability or self-sufficiency of O&M is one of the most essential ingredients for successful future operation of a water resources scheme. In recent years, there has been increasing concern over the level of recurrent costs required to keep water resources system functioning and substantial efforts have been made to raise revenues from water users to bear O&M costs and often some percentage of structural components of the system The result of Financial Viability Index (FVI) has been calculated using Equation 3.2 and the result is given in Table 5.22 and 5.23

The Tables 5.22 shows that financial viability on the basis of beneficiary's contribution collection for cooperatives in all the three sub-projects is good (above 100%) but on the basis of O&M fund collection Fuleswari Sub-project shows very poor performance (only 9.8%). However it is worthy to mention that Brazamul-Bhitikhal Sub-project and Fuleswari Sub-project were registered in the same year (1998), savings of Fuleswari Sub-project is notably lower than savings of the

Brazamul-Bhitikhal Sub-project. On the other hand, as a new project of second phase, Alamkhali Sub-project (Registered in 2004) shows very promising performance in savings and micro-credit activities

The Tables 5.25 and 5.26 show that land value and wage rate has changed signification with respect to pre-project time. This is partially for the impact of the sub-project and partially for the impact of the national development.

Chapter 7

Conclusions and Recommendations

7.1 Conclusions

The main objective of this study was to evaluate the performance of the participatory water management of some selected Small-Scale Water Resources Projects of LGED.

The following conclusions can be drawn from this study.

7.1.1 Performance of Water Management Cooperative Association (WMCA)

- All the three WMCAs were registered. WMCA formation in Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project were found more or less fair whereas in Fuleswari Sub-project the process was not fair at all. A big number of respondents in Fuleswari Sub-project were not aware of the WMCA formation activities.
- In regards of meeting attendance, it shows very good percentage of attendance in Brazamul-Bhitikhal Sub-project. Alamkhali Sub-project also shows a very promising picture though being a new sub-project. But the meeting attendance of Fuleswari Sub-project is not appreciative. The participants in the meeting are not regular in Fuleswari Sub-project and in most of the cases they think that the meeting had no importance. They are not informed properly about the meetings also. Women participation index (WPI) is highest in Brazamul-Bhitikhal Sub-project among the three sub-projects. It is 10.3%, 5.4% and 3.7% in Brazamul-Bhitikhal Sub-project, AFC and Fuleswari Sub-project , respectively. In all the three sub-projects, meeting discussions were dominated with beneficiaries' contribution for their cooperatives and loan giving affairs. O&M related affairs were discussed as important issue only in Brazamul-Bhitikhal Sub-project.
- WMCA could not solve various problems within the sub-projects as the EC members are not getting any financial benefits for their time and contribution. In Fuleswari Sub-project, many of the EC members are not much dedicated to

their responsibilities. There was also internal conflict within WMCA executives.

- Maintenance of office books and records was found appropriate in Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project where it was found improper in Fuleswari Sub-project. Even they don't have their own office premises.

7.1.2 Agricultural Performance

The overall increase of crop production in Brazamul-Bhitikhal Sub-project, Fuleswari Sub-project and Alamkhali Sub-project are 31%, 10 5% and 27% respectively The increase of cropping intensity in Brazamul-Bhitikhal, Fuleswari and Alamkhali Sub-project are 29%, 6% and 35% respectively The reported increase in agricultural production is the result of the change of cropping pattern and intensity due to change of land type. However, it is reveal that in Fuleswari Sub-project, crop production and cropping intensity has not been increased significantly. Due to lack of proper O&M, most of the structures remained inactive. For this reason, this sub-project area can not be fully or properly drainage free.

7.1.3 Condition of the Infrastructure

The overall physical condition of the infrastructure in Brazamul-Bhitikhal Sub-project and Alamkhali Sub-project are found more or less in good condition. The vent sizes and number of regulators and sluices are found adequate. The physical conditions of the infrastructure in Fuleswari Sub-project are not good at all. Regulator size and number are grossly inadequate. The shaft, gate-plate and gear-box of the regulators of Fuleswari Sub-project were stolen. This is an example of improper management of WMCA. The gates were not painted. No O&M works have been done for the last three years due to careless of WMCA.

In Fuleswari Sub-project, there observed four public cuts at the embankment due to inadequate boat passage. The width of the embankment was also found decreased in some places due to illegal use of bank area as private property by the beneficiaries.

There was huge siltation in most of the khals of the three sub-projects specially the khals of Fuleswari Sub-projec.

7.1.4 Environmental Impact

There was no remarkable environmental change in water quality and natural vegetation from pre- to post-project conditions. Natural fish migration has hindered due to construction of embankment and regulators. But culture fish production has increased after implementation of the sub-project and better training especially in Brazamul-Bhitikhal Sub-project.

In Fuleswari Sub-project, navigation has been obstructed due to inadequate implementation of facility for boat-passage across the embankment. For this reason, there was found four public cut across the embankment.

7.1.5 Sustainability of O&M, Capital Funding & Micro-credit Activities

The financial viability as per beneficiary's contribution collection for cooperatives in all the three sub-projects is good (above 100%) but as per O&M fund collection Fuleswari Sub-project shows very poor performance (only 9.8%). However it is worthy to mention that Brazamul-Bhitikhal Sub-project and Fuleswari Sub-project were registered in the same year (1998), savings of Fuleswari Sub-project is notably lower than savings of the Brazamul-Bhitikhal Sub-project. On the other hand, as a new project of second phase, Alamkhali Sub-project (Registered in 2004) shows very promising performance in savings and micro-credit activities.

The land value and wage rate have changed significantly with respect to pre-project time.

7.2 Recommendations

From this study, it is reveals that lack of beneficiaries' participation and lack of proper infrastructure maintenance by WMCA to be the main reason behind the lesser success of a water resource scheme. The performance can be improved by increasing beneficiaries' involvement in local levels.

Based on the foregoing discussions, the following recommendations are, therefore, put forward for further improvement of the performance of Small Scale Water Resources projects of LGED.

i. Executive members of WMCA should be formed with dedicated stakeholders and their activities should be monitored regularly. Linkage with WMCA and LGED project level authority must be further improved.

ii. For drainage improvement, Canals should be re-excavated immediately.

iii. At pre-feasibility and feasibility phase, feedback from the beneficiary regarding the structure type and location should be given emphasize.

iv. For further study, more numbers of Sub-projects can be taken randomly to evaluate their performance and to find out the reasons of success or failure of those small scale projects.

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Annex-A

Questionnaire Survey for Field data collection/ Beneficiaries response

Serial Code.....

Name of the Sub-project:

Mouza/Village..... .... Union.....

A. Personal Background of Respondent

(i) Name:..... ..... (ii) Age:... ..... (iii) Sex: Male/Female

(iv) Education:.....

(v) Main occupation: Farmer/Fisherman/Boatman/Daylabour/Serviceholder/Businessman/Others

(vi) Secondary occupation :.....(vii) Number of family members.....

(viii) Class: Landless (<0.2 ha)/ Small & Marginal (0.2-1.0 ha)/Medium & Large (>1.0 ha).

[Note: 1 ha=2.47 acres=247 decimal=10,000 sqm=7.47 Bigha and 33 decimal=1 Bigha]

(ix) Post holding in WMCA: Executive member /General member/Non-member

B. General question regarding the Sub-project

(i) Do you know when and by whom this sub-project was implemented?.....

(ii) Why this sub-project was taken (problem on that time)?

.....

(iii) Do you think that this project is beneficial for the people of the area?

- Most beneficial
- Somewhat beneficial
- Not beneficial
- Harmful
- Do not know

(iv) Is there any land acquisition of your family for the implementation of the sub-project? Y/N

If yes, specify land area (decimal) .....

(v) Do you get proper compensation for your land acquisition? Y/N

If yes, specify-

- Get adequate land value
- Timely get money

If no, specify-

- Not get adequate land value. Why.....
- Not timely get money. Why.....

(vi) Was there arise any problem at the time of starting of the sub-project?

a. If yes, why

- Earth excavation without land acquisition
- Construction works hampering crops
- Others(specify)

b. No

c. Not know

(vii) Did you willingly participate in the construction work of the project? (Y/N)

If yes, By voluntary labor/By food for work/For wages

If no, why?.....

(viii) Is there any conflict among the villagers/stakeholders regarding the sub-project? Y/N

If yes, specify (such as conflict betn. Farmer & Fisherman regarding drainage & water logging or conflict betn.the people of u/s & d/s)

.....

C. For Evaluation of Infrastructure

(i) Is there any complain about the infrastructure construction? Yes/No

If yes, then specify.....

(ii) Was LGED consider the idea of local wise & old people regarding structure? Yes/No

Regulator/Sluice:

(iii) Location of Regulator/Sluice: Ok/Inappropriate

(iv) Vent size: Ok/Inappropriate

(v) Sill Level /Gate height: Ok/Higher/Lower than required

Embankment:

(vi) Is the alignment of Embankment satisfactory? Yes/No

If no, specify.....

(vii) Is crest level of the embankment adequate? Yes/No

If no, specify.....

Canal:

(viii) Is the alignment of Canal satisfactory? Yes/No

If no, specify.....

(ix) Is the width of the Canal adequate? Yes/No

If no, specify.....

D. Agricultural Aspect

(i) Whether Cultivated Area has increased? Yes/No change/No
If yes, specify the amount (% or ha.or decimal or Bigha).....

(ii) Is there any increase in number of crops after Project? Yes/No change/No

If yes, specify the number, Pre-project....., Post-project.....

(iii) Is there any increase in crop yield/productivity after Project? Yes/ No change /No

If yes, specify (% or amount-ton, kg, mon etc) .....

(iv) Is the facility of irrigation increase after Project? Yes/ No change /No

E. Institutional Aspect (Performance of WMCA)

a. Awareness & Membership of WMCA

(i) Is there any WMCA? Yes/No

(ii) Are you a member of WMCA? Yes/No

(iii) If not a member of WMCA, do you want to be a WMCA member? Yes/No

Specify why.....

(iv) Is there any obligation of being a general member of WMCA?

(v) Are you (if general member) aware of your responsibilities in day to day management and decision making? Yes/No

(vi) Do you know the name of your WMCA President/Secretary/EC? Yes/No

b. Formation & Status of WMCA

(i) How the WMCA executive members are selected?

(a) Democratically elected/selected (b) By local influential people's decision (d) LGED officials formed committee with elites (e) Heard later from others (f) Not well informed/Not known

(ii) Is the WMCA controlled by few influential people? Yes/No

(iii) Are the WMCA members influential in their locality? Yes/No

If yes, specify how: Financially/Politically/Experienced

(iv) Is there any (serious) internal conflict within WMCA members? Yes/No

If yes, specify why.....

(v) Is the managing/executive committee active? Yes/No

c. Regularity of meeting/Beneficiary involvement in management

(i) Is group meeting held regularly? Yes/No

(ii) Do you attend the group meeting? Yes/No

If yes, specify the number.....out of.....

(iii) What is your reason for not attending meeting?

(a) Not informed (b) Busy (c) Meeting were dominated by local elites (d) Meeting had no importance (e) other, specify.....

(iv) Is the attendance book of meeting maintain with resolution properly? Yes/No

(v) What is the general issue of meeting discussion?

(a) Water related problem (b) O&M. (c) Beneficiary's contribution (d) Conflict resolution (e) other, specify.....

(vi) Why WMCA did not try to solve problem?

(a) no financial benefit, (b) Not aware of their duty (c) not extra manpower (d) infrequent in field

d. Training

(i) Do you (WMCA member/Not) receive any training and in which sector? Y/N

If yes, Number.....and Sector/Type of training (IPM/Soil/DAE/Fishery etc).....

By whom.....

(ii) By whom you receive the training? (LGED/DAE/DOF/Others.....)

(iii) What is your comment about the training? Insufficient/good/Sufficient

e. Operation and Maintenance

(i) What is the basis of operation? Clear instruction/Operators judgment/Wish of influential/Others.....

(ii) Is there any conflict in operation: Yes/No

If yes, specify.....

(iii) Are you directly involved on the decision making for the O&M activities? Yes/No

If no, why.....

(iv) By whom O&M mainly carry out? WMCA/LGED/Others

f. Co-operation

(i) Have you taken any loan or any benefit from WMCA?

If yes, specify how.....

If no, specify why.....

(ii) Is the WMCA generating income? Yes/No

If yes, specify how.....

(iii) Are the books & documents/records of WMCA kept properly as per *cooperative law*? Yes/No

g. Overall

(i) Is the WMCA well organized? Yes/No

If yes, specify how: (a) Prob.solution (b) Regularly held General/EC/Group meeting (c) Reflection of alls opinion with maintaining records (d) Proper O&M

(ii) Do you satisfied on the activities of WMCA? Yes/Somewhat satisfied/ Not

Specify .....

(iii) Do you have any objection on the activities of WMCA? Yes/No

Specify .....

(iv) Is the WMCA likely to function well after in future?Yes/No

G. Social and Financial Aspect

(i) Do you think this project is helping on increasing employment generation? Yes/No change/No

If yes, specify how.....

(ii) Do you give your beneficiaries contribution for- (a) O&M, (b) share & (c) savings collection timely? Yes/No

If no, specify why.....

(iii) Do you think that the project is beneficial for women?

- Beneficial

  If beneficial, how?

  - Income generation through construction work(earth-work etc)
  - Agricultural day labor
  - Income generation from post-harvesting work
  - Income generation through micro credit activities/share/savings/financial self sufficiency.
  - Reduction of disease, easy available of treatment facility.
  - Others(specify)
- Adverse impact
- No impact

- Do not know

(iv) Do you believe /feel that the project plays a role for poverty reduction? Yes/No/No change

H. Environmental Aspect

(i) Have you been beneficial from the project? How,

- The scheme provides protection from flood
- Helps drainage of the area
- Provides water for irrigation
- Increases crop yielding & cropping intensity
- Employment generation
- Provides road facilities
- Increase land value
- Decrease water borne disease
- Increase of fish culture
- Increase of house- hold
- Provides scope for social forestry
- Others(specify)

(ii) Is the sub-project creating any problem? Y/N. If yes, how..

- Increase water logging
- Decrease land fertility
- Irregular irrigation supply
- Decrease natural fishing
- Destroy natural forestry or house- hold
- Increase of mosquito, bees
- Others(specify)

(iii) Is the Project helped on health facilities? Yes/ No change /No

If yes, specify (such as any new hospital set-up).....

(iv) Is the Project helped on transportation facilities? Yes/No change/No

If yes, specify (such as any new road).....

(v) Is there any *impact* on natural fishing? Positive/Negative/No change

(vi) Is there any *impact* on livestock? Positive/Negative/No change

(vii) Is there any reduction of water born disease after the SP? Y/N

Annex-B

Personal observation and reconnaissance at Field/FGD

(Discussion/FGD with LGED's official/WMCA/Concern person)

A. For Evaluation of Infrastructure:

a. Embankment

(i) Year of Construction..... Length of Embankment.....

(ii) Alignment

(a) New alignment/along the existing road or embankment/re-sectioning

(b) Deviation from the design: Yes/No

(c) Reason for Deviation:.....

(d) Distance from river:.....

(iii) Crest level: (a) Design..... (b) Observe.....

(iv) Crest Width: (a) Design..... (b) Observe.....

(v) Side Slopes: (a) Design..... (b) Observe.....

(vi) Rain cut: None/Rare/Frequent

(vii) Public cut: None/Rare/Frequent

(viii) Ghoes and rat holes: None/Rare/Frequent

(ix) Piping/Leakage: Number of location.....

(x) Filling Materials:.....

(xi) Quality of earthwork: Good/Reasonable/Poor

(xii) Trees beside the embankment for earth protection: Adequate/Reasonable/ Inadequate

b. Canal

(i) Name of Canal:

(ii) Year of excavation

(iii) Purpose: Drainage/Water conservation/ Irrigation

(iv) Alignment:

(a) New alignment/along the existing road or embankment/re-excavation

(b) Deviation from the design: Yes/No

(c) Reason for Deviation.....

(v) Depth: (a) Design..... (b) Observe.....

(vi) Width: (a) Design..... (b) Observe.....

(vii) Side slopes: (a) Design..... (b) Observe.....

(viii) Conveyance: Adequate/Reasonable/Inadequate

(ix) Siltation: High/Moderate/Low/None

(x) Weeds/Hyacinth: High/Moderate/Low/None

(xi) Quality of excavation work: Good/Reasonable/Poor

c. Regulator/Sluice

(i) Name of Canal on which the WRS is constructed:

(ii) Year of Construction:

(iii) Purpose: Flood control/Drainage/Water regulate/ Flushing/ Water retention

(iv) Location: Ok/Inappropriate

(v) Vent size/Ventage: (a) Design..... (b) Observe.....

(vi) Sill Level/Height: Ok/Higher/Lower than required

(vii) Protection works of upstream: Good/Reasonable/Poor

(viii) Protection works of Downstream: Good/Reasonable/Poor

(ix) Quality of concrete work: Good/Reasonable/Poor

(x) Gate:

(a) Exists/Does not exists/ Missing

(b) Type: Steel vertical lift/Fallboards/Flap

(c) Condition: (1) Gate: Good/Reasonable/Poor

(2) Lifting Device: Operational/Not operable

(3) Rubber Sill: Good/Reasonable/Poor/Missing

B. Appropriateness and Adequacy of Design

(i) Is the alignment of Embankment satisfactory? Yes/No

If no, specify.....

(ii) Is crest level of the embankment adequate? Yes/No

If no, specify.....

(iii) Is the side slope of the embankment adequate? Yes/No

If no, specify.....

(iv) Is the alignment of Canal satisfactory? Yes/No

If no, specify.....

(v) Is side slope of the Canal adequate? Yes/No

If no, specify.....

(vi) Is the bank width of the Canal adequate? Yes/No

If no, specify.....

(vii) Is the location of Regulator appropriate? Yes/No

If no, specify.....

(viii) Is the vent size of the regulator adequate? Yes/No

If no, specify.....

(ix) Is the sill/crest level is adequate? Yes/No

If no, specify.....

(x) Is the gate height is adequate?

If no, specify.....

C. Agricultural

(i) How much area, which crops and what is the production of each crop you cultivate each season?

Sl. No.	Name of crop	Area	Production
1	B Aman		
2	T Aman		
3	HYV Aman		
4	B Aus		
5	Jute		
6	Wheat		
7	Pulses		
8	Oil seeds		
9	Vegetables		
10	Spices		
12	Sugarcane		
13			
14			

Agriculture related changes due to implementation of the sub-project:

Type of changes	Pre-project condition (yr.)	Post-project condition (yr.)
Own land in SP area(flood affected/flood free)		
Own land out side of SP area(flood affected/flood free)		
Three(03) main crops		
Production of three(03) main crops		
Seed bed at Canal bed(Y/N)		
Land value(Tk./Decimal)		
Own bullock/Power tiller(Y/N)		

D. Institutional Aspect (Performance of WMCA)

(i) Is the WMCA has Govt. registration? Yes/No

(ii) How many farmers are the members of WMCA? .....

(iii) How many females are the members of WMCA? .....

(iv) Whether women should be involved in PWM activities? Yes/No

If yes, specify.....

(v) How many members attend in a group meeting (in an average)?

Male.....Female.....

(vi) Is there an appointed operator for each of regulator? Yes/No

If yes, then how much salary he received monthly.....

(vii) Did the operator receive any training? Yes/No

If yes, specify type of training.....

(viii) Was the O&M manual submitted to WMCA upon completion? Yes/No

(ix) Operation logbook: Maintain/Not maintain

(x) Type of O&M? Oil &greasing /Painting/Removal of weeds/gate or rubber seal repairing/pipe replacing/earth filling for preventing water leakage/others

(xi) Are the member willingly to make contribution to O&M? Yes/No

Specify why.....

(xii) How much the member has to contribute per year/season?

a.Cash(Tk.)..... b. Crop(name & quantity in kg)..... .....

c. labour(no. of man days).....

(xiii) Monitoring plan of WMCA: Yes/No

If yes, specify.....

(xiv) Is there any co-operative development funding? Y/N

(xv) Rate of fee collection (Tk/area).....

(xvi) Amount of WMCA fee collection (Tk/%).....

(xvii) Is there any implementation of laws & regulations for the defaulters?

a. Within over the general members

b. Within over the executive committee

(xviii) Is any villager, out of WMCA member receiving training? Yes/No

If yes, specify.....

(xix) Is O&M is a schedule program by a well appointed operator? Yes/No

(xx) Meeting attendance of WMCA members:

Meeting attendance	% of WMCA members
None	
One – Two	
Three - Four	

(xxi) Status of WMCA:

Name of SP/WMCA	**Registration Status**		**Membership**					**Election of executive committee held**	
	Registered	Non Registered	Total eligible member	Present member No.	Present member % of total eligible	Present female member No.	Female member % of present member No.	Yes	No

E. Social & Environmental

(i) Wage rate has been increased: Yes/No change/No [especially for this SP/PWMA, not other influencing factors out side of this SP]

If yes, specify the amount.....

Impact of the sub-project on the wage rate				
a. Increase in wage rate	Amount(Tk/Day)			
b. Decrease wage rate	1999	2000	2005	2006
c. Wage rate remaining static				

(ii) Is the PWMA intervention helped on education? Yes/No change/No

If yes, specify (set-up of any new school).....

(iii) What is Per Capita Income of stakeholders? Pre-project..... Post-project.....

(iv) Is there any flooding/drainage/ and/or water logging: (considering pre & post condition of SP): High(above 6')/Medium(3~6)/Moderate(1~3)/Low(below 1')

(v) Area Subjected to Flooding/ water logging (ha/%)? (considering pre & post condition of SP) Pre-project.....ha, Post-project.....ha.

(vi) Is there any impact on land fertility (considering pre & post condition of SP)? High/Medium/Low

(vii) Is there any impact on pesticides and fertilizer use (considering pre & post condition of SP): (+/-): High/Medium/Low

(viii) Is there any impact on fish culture (considering pre & post condition of SP): High/Medium/Low (interview the fisherman)

(ix) Fish culture increased .....(Kg/ton), Natural fish decreased .....(Kg/ton). (interview the fisherman)

F. Awareness

(i) Is the beneficiaries aware about PWMA? Yes/No

(ii) Is the villagers concern about the project? / Is the LGED previously discuss with the villagers regarding project planning & design?

(iii) Is DoC carried out the annual audit of WMCA?

Annex-C

Interviewee background/classification

Table 1: Demographic background of the respondents-Main occupation

Occupation	Frequency	Percent
Agriculture	91	74
Service	6	5
Business	16	13
Day labour	10	8
Total	123	100

Table 2: Demographic background of the respondents-Education Range

Category	Frequency	Percent
No education	30	24
1-5	40	32
6-10	45	37
10+	8	7
Total	123	100

Table 3: Demographic background of the respondents-Household size

Category	Frequency	Percent
2-5	48	39
6-10	63	51
10+	12	10
Total	123	100

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তাং 25-10-08
লাইব্রেরী, ঢাকা