Government of the People's Republic of Bangladesh

Flood Plan Coordination Organisation,
Ministry of Irrigation, Water Development and Flood Control

## BANGLADESH FLOOD ACTION PLAN

## FAP 12
## FCD/I AGRICULTURAL STUDY

# RAPID RURAL APPRAISAL OF BRAHMAPUTRA RIGHT EMBANKMENT KAZIPUR REACH



December 1991

Hunting Technical Services Limited

in association with

Bangladesh Institute of Development Studies
Flood Hazard Research Centre
Hunting-Fishtech
Technoconsult International Limited

under assignment to
UNITED KINGDOM
OVERSEAS DEVELOPMENT ADMINISTRATION

Sanyu Consultants Inc.

under assignment to
JAPAN INTERNATIONAL COOPERATION AGENCY

The present report is one of a series being produced by Flood Action Plan components 12, the FCD/I Agricultural Study and 13, the Operation and Maintenance Study.

The full series is expected to comprise the following reports:

**FAP 12**


Inception Report (joint with FAP 13)
Methodology Report (2 Volumes)
Rapid Rural Appraisals Overview

Project impact Evaluation studies of:

* Chalan Beel Polder D
* Kurigram South
* Meghna Dhonagoda Irrigation Project
* Zilkar Haor
* Kolabashukhali Project


Rapid Rural Appraisal Studies of:

Protappur Irrigation Project
Nagor River Project
* Sonamukhi Bonmander Beel Drainage Project
Improvement of Sakunia Beel
Silimpur - Karatia Bridge cum Regulators
* Khatakhali Khal
Halir Haor
Kahua Muhuri Embankment
Konapara Embankment
Polder 17/2
BRE Kamarjani Reach
**BRE Kazipur Reach**


* Draft Final Report (2 Volumes)
* Final Report (2 Volumes)

**FAP 13**

Methodology Report
Appraisal of Operation and Maintenance in FCD/I Projects (2 volumes)
Draft Final Report
* Final Report

Note: * Report not yet available

# BRAHMAPUTRA RIGHT EMBANKMENT
# KAZIPUR REACH

## Project Summary Sheet

| | |
|---|---|
| **Project Name** | : Brahmaputra Right Embankment, Kazipur Reach |
| **Project Type** | : Flood Control and Drainage |
| **Location** | |
| **FAP Region** | : North-West |
| **District** | : Sirajganj |
| **Area (ha.)** | : 10,500 ha.(gross) (Kazipur Reach) |
| **Funding Agency** | : IDA |
| **Implementing Agency** | : BWDB |
| **Construction started** | : 1963 original, 1974 rehabilitation |
| **Scheduled Completion** | : |
| **Actual Completion** | : 1970 original 1985 rehabilitation |
| **Original Cost Estimate** | : Tk.78.95 million (1963-70) for the entire BRE |
| **Final Cost Estimate** | : Tk.395.8 million (1974-85) for the entire BRE |
| **Major Flood Damage** | : Annual, since 1984 |
| **Repair/rehabilitation** | : Major work in 1974-85 period, frequent erosion and construction of retired embankments, particularly since rehabilitation. |

# BRAHMAPUTRA RIGHT EMBANKMENT, KAZIPUR REACH

## SUMMARY OF FINDINGS

### Introduction

The Brahamputra Right Embankment (BRE) is one of the oldest FCD projects in Bangladesh. It was originally started in 1963 to build 225 km. of embankment to protect about 240,000 ha. from flooding of the Brahmaputra. Major rehabilitation was carried out from 1975 onwards.

Since BRE is a huge project, two sections only were purposively chosen for two separate RRAs - one in Kamarjani reach in Gaibandha and the other in Kazipur in Sirajganj. The rationale for selecting Kamarjani reach was that this section of the BRE has been relatively stable so far. However, during the RRA in early June, 1991, the embankment near Kamarjani Bazar was found to be only a few meters away from the river bank and was eroding very fast. In this section, the benefited area slopes towards the Brahmaputra and there have been few embankment retirements.

In contrast, Kazipur reach is in an unstable section of the BRE. There are frequent breaches and embankment retirements and because the land slopes away from the embankment the breaches cause severe damage to a large area.

Kazipur reach of the BRE is located in Maijbari, Sonamukhi, Kazipur, Chalitadanga, Gandail and Subhagachha Unions in Kazipur Upazila and Ratankandi Union of Sirajganj Upazila of Sirajganj District. The study area covers about 10,500 ha. inside the BRE and the area coincides with BRE mileage- 85 (near Dhekuria) to mileage 95 (near Jhunkail) or 16.0 km. in length of the reach.

The general topography of the study area comprises two directional components. One component slopes gently towards the south parallel to the Brahmaputra river flow and the other slopes steeply towards the west, away from the Brahmaputra river.

During the pre-project period the whole area used to be submerged due to inflow of flood water from the Brahmaputra river causing damage to B. Aus, B. Aman and Jute crops. The construction of the BRE was expected to provide protection from floods and to permit a shift from local paddy to transplanted paddy varieties to boost agricultural production.

Between construction and 1984 the primary flood protection objective was achieved. Since 1984 however, there have been frequent embankment breaches due to erosion by the Jamuna (Brahmaputra) River. The area is now subject to severe and unpredictable floods and is probably worse off than in the pre-project situation.

### Engineering

Until 1984, when breaches of the BRE due to river erosion started severely, the primary objective of flood control was achieved. Crops such as B. Aus, B.Aman, Jute were protected from flood damage and human and animal living conditions were improved to a great extent. The situation has reversed during the period from 1984. There has been a

worsening flood situation rendering crop production in the monsoon season highly vulnerable as a result of embankment breaches along the Kazipur Reach.

The BRE has generated benefits by providing roads for transport and communication, shelter for human and animal population, land for linear housing, tree plantation, cattle/sheep grazing, borrow pits for fish culture, etc.. However, these should not be overestimated because they are incidental benefits of the Project.

River erosion and subsequent retirement of the embankment has led to unauthorised settlement of the affected people on the BRE. This reduces the strength of the embankment and also hinders regular maintenance work or emergency activities relevant to safety of the embankment. A modified design of embankment should be provided to accommodate construction of houses for the destitute people without hampering the quality of the embankment.

The improper construction of the retired embankments with respect to bad quality of embankment soil, inadequate compaction, untimely start of earthwork, non-payment of land and crop compensation and finally poor repair and maintenance of the embankment, all indicate lack of capacity on the part of the authority concerned. This ultimately reduces the credibility of BWDB to negotiate funds and assistance for flood control projects.

**Institutional Performance**

The embankment section is very poorly maintained and supervised. Due to lack of proper maintenance severe damage occurs to the embankment which jeopardises the stability of the embankment and security of crops, lives and property in the project area.

There is no Operation and Maintenance (O&M) committee in existence, although this was proposed in the Project Proforma (PP). There was no public participation in the repair and maintenance of the embankment or structures. Neither was there any instance of consultation between the beneficiaries and the executing agencies at any stage of planning, design and implementation of the Project.

The inadequate and delayed payment of compensation for the land acquired often delayed timely acquisition of land. This ultimately caused delayed start of construction, which is often done very inefficiently.

**Agriculture**

As projected in the PP, the BRE did successfully change the B. Aus/Jute-B. Aman - minor rabi crops cropping pattern into a B. Aus/Jute - T. Aman pattern in the initial years and then into Irrigated HYV Boro - HYV T. Aman over a large area. There has been a 50 percent increase in T. Aman production and about a 10 percent increase in the total monsoon rice production due to the Project.

The embankment breaches since 1984 have again caused uncertain and serious flooding in 3 out of every 5 years, making T. Aman production vulnerable to flood damage. Consequently both acreage and output of T. Aman has declined due to flooding caused by breaches of the BRE.

In the pre-project situation B. Aman used to be followed by minor rabi crops such as pulses and oilseeds. In the post-BRE period there has been a significant reduction in the production of these crops. However this is largely due to the expansion of HYV Boro cultivation which is not related to BRE.

The reemerged risk of annual flooding due to breaches and overtopping has seriously reduced the scope for monsoon season crop intensification, which requires a controlled water regime.

**Livestock**

The cattle population has seriously declined compared to the pre-project situation due to:

i. abrupt and severe inundation caused by the embankment breaches/flooding;

ii. shortage of straw for fodder from HYV paddy production in the monsoon.

**Fisheries**

One of the conspicuous negative consequences of the BRE, as elsewhere in FCD projects, is the serious decline in open water capture fisheries through:

i. the blockage of fish migration routes to and from the rivers and beels, reduction of fish spawning areas and restriction of migration by the major carps;

ii. reduction of wild spawn collection in the river;

iii. annual flooding due to breaches and overtopping of embankment, limiting the scope for pond culture fisheries.

The reduction of fish production has led to an occupational change by erstwhile professional fishermen to low income, irregular activities such as boat plying, wage labour or anything that brings some supplemental income.

**Nutrition and Health**

People's nutritional status, especially that of women and children, has deteriorated, due to decline in fish and pulse production. In flood times the poor are the most hard hit nutritionally because their food consumption goes down seriously.

Family planning activities and health care facilities have been improved to some extent as a result of the improvement in road communications, but this seems to be only partly due to the BRE.

**Women**

The BRE has had some positive impact on women as it has increased employment opportunities for women in agricultural activities, especially in post-harvest operations. As a

secondary effect of the project, better communication within the project area has facilitated increased female access to education, family planning and income generating activities. Better communication has also helped in the extension of NGO and GO activities in respect of women's development.

However, occasional breaches in the BRE and river erosion not only affect crop production but also cause a lot of suffering for women. Day-to-day life, especially in terms of communication between places, household working pattern, drinking water availability and sanitation, becomes difficult. For the same reason sometimes women's groups are unable to continue with their activities.

**Social Impact**

The BRE has generated considerable unintended benefits as it has been commonly used as both a temporary and permanent shelter for flood affected people and animals. The BRE as well as the internal village roads connected to it have facilitated the developmental activities of the GOs and NGOs in the Project area.

Improved communication on the embankment road networks has facilitated distribution of inputs and movement of goods and services to and from the Project area. It has also created some opportunities for income generating activities, especially for distressed women.

The BRE has had some positive impacts on employment creation through direct employment for the construction and maintenance of the original and retired embankments.

There has been a large loss of infrastructure and buildings due to severe river erosion in the post-Project period. There is no long-term investment in land, tree plantation, housing or business installations in the vicinity of the embankment.

Only partial payment has been made for the land acquired for the retired embankment and this has created dissatisfaction amongst the land owners.

**Environment**

The environmental impacts of the Project have been assessed with respect to physical, biological and human issues.

The project succeeded in protecting the area from Brahmaputra flooding in the initial years e.g. upto 1984, but the situation worsened since 1984 when severe river erosion caused frequent breaches of the embankment leading to a series of retired embankments.

The increased sand deposition due to sudden inflow of flood water as a result of breaches has taken a large area out of rice cultivation, but some of these lands are now used for sugarcane cultivation.

The other main negative impacts include decrease in soil fertility, changes in soil physical properties, decline in capture fisheries, deterioration of social attitudes and failure to achieve institutional effectiveness.

**Economic Impact**

The BRE Kazipur Reach has achieved a moderate increase in the incremental value of monsoon paddy production. However, because the Project also led to a loss of capture fishery and fails to protect the T. Aman crop effectively, the Project yields a low economic return.

The project has had a positive impact through creation of substantial employment in the construction of the original embankment and construction and repair of the retired embankments. The project has also generated additional employment in the crop sector at an annual rate higher than the population growth rate.

The overall equity implications of the Project are not at all clear, although it appears that a substantial portion of the additional employment created in the construction, repair and maintenance of the embankment sections went to the poorer section of the population.

**Lessons**

The delayed payment or non-payment of land compensation has created frustration amongst those who have lost land to allow the construction of the embankment. This complicated the acquisition of land and ultimately resulted in the late start of work, incomplete construction and wastage of money, manpower and administrative resources. One of the lessons is that the whole process of land acquisition, all the way from BWDB to the President's Secretariat via DLAC and Ministry of Land, should be subjected to review and reform.

The arrangements for embankment construction and maintenance by the BWDB seem unsatisfactory. Despite the fact that the embankment does not last or fails to protect the crops, life and property of the poor from flooding, disgruntled flood affected people told the RRA team members that a group of people - contractors, labourers, local influential individuals and in some cases officials, with access to political and other sorts of patronage, are skimming the flood control project through rent-seeking, deceitful acts and collusion. This is a delicate area no doubt, but the prevention of such tendencies is no less important than prevention from floods. Rather the former is a prerequisite for the successful implementation of the latter.

The most important lesson of all is that an embankment project with inadequate set-back on an erosion-prone reach of a major river is almost certain not to deliver the expected long-term benefits (due to short working life before being breached by erosion, and subsequent insecurity of retired embankments). Such an embankment cannot provide permanent stable conditions for development, and probably should not have been built.

## CONTENTS

**Chapter/Section** **Page No.**

**TABLES**

## FIGURES

## ABBREVIATIONS AND GLOSSARY

| | |
|---|---|
| ARCHES | Association for Renovation Community Health Education Services |
| BWDB | Bangladesh Water Development Board |
| BIDS | Bangladesh Institute of Development Studies |
| BRDB | Bangladesh Rural Development Board |
| BFEP | Brahmaputra Flood Embankment Project |
| BRE | Brahmaputra Right Embankment |
| BRFE | Brahmaputra Right Flood Embankment |
| CARE | Cooperative American Relief Everywhere |
| DTW | Deep tube-well (with positive-displacement pump) |
| DAE | Department of Agriculture Extension |
| DOF | Department of Fisheries |
| DLS | Directorate of Livestock Services |
| DLAC | District Land Acquisition Committee |
| EPWAPDA | East Pakistan Water and Power Development Board |
| XEN | Executive Engineer |
| FAP | Flood Action Plan |
| FCD | Flood Control and Drainage |
| FCDI | Flood Control Drainage and Irrigation |
| FDR | Flood Damage Repair |
| FFW | Food For Work |
| GOB | Government of Bangladesh |
| IDA | International Development Agency (World Bank) |
| JICA | Japan International Cooperation Agency |
| LDL | Leedshil De Leuw |
| MPO | Master Plan Organisation |
| NGO | Non-government Organisation |
| PCR | Project Completion Report |
| PIE | Project Impact Evaluation |
| PP | Project Proforma |
| RRA | Rapid Rural Appraisal |
| SAR | Staff Appraisal Report |
| SCF | Shadow Conversion Factor |
| SSDFCP | Small Scale Drainage and Flood Control Project |
| STW | Shallow tube-well (with suction pump) |
| SDE | Sub-Divisional Engineer (BWDB) |
| ODA | United Kingdom Overseas Development Agency |
| UNO | Upazila Nirbahi Officer (principal staff officer of Upazila Parishad) |

# 1 INTRODUCTION

## 1.1 THE FAP 12 STUDY

The FAP 12 Study is one of the 26 numbered component studies of the Bangladesh National Flood Action Plan, and is jointly supported by the United Kingdom Overseas Development Administration (ODA) and the Japan International Cooperation Agency (JICA). It is led by a group of Bangladeshi and international consulting organisations, involving Hunting Technical Services Limited of the United Kingdom, Sanyu Consultants Inc. of Japan, the Bangladesh Institute of Development Studies (BIDS), the Flood Hazard Research Centre of Middlesex Polytechnic, UK, Hunting Fishtech of UK, and Technoconsult International Limited of Bangladesh.

The objective of FAP 12 is to conduct post-evaluations of a total of 17 projects, representative in type and location of the FCDI projects so far executed in Bangladesh (see Figure 1.1). The results of these evaluations will be passed to other FAP components for guidance in developing strategies for improved flood control and management for the future.

Of the 17 projects for study, 5 will be assessed mainly by Project Impact Evaluation (PIE) methods, using a formal questionnaire approach and probability sampling. The remainder will be assessed by Rapid Rural Appraisal (RRA) methods, and RRA has also been used for preliminary reconnaissance of the 5 PIE projects. The present report describes the findings of the RRA of the Brahmaputra Right Embankment (BRE), Kazipur reach.

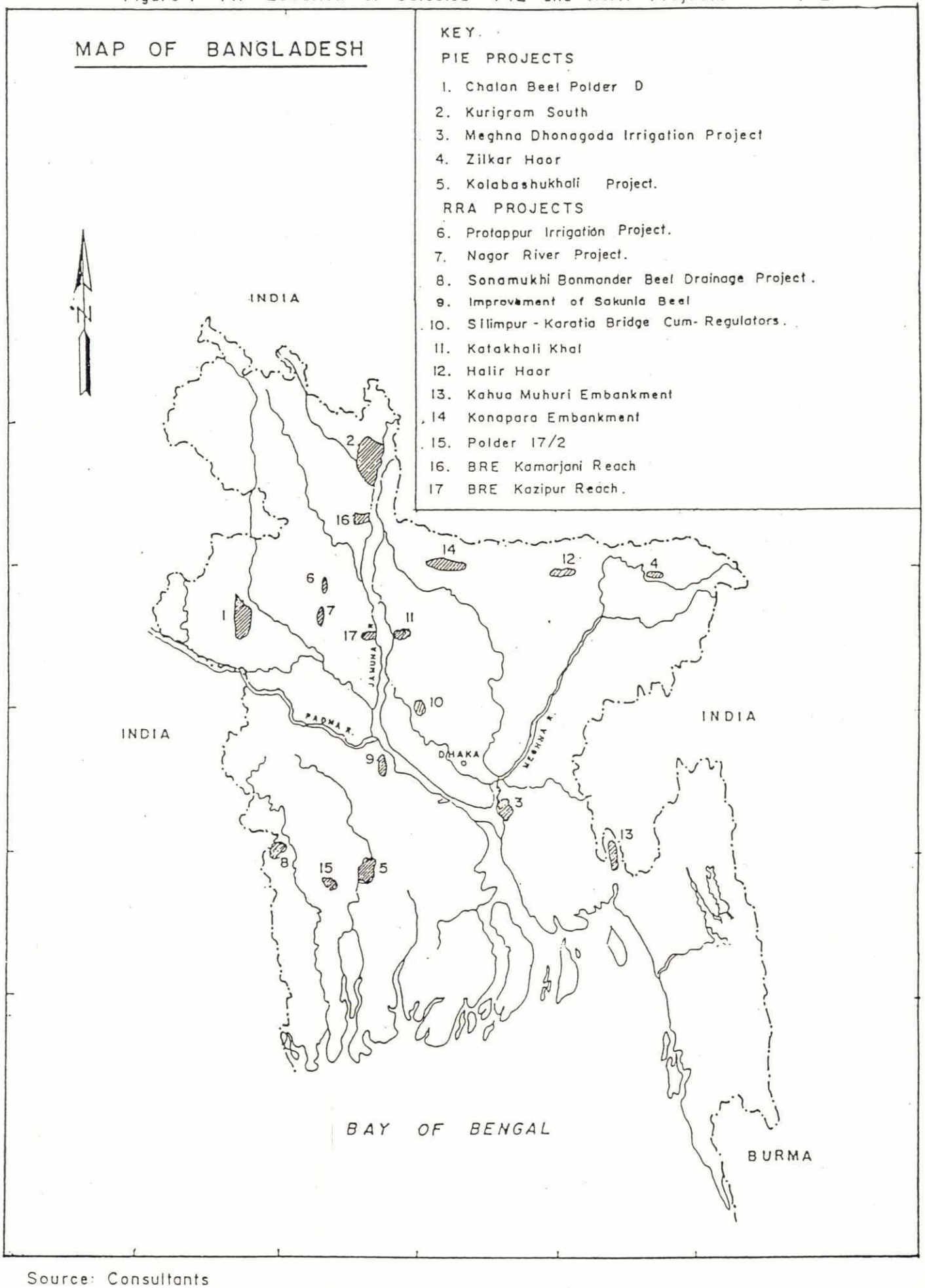
## 1.2 RAPID RURAL APPRAISAL

RRA is a technique of project assessment intended to produce results more quickly than formal interview surveys, while avoiding biases in the data collected. RRA consists of **selective** direct observation and interviews of informed respondents from representative areas of the Project by a small team of well-qualified and experienced specialists who can reach informed judgements quickly in the field. Maximum use is made of documentary sources to minimise the amount of data which have to be collected by interview and to obtain guidance on the location and content of interviews.

In well-conducted RRAs great care is taken to avoid both locational biases (for example observing and interviewing only in easily accessible areas) and socio-economic biases (for example, omitting coverage of women, landless people, and other groups which are difficult to identify, locate or obtain access to).

By its nature RRA is better at obtaining qualitative data rather than quantitative data, though it is generally possible to obtain fairly good quantitative data on key agricultural parameters for the selected locations. What RRA cannot do (in contrast to PIE methods using probability sampling) is provide statistical validation of how far observations can be generalised over the Project area, or of differences between areas and time-periods. Its findings must therefore always be interpreted as informed judgements, not as precise statements with known margins of error. Further background to RRA will be found in the FAP 12 Methodology Report.

Figure : 1.1 Location of Selected PIE and RRA Projects




Source: Consultants

## 1.3 DESCRIPTION OF THE PROJECT

The Brahmaputra Right Embankment (BRE) is one of the oldest FCD projects in Bangladesh. In 1957, the then Irrigation Directorate constructed the 50 km. flood embankment between Belka and Fulchhari along the Brahmaputra Right Bank, but the embankment was not fully closed and could provide only limited local flood protection (EPWAPDA, 1968). The full-fledged Brahmaputra Flood Embankment Project (BFEP) was started in 1963 to construct 225 km. of flood embankment and was completed in 1968. The major purpose was to protect about 240,000 ha. from Brahmaputra and Teesta flooding. Major rehabilitation work was started from 1974 and was completed in 1985.

The length of the BRE is 225 km. between Kaunia in the District of Rangpur and Bera in the District of Pabna. The benefited area of the Project covers parts of 14 Upazilas, i.e. Kaunia, Pirgachha, Sundarganj, Gaibandha, Fulchhari, Shaghatta, Sonatola, Sariakandi, Dhunat, Kazipur, Sirajganj, Belkuchi, Chowhali and Shahjadpur.

There are various estimates of the area protected by the BRE. These are summarised in Table 1.1. All these estimates fail to analyse the gross area by flood levels or other flooding criteria, and therefore their estimates can not be related to degree of protection in any way. The estimate by Dhaka University is particularly low as it deducts the area lost due to severe erosion, "mainly in Sirajganj Division but partly also in Bogra and Gaibandha O&M Divisions" (DU, 1986).

**Table 1.1 : Estimates of the Area Protected by the BRE.**

| Source | Acres | | Hectares | |
|---|---|---|---|---|
| | Gross Area | Net Cultivated Area | Gross Area | Net Cultivated Area |
| IECO, 1962 (BRE Proposal) | 593500 | 393700 | 240186 | 159328 |
| EPWAPDA, 1988 (PCR) | 641000 | 428000 | 259409 | 173209 |
| BWDB, 1985 Project Proforma | 558000 | 180000 | 225820 | 72845 |
| Dhaka University, 1986 (Evaluation) | 303000 | n.a | 122622 | n.a |
| FAO (PCR) | - | - | n.a | 72800 |

Sources : As indicated.

Since BRE is a huge project, two sections only were purposively chosen for two separate RRAs - one in Kamarjani reach in Gaibandha Upazila and the other in Kazipur in Sirajganj Upazila (Figure 1.2). The rationale for selecting Kamarjani reach is that this section of the BRE has been relatively stable so far. However, during the RRA in early June, 1991, the embankment near the Kamarjani Bazar was found to be only a few meters away from the river bank and was eroding very fast. In this section, the benefitted area slopes towards the Brahmaputra and there have been few embankment retirements.

In contrast, Kazipur reach is in an unstable section of the BRE. There have been frequent breaches and embankment retirements and because the land slopes away from the embankment the breaches cause severe damage to a large area.

This report presents the results of the RRA of Kazipur reach of the BRE. References to "the Project" refer to the rehabilitation of the BRE during the period from 1974 to 1985. There is a separate report on the RRA of BRE Kamarjani reach.

### 1.3.1 Location of BRE, Kazipur Reach

The study area for the RRA of the BRE Kazipur reach covers seven Unions, partly or wholly. These are Kazipur, Maizbari, Sonamukhi, Chalitadanga, Gandiail and Subhagachha Unions of Kazipur Upazila, and Ratankandi Union of Sirajganj Upazila. The Kazipur reach stretches from BRE mileage 85 at Dhekuria in the upstream direction (North) to BRE mileage 95 near Jhunkail in the downstream direction (South). The features of the study area are shown in Figure 1.3.

### 1.3.2 Floods and Drainage

Peak flows in the rivers Teesta and Brahmaputra occur during the months of June, July, August and September. In the pre-Project period the study area under the Kazipur reach used to be inundated due to inflow of flood water from the Brahmaputra river and remained submerged for several days. In the post-Project period, the BRE has largely failed to protect the area from the heavy inflow of monsoon floods from the Brahmaputra due to severe river erosion.

### 1.3.3 Crops Grown

In the Kazipur reach, the major paddy crops grown in the pre-Project period were B. Aus, mixed B. Aus - B. Aman, T. Aman (local as well as HYV) and jute. In the post-Project situation, there has been a remarkable shift of acreage from B. Aus (local) to HYV Boro and from mixed B. Aus-B. Aman and T. Aman (local) to T. Aman (HYV). The expansion of HYV Boro production is considered to be independent of the BRE and has been facilitated by the introduction of tubewell irrigation.

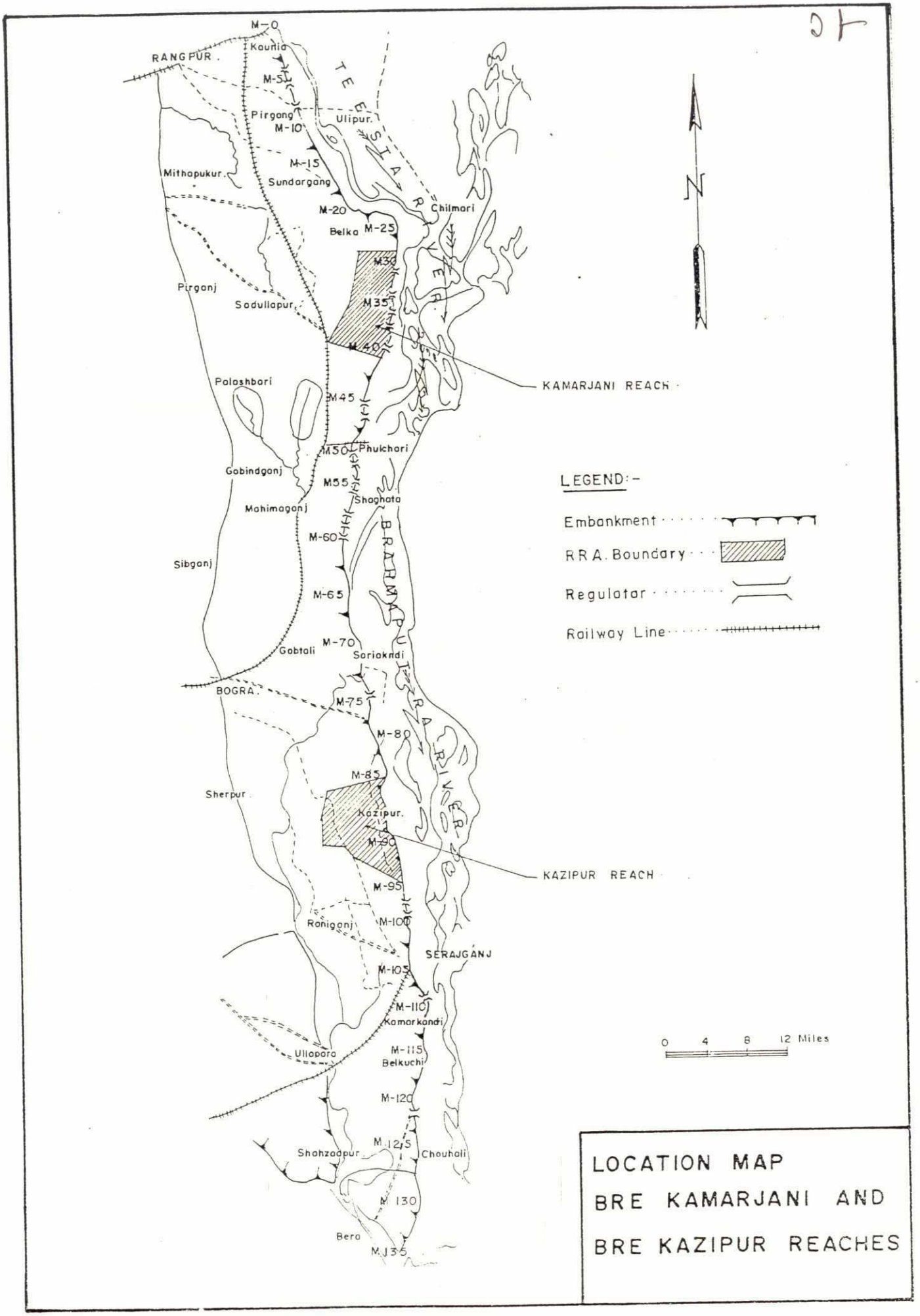
## 1.4 OBJECTIVES OF THE PROJECT

The overall objective of the BRE was to build up a flood-free and well-drained environment to accelerate crop production. The Project was to provide flood control permitting a shift from long stemmed paddy to transplanted varieties and thus promote higher yields and production levels. The major objectives (IECO, 1962) were to:

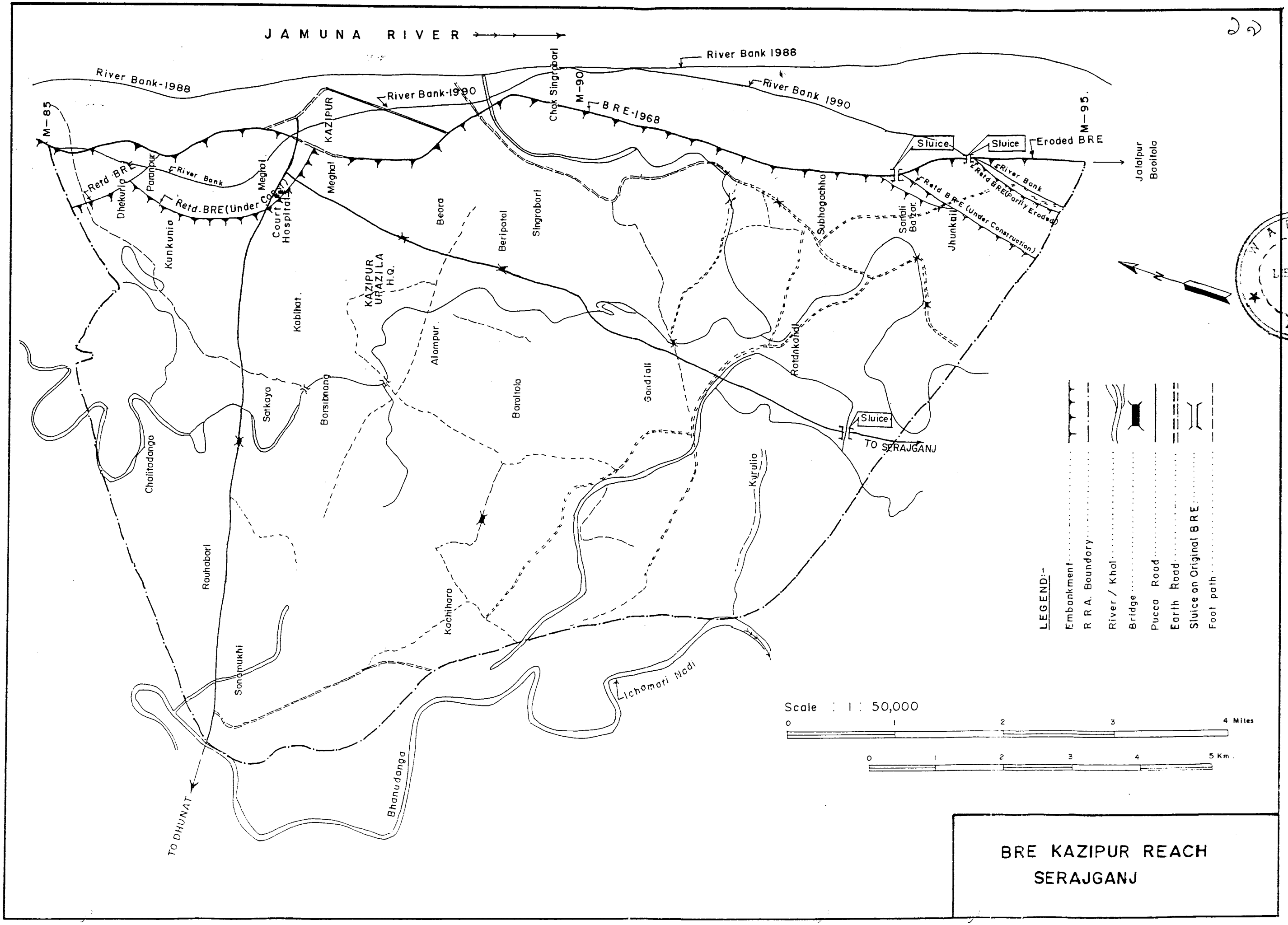
- facilitate shift of cropping patterns from local varieties to high yielding varieties;
- facilitate a move from B. Aman and Aus/Aman to Transplanted Aman (both Local and HYV) and to a lesser extent to Aus and Jute;
- increase in area and output of rabi crops.

These objectives are also considered relevant for the BRE, Kazipur reach.

Figure : 1·2 Location of BRE RRA Sites.




LOCATION MAP
BRE KAMARJANI AND
BRE KAZIPUR REACHES




BRE KAZIPUR REACH
SERAJGANJ

## 1.5 BRE, KAZIPUR REACH RRA PROCESS

The RRA of the BRE Kazipur reach was conducted during the period from 7-26 July, 1991, including 5 full days in the Project area. The RRA team consisted of an Agricultural Economist (Team Leader), Agronomist, Fisheries Specialist, Environmental Specialist, Engineer, Sociologist and a Women's Issues Specialist. The main RRA fieldwork was conducted during a period when road communication in Sirajganj was disrupted by flooding, but this did not prevent the team gaining access to all parts of the study area.

A brief return visit was made to the study area in September 1991 by a small party consisting of an Agricultural Economist and an Engineer to monitor the rapidly developing erosion of the embankment and to verify impressions gained regarding cropping patterns, which were largely obscured by flooding during the earlier visit.

## 1.6 ACKNOWLEDGEMENTS

Individual interviews and group discussions were held with the officials of BWDB, DAE, DLS, Fisheries, BRDB, and NGOs and with farmers, fishermen, wage labourers, regulator khalashis, settlers on the embankment and women's groups. Detailed sources of RRA data are noted in individual chapters.

The team received very active cooperation from officials and farmers. Despite his busy schedule at flood time, the Executive Engineer of BWDB at Sirajganj was very helpful in providing useful information about the Project.

# 2 ENGINEERING

## 2.1 PRE-PROJECT SITUATION

### 2.1.1 General Topography

The general topography of the study area comprises two directional components. One component slopes gently towards the south along the flow direction of the Brahmaputra river. The other slopes towards the west away from the Brahmaputra river.

This general topography indicates a remarkable contrast with the Kamarjani Reach in which the general topography is gently sloping towards the Brahmaputra river itself causing serious drainage congestion during the monsoon season in the vicinity of the regulator sites.

The general topography in the Kazipur area also indicates that the embankment is built along a saddle portion of the river cross-section. This might be a reason why this reach of the BRE is relatively more vulnerable to river erosion, causing recurrent breaches.

### 2.1.2 Flood Control

During the pre-Project period the whole area used to submerge due to inflow of flood water from the Brahmaputra river. The flooding was of the over field type in the form of sheet flow and drained into the Ishamati Nadi and the Karatoya river.

### 2.1.3 Drainage and Irrigation

As the drainage runs westward, no new irrigation regulators were constructed in the retired embankment, and no drainage congestion problems were caused by the absence of drainage regulators. The original BRE in this reach was provided with one vent irrigation regulators (flushing sluices) for supplementary irrigation during periods of drought in the monsoon, which were ineffective as the Jamuna was invariably too low to command the irrigable area when irrigation water was required. The sluices were used very rarely. At present the cultivators irrigate their lands by shallow and deep tubewells.

## 2.2 PROJECT OBJECTIVES

The primary objective of the BRE was to protect the Project area from monsoon flooding by means of the embankment. In the pre-Project period, the Brahmaputra River recurrently spilled over the bank causing serious damage to crops, livestock, property etc. in the area. The BRE was also expected to achieve the long term goals of increased agricultural production, creation of employment opportunities and improvement of living conditions.

## 2.3 SOURCES OF DATA

The reports and Project documents reviewed in connection with the Kazipur Reach are as follows:

- Feasibility Report on Brahmaputra Right Flood Embankment Project (rehabilitation and drainage), November 1977 by DPS, BWDB.

- Brahmaputra Flood Embankment Project (Phulchari to Sirajganj) in February 1962 by EPWAPDA and IECO Inc.

- Project Proforma on BRFE Project (Rehabilitation and Drainage) Phase-I, June 1985 by BWDB.

- Project Proforma on BRFE Project (Rehabilitation and Drainage) Phase-II, May 1987 by BWDB.

- Report on Completion of Construction of the Brahmaputra Flood Embankment Project (Kaunia to Hurasagar River), December 1986 by EPWAPDA.

- Project Completion Report in January, 1989 by Food and Agriculture Organization of the United Nations, Rome.

- Project Completion Report of BRE (Rehabilitation and Drainage) under 864-BD.

- Evaluation Study of BRE Sub-Project under DFC-I in November 1986 by the Chairman, Department of Economics, University of Dhaka, Dhaka-2.

## 2.4 PROJECT STRUCTURES

The parts of BRE, Kazipur Reach, that were visited by the RRA team extended from mileage M-85 to M-95 covering a total length of 16.0 km. of embankment. The different structures are detailed below describing the present conditions.

a) Embankment

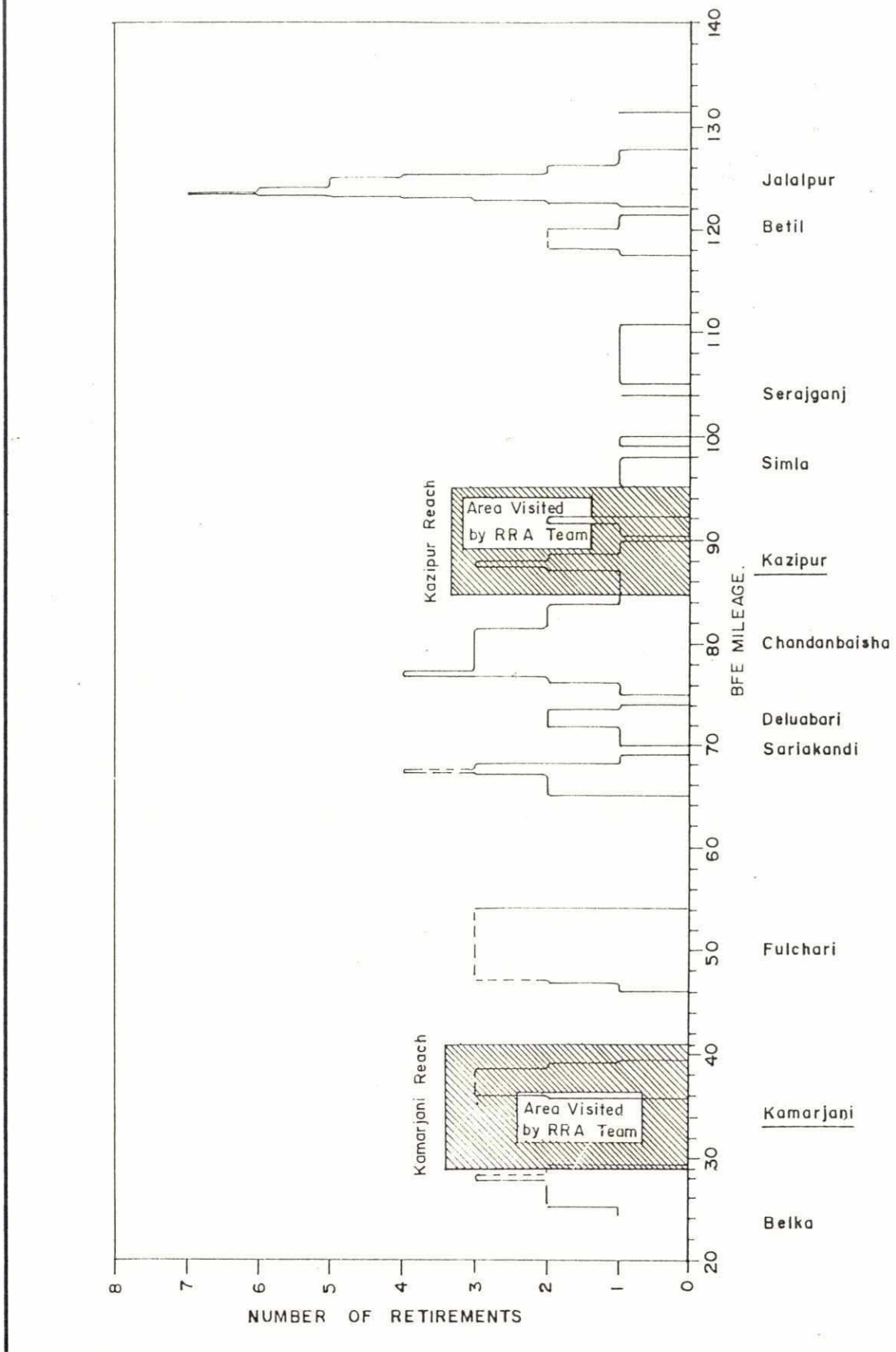
The parts of the original embankment which were visited by the RRA team were constructed in conformity with the design criteria set out in the detailed design in keeping with the values of country side and river side slopes, the crest width and crest elevation. There are now minor deviations due to lack of maintenance.

b) Flushing Sluice

A number of flushing sluices built in the original BRE along this section were washed away along with the original BRE.

c) Embankment Retirements

The BRE is a noteworthy project from the viewpoint of the frequent retirement of the embankment due to serious river erosion. The maximum number of retirements is seven at the Jalalpur site (mileage - 124) as shown in Figure 2.1. The on-going or proposed retired embankments at Kazipur reach are on four sections according to the drawing furnished by BWDB O&M division.




## NUMBER OF RETIREMENTS ALONG BRE

Source : BRTS. First Interim Report (Four Volumes) – FPCO.

d) Cuts and Breaches

No cuts were reported in this reach but a number of breaches have been recorded. During the visit of the RRA team, two breaches were observed at M-92 and M-95 sites.

The RRA team visited the M-95 breach site near Jhunkail by boat, approaching it from the Brahmaputra river side at Sirajganj.

Following the breaches, a retired embankment was constructed, but the section at Jhunkail, which was constructed in April, 1991 also breached in July 1991 causing a tremendous flow of flood water into the inland areas.

## 2.5 PROJECT SUCCESS IN ACHIEVING OBJECTIVES

Achievement of Project benefits depends on the correct planning and design of the scheme and its appropriate implementation in the field. The Project's success and lack thereof is detailed below in terms of positive and negative aspects.

a) Positive Aspects

i. The primary objective of the BRE is the protection of the Project area from the Brahmaputra floods. In this sense, the Project objective was achieved after completion of the embankment in 1964/65. Up to 1983 this could be justified in overall comparison with the pre-Project conditions. Pre-Project, flood water had intruded into every place where the land elevation was lower than the river water level without any hindrance. However, the breaches of the embankment due to Jamuna river erosion started in 1984 and have continued to 1991. This is described in the next section as a negative aspect.

ii. The positive impacts of BRE from 1964/65 to 1983 rest on the removal of uncertainty caused by flood water. This is a psychological or mental aspect of Project impact but can be stressed from the viewpoint of stabilisation of farming or social life in general. However, such a psychological aspect may be very elusive as the frequent breaches of embankment section cause sudden devastation causing danger to life and property.

iii. The BRE has generated benefits by providing roads for transport and communication, shelter for the human and animal populations, land for linear housing, tree planting, cattle/sheep grazing, borrow pits for fish culture etc.. However, these should not be overestimated because they are incidental benefits of the Project and were not counted in the economic justification during the planning stage.

b) Negative Aspects

i. River bank erosion and subsequent breaches of the embankment started in 1984 and have continued through to 1991. These cause serious social disturbance to the people living in the Project area. In order to cope with these river actions, retired embankments have been recurrently built along the BRE reaches with considerable losses of land, property and social assets.

ii. Regarding losses of land, "The Daily Inqilab" ( a local newspaper) of 25th July 1991 reported that land was lost as the river course moved 4 to 5 km from 1949 to 1991 in the Sirajganj area. These negative impacts tend to be increased by peoples' excessive expectations from provision of the embankment.

## 2.6 OBSERVATIONS AND CONCLUSIONS

i. River erosion and subsequent retirements of the embankment have led to unauthorised settlement of the affected people on the BRE. This damages the strength of the embankment and also hinders regular maintenance work or emergency activities relevant to safety of the embankment.

ii. The embankment reaches covered by this RRA are very poorly maintained and supervised. There was no existence of an O&M Committee although this was proposed in the Project Proforma and other project documents.

iii. There was no instance of consultation between the beneficiaries and the executing agencies at any stage of planning and design or implementation of the Project.

iv. There is no instance of public participation in the repair and maintenance of the embankment or structures.

v. Unless the embankment is properly maintained and operated, the provision of the embankment jeopardises the livelihood of people in the Project area. Ignorance of this viewpoint misleads both government and local people, subsequently causing perceptional discrepancies between them with respect to effectiveness of the embankment. An embankment without O&M is more dangerous than no embankment.

## 2.7 RECOMMENDATIONS

i. Rigorous river morphological studies with mathematical and physical models should be executed to understand the river's erosion behaviour. River erosion can then be reduced to a minimum by incorporating the study outcomes into the bank protection and river training works.

ii. A modified design of embankment should be provided to accommodate construction of houses for the destitute people without hampering the quality of the embankment.

iii. The retired embankments constructed under FDR & FFW programmes are different from the original embankment. The crest width is 14 ft instead of 21 ft, to save land and to cope with insufficient funding. There was no quality control of the work on the retired embankment, in which no compaction was made, and side slopes were steeper ( the original embankment was mechanically compacted). These factors caused easy breaches in the retired embankment during floods.

iv. Dredging of the Brahmaputra river under trial basis should be given consideration to divert the flow channel towards the centre line of the river stream.

v. The Project should be formulated in such a manner as to maximise the benefit and to minimise the disbenefit with local involvement and overall coordination during the planning stage.

# 3 INSTITUTIONAL DESIGN AND PERFORMANCE

## 3.1 IMPLEMENTATION AGENCY OF THE PROJECT

The only agency directly involved with implementation of the Project was the Bangladesh Water Development Board (BWDB). BWDB was created to centralize the control of water resources of Bangladesh. It was the agency responsible for preparing comprehensive plans for the development and utilization of water resources. The Board was granted the power to finance schemes for water development, to make detailed studies of them, and with the approval of the government to execute the Projects.

### 3.1.1 Project Implementation

BWDB carried out the work through its normal channels. Overall responsibility was entrusted to the Member (Implementation) of BWDB. Planning and Design were undertaken in Dhaka under the Chief Engineer (Planning) and detailed financial control was undertaken through Regional Chief Engineers, Superintending Engineers and Executive Engineers. It was a condition of credit effectiveness that BWDB should appoint a project coordinator, who headed a small project cell monitoring progress and coordinating the work of various BWDB units and resolving implementation problems.

### 3.1.2 Operation and Maintenance of Embankment

BWDB was also authorized to collect payment for the Project from the benefited persons, and to prescribe the standards for operation and maintenance works. The BRE is under the jurisdiction of the BWDB. Therefore, the responsibility of BWDB (among others) was to carry out the operation and maintenance of the embankment and structures of the Project in such a manner that it would best serve the aims of the scheme.

It was expected that the facilities of the Project would be operated to protect the Project lands from excess flooding in order to increase the productivity of land and raise more and better food crops of the areas. Therefore, sluices protected the area according to necessity and in accordance with the written schedule and specifications of the sluice operation committee.

a) Principles Governing Sluice Committees and Sluice Operation

The East Bengal Embankment and Drainage Act 1952, as amended in 1962 states that "sluices constructed in any public embankment shall be opened or shut only by or with the general or special permission of the Executive Engineer, or of the officer in the immediate charge of the embankment under such orders, either general or special, as they may receive from the Executive Engineer".

The officer-in-immediate charge is the sub-Division Engineer (SDE). He may delegate his authority to the section officer (SO). The next immediate charge is with the Work Assistant who is authorized to operate the sluice in emergency conditions without a sluice committee meeting if the structure or crops are suddenly threatened. Each sluice has a Sluice Khalashi who is responsible for clearing the sluice/structures and guards the sluices.

The SDE is responsible for organising the sluice committee. A sluice committee should consist of:

- the BWDB sectional officer (SO) assigned for operation and maintenance of the sluice, or his representative;
- Union Parishad Chairman or his authorised representative;
- Block Supervisor, if any, of the Agriculture Department; and
- representatives from the beneficiaries.

A sluice committee may be formed with 12-20 members. The SO should be the convenor of the committee. Quarterly meeting of the sluice committee should be scheduled by the SDE-IV. These regulations aim to anticipate trouble and thus gain the cooperation of the local people.

Operation and Maintenance (O&M) was specifically discussed for SSDFCP and the problems of funding routine maintenance in Bangladesh and other countries noted. It was proposed (World Bank, 1979) that since O&M of earthwork is mostly labour intensive, it would be achieved by "Local Councils" on a voluntary basis, or under FFW, but maintenance of structures was to be funded by BWDB. Although BRE is not under SSDFCP, these principles could be applied there.

### 3.2 RRA OBSERVATIONS

The O&M Manual is not followed although one was produced in 1968 (EPWAPDA, 1968). There is no effective Project committee for O&M of the Project. Public participation is also not found in the O&M of the Project.

In Kazipur Reach no sluices exist at present, although there were previously a number of flushing sluices for the purpose of irrigation. The RRA Team visited Baoitola 3-vent regulator, which is located outside the study section of the BRE, and interviewed the sluice khalashi and some members of the committee. The committee was formed as early as 1970 and it seems to be non-functioning. Although the sluice khalashi operates the sluice, the local people also take part in deciding when to open or close the regulator.

Maintenance of the earthwork of the embankment is carried out through BWDB. The organisation of this work is that BWDB contracts local UP members to enrol labourers for the earth work with supervision by the Work Assistant and the Section Officer. As is reported by the XEN/BWDB, maintenance work is largely absent due to lack of funds. During floods, many seepages through rat holes are observed. Curative measures in such cases are taken by BWDB using "Emergency Funds".

The embankment reaches observed during the RRA are very poorly maintained and supervised. Due to lack of proper maintenance and supervision, severe damage occurs to the embankment which jeopardises the embankment and the protected area. As is stated earlier, there is no O&M committee, although this was proposed in the PP.

River erosion as well as embankment retirement have left many people who were previously on the country side homeless. These homeless people have taken shelter by constructing small huts in clusters by cutting the slopes and excavating the toe area of the embankment. This type of linear housing is reducing the stability of the embankment to a significant level and hindering O&M activities.

Seepage through rat holes, rain-cuts and ghogs reduces the embankment stability and thereby threatens human lives and crops in the Project area.

There was no instance of public participation in the repair and maintenance of the embankment or structures. There was no instance of consultation between the beneficiaries and the executive agencies at any stage of planning and design or implementation of the Project.

It was recognized at appraisal that landowners were often reluctant to part with land, and that inadequate and delayed financial compensation often delayed timely land acquisition. During negotiations for the credit, IDA received assurances from GOB that sufficient funds would be deposited with the District Commissioner or other appropriate authority in good time to ensure timely acquisition of the land required for Project works.

Nevertheless, there were considerable delays in BRE due to land acquisition. The land acquisition process took longer than foreseen in the SAR and there were strenuous objections by landowners, sometimes assisted by their MPs. The process of land acquisition often involves very poor farmers with limited or no alternative production assets to substitute for land. The situation is further complicated by unfair assessment of land value for compensation, caused by differences between the actual market value and its assessed value based on recorded transactions. This discrepancy is the result of substantial deflation of reported land prices (up to 2/3) at the time transactions are recorded for the purpose of tax evasion.

Thus, farmers giving up their land for the public interest suffer the consequences of the tax evasion of those who sold their land at its actual market price. Moreover, even when they agree to accept the low assessed value of their land, farmers have been subjected to substantial delays (often years) in payment and to complex and costly payment procedures. These factors have resulted in resentment by farmers of Project activities and in active opposition to the Project. GOB's failure to adequately resolve this problem not only delayed implementation but also resulted in insufficient land being acquired in some places to adequately construct the works.

### 3.3 RECOMMENDATIONS

i. More sophisticated methods such as mechanical compaction should be practised for construction of the flood embankments to obtain the required degree of compaction rather than labour intensive methods.

ii. Effective annual maintenance of physical facilities on a sound engineering basis must be ensured. Adequate maintenance budgets have to be provided to meet actual requirements.

iii. A high standard and effective operation and maintenance (O&M) organisation is a pre-requisite for realisation of optimum benefit from the Project, and therefore, a practical and effective O&M system for the embankment must be developed.

iv. There should be an O&M Committee consisting of peoples' representatives of all the areas serviced and Development agencies and BWDB.

v. There should also be effective regulator committees including representatives of all the area served and the different interest groups there and BWDB for operation of the regulators.

vi. The last but not least important point is the huge cost involved in maintenance of the BRE. At least part of annual maintenance should be funded from local resources. A cash or kind levy could be charged to the beneficiaries according to the extent of their benefit.

# 4 IMPACT ON AGRICULTURE



## 4.1 INTRODUCTION

This report has been written based on the information obtained from the eight villages (Table 4.1) visited during the RRA field trip.

## 4.2 PRE-PROJECT SITUATION

### 4.2.1 Land Use

The land use pattern showed that the net cropped area was about 85 per cent of the gross area (Table 4.2). During the pre-Project situation, the fertility of the land was satisfactorily restored every year due to silt deposition on the top soil coming with the natural flood water. This helped growing of almost all crops including B. Aus, B. Aman, T. Aman, Jute, Pulses, Oilseeds, Millets, Potato, Chilli, Brinjal and Sugarcane. The flooding characteristics and sedimentation process of the Jamuna river influenced the formation of the agricultural lands of the area. Some low-lying water bodies were present (Table 4.3) which also influenced the land-type of the area.

### 4.2.2 Flood Conditions and Drainage

The agricultural land received flood water during the monsoon season (July - October). The depth of flood water varied from place to place and was dependent on the land types as well as severity of flood. The high crop-land (on an average 5 per cent) received 1-2 ft. flood water (Table 4.1), the medium land (on an average 51 per cent) 4-6 ft. and the low land (on an average 44 per cent) received more than 6 ft. of flood water in almost every year (with the exception of abnormal flooding years). About 12 per cent of the area remained almost flood-free which mainly consisted of homestead, roads, schools and markets. The village people named some water bodies located in the study area (Table 4.3), whose water levels varied from 3-6 ft. in dry months, and 10-12 ft. in monsoon months; as a result no crops were grown there before the Project.

The local people also informed the team that during the monsoon, the Jamuna river over-flowed the bank and gradually flooded a large portion of the area (about 88 per cent) in almost every year before construction of the BRE. The flood water normally came in early July and gradually receded in late September or early October. Paddy and Jute crops in the low-land were submerged and suffered partial damage. The situation was sometimes so bad that the extent of crop-damage might reach 60 per cent (from farmers' group interview). The severity of flood damage was more along the river-side and less towards the interior. The crops and property suffered from those flood hazards and thus the local economy was affected. Due to poverty some of the people sold their good agricultural lands and ultimately became landless (Table 4.5). The percentage is higher in Meghai village because of the Jamuna river erosion.

Further, it was stated that the abnormal flood of 1988 caused approximately 90 per cent damage to the crops and other properties of the entire area.

**Table 4.1: Distribution of Crop Land and Depth of Water at Villages Visited During RRA.**

| Villages | Total Area (ha.) | Area (%) | | | Maximum Depth of Flood Water (ft.) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Without Project | | | With Project | | |
| | | High | Medium | Low | High | Medium | Low | High | Medium | Low |
| Beripatal | 202 | - | 50 | 50 | - | 5 | 8 | - | 3 | 5 |
| Meghai | 557 | - | - | 100 | - | - | 10 | - | - | 5 |
| Kazipur | 800 | 20 | 60 | 20 | 1 | 5 | 10 | - | 1 | 3 |
| Kunkunia | 189 | 20 | 60 | 20 | 2 | 4 | 7 | - | 1 | 3 |
| Jhunkail | 617 | - | 100 | - | - | 6 | - | - | 3 | - |
| Sonamukhi | 213 | - | 100 | - | - | 5 | - | - | 3 | - |
| Barsibhanga | 73 | - | - | 100 | - | - | 6 | - | - | 3 |
| Chalitadanga | 395 | - | 40 | 60 | - | 5 | 10 | - | 3 | 7 |

Source: Farmers' group interview, 1991

**Table 4.2: Land Use Pattern of the Villages visited in the Study Area**

| Land use | Without Project | | With Project | |
|---|---|---|---|---|
| | Area (ha.) | % | Area (ha.) | % |
| Net cropped area | 2591 | 85 | 2551 | 84.0 |
| Homestead | 244 | 8 | 264 | 8.7 |
| Road, market, school, etc. | 122 | 4 | 152 | 5.0 |
| Fallow Land | 61 | 2 | 9 | 0.3 |
| Other use (orchard, bamboo brush, etc.) | 30 | 1 | 4 | 2.0 |
| Total | 3,048 | 100 | *2980 | 100.0 |

* Area decreased due to river erosion

Source: Upazila Office, Kazipur and Farmers' group interview, 1991

**Table 4.3: Water Bodies and their Water Depth (ft.) With and Without Project Situation**

| Water Bodies | Area (ha.) | Without-Project | | With-Project | |
|---|---|---|---|---|---|
| | | March | July | March | July |
| Adekha beel | 0.6 | 3 - 4 | 15 - 20 | - | 8 - 10 |
| Kachihara beel | 40.5 | 5 - 6 | 15 - 20 | 2 - 3* | 5 - 7 |
| Dogachcha beel | 2.0 | 4 - 5 | 10 - 13 | 2 - 3 | 8 - 10 |
| Beel chator | 20.2 | 4 - 5 | 10 - 15 | 2 - 3** | 5 - 6 |

* In 10 per cent Area
** In 40 per cent Area

Source: Farmers' group interview, 1991

### 4.2.3 Crops and Cropping Patterns

Broadcast Aus, Broadcast Aus-Aman mixed, Jute, Oilseeds and Pulses (Lathyrus, Lentil, Chickpea, Blackgram and Mungbean) were the main crops grown during the pre-Project period, both in terms of acreage and production (Table 4.4). B. Aus, mixed B. Aus-Aman and Jute were grown in 85 per cent of the net cropped area. These crops were grown in March and harvested in June (Fig. 4.1). Mixed B. Aus-Aman was also grown in March; the Aus was harvested in June leaving the Aman crop in the field to grow normally and be harvested in December. Local T. Aman covered about 61 per cent of the area while mixed B. Aus-Aman covered about 20 per cent of the net cropped area. Jute occupied about 30 per cent of the net cropped area. In winter, pulses, oilseeds, and some vegetables were grown and occupied about 30 per cent of the net cropped area. Crops grown and cropping patterns of the study area were almost similar for similar types of land. However, growing of crops in low lands was dependent on the flood situation and drainage conditions. HYV Boro and T. Aman HYV were not grown in the area before the construction of the embankment.

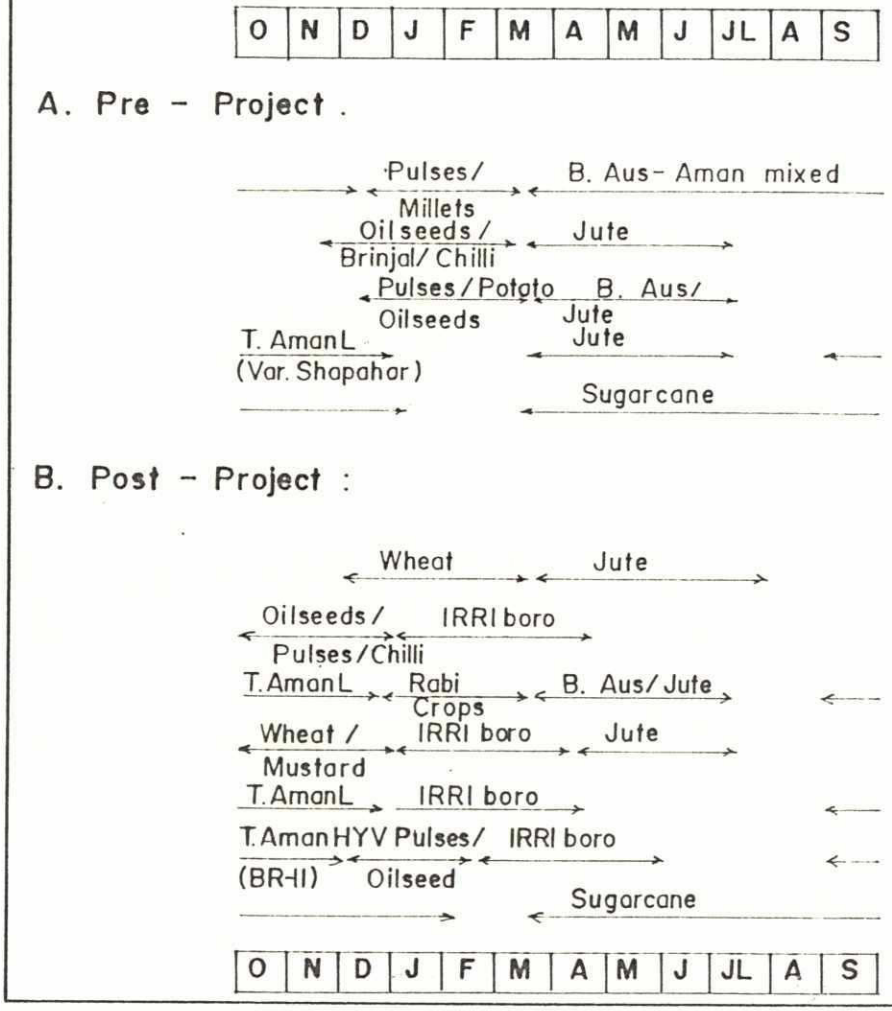
### 4.2.4 Inputs Used

Farmers generally applied cowdung in the field at the rate of approximately 5.5 md/ha. Normally, no chemical fertilizer was used, except for HYV T. Aman and HYV Boro (Table 4.4). Insecticides and pesticides were not used during the pre-Project period.

### 4.2.5 Crop Management

In Paddy, Jute and other crops, farmers tended to follow a low labour input management system. Land preparation was done by country plough. About 77 per cent of farmers had their own plough to plough their lands. Only 23 per cent of farmers hired ploughs and the rate of hiring varied from Tk. 30 to Tk. 50 per ploughing per 33 decimal of land. Ploughing and weeding were done 2-4 times depending on the nature of crops (Table 4.4).

Fig. 4.1 Pre – and Post – Project Cropping Patterns



Jute and sugarcane need more ploughing and weeding compared to other crops, while requirements were less for pulses. Different kinds of weeds were found to grow and compete with the growing crops. In sugarcane mulching and earthing-up were done for field-moisture retention and protection of the crop from water logging.

## 4.3 PROJECT OBJECTIVES

The BRE Project was proposed to provide protection from external floods by construction of earthen embankments on the right bank of the river Brahmaputra (PP-II, 1987), to accelerate agricultural activity for increasing crop production. The Project also had the objective to provide flood control permitting a shift from local paddy to transplanted paddy varieties for promoting higher yields and production levels.



## 4.4 SOURCES OF DATA COLLECTION

Data were collected from the following sources:

- Interview of officials including Upazila Agricultural Officer (Kazipur), UNO (Kazipur), and BWDB Engineers (Sirajganj) to know the preceding conditions, the impact of the Project and the conditions within and around the Project area;
- interview of farmers in different villages namely Beripatal, Meghai, Kunkunia, Jhunkail, Sonamukhi, Barshibhanga, Chalitadanga, and Kuralia. Farmers were interviewed in groups and also individually. At the time of interview, cross checking was done to have more reliable information;
- interview with some traders at several market places to know their opinion regarding pre- and post-Project conditions of the area;
- direct personal observation of land type, crops grown, varieties of crops grown, inputs used and prevalence of pests and diseases;
- Project documents including Project Proposals, Feasibility Report, Evaluation Study Report and Project Completion Reports;
- official publications including Statistical Year Book of Bangladesh.

## 4.5 VALUE AND FEASIBILITY OF THE PROJECT OBJECTIVES

The embankment gave protection to the area from monsoon flooding for several years up to 1984 (i.e. from 1964-65 to 1984) when severe breaches of embankment started due to the Jamuna river erosion. Protection from yearly flooding facilitated more intensive crop cultivation, especially T. Aman cultivation.

B. Aman had been replaced by HYV T. Aman; however, during the past few years (since the time of breaches) T. Aman has been damaged substantially due to sudden inflow of flood water. Nevertheless, the farmers are interested in growing more HYV paddy, particularly HYV T. Aman if a safe harvest is ensured. Depending on their ability, farmers are applying chemical fertilizers and agro-chemicals to increase crop production.

**Table 4.4: Inputs, Area and Production of Different Crops Pre and Post-Project**

| Crops | Pre-Project | | | | | | | Post-Project | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area (ha.) | Yield mt./ ha. | Prod. mt. | Fertilizer/ cowdung used | No. of plough-ing | No. of weeding | Labour man-day/ha. | Area ha. | Yield mt./ha. | Production mt. | Fertilizer kg./ha. | No. of ploughing | No. of weeding | Labour (man day/ha.) |
| B.Aus L | 826 | 0.91 | 752 | CD | 3 | 3 | 74 | 79 | 0.92 | 73 | 50 | 4 | 3 | 80 |
| B.Aus-Aman mixed | 641 | 1.56 | 1000 | CD | 3 | 3 | 86 | 51 | 1.55 | 79 | 60 | 4 | 3 | 90 |
| T.Aman L | 1030 | 1.65 | 1700 | CD | 3 | 2 | 122 | 322 | 1.65 | 531 | - | 3 | 2 | 120 |
| T.Aman HYV | 300 | 2.95 | 885 | 100 | - | - | 130 | 1479 | 2.27(3.02) | 3357(4466)* | 120 | 3 | 3 | 130 |
| T.Boro HYV | 209 | 3.11 | 650 | 108 | - | - | 160 | 1275 | 3.05 | 3889 | 138 | 4 | 3 | 160 |
| Jute | 777 | 1.25 | 971 | CD | 4 | 3 | 150 | 638 | 1.20 | 765 | 60 | 4 | 3 | 150 |
| Wheat | 69 | 1.46 | 101 | CD | - | - | 40 | 198 | 1.48 | 293 | 80 | 3 | 3 | 40 |
| Millets | 36 | 0.82 | 30 | CD | 3 | 2 | 49 | 16 | 0.80 | 13 | - | 3 | 2 | 49 |
| Pulses | 287 | 0.91 | 261 | CD | 2 | - | 25 | 158 | 0.90 | 142 | - | 1 | - | 25 |
| Oilseeds | 264 | 0.82 | 216 | CD | 3 | 2 | 38 | 150 | 0.82 | 123 | 50 | 3 | 2 | 38 |
| Chilli | 46 | 1.65 | 76 | CD | 3 | 2 | 72 | 68 | 1.60 | 109 | 20 | 3 | 2 | 72 |
| Potato | 21 | 9.42 | 198 | CD | 3 | 2 | 180 | 19 | 9.40 | 179 | 100 | 3 | 2 | 180 |
| S.Potato | 10 | 10.7 | 108 | CD | 3 | 2 | 75 | - | - | - | - | - | - | - |
| Brinjal | 31 | 7.96 | 247 | CD | 3 | 2 | 100 | 5 | 8.00 | 40 | 70 | 3 | 2 | 100 |
| S.cane | 41 | 39.5 | 1620 | CD | 4 | 3 | 270 | 41 | 40.00 | 1640 | 75 | 3 | 3 | 270 |
| Total | 4,588 | - | | | | | | 4500 | | | | | | |
| CI (%) | 177 | | | | | | | 176 | | | | | | |

Note: CD - Cowdung; CI - Cropping Intensity; * Figures in the parantheses indicate yields/output if there is no flood damage. The RRA results indicate that about one-fourth of T. Aman crop is damaged annually due to embankment breaches/flooding.

Source: Farmers' group interviews, 1991

## 4.6 PROJECT SUCCESS IN MEETING THE OBJECTIVES

The primary objective of the Project was the protection of the area from flooding to increase agricultural production. Due to construction of the embankment flood levels and frequency decreased and the land type changed (Tables 4.1 and 4.2) in some areas, bringing a change in crop cultivation and cropping patterns (Fig. 4.1). Cultivation of HYV crops was introduced. Since high yielding varieties are grown, the rate of application of chemical fertilizers and crop management practices has improved (Table 4.4).

Until 1984, when severe breaches took place due to the Brahmaputra river erosion the primary objective of flood control was achieved to a great extent, meaning protection of crops including B. Aus/Jute/B. Aman, from flood damage, and improvement of human and animal living conditions. However, the situation has been reversed during the period from 1984. The worsening flood situation renders crop production in the monsoon season highly vulnerable as a result of embankment breaches, such as the breaches at Meghai and Jhunkail.

As expected in the PP, the BRE did successfully change the B. Aus/Jute - B. Aman - minor Rabi crops cropping patterns into a B. Aus/Jute - T. Aman pattern in the initial years and then into irrigated HYV Boro - HYV T. Aman. However, the embankment breaches since 1984 have again caused uncertain and serious flood inundation in about three out of every five years, causing HYV T. Aman production to have declined in some areas. For example, the production of T. Aman paddy in the villages visited has gone up from 2585 mt. on 1330 ha. in the pre-Project period to 3888 mt. on 1801 ha. in the post-Project period, an increase of about 50 per cent.

There has been a substantial increase in HYV Boro production, although in years of early floods such as in 1990 in Kazipur area about 10-15 per cent of Boro crop is damaged due to inundation. Nevertheless, HYV Boro paddy production in the villages visited has increased from 650 mt. on 209 ha in the pre-Project period to 3889 mt. on 1275 ha. in the post-Project period (Table 4.4). Even though T. Aman production has been very vulnerable in the recent years, increased HYV Boro production has meant that the total paddy production in these villages has increased from 4987 mt. in the pre-Project period to 7929 mt. in the post-Project period, a substantial increase of about 59 per cent. However, the increase in HYV Boro production is not considered as an impact of the BRE.

In the years following breaches in 1984, acreage and output of T. Aman has been reduced to some extent. This has meant that land-use-intensity/cropping-intensity has remained at the pre-Project level (Table 4.4).

In Table 4.6 an estimate of changes in land use in the Kazipur Reach is presented. As 2 per cent of the gross area may have been lost to the Jamuna River, the areas of all other categories are reduced.

## 4.7 NEGATIVE ASPECTS

In recent years, since the 1984 breaches of the BRE, the primary objective of flood control has not been achieved fully. Moreover, the severity and uncertainty of floods has increased significantly, damaging life and property probably on a larger scale than in the pre-Project situation.

In the pre-Project situation, B. Aman used to be followed by some rabi crops such as pulses and oilseeds. In the post-BRE period there has been a significant reduction (by 80 - 90 per cent) in the production of these crops, probably due to the expansion in HYV Boro.

The increased sand deposition in Kazipur, Meghai and Jhunkail areas due to sudden inflow of flood water through breaches has taken vast tracts of land out of paddy cultivation, although some of these areas are now put under sugarcane or other crops.

The increase in paddy production has increased rat infestation (Table 4.5), but this is only partly a result of the BRE because there has been a large growth in Boro production which is not due to BRE (see Section 4.6).

## 4.8 LESSONS LEARNED

The recent increased risk of annual flooding due to breaches and overtopping has reduced the production of non-rice crops which required a controlled water regime and soil moisture conditions.

A regular phenomenon of T. Aman damage due to inundation since 1984 has by implication led to increased input intensification for irrigated HYV Boro production because in a large part of the Kazipur area this has turned out to be the secure rice crop. This, perhaps, is a positive response to the negative impact of the BRE.

If full flood protection is ensured, HYV T. Boro/T. Aus followed by HYV T. Aman could be grown covering about 75 per cent of net cropped area and leading to higher production.

**Table 4.5: Miscellaneous Present Information on the Eight Villages of the Study Area**

| Name of Villages | % of landless people | | % of people having own plough | % of people who hired plough | Rate of hiring Tk./ plough | No. of rat pits/ acre | Name of common weeds (local names) |
|---|---|---|---|---|---|---|---|
| | Before | After | | | | | |
| Beripatal | 2 | 5 | 95 | 5 | 50 | 40 | Dubba, Bhadail, Kalmi |
| Meghai | 25 | *75 | 90 | 10 | 50 | 50 | Dubba, Bhadail, Gobra, Chutki |
| Kazipur | 5 | 10 | 95 | 5 | 50 | 10 | Dubba, Bhadail |
| Kunkunia | 5 | 10 | 90 | 10 | 50 | 15 | Dubba, Bhadail, Kalmi |
| Jhunkail | 10 | 20 | 80 | 20 | 50 | 10 | Dubba, Bhadail, Kalmi |
| Sonamukhi | 10 | 15 | 75 | 25 | 50 | 15 | Dubba, Bhadail, Gobra |
| Barsibhanga | 5 | 20 | 40 | 60 | 50 | 15 | Dubba, Bhadail, Gobra, Moishna |
| Chalitadanga | 5 | 10 | 50 | 50 | 40 | 12 | Dubba, Bhadail, Gobra, Moishna |

*Due to river erosion

Source: Farmers' group interviews, 1991

**Table 4.6 : Estimated Land Use Change in the Study Area**

| | Area in hectares | |
|---|---|---|
| | Pre-project | Present (1991) |
| Gross Area | 10500 | 10500 |
| Lost to River due to erosion | - | 234 |
| Permanent beels | 63 | 14 |
| Non-cultivated land, not normally flooded | 1512 | 1464 |
| Cultivated land, now protected (partially) from flooding | 8925 | 8788 |

Source : Tables 4.2 and 4.3

# 5 IMPACT ON LIVESTOCK

## 5.1 PRE-PROJECT SITUATION

In the pre-Project period, the average farmer owned about 4 head of cattle, of which 2.5 were working animals (EPWAPDA 1962). There was an average of about one work animal for each 2.3 acres of cultivated land and feed supplies were insufficient.

The Project area was flooded annually and would remain under water (3 to 6 ft. depth) for 3-5 months. Mixed Aus and B. Aman were the main crops. The straw of B. Aman was the main source of cattle feed.

## 5.2 PROJECT OBJECTIVES

No livestock objectives were set during Project planning. The main objective of the BRE II Project was to protect the area from flood which would help the farmers to shift from mixed Aus/Aman cultivation to transplanted Aus and Aman cultivation.

It was thought that, with construction of the flood protection embankment, a higher percentage of land would be devoted to T. Aman and that this would slightly increase the animal work load in July and August. There would be additional straw available for feed, and grazing conditions would be favourable.

## 5.3 RRA DATA SOURCES

During the RRA interviews and informal discussions were held with the Kazipur Upazila Livestock Officer, UNO and other administrative Officers. Data were also collected by interviewing farmers. Personal observations during RRA are also presented to bring the information to a sharper focus. In addition, Project documents such as the Feasibility Study, Project Proforma - I & II, Project Completion Reports and Evaluation Reports by the Department of Economics, Dhaka University were also consulted.

## 5.4 PROJECT IMPACTS

### 5.4.1 Positive Impacts

a) Straw, Feed Availability and Livestock

The embankment was rehabilitated during the period 1974-85 and protected the area from flood up to 1984. Successful cultivation of T. Aman supplied good quality straw to maintain livestock. From discussion with the villagers it was understood that the livestock population showed a tendency to increase.

Since 1984, after the breach, the livestock population has started to decline. During the period of increasing T. Aman cultivation (1964 - 1983) the Project area was reasonably dry. The small earthen bunds dividing the cultivated plots (8 - 12 inch width) supported a heavy growth of grasses (Cynodon sp. and Auxonopus sp.). These grasses supplied green

fodder to the livestock, particularly in the late winter. In addition, after the harvest of T. Aman (from the middle of December to the middle of February) the lands were fallow and were used for grazing by cattle and goats, and animals were able to graze more widely than in the pre-harvest period.

b) Pulse Cultivation and Feed Availability

Rabi crops, particularly various kinds of pulses, were extensively cultivated in the pre-breach period, when the bund protected against floods. The plant residues of pulses were good sources of feed for both cattles and goats. The farmers kept cows and took the opportunity to utilise the plant residues of pulses. Hence the milk supply also increased considerably.

### 5.4.2 Negative Impacts

a) Change of Cropping Pattern and Feed Production

i. As a result of breaches, several square kilometers in locations such as Meghai and Jhunkail have been affected by sand deposition. These areas are now used for sugarcane cultivation. The young leaves of sugarcane to some extent are used as a forage for cattle;

ii. Cattle health is less satisfactory, possibly because of the reduced availability of feed and good quality straw. However, it was noted that the livestock of a few wealthy landlords, who supply wheat and rice bran, and oil cake to their cattle, showed good health;

iii. The cattle and goat populations have decreased after the breach (1984), although there was an increase of these animals during the period prior to 1983; and

iv. Although cultivation of HYVs has increased the quantity of straw, it is reluctantly accepted by the cattle, possibly due to its high lignin content. In addition, during the ripening of the HYV crop, the straw is not at all acceptable to cattle.

## 5.5 LESSONS LEARNED

Although HYV cultivation increased the paddy production, it had a serious adverse affect on cattle feed. Discontinuation of B. Aman cultivation has strongly affected straw availability and quality. In the future, Project design should include options for cattle feed intensification.

# 6 IMPACT ON FISHERIES

## 6.1 PRE-PROJECT SITUATION

Flood protection works along the right bank of the Brahmaputra River (BRE) date from about 1957, when a 30 mile embankment was built from Belka to Fulchhari. A further 135 miles, from Kaunia to Bera, were built between 1963 and 1968 with IDA finance. This was followed by a major reconstruction and rehabilitation programme for BRE, also with IDA funding, which was implemented between 1975 and 1985. All of these developments, along with others on the left bank, will have had cumulative adverse impacts on migratory fish stocks in the river and adjacent beel and floodland areas.

It does not appear that any base-line or bench mark fishery studies were ever carried out and as Fisheries Department catch statistics prior to 1983/84 are of doubtful reliability and are not readily comparable to subsequent data, it is difficult to judge what the true pre-Project fisheries situation was, or to what extent it has changed.

Only two of the reports made available to the team were written prior to 1980. These were a feasibility study dated 1962 and prepared by consultants for EPWAPDA, and a BWDB Feasibility Report dated 1977, neither of which contained any reference to fisheries. A 1986 evaluation study and the 1989 FAO/World Bank PCR make little or no mention of the pre-Project fisheries situation.

Fishermen and others interviewed during the RRA field study spoke of former beel areas, now mostly drained, which at one time supported large fish populations. These beels were an important source of fish for the community of full-time professional fishermen at times of the year when they could not operate in the main rivers. The area inland from BRE also contained numerous ponds excavated in the course of building up household mounds. These ponds were largely uncultivated because of the high risk of overtopping during the annual flood season. They were nevertheless cropped by the households concerned, before the onset of the next monsoon, to catch whatever fish might have remained trapped in the ponds as the previous flood receded.

The fishery for spawn/fish fry during part of May, June and July was a long established and important seasonal activity for many fishermen. The right bank of the Brahmaputra/Jamuna seems to be especially favoured in this regard because the river current sweeps floating masses of eggs and hatchlings close to the river bank in many places where they can be netted. Such naturally produced wild spawn was and still is in high demand amongst pond owners in flood-free areas so that, in addition to fishermen, this trade also supports a large number of fish fry sellers who carry the live fry from riverside to pondbank, sometimes over considerable distances.

## 6.2 SOURCES OF DATA

The main documentary sources were an EPWAPDA feasibility study dated 1962, a feasibility report prepared by BWDB in 1977, an evaluation study on BRE by the Economics Department, University of Dhaka dated 1986 and a PCR dated 1989 by the FAO/World Bank Cooperative Programme. Reference was made to DOF annual fish catch statistics bulletins from 1983/84 to 1988/89 inclusive. Discussions and interviews were held with BWDB officials,

A summary of fish production trends in old Pabna District (which included the present Sirajganj District) is shown in Table 6.2. Current (1990) data on fisheries in Kazipur Upazila are listed in Table 6.3, whilst data on fish pond utilisation, carp spawn collection and fish market prices are given in Tables 6.4, 6.5 and 6.6 respectively.

## 6.3 POSITIVE EFFECTS

The overall impact of the Kazipur section of BRE on fisheries has to be judged as negative and lacking in virtually any beneficial aspects. Initially, following completion of the original embankment in 1968, there were several years of effective flood protection which did result in some ponds being stocked with fry to compensate for capture fishery losses. Some pond owners benefitted thereby. Unfortunately this positive effect proved short lived because by the mid-1970's river bank erosion, the need for retired embankments and the frequency of breaches causing near catastrophic flooding were all increasing.

The 1980/1987 rehabilitation programme does not appear to have affected or checked the inexorable westerly encroachment of the Brahmaputra, especially in the Kazipur sector. The risk of flooding has, in consequence, increased so that even those ponds which were cultivated have reverted to their pre-Project semi-derelict status.

The only slight mitigation which is discernable is that water flowing through the breaches may carry some young fish onto the flood plain where they can grow and may also facilitate some fish breeding which otherwise would not be possible.

## 6.4 NEGATIVE EFFECTS

Formerly perennial beels, because their connecting khals to the river have been blocked by BRE, now mostly dry out after the flood season and thus contain few fish nowadays. These used to be important seasonal fishing grounds for local full time fishermen. The fishermen are now forced to concentrate on fishing in the Jamuna River.

The fishing community, traditionally comprising mainly Hindu fishermen, complain that their inability to catch fish other than in the river has reduced their catch rates by up to 50 per cent. In consequence, many have been forced to seek other work, at least on a part-time basis and some fishermen have had to move elsewhere.

Numbers of landless people, including former land owning small farmers whose land has been destroyed by the river or acquired for BRE flood control works, have also become increasingly involved in part-time fishing, not withstanding the apparently poor catches. As pointed out by some fishermen, the attraction is that even one kg. of fish can be sold for more than the wage for a day's labour.

The natural stocks of Indian major carps, and many minor carp species also, have been decimated by the cumulative impact of embankment developments throughout the country. BRE construction has blocked the access routes for such fish in the Project area, on their spawning migrations from beels to the river, and has likewise prevented the return and distribution of spawn and fry from the river across the floodplain areas.

According to reports by fishermen and fishery officials, the quantity of fish spawn and fry in the river is decreasing year by year, almost certainly because of the interruptions to spawning migrations. The number of licences issued for spawn collection in Sirajganj District has had to be reduced from 200 in 1990 to only 20 in 1991. Prospects for the future do not appear to be very good.

Pressure on the remaining fish stocks in the river and other inland minor water bodies is continually increasing because of unsatisfied demand, with consequent very high risk of overfishing. This is exacerbated by the widespread use of illegal small mesh nets to maximise catches even of very small and juvenile fish, such is the demand. DOF seems powerless to control the situation.

A number of formerly important components of commercial catches are now very rare, e.g. minor carps such as Chela (Salmostoma spp), Nandil (Labeo nandina) and other groups such as Pabda (Ompok padda) and Bheda (Nandus nandus), as well as the major carps already referred to. Such changes also bode ill for the future.

## 6.5 LESSONS

The need for FCD developments to be planned and implemented with the closest cooperation and consultation with all the relevant agencies is demonstrated yet again in this experience. Failure by BWDB to consult with DOF is unquestionably a factor contributing to the strongly negative impacts of the Project on fisheries, which might have been much reduced, had there been any possibility of influencing the design, location or mode of operation of BRE from the onset.

There have been numerous past warnings about the consequences of such unilateral planning, addressed both to BWDB and donors including the World Bank - e.g. the World Bank/Bangladesh Land and Water Resources Sector Study of December 1972, Volume IV, Technical Report No 11, para 5-11, to cite one of the earlier accounts of such difficulties. There is no evidence that any of them have been heeded.

The extensive use of harmful small mesh fishing gear must be stopped regardless of the problems of enforcement. More than enough damage has already been inflicted on fish stocks and hereafter it should be an over-riding priority to safeguard the remaining stocks from any further misuse and over-exploitation. DOF must reorganise itself in such a way as to ensure that this task can be carried out effectively.

The World Bank/FAO Project Completion Report, in para 4.17 on page 15, recognised that there was a loss in fish production from BRE (as a whole) due it was suggested to "..... a reduction in the incidence, depth and duration of flooding, ..... ". This is true, but only part of the reason for the decline. The PCR estimated lost production to be about 210 tons per annum, based on an FCD 4 estimate of floodplain productivity as 11.3 kg./ha./year and corresponding to a loss of productive area of 18500 ha. Average fish prices were taken as Tk. 21 per Kg. and the financial loss to fisheries caused by BRE was thus calculated to be Tk. 4.43 million per annum.

The RRA considers the above figures to seriously underestimate both the quantity and value of fisheries losses due to the embankment. MPO (TR No 17) conservatively assessed

floodplain production losses as 37 kg./ha./year, and on that basis, and using FAP 12 estimates for beel productivity, annual production losses are estimated as shown in Table 6.1.

**Table 6.1 : Estimated Fishery Losses, BRE Kazipur Reach**

| Category | Area (ha, from Table 4.6) | kg/ha | mt |
|---|---|---|---|
| No longer annually flooded | 8925 | 37 | 330 |
| Reduction in permanent beels | 49 | 400 | 20 |
| Remaining beels | 1'4 | 150 | 2 |
| Jamuna River | Impossible to estimate | | |
| Total | | | 352 |

Source : MPO Technical Report No.17 and Consultant's estimate.

A rough estimate of the loss on this reach alone would therefore be 350 mt/annum, more than the FAO PCR estimate for losses attributable to the full length of the BRE. The main loss is of top quality high value migratory carps.

**Table 6.2: Fish Production Trend - Pabna Old District**

| | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 |
|---|---|---|---|---|---|---|
| **1. Riverine Catches** | | | | | | |
| Major Carp | 405 | 565 | 110 | 73 | 14 | na |
| Other Carp | - | 168 | 209 | 42 | 21 | na |
| Catfish | 397 | 1088 | 671 | 530 | 221 | na |
| Live Fish | - | - | - | 82 | - | na |
| Hilsa | 256 | 918 | 685 | 226 | 1259 | na |
| Shripm | 25 | 335 | 120 | 92 | 251 | na |
| Other spp | 2684 | 7494 | 4988 | 2608 | 2480 | na |
| Total | 3767 | 10568 | 6783 | 3653 | 4246 | na |
| | | | | | | |
| **2. Beel Fisheries** | 1465 | 1351 | 1134 | 965 | 938 | 908 |
| **3. Floodlands** | 21686 | 11568 | 9897 | 5560 | 5568 | 4972 |
| **4. Ponds** | 4018 | 3767 | 3590 | 4200 | 5104 | 5197 |
| | | | | | | |
| **Grand Total** | 30936 | 27254 | 21404 | 14378 | 15856 | - |

Source: Fisheries Department, Annual Fish Catch Statistics Bulletins. 1983/84 to 1987/88 inclusive, and partial, provisional data for 1988/89.

Notes: Pabna old District included the present Sirajganj District

**Table 6.3: Background Information on Fish Farming and Capture Fisheries in Kazipur Upazila**

| 1. Fish Farming | No. | Area (acres) |
|---|---|---|
| Private ponds | 223 | 34.30 |
| Khas ponds | 16 | 26.20 |
| Total | 239 | 60.50 |
| of which Cultivated | 45 | 14.20 |
| balance are non-cultured & semi-derelict | | |
| 2. Perennial Water Bodies | No. | Area (acres) |
| Beels - less than 20 acres | 3 | 7.14 |
| Beels - more than 20 acres | nil | - |
| | | |
| 3. Estimated Catchs | mt. | |
| Ponds | 5 | |
| Beels | 3 | |
| Rivers | 150* | |
| | | |
| 4. Fishing Effort | | |
| Fishing Villages | 14 | |
| Fishing Families | 3500 | |
| Fishing Cooperatives | 3 | |
| Cooperative membership | 650 | |

* 1012 mt. in 1988 according to the District Fishery Officer

Sources: Kazipur Upazila Fisheries Officer.

**Table 6.4: District Fish Pond Survey Data 1983, Pabna Old District**

| Pond Status | No. | Area (acre) | Production (mt.) |
|---|---|---|---|
| Cultured | 11,629.00 | 5,582.00 | 2,624.00 |
| Cultivable | 16,390.00 | 8,207.00 | 1,124.00 |
| Derelict | 8,322.00 | 4,508.00 | 270.00 |
| Total | 36,341.00 | 18,297.00 | 4,018.00 |
| Derelict (%) | 22.90 | 24.60 | 6.70 |
| Cultivated Ponds productivity | 470 kg./acre (1161 kg./ha) | | |

Source: Department of Fisheries, Fish Catch Statistics Bulletin, 1983/84

**Table 6.5: Carp Spawn Collection from Jamuna River, Sirajganj District**

| Year | Collection Centres | People Engaged | Nets Used | Quantity of Spawn Caught (Kg.) | Selling Price (Tk./Kg.) |
|---|---|---|---|---|---|
| 1984 | 20 | 655 | 2857 | 4203 | na |
| 1985 | 11 | 462 | 1836 | 3331 | na |
| 1986 | 14 | 703 | 2685 | 4106 | 500-6500 |
| 1987 | 12 | 1047 | 8210 | 10724 | 2000-3750 |
| 1988 | 12 | 1383 | 4237 | 4172 | 1500-4750 |
| | | | | | |
| AVERAGE SPAWN COLLECTION PER NET (kG.) | | | | | |
| 1984 - 1.47 | | | | | |
| 1985 - 1.81 | | | | | |
| 1986 - 1.53 | | | | | |
| 1987 - 1.31 | | | | | |
| 1988 - 0.98 | | | | | |

Note: District Fishery Officer stated that 200 licences in 1990 averaged only about 1 kg. each & in consequence only 20 licences were allocated for the 1991 season.

Source: Department of Fisheries, Annual Fish Catch Statistics Bulletins.

**Table 6.6: Sirajganj Market Fish Prices, 16 July 1991**

| Species | Remarks | Price (Tk./Kg.) |
|---|---|---|
| Hilsa (salted) | ex-Barisal | 55 |
| Hilsa (iced, fresh) | ex-Barisal | 60 |
| Katla (very large) | river fish about 20 Kg. | 120 |
| Katla (medium) | ex-local ponds | 55-60 |
| Katla (small) | ex-local ponds | 55 |
| Mrigal (small) | ex-local ponds | 55 |
| Singi, Shol | Sold singly @ Tk. 2 each | 80 approx. |
| Koi | Live @ Tk. 30 for 18 fish | 90 approx. |
| Dried Hilsa roe | - | 72 |
| Miscellaneous fish (very small) | ex-local lift nets | 40 |

Some of the above fish categories seen were of poorer than average quality & freshness & were on offer at much lower prices.

Source : Sirajganj Market Fish Traders.

# 7 IMPACT ON NUTRITION AND HEALTH

## 7.1 PRE-PROJECT SITUATION

As no baseline survey or document could be found on the nutrition and health status of Kazipur area in the pre-Project period, informal interviews with village men and women provided the pre-Project scenario. From these interviews it was apparent that there used to be a food grain shortage within the Project area. Frequent floods and drainage congestion affected the cropping pattern of the Project area and as such most of the Project area was under a single cropping system (see Chapter 4 for details). Foodgrain shortages occurred from mid-April to mid-June and from mid-October to mid-December.

Availability and consumption of the protein foods, such as fish, meat, milk and pulses, however, was relatively high in the pre-Project time. So was the availability and consumption of fruits. These products were within the purchasing power of a large number of people. The overall production of some of these foodstuffs was also higher than post-Project, (Table 7.1). The family size in the Project area in 1967 was 7.19 (Evaluation Study of BRE Sub-Project under DFC-I; Nov. 1986; Dhaka University). Consumption of vegetables was minimal and very few families were interested in kitchen gardening. Consumption of wheat or flour was occasional and only used as a part of the morning meal. For most of the people living within the Project area the source of drinking water was wells, but from the middle of March to the middle of June some of these wells used to run dry or the water turned muddy.

According to the interviewees children looked more healthy during the pre-Project period. This could be due to higher food availability per capita and access to greater variety of food due to lower prices of the produce. Primary health care facilities were not easily accessible to all villagers. The number of children getting inoculated or vaccinated through the government effort was nil. Diseases like small pox, malaria, cholera, common cold, diarrhoea, dysentery, whooping cough, measles, etc. were more common and the number of deaths from some of these diseases was much higher than at present.

## 7.2 OBJECTIVE

In the Project planning stage no explicit objective in the area of nutritional and health impact was included. However, as the Project aimed at protecting the area against river flooding and thus increasing foodgrain production by changing the cropping pattern and cropping intensity, it could have included an objective relating production increase to overall nutritional status of the area. Also, as the Project had a positive impact (especially between 1968 and 1984, when the incidence of floods due to breach in the embankment was almost absent) on nutritional and health status through increased paddy production and increased purchasing power of the Project beneficiaries, there was a need to include an explicit objective in the Project planning stage.

## 7.3 SOURCES OF DATA

- East Pakistan Population Census, 1961;

- Bangladesh Population Census, 1981;

- group interviews with men and women in the project area;

- interviews with Upazila officials of BRDB and Public Health Department and NGOs; and

- Project documents such as Feasibility Report, PP, PCR and Evaluation Studies.

## 7.4 POST-PROJECT SITUATION

### 7.4.1 Food Consumption

The Project area shows an increase in foodgrain production which can partly be ascribed to the embankment. This increase in production resulted in better consumption of rice (both in terms of number of meals and amount cooked) during the initial years. However, since 1984 the situation has declined because of the increase in the frequency of floods due to breaches in the embankment. In such a situation most of the damage occurs to the Aman crop and also results in declining economic situation of the villagers. As such a declining trend in consumption was currently noted among the rural families, especially among the landless and destitute groups. No change was observed in wheat consumption among the people living within the Project area. Most people eat wheat occasionally and as a part of their morning meal.

As for protein food consumption, especially meat and pulses, this too has declined. This was due to several reasons:

- decrease in pulse production as more emphasis was being placed on foodgrain (IRRI-Boro) production;

- increased poverty and landlessness; and

- higher prices of protein foods.

An increase in egg consumption was noted within the households where chicken and duck population has increased. Within the fishing community regular consumption of fish was noted, but for other villagers (except those who are well-off), it was noticed that fish consumption has declined. During the pre-Project period consumption of larger fishes was more frequent than smaller fishes. Due to construction of the embankment large fishes now cannot migrate to inland areas. As a result, this area shows a decline in the availability of large fishes (Feasibility Report on BRE BWDB Nov. 1977 and interview of fishermen).

An increase in the consumption of vegetables was noted within the Project area. Currently all villagers surveyed consume vegetables almost every day of the week, but there was no direct linkage between increased vegetable consumption and the embankment. Villagers reported seasonal fruit consumption, but the general trend was one of declining consumption. Over the years the number of fruit trees has declined and the trees have also grown old, and therefore there has been a decline in the yield.

### 7.4.2 Health Status

The source of drinking water for all the families living within the Project area is tubewells. During the flood period, tubewell water is used for cooking, bathing and washing

as well. There were 2,030 tube wells in Kazipur Upazila in 1981. This may have had an affect on the reduction of diarrhoeal disease.

For most of the households there is no pucca sanitary facility. Primitive sanitary behaviour (use of open space or field) was observed among the fisherman group. In case of flood they face serious problems in terms of sanitation.

The appearance of the children in the nutritionally most risk age groups (0-15 years) suggests the presence of borderline nutritional deficiency. Children observed (especially among those who are coming from poorer economic conditions) show signs of being ill-nourished and underweight in relation to their height and age. This suggests occasional periods of insufficient food intake.

After the Project, food scarcity seemed less frequent in this area, as cultivation of more than one crop became a reality. But in the later years, with the frequent breaches in the embankment and river erosion, the intensity of paddy production has declined and the number of landless people has increased. Data collected from the affected women shows that their families suffer from food shortage for the major part of the year (mid-April to mid-June and mid-August to mid-November) in recent years. This situation worsens when there is a flood in the area. Most of the families consume less than they need and they also borrow foodgrain or cash to meet their needs. As a result nutritional status is affected and this is reflected in the poor body structure, change in hair colour, skin disorder, etc.. Some cases of goitre and cretinism were also observed within the Project area. This is caused by long term inadequate iodine intake. It could be possible that due to frequent flooding in the past iodine rich soil was swept away and was replaced with new crystalline soil, which can not retain iodine. As the iodine concentration of plants relates directly to the soil content, animals fed on such vegetation also lack iodine. As such, people who depend on local food supply (especially protein, which is the primary source of iodine for humans) ultimately develop signs of goitre and cretinism.

Lastly, the high rate of population increase (growth rate in 1981 was 2.41 per cent per year) within the Project area has adversely affected nutritional status. Average family size in 1981 was 5.8. This shows a decline in the family size compared to the pre-Project situation (7.1 in 1961). But total population increase within the Project area has resulted in decline of foodgrain sufficiency necessary for adequate intake.

Within the Project area family planning activities and health care facilities have improved. Women interviewed reported regular visits from the family planning and EPI workers. There were no such visits or programmes in the pre-Project period. There is one hospital and five family planning and health centres in the Kazipur Upazila. Currently the hospital is in grave danger due to flood and river erosion.

The most common diseases children suffer from in recent years are fever, diarrhoea and cold. The number of deaths from diarrhoea has declined. Volunteers have been able to teach all villagers the process of making oral saline solution, which to a large extent helped to reduce child mortality (as reported by the Upazila Magistrate).

Table 7.1 presents the pre- and post-Project situation in terms of nutritional and health impact.

## 7.5 CONCLUSION

Although the Project has helped in increasing food grain production to some extent, Kazipur reach is still a deficit area. This situation could be attributed to the shortcomings of the embankment to some extent. Since 1984 the embankment has failed to provide security from flood. As a result people living within this area suffer from food scarcity and from depressed economic conditions for a major part of the year. Also production increase has occurred mostly in the case of foodgrains, while a decline was noted in the case of most protein foods. As a result people living within the Project area, especially poorer households, suffer from food shortage for most part of the year. As such the nutritional status of the area is poor.

## 7.6 LESSONS LEARNED

Since nutritional and health status are closely associated with food production, both the quality and quantity of food production need to be considered at the planning stage of FCD Projects. Although BRE has had some impact on grain production it has done little or nothing for other crops such as pulses and mustard. Too much emphasis on grains (especially paddy) production and river erosion has actually reduced the area on which other crops could be cultivated. As such there is a need for encouraging farmers in increasing cultivation of pulses and legumes as alternative sources of protein. A lot of fishery activity was observed within the Project area, and increased fish culture along with higher paddy production may in time reverse the present declining trend of nutritional status. Women need to be encouraged to give more effort to homestead gardening. They also need to be taught in basic health care and proper weaning practice. All of these activities need to be planned in a proper manner so that they can have a positive impact on nutritional status in the long run.

## 7.7 RECOMMENDATIONS

Future FCD projects should consider an objective in the planning stage for the improvement of the nutritional status of the Project area. An objective for this type of project could be introduction of planned cropping (i.e. crop diversification) for increasing food grain production, as well as that of other crops (i.e. pulses) through reduction of flood damages, for better health and socio-economic status of the people.

Some diversified income generation opportunities related to the Project should be explored within the framework of the Project proposals to increase purchasing power of the people (especially those who are landless) living within the Project area. This will help the rural disadvantaged in gaining a change in income and wealth distribution and a change in their food purchasing habits, which will result in better nutritional status.

**Table 7.1 Pre- and Post-Project Nutritional and Health Status of the Project Area.**

| Indicators | Pre-Project | Post-Project | | change |
|---|---|---|---|---|
| | | before 1984 | after 1984 | |
| No. of meals/day | 2 | 3 | 2 | ▲ |
| No. of people/meal/day | 7.10[1] | 5.25 | 5.8[2] | ↓ |
| Rice consumption | √ | √ | √ | ▲ |
| Wheat consumption | √ | √ | √ | ▲ |
| Pulses consumption | √ | √ | √ | ↓ |
| Fish consumption | √ | √ | √ | ↓ |
| Meat consumption | √ | √ | √ | ↓ |
| Milk consumption | √ | √ | √ | ↓ |
| Egg consumption | √ | √ | √ | ↑ |
| Vegetables consumption | √ | √ | √ | ↑ |
| Fruits consumption | √ | √ | √ | ↓ |
| Scarcity of food (among poor) | mid-April to mid-June, mid-October to mid-December | mid-April to mid- June | Same as pre-Project | ▲ |
| Source of drinking water | Well | TW | TW | improved |
| EPI program (immunization) | X | √ | √ | ↑ |

Note : 1. Based on 1961 Population Census data
2. Based on 1981 Population Census data

↑ = increased ↓ = decreased ▲ = no change
√ = present X = not present

Source : 1. Population Census 1961 and 1981.
2. Group Interviews with Men and Women in the study villages.

# 8 IMPACT ON WOMEN

## 8.1 PRE-PROJECT SITUATION

According to the population census agriculture was the main occupation of the people living in Kazipur Upazila. Other occupations or sources of income were manual labour, petty business, livestock and poultry, fishing, weaving, etc. There were also a number of landless families within the Project area.

Women's involvement in agriculture was limited to the immediate post-harvest period. Parboiling, drying, winnowing, husking and proper storage of paddy and rice were the main activities performed by women. These post-harvest activities were performed by two classes of women: women within the family and wage labour women. Big farmers usually engaged wage labourers for post-harvest operations, but the number of wage labour women was minimal (because the numbers of landless and destitute women were lower) and they were responsible for processing only a small part of the total crop. Wages for this type of work consisted of a certain amount of paddy and three meals a day, but this was seasonal and for the remainder of the year there were few opportunities for productive activities. In case of flood, finding post-harvest work used to became harder for wage labour women.

In the 1960s, the traditional outlook was much stronger. Due to the traditional conservative outlook even the destitute women did not consider working outside in non-traditional fields (e.g. road mainteinance). Apart from tending livestock and poultry, women were engaged in small scale vegetable and fruit gardening around the homestead and this was only for household consumption. There were a number of fishing and weaving families. Women of these families were involved in repairing fishnets, threading bobbins and harnesses for weaving.

In the pre-Project period travel within and among the villages was not easy, especially in the dry season. There was a severe lack of good road communication linkages. In the rainy season travelling was much easier, mostly by boat.

The number of schools in the Project area was lower before the Project and traditional views encouraged parents in marrying off the girls at an early age (11-14 years; at even lower ages among the Hindu families). These factors contributed to the extremely low presence of girls in the schools.

In 1961, the total population of the sample villages was 16,908, out of which 8,524 were males and 8,384 were females. The literacy rate for females was not available, but it was reported that the number of male students was much higher than that of females.

## 8.2 OBJECTIVES

There were no explicit objectives concerning women in the BRE Project. This is not surprising, since at the time of Project implementation little attention was given to women's issues and their consequent role in the area of rural development. Although in Bangladesh the role of women is best exemplified in the agricultural sector it was not considered as an economic activity then and hence received little attention from the planners. However, one of the BRE Project objectives implied that through increasing production the Project would

increase opportunities for employment in general. This does have an implication on the increase of post-harvest activities and job opportunities for women.

**Table 8.1: Household Numbers, Population and Literacy**

| Village | Household | | Population | | | Literacy | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1981 | |
| | 1961 | 1981 | 1961 | 1981 | 1991[1] | 1961(total)[2] | Total | Female |
| Barshibhanga | 142 | 198 | 757 | 1268 | 1574 | 146 | 196 | 66 |
| Satkaya | 118 | 194 | 648 | 1052 | 1305 | 84 | 104 | 31 |
| Beripatal | 202 | 345 | 1077 | 2090 | 2594 | | 383 | 123 |
| Kazipur | 987 | 1330 | 6651 | 6880 | 8538 | 935 | 1037 | 351 |
| Singrabari | 168 | 341 | 1097 | 1852 | 2298 | 112 | 181 | 63 |
| Meghai | 731 | 392 | 3962 | 6743 | 8368 | | 1180 | 380 |
| Jhunkail | 483 | 1263 | 2716 | 7696 | 9551 | 401 | 1110 | 322 |

Note:1. Projected by the annual growth rate of 2.41 per cent for the Upazila.
2. Data for female was not available.

Source: Population Census, 1961 and 1981.



## 8.3 SOURCES OF DATA

The following sources were used during the RRA for data collection:

- population Census, 1961 and 1981;
- Kazipur Upazila Profile, 1981. Provided by the UZHQ;
- Upazila Officials;
- interviews with men and women of the study villages;
- ARCHES Manager and Workers; and
- Grameen Bank Officials.

## 8.4 POST-PROJECT SITUATION

### 8.4.1 Agricultural Activities

Based on the information on acreage cultivated, change in cropping pattern and yield per acre, it could be said that the scale of off-farm activities has increased. Increase in the

amount of paddy to be processed has created a higher demand on the housewives' workload and provided better wage earning opportunities for wage labour women. However, frequent flooding and river erosion in recent years have reduced the acreage under cultivation and increased the number of landless households. Therefore there are more workers competing for the few wage earning opportunities available.

Female labourers also process paddy in the rice mills on a daily wage basis. The usual working hours of these women are from 8 a.m. to 6 p.m. This employment opportunity for women began in recent years. Most of these women are the sole wage earners in their households.

There was some incidence of employing women in crop harvesting activities (i.e. cutting sugarcane and making bundles of paddy), but there was no report of ever employing women in activities such as transplanting, sowing or weeding.

### 8.4.2 Work on Embankment

One direct impact of the Project is that it has created some employment for women under the FFW programme for the construction and maintenance of the embankment. The usual wage for this type of work is five kilograms of wheat per day. This type of worker is only found in the villages closer to the embankment.

### 8.4.3 Road Construction and Maintenance

An indirect impact of the BRE (as need for developing internal communication has increased because of security from flooding) is that there is some employment for women as labourers for road maintenance under the CARE and IDP programmes of the Upazila Parishad. The number of women working on such programmes is small. Earnings from this type of employment are often their only source of income and are therefore critical for their family welfare and existence.

### 8.4.4 NGO and GO Activities

There are other signs of change in women's economic roles which are not directly linked to the Project but result from the effects of overall rural development activities. There are some income generating opportunities for women through various activities of BRDB and Grameen Bank.

One such programme (by BRDB) was actually targeted at the women who were displaced by the construction of the embankment and river erosion. These women were encouraged to make paper bags, weaving, etc. for daily wages. A women or a girl could earn about twenty Taka per day from such activities. The usual workplace for these groups of women was the embankment itself. This programme was discontinued in later years as the frequency of breaches of the embankment became more common.

There were 89 MSS (Mohila Somobaya Samity) run by the BRDB in Kazipur Thana in the late 70's to early 80's. In 1986 all MSS became inactive due to non-availability of resources. These women's groups still exist and have shown an eagerness for group activity.

Grameen Bank gives loans to groups of destitute women for purchase of poultry and livestock and for buying paddy to process into puffed or pounded rice (cheera) for sale.

Women pay back these loans in instalments and Grameen Bank reported a very satisfactory recovery rate for women.

Another NGO, ARCHES (Association for Renovation of Community Health Education Services), also has specific programmes for generation of earnings for the poor women. There are 128 female groups involved with their various Projects. ARCHES is working in all eleven Unions of Kazipur Upazila.

These organizations also offer motivational and consciousness raising activities for women. The aim of these activities is to bring about positive changes in attitudes among women towards education, family planning, work outside the home, the dowry system, etc..

### 8.4.5 Education

From interviews with school teachers it was found that the number of girls attending primary school is higher than at the pre-Project time. At present, there are 2 college, 20 high schools, 3 girls' schools, 108 government and 25 non-government primary schools and a number of Islamic educational institutions within the Project area (Population Census, 1981). Girls and boys attend the same school where there is no separate school for girls. In the selected villages the literacy rate for the age group years and over is 9.72 per cent as against the Kazipur Upazila literacy rate of 8.9 per cent. Still it is much lower than that of males (20.9 per cent).

School attendance among girls has increased in recent years. According to a primary school teacher of Beripatal village recent class composition is made up almost 50 per cent of girls. The number of girls dropping out of school is however much higher than that of the boys. This is due to several reasons:

- when there is a flood, transportation to and from school becomes difficult;
- during harvesting and planting seasons they are needed at home for work as supportive hands; and
- some parents still prefer not to let their girls become too educated since it makes arranging marriage difficult.

Parents tend to arrange marriage for girls between 14-18 years of age. In Unions like Chalitadanga and Subhagachha where people are more well-off, the age of marriage for girls tends to be on the higher side. But in the lowlands, which are affected by frequent flood and erosion (e.g. Maizbari), the marriage age for girls is lower.

### 8.4.6 Other Positive Findings

Compared to the pre-Project period opportunities for women and girls in handloom weaving have increased. Women and girls do the preliminary work such as starching thread, putting thread in the bobbin, preparing harness, etc., of weaving. Women spend as long as 5-6 hours a day between housework in these activities. Wages for different activities related to weaving range from Taka 90-300 per month. Almost 80-85 per cent of the women and girls in the weavers villages are engaged in these types of activities.

Family planning activities have increased within the Project area. Local women are engaged as family planning workers. Though this program is successful to some extent it needs to be more emphasized to be successful in population control.

Outward migration of women workers was also observed in the Project area. It was reported that some women have moved to Dhaka to work in the garment industries.

Within the fishermen's villages, where no NGO activities have been extended, some women formed groups of their own for saving money for future needs.

Table 8.2 presents different activities of women in the pre- and post-Project situation. Table 8.3 shows current wages received by women for different activities.

## 8.5 CONCLUSION

Overall there is some positive impact of BRE as it has increased employment opportunities for women as agricultural workers. As a secondary effect of the Project, better communication within the Project area has facilitated increased female access to education, family planning and income generating activities. Better communication has also helped in the extension of NGO and GO activities in respect of women's development.

However, occasional breaches in the BRE and river erosion not only affect crop production but also cause a lot of suffering for women. Day-to-day life, especially in terms of communication between places, household working pattern, drinking water availability and sanitation, becomes difficult. For the same reason sometimes women's groups are unable to continue with their activities. Disbursement of loans by the NGOs becomes hard during such periods. As a result some women turned into defaulters and groups are discontinued. Significant loss of land and homesteads also increased the number of landless and destitute families, and as such reduced socio-economic status of affected women.

## 8.6 LESSONS LEARNED

As to its impact on women, BRE failed to consider any objectives at the planning stage. As such the value of the Project or its success in meeting its objectives, relating to women, cannot be discussed. Since a large majority of the families within the Project area are poor (number of landless families in 1981 was 6,741 and according to the information provided by the Upazila magistrate the current figure is 9,120), there is a need for giving more attention to the potential role of women in economic activities and its consequent impact on raising the standard of living within the Project area.

## 8.7 RECOMMENDATIONS

FCD projects should consider creating more job opportunities (from the execution stage of the Project to O&M) for women in the planning stage. Women should be linked with the Project in such a way that some benefit of the Project can be reaped by the poorer women, especially by widowed and divorced women.

As there are more women than men (106,714 males and 107,171 females) in this area they should be motivated in participating in on-farm activities such as sowing, planting, etc.. Some agricultural extension work needs to be aimed at women. They can teach women in vegetable gardening and raising fruit trees (e.g. banana or papaya) and techniques for reducing post-harvest loss. Through such extension work women's participation in economic activities can be increased.

Different government agencies and NGOs need to coordinate their activities for women so that they can avoid duplicating projects or being in the same village, as happens in most cases.

**Table 8.2.: Women's Involvement in Different Activities in the Pre- and Post-Project Situation.**

| Activity | Pre-Project (if present) | Post-Project | | | |
|---|---|---|---|---|---|
| | | Before 1984 | | After 1984 | |
| | | (if present) | Change since 1961 | (if present) | Change since 1984 |
| Agriculture: | | | | | |
| on-farm: sowing, etc. | √ | X | ▲ | √ | ▲ |
| harvesting | X | X | ▲ | √ | ↑ |
| off-farm: paddy boiling | √ | √ | ↑ | √ | ↓ |
| drying | √ | √ | ↑ | √ | ↓ |
| winnowing | √ | √ | ↑ | √ | ↓ |
| husking | √ | √ | ↑ | √ | ↓ |
| Kitchen gardening: | | | | | |
| land preparation | √ | √ | ↑ | √ | ↑ |
| sowing | √ | √ | ↑ | √ | ↑ |
| watering | √ | √ | ↑ | √ | ↑ |
| weeding | √ | √ | ↑ | √ | ↑ |
| harvesting | √ | √ | ↑ | √ | ↑ |
| Chicken, duck and goat rearing: | | | | | |
| purchase | X | X | ▲ | √ | ↑ |
| rearing | √ | √ | ↑ | √ | ↑ |
| sale | X | √ | ↑ | √ | ↑ |
| Other activities: | | | | | |
| care and repair fishnets road | √ | √ | ↓ | √ | ↓ |
| construction (RMP/CARE) | X | X | ▲ | √ | ↑ |
| making paper bags | X | √ | ↑ | √ | ↓ |
| making puffed rice/cheera | √ | √ | ↑ | √ | ↑ |
| Weaving: | | | | | |
| preparing bobbin | √ | √ | ↑ | √ | ↑ |
| starching thread | √ | √ | ↑ | √ | ↑ |
| putting thread through harness | √ | √ | ↑ | √ | ↑ |
| Education: | | | | | |
| number of female student | √ | √ | ↑ | √ | ↑ |
| no of schools | √ | √ | ↑ | √ | ↑ |
| NGO activity: | | | | | |
| Grameen Bank (female groups) | X | X | ▲ | √ | ↑ |
| ARCHES (female groups) | X | X | ▲ | √ | ↑ |

Note: √ = present X = not present ↑ = increased ↓ = decreased ▲ = no change

Source: Interview with Men and Women of the study villages.

**Table 8.3: Current Wage for Different Activities.**

| Activity | Types of Wage | | |
|---|---|---|---|
| | Cash (Tk.) | Food/meal | Foodgrain |
| Post-harvest work (upto 60 mds. of paddy processing) | - | 3 meals | 1/2-1 mds. of paddy |
| Rice Mill worker (daily wage) | 1.00/mds. | - | 1 kg. rice |
| Embankment worker/ FFW (daily wage) | - | - | 5 kg. wheat |
| Road workers: CARE, IDP/RMP (monthly wage) | 550.00 | - | - |
| Weavers helpers:<br>for threading bobbin<br>for threading harness | <br>80.00-90.00<br>300.00 | <br>-<br>- | <br>-<br>- |
| Poultry and egg sale | 600.00-700.00 | - | - |

Source: Group interviews with men and women of the study villages.

# 9. SOCIAL IMPACT

## 9.1 PRE-PROJECT SITUATION

In the pre-Project period, agriculture was the dominant activity of the villages in the study area, but agriculture was a gamble and depended on the mood of the river Brahmaputra. Flood disaster was a part of life. Most of the cultivators were poor. Farming, fishing or farming-cum-fishing were the major occupations in the area. A cheap labour supply has always been another important characteristic of the Project area. As reported the land distribution has been highly skewed. Landless people were numerous because of flood disaster and river erosion every year.

Social infrastructure such as schools, madrasahs, hospitals, roads and transport systems were poorly developed. The dominant form of transport was ox-carts in the dry season. There were very few social organisations such as formal and informal cooperatives, youth clubs, fishermen's societies and landless groups. Traditional RCS cooperatives were reportedly functioning in and around the Project area. However, the pre-Project period is too distant to assess the effectiveness of such organizations at that time.

## 9.2. OBJECTIVE OF THE PROJECT

The original planners of the BRE were aware that it would not just have an impact on agriculture. IECO (1962) noted that additional benefits would include a vastly improved road transportation system, protection of the towns of Sirajganj and Gaibandha, protection to villages, improved sanitary and health conditions and benefits to industrialisation, through reduced risk of flood damage. These benefits were not quantified.

## 9.3 PRESENT SOCIAL AND INSTITUTIONAL CONDITIONS PREVAILING IN THE PROJECT AREA

The social situation at present appears to be significantly different from that before the Project. However the social variables such as occupational composition, demographic transitions, social interaction in terms of leadership pattern, values, tastes and behaviour have more or less remained the same as in the past.

One important social issue in the area is the increase in landlessness after the execution of the Project. The growth rate of landlessness has increased in recent years, the major cause of which has been the erosion of the river Brahmaputra which leads to huge loss of cultivable land every year. The area was a labour surplus one before execution of the Project and due to increase in landlessness after the execution of the Project day labourers have increased to as much as 50 per cent of the total workforce in the study area. The out-migration of labourers to the districts of Rangpur, Sylhet and Dhaka has increased in recent years. Before execution of the Project, women were not found in work outside the homestead. At present disadvantaged women are found to work as maintenance labourers in CARE's Rural Maintenance Programme (RMP). Many poor women have migrated to Dhaka to find jobs in the garments industry. However, the reported increases in landlessness or outmigration of men and women are not entirely due to the Project.

Institutions like Traditional Cooperatives (RCS), BRDB cooperatives and a local NGO are functioning in and around the Project area. The RCS cooperatives began functioning from long before the execution of the Project while BRDB has been functioning after the Project was built. ARCHES, a local NGO has started functioning since 1990.

### 9.3.1 Traditional Cooperatives (RCS)

The traditional type of cooperative started functioning in the area in the 1950s. Present performance of the societies under RCS is shown in Table 9.1.

**Table 9.1: Characteristics of Traditional Cooperatives**

| Type of Societies | No. of Societies | Membership No. | Share | Savings (Taka) |
|---|---|---|---|---|
| UCMPS | 11 | 2393 | 24288 | 5268 |
| Fishermen | 3 | 596 | 5137 | 4049 |
| Weavers' | 8 | 620 | 11300 | 10461 |
| Rickshaw Puller | 1 | 201 | 2010 | 6490 |
| Adarsha MPS | 3 | 82 | 2650 | 8325 |
| Agriculture | 4 | 75 | 1692 | 311 |
| Ansar/VDP | 2 | 129 | 14290 | 18977 |
| Total | 32 | 5596 | | |

Source : Kazipur Upazila Cooperative Department.

Except for the fishermen and rickshaw pullers' societies, most of the societies are not functicning properly.

### 9.3.2 BRDB Cooperatives

There are various types of cooperative societies functioning inside the Project area under the direct supervision of the Bangladesh Rural Development Board (BRDB). These cooperatives were organised in Kazipur Upazila when the Integrated Rural Development Programme (IRDP) started in the beginning of the 1970s. The present position of the BRDB cooperatives in Kazipur Upazila is presented in Table 9.2.

**Table 9.2 : Characteristics of BRDB Cooperatives**

| Name of Societies | No. of Societies | Membership No. | Share (Taka) | Savings (Taka) | Loans (Taka) | Recovery (Taka) | Outstanding (Taka) |
|---|---|---|---|---|---|---|---|
| KSS | 157 | 12313 | 7,88,470 | 7,56,314 | 2,25,53,303 | 1,31,33,740 | 9,41,563 |
| BSS | 55 | 2038 | 66,585 | 79,680 | 2,50,000 | 1,27,320 | 1,22,680 |
| MSS | 89 | 3403 | 69,755 | 1,65,365 | 5,84,100 | 1,66,502 | 4,17,598 |
| Total | | | | | 2,33,87,403 | 1,34,27,562 | 99,59,841 |

Source: Office of the URDO, Kazipur Upazila.

Note: KSS: Krishi Samabay Samity (Farmers' Cooperative Society)
BSS: Bithaheen Samabay Samity (Landless Cooperative Society)
MSS: Mohila Samabay Samity (Women's Cooperative Society)

The principal functions of the KSS are to promote agricultural output and marketing of agricultural produce. This happens if some surplus above the home consumption can be achieved by the farmers. As reported, few farmers have an investible surplus while most of the farmers in the Project area were found to be at subsistence level. Hence, such cooperatives benefit relatively rich families.

Some of the BRDB cooperatives are reported to be inactive, and some are reported to function well below expectation. Cooperative societies involved in small trading, cattle raising, and poultry raising were reported to be quite active.

### 9.3.3 ARCHES: A Local NGO

Information obtained from the RRA field visit indicates that besides traditional and BRDB cooperatives, a local NGO called ARCHES (Association for Renovation of Community Health and Education Services) has been functioning since 1989 in 11 Unions of Kazipur Upazila. It is funded by Oxfam and the British High Commission Small Projects Scheme. It has already formed 200 groups (72 male and 128 female). Important activities, among others, are sugarcane cultivation under lease, mulberry plantation for sericulture by the roadside ( 7000 plants already established) and raising cattle and ducks.

## 9.4 SOCIAL IMPACT OF THE PROJECT

### 9.4.1 Positive Impacts

The positive impacts of the Project are shown below.

i. The BRE has generated considerable benefits as it has been commonly used as a temporary and permanent shelter for flood affected people and animals.

ii. The BRE as well as the internal village roads connected to it have facilitated the developmental activities of the GOs and NGOs in the Project area.

iii. Improved communication on the embankment road networks has facilitated distribution of inputs and movement of goods and services to and from the Project area. It has also created some opportunities for income generating activities, especially for distressed women.

iv. Prices of land have increased in the mouzas where more than one crop including HYV Boro is now grown inside the Project area, but in mouzas which are close to the embankment or left outside the embankment prices of land have gone down.

v. The BRE has had some positive impacts on employment creation through:

- direct employment for the construction of the 225 km. of original embankment; and

- as a consequence of constructing the series of retired embankments, additional employment for earthwork has been created. The number of people permanently employed for watching, inspection and repair and maintenance of the embankment has also increased in recent years. However, because of the numerous failures of the embankment in recent years, much of the employment that has been created due to the construction of the embankment has been unproductive.

vi. During the post-BRE period, non-farm economic activities seem to have increased in the following sub-sectors:

- petty trade in food-grains, fertilizers and oil-fuel for irrigation equipment;

- support services such as drilling of tubewells, mechanics services for repair of irrigation pumps, and supplies of spare parts, (but these are not related to the Project); and

- improvement of the road network simultaneously with the construction of the original and retired embankments and an increase in the volume of rice production have promoted low-cost but robust road transport such as rickshaws and rickshaw vans.

### 9.4.2 Negative Impacts

The negative impacts of the Project include the aspects shown below.

i. There has been a significant loss of land (homestead and cultivable) due to construction of the embankment and retired embankments which has created dissatisfaction amongst the affected people.

ii. There has been a large loss of infrastructure and buildings due to severe river erosion in the post-Project period. For example, the old town of Kazipur has been washed away and the Upazila headquarters have been shifted to a new site, meaning displacement of people. Whether or not this was due to the

construction of BRE, or could have been prevented by Project activities, could not be ascertained by the RRA.

iii. Only partial payment has been made for the land acquired for the retired embankment and this has created dissatisfaction amongst land owners. This experience causes delay in construction of new retired embankments as the landowners refuse to give land unless the compensation money has been fully paid.

iv. The reduction of fish production has led to occupational changes by erstwhile professional fishermen to low income irregular activities such as boat plying, wage labour or anything that brings some supplemental income.

## 9.5 LESSONS LEARNED

i. The delayed payment or non-payment of land compensation created frustration amongst those who lost land to allow the construction of the embankment. This has complicated the acquisition of land and has resulted in the late start of work, incomplete construction and wastage of money, manpower and administrative resources. One of the lessons from such unsatisfactory human intervention is that the whole process of land acquisition all the way from BWDB to Presidents' Secretariat via DLAC and Ministry of Land should be seriously reviewed and adequately reformed.

ii. The arrangements for embankment construction and maintenance appeared to be unsatisfactory. The RRA team encountered persistent allegations of profiteering and collusion amongst contractors, labour leaders, local influential groups and, in some cases, officials. This is a delicate area no doubt, but the prevalence of such views amongst the supposedly benefited population indicates, at the very least, an urgent need for greater consultation and openness on the part of the relevant agencies and organisations.

iii. The main technical problem with BRE, Kazipur Reach is that it has failed due to insufficient set-back, and this was due largely to social/political pressure or agitation at the time of construction of retired embankments. This implies that different occupational groups of local people must be consulted and involved at the initiation, planning and implementation steps of any similar future projects.

# 10 ENVIRONMENTAL EVALUATION

## 10.1 PRE-PROJECT SITUATION

The Project area falls within the Agroecological subregions 4a and 4b belonging to the north central part of Karatoya Bengali Flood Plain Agro-ecological Region (FAO 1988). The area is medium highland and medium lowland. Most of the western parts of the benefited area are highland. In the subregions 4a and 4b, grey silt loams and silty clay loams predominate.

Flooding in the area is mainly due to rainfall in the upstream areas, i.e. from Assam and the Himalayan Region. In pre-Project conditions, it was reported that flood water from the Brahmaputra-Jamuna river entered the area gradually and would support B. Aman cultivation in the monsoon followed by Aus cultivation. Early floods used to damage the Aus crop occasionally. During B. Aman cultivation, aquatic vegetation would flourish to some extent. Since a large area used to remain under water for 4-5 months, the area was very rich in various species of fresh water fishes.

## 10.2 PROBLEMS

The following problems occur in the Project area:

i. since the Brahmaputra-Jamuna river is a highly braided channel, the Project has suffered from breaches, especially from 1984 onwards. Therefore, environmental impact is quite difficult to evaluate;

ii. the soils of the present retired embankment are of low quality and it was built with inadequate care; and

iii. the short term channel migration is quite drastic, with rates of movement as high as 2,600 ft. a year being common. The rate of rise and fall of the river, the number and position of major channels active during flood, the formation and movement of large bedforms, cohesion and variability in composition of bank material are some of the factors responsible for controlling the bankline configuration and movement (Coleman 1969).

## 10.3 PROJECT OBJECTIVES

The Project documents did not include environmental aspects. However, the objective stated in the PP (1985) was to build up a flood free and well drained environment which would accelerate agricultural activity to increase food grain production consistent with national objectives.

## 10.4 SOURCES OF INFORMATION

The Project documents such as Feasibility Report (IECO Inc. 1962; WDB 1977; Dhaka University 1986) include some data of relevance to physical and human aspects of the

environment but no biological data. Information on agroecological zonation and characteristics are available in the comprehensive FAO (1988) work which covers all of Bangladesh.

All other information and data were acquired by the RRA approach of interviews with villagers and government officials and by direct field observation. Equally important for the environmental evaluation have been the findings of other disciplines within the RRA team.

## 10.5 PHYSICAL ENVIRONMENTAL IMPACTS

Physical issues have been subdivided into water related and land related issues (Table 10.1). Other physical issues such as climate and atmosphere have not been affected by the Project.

### 10.5.1 Physical Impacts (Water)

a) River Flow

The volume, duration, timing and velocity of the Brahmaputra-Jamuna River does not seem to be significantly affected by the BRE in Kazipur Reach. The combined effect of upstream river contained projects (Kurigram South; Teesta embankment; remainder of the BRE) cause impacts on river flow and duration and flow is concentrated by the above mentioned upstream projects. This collective influence is creating cumulative impacts which cannot be realistically assessed for each project in isolation. However, the volume of flow has been increased by the BRE Kazipur embankment but not significantly.

There are no active rivers within the Project area. The small khals, "Dha" (large pond like features, depth 16 to 50 ft; formed inside the Project area due to breach) and silted river channels, such as the Isamati River, are considered as part of the wetlands and water bodies inside the Project area.

b) River Quality

Salinity is not a factor in the Brahmaputra river. The possibility of pollution of the river by agrochemicals or sewage is strongly diluted by the huge flows accumulated in the rivers of the Teesta, Dharla and Dudkumar. The chief quality concern, is therefore, sediment. Since the Brahmaputra is a braided channel, the increased bedload due to scouring (section (c)) is an important factor. This shows a moderate negative impact on the quality of the lower Brahmaputra with notable secondary impacts. In addition, high bedload causes considerable problems as it is deposited on good agricultural land in the downstream reaches.

Overall external impact on river quality is assessed as minor negative.

c) River Morphology

Some increase in river flow has resulted from the BRE Project, in combination with other upstream projects, but the effect on river morphology is probably negligible. Studies by FAP 1 indicate that most morphological activity by the river takes places at less than bank full stages and therefore cannot be influenced by the BRE. However, FAP 1 studies also indicate that some BRE structures, especially groynes, may act as a focus of severe local scouring Some locations on the Kazipur Reach are strongly affected.

The old Kazipur town and a major part of Meghai, the attached village, have almost disappeared now; retired embankments have been built a number of times (possibly 3 or 4 times); the last one is approximately 2 km further east of the original embankment.

The 1991 breach occurred on the retired embankment near Jhunkail. A part of the old embankment still remains approximately 1 km close to the river side. However, the breach of 1991 was possibly due to the poor design and inadequate construction of the embankment.

The high current in the river accelerates scouring and deepening of the river bed, and also siltation occurring both within and outside the river. This is the usual nature of the Brahmaputra river and the effect of BRE is probably negligible. Therefore, the overall impact of the BRE has been considered as minor negative.

d) Flooding

The Project was designed and built to exclude the entry of flood water within the Project area. The Project achieved its objectives up to 1983 but from 1984 onwards regular flooding occurred, due to breaching of the embankment by river erosion as the Brahmaputra migrates westward. The effect of flooding within the Project Area is a moderate negative impact, because the T. Aman crop has been adversely affected in about 60 per cent of recent years (see Chapter 4).

External impacts have been similarly negative especially outside the embankment, since retired embankments are needed in a number of places approximately every two years. However, the combined flow due to upstream projects is creating a negative impact outside the Project area. The Project may have a negative impact further downstream, but the total effect is slight in relation to the normal river regime.

Overall, the external impact is scaled as minor negative.

e) Groundwater Levels

This is an important issue because of the presence of the growing number of shallow tubewells and deep tubewells in the Project area, particularly for HYV Boro cultivation. It is difficult to detect any immediate trends about groundwater levels as this is a relatively long term phenomenon but in recent years frequent flooding due to embankment breaches has probably increased the rate of recharge. Overall the impact is negligible. Monitoring of groundwater levels is essential which will help to clarify the degree of impact of the Project on groundwater levels.

Externally, there is no impact on groundwater levels due to BRE.

f) Groundwater Quality

A lack of analytical data means the impact cannot be assessed. The use of agro-chemicals, particularly fertilisers and insecticides, especially for HYV Boro and also to some extent for T. Aman has increased which may affect groundwater. As a result of increase of population it is likely that amount of sewage pollution has increased in the surface water. Since the Project is now subject to frequent flooding, these substances are likely to be washed away by the flood water.

With the gradual expansion of HYV T. Aman cultivation, which needs a lot of fertilizer and pesticides, it is possible that contaminated water from the surface reaches the groundwater and a minor negative impact is possible here.

g) Wetland and Waterbodies Extent/Recharge

The entire benefitted area was flooded due to a breach when visited by the RRA team (July 16-20, 1991) and looked like marsh. Only a very little B. Aman cultivation was observed, but a repeat visit in September 1991 showed that considerable crop areas had in fact survived.

During the dry season, the wetland areas dry out almost fully, although 40-50 ha. of "Dha" (5-6 depressions of various sizes which have been formed as a result of breach) remain wet (16-50 ft depth) throughout the year.

The Project has not had any significant impact on wetlands inside the Project area. In the wetlands downstream, a similar impact is assumed, due to increased extent of flooding in wet years.

h) Wetland and Waterbodies Quality

From the discussion in (g) it is apparent that the Project has not affected this issue significantly.

**10.5.2 Physical Impacts (Land)**

a) Soil Fertility

Soil fertility has been little affected, particularly from 1984 onwards, because the extent and depth of flooding is more or less the same as in the pre-Project period due to breaches. Therefore, blue green algae and aquatic vegetation flourish and probably maintain fertility at previous levels. However, prior to 1983, as the bund was reported to be successful, no flood water entered the Project area. In the absence of flood, siltation was also absent.

Coarse sand enters through the breaches and is deposited in some locations on agricultural land and fertility is affected to some extent. Overall, a minor negative impact may occur both within the Project area and outside.

b) Soil Physical Characteristics

Since the bund is subject to frequent failure, the important change is the deposition of fine sand and also coarse sand by the strong flow of water through the breach. The resulting top soil is sandy and has low water holding capacity and provides a poor physical medium for plant growth. Approximately 2 sq.km. area near the breaches are very sandy and another 1 sq.km. is affected by a mixture of sand which changed the cropping pattern from HYV Boro to sugarcane cultivation. Overall the impact within the Project area is a moderately negative one.

Externally sand deposition occurs, but this is not related to BRE.

c) Soil Moisture Status

Flood water at present stays for long periods, and this has been used for the retention of surface water for irrigation in some low pockets at the end of the monsoon period, particularly in the initial stage of rabi crops.

d) Soil Erosion

High velocity flows at embankment breaches may cause localised erosion inside the Project. A minor negative impact is assumed.

e) Land Capability

Land capability change was initially considerable, due to the change from B. Aman cultivation to T. Aman cultivation when the embankment was successful. Since breaches now occur frequently T. Aman cultivation is vulnerable, and the land capability change is reduced, though still significant. Outside, the depth and extent of flooding has increased and probably means a minor negative impact.

f) Land Availability

There was a significant increase in land availability for cultivation during the period when the embankment was relatively successful. In recent years, sudden flooding due to breaches damages T. Aman cultivation. A minor negative impact is assumed both within and externally.

## 10.6 BIOLOGICAL ENVIRONMENTAL IMPACTS

Biological environmental issues affected by the BRE Project can be divided into fauna and flora issues (Table 10.2). Most biological issues in BRE (with the important exception of fish habitat) have shown no significant impacts but they are briefly examined because of popular awareness of such issues.

### 10.6.1 Biological Impacts (Fauna)

a) Bird Communities/Habitats

The decline of migratory bird communities and their habitats was more or less complete pre-Project and any further deterioration is a function of human population increase rather than the Project. Approximately two decades ago, migratory birds would visit low lying areas off and on in the winter.

b) Fish Communities/Habitats

There has been a general negative impact on fish ecology due to decrease of flooded area and depth. In addition, the embankment construction has blocked the access routes for the major carps in the Project area, on their spawning migration from beels to the river, and distribution of spawn and fry from the river across the flood plain areas.

The fish ecology in the beels is deteriorating because the beels are cut off from both the rivers and from each other, but also because of the increasing number of fishermen.

The only slight benefit which is discernable is that water flowing through the breaches may carry some young fish into the flood plain where they can grow and may also facilitate some fish breeding which otherwise would not be possible.

The Project overall seems to have had severe negative impacts on fish ecology in the Project area.

c) Other Macro-fauna Communities/Habitats

The same comments apply as for (a) above: already by 1963 intensive occupation and utilization of the land had reduced mammals, reptiles, amphibians etc. almost to the very low populations found today. The continued imperceptible decline during the Project life has not been significantly accelerated by the Project, in part because it started from too low a base level.

The lack of historical data for this and most other biological issues in Bangladesh does not permit detailed analysis of impact on the country's wildlife and habitats. More data would have enabled the Project's impact on these issues to be shown in a clear perspective.

d) Micro-fauna Communities/Habitats

This issue has already been touched upon in section 10.5.2.(a), where it was noted that no significant change had occurred with respect to the incidence of blue green algae, one of the major microbiota elements in Bangladesh. In the total absence of data. It is assumed that other microbiota remain similarly not significantly affected by the Project.

**10.6.2 Biological Impacts (Flora)**

a) Trees

The population in the area have been affected slightly by the Project. Because of embankment erosion there is not the opportunity for afforestation noted in other FAP 12 areas. The erosion of the soil destroys homestead forests outside the Project area every year. The destruction of homestead forest was also common before the BRE, though possibly to a lesser extent. The overall impact was therefore shown as slightly negative both within and outside the Project.

b) Other Terrestrial Vegetation

The same comments apply as to (a) and (c) in section 10.6.1.

c) Aquatic Vegetation

The communities and habitats of aquatic vegetation from 1984 onwards have remained more or less unchanged during the Project, as the flooded area seems to be much the same.

## 10.7 HUMAN ENVIRONMENTAL ISSUES

Some of the most important environmental impacts of the BRE Project are those affecting the human environment. However, many of these are covered in other chapters of this report. Here they are presented in Table 10.3 and are briefly summarised below.

Human impacts can be conveniently grouped into five sub-categories: human use, social, economic, institutional and cultural.

### 10.7.1 Human Use Impacts

a) Crop Cultivation

In Chapter 4 it was shown that the loss of mixed B. Aus-B. Aman has been more than offset by the positive impact on the important HYV T. Aman crop. In recent years HYV. T. Aman cultivation is known to have been free from damage in only 2 out of every 5 years. The rapid rise of flood waters due to breaches also did not allow B. Aman cultivation successfully. The net result is therefore a moderate positive impact inside the Project and negligible impact outside the Project.

As a result of breaches, sand is deposited in many areas which now support the cultivation of sugarcane. The same area used to be cultivated for HYV Boro and T. Aman when the embankment did not breach.

b) Livestock

Some increase in livestock is reported (Chapter 5) up to 1983 when the embankment allowed successful cultivation of T. Aman. The BRE embankment is less suitable for grazing and the overall impact is a minor negative one both within the Project area and outside. The main cause is the loss of grazing lands, and lack of sufficient good quality straw from the T. Aman crop. The diseases of cattle have also showed a tendency to increase particularly in the post 1984 period.

c) Fisheries

During the period when the embankment was successful, perennial beels were cut off from their connections to the river through khals, the wetland dried out, and the impact was therefore negative. The embankment failures mean that the capture fishery may now be less affected. The increase in the number of part time fishermen and overfishing are also the reasons for the decrease of capture fishery. The Project seems to have had a severe negative impact both in the Project area and outside.

d) Afforestation

A slightly negative impact was noted due to heavy erosion of the homestead forest. In addition the embankment does not provide the opportunity for an afforestation programme because of its sandy soil and frequent retirement.

e) Agro-industrial Activities

A very minor positive impact. There is an increase in rice mills, partly due to increased HYV Aman output, but owing much more to the successful cultivation of irrigated HYV Boro.

f) Transport and Communication

A minor positive impact within the area. It is mainly concerned with non-metalled roads and with water transport. A number of kutcha roads in the medium highland areas have been built, and the embankment itself provides access for pedestrians.

Boat transport has declined, as boats can no longer enter the Project area from the rivers.

g) Infrastructure

The partial control of floods may have had small benefits but in fact the floods that are really damaging houses, Government buildings and other infrastructure will continue due to breaches. Thus no significant impact is assigned.

h) Domestic Water Supply

The assumed slight project impact on maintaining groundwater levels may have had a small positive impact on domestic water supplies from shallow drinking water tubewells.

i) Sanitation

Flooding continues to allow flushing of surface water in which indiscriminate sewage has accumulated, as it did pre-Project, so there is no real impact.

j) Recreation

Not affected

k) Energy

Not affected

### 10.7.2 Social Impacts

a) Human carrying capacity

The effect of the Project in replacing the mixed B. Aus-B. Aman and T. Aman (local) by HYV T. Aman has meant some increase in monsoon season paddy production (Chapter 4) which has improved the human carrying capacity to some extent. Therefore the impact is moderately positive inside the Project.

b) Demography

The Project itself has probably not significantly influenced demographic structure and trends, except as in (a) above, and as noted this has not inhibited population growth or structure, due to other compensating factors.

c) Gender

The Project has slightly increased employment opportunities for women. A minor positive impact is assessed.

d) Age

No real impact

e) Health and Nutrition

Minor positive impact due to project related increase in crop production and to the maintenance of a clean drinking water supply from the shallow tubewells (Chapter 7) up to 1983. Since 1984 the situation has changed because of the increase in the frequency of flood due to breaches in the embankment. Overall impact is minor positive within the Project area.

f) Disruption, Safely and Survival

Embankment insecurity since 1984 has increased the risk of rapid flooding, with moderate negative impacts on disruption, safety and survival. Over the Project life, the impact is assessed as minor negative inside the Project. The external impact is negligible.

g) Land Ownership

Not affected

h) Equity

The impact is moderately negative because the agricultural benefits of the Project have been achieved at the cost of major disbenefits to fishermen, a poor group.

i) Social Cohesion

Social cohesion is negatively affected both within and outside the area. When the embankments are breached, this involves bitter relationship between the people, particularly those living near the embankment.

j) Social Attitudes

It is clear from (i) that there is public discontent particularly amongst small farmers, due to the failure of the Project. There is a strong feeling amongst the villagers that BWDB should make the embankment stronger and repairs should be made before the monsoon.

It was noted that the impact on social attitudes in outside areas is also negative.

### 10.7.3 Economic Impacts

The three main potential economic impacts of the Project on the people are incomes, employment and land values. These have all received some positive impacts. The net impact is that the small benefits from crops are offset by the large losses from fisheries and livestock. The losers, in this respect, have been the traditional capture fishermen. The construction and repair of retired embankments involves seasonal employment of a large group of rural poor.

There are no significant external economic impacts.

### 10.7.4 Institutional Impacts

Institutional effectiveness does not seem to have improved as a result of the Project. This has created substantial public resentment against the government institutions concerned. Both institutional roles and public participation therefore have suffered moderate negative impacts, perhaps outside the area as well as within it.

### 10.7.5 Cultural

It is difficult to see that the Project has significantly influenced cultural heritage and continuity or scenic qualities in the Project area. There are no particular historical, archaeological or more recent cultural sites within the area or in the adjacent external areas.

Quality of life has not been changed significantly within or outside the Project area.

## 10.8 ENVIRONMENTAL SCREENING

The primary Project activities was flood protection. The scoping exercise in sections 10.5 - 10.7 shows that this was fully achieved only up to 1984. The threat of catastrophic flood has returned since then due to breaches, but these are not a result of the Project as such, but rather of its siting on the bank of a powerful and unpredictable river.

The environmental screening of Project activities implicit in Sections 10.5 - 10.7 shows that the component of most immediate concern is flood protection.

## 10.9 CONCLUSIONS AND RECOMMENDATIONS

There has been one moderate positive impact (on crop cultivation) and one minor positive impact (transport and communication) in the Project area overall.

The main negative impacts overall have been:

- the decrease of soil fertility and change of soil physical characteristics;
- the decline in capture fisheries;
- deterioration of social attitudes;
- failure to achieve institutional effectiveness and to encourage public participation.

Recommendations include:

i. Design and implementation of a long term integrated plan for the coordination of development in the Brahmaputra Basin as a whole.

ii. Establishment of monitoring programmes now for certain critical environmental parameters, including: groundwater levels and quality; wetland fish and microbiota.

**Table 10.1 : Physical Environmental Impacts.**

| Physical Issues | Degree of Environmental Impact | |
|---|---|---|
| | Project Area Impacts | External Impacts |
| **WATER** | | |
| a. River Flow | - | 0 |
| b. River Quality | - | -1 |
| c. River Morphology | - | -1 |
| d. Flooding | -2 | -1 |
| e. Groundwater Levels/Recharge | 0 | -1 |
| f. Groundwater Quality | 0 | 0 |
| g. Wetland and Waterbodies Extent/Recharge | 0 | 0 |
| h. Wetland and Waterbodies Quality | 0 | 0 |
| **LAND** | | |
| a. Soil Fertility | 0 | 0 |
| b. Soil Physical Characteristics | -1 | 0 |
| c. Soil Moisture Status | 0 | 0 |
| d. Soil Erosion | -1 | 0 |
| e. Land Capability | +1 | -1 |
| f. Land Availability | -1 | -1 |

**Table 10.2 : Biological Environmental Impacts**

| Biological Issues | Degree of Environmental Impact | |
|---|---|---|
| | Project Area Impacts | External Impacts |
| **FAUNA** | | |
| a. Bird Communities/Habitats | 0 | 0 |
| b. Fish Communities/Habitats | -3 | -1 |
| c. Other Macro-Fauna Communities/Habitats | 0 | 0 |
| d. Micro-Fauna Communities/Habitats | 0 | 0 |
| **FLORA** | | |
| a. Trees | -1 | -1 |
| b. Other Terrestrial Vegetation | 0 | 0 |
| c. Aquatic Vegetation | 0 | 0 |

**Table 10.3 : Human Environmental Impacts**

| Human Issues | Degree of Environmental Impact | |
|---|---|---|
| | Project Area Impacts | External Impacts |
| **HUMAN USE** | | |
| a. Crop Cultivation | +2 | 0 |
| b. Livestock | -1 | -1 |
| c. Fisheries | -3 | -2 |
| d. Afforestation | -1 | 0 |
| e. Agro-industrial | +1 | 0 |
| f. Transport Communications | +1 | 0 |
| g. Infrastructure | 0 | 0 |
| h. Domestic Water Supply | 0 | 0 |
| i. Sanitation | 0 | 0 |
| j. Recreation | 0 | 0 |
| k. Energy | 0 | 0 |
| **SOCIAL** | | |
| a. Human Carrying Capacity | +1 | -1 |
| b. Demography | 0 | 0 |
| c. Gender | +1 | 0 |
| d. Age | 0 | 0 |
| e. Health and Nutrition | +1 | 0 |
| f. Disruption, Safety and Survival | -1 | 0 |
| g. Land Ownership | 0 | 0 |
| h. Equity | -2 | 0 |
| i. Social Cohesion | -1 | -1 |
| j. Social Attitudes | -1 | -1 |
| **ECONOMIC** | | |
| a. Incomes | -1 | 0 |
| b. Employment | +1 | 0 |
| c. Land Values | +1 | 0 |
| d. Credit Availability | 0 | 0 |
| **INSTITUTIONAL** | | |
| a. Institutional Activity/Effectiveness | -2 | - |
| b. Public Participation | -2 | - |
| **CULTURAL** | | |
| a. Historical/Archaeological Sites | 0 | 0 |
| b. Cultural Continuity | 0 | 0 |
| c. Aesthetics | 0 | 0 |
| d. Lifestyle (Quality of life) | 0 | 0 |

# 11 ECONOMIC IMPACT

## 11.1 PRE PROJECT CONDITIONS

During the pre-Project period the production of rainfed rice crops such as B. Aus, B. Aman, T. Aman (Local), jute, pulses and oilseeds were the major sources of farm income. The cropping intensity was as low as 147 per cent as estimated from the PCR of the Rehabilitation phase, but the RRA estimate shows the pre-Project cropping intensity to be about 177 percent (Chapter 4). The average financial return and economic return per hectare of net cropped area were estimated to be Taka 3008 and Taka 10945 respectively, presumably at 1985 prices, the year when the rehabilitation phase of the Project was declared completed (BWDB, 1987, Table III).

Open water capture fishing in the river Brahmaputra and vast flood plains was the major source of income for the professional fishermen and the major source of protein in the diet of the people.

The sudden inflow of flood water from the Brahmaputra during the pre-Project period used to devastate the entire area causing severe damage to monsoon crops, human and animal lives and property. The widespread inundation, disruption of communication and massive economic loss used to worsen the living conditions of the people, especially the poorer sections of the population. Especially, old Kazipur town was washed away causing displacement of official and business establishments.

## 11.2 PROJECT OBJECTIVES

The economic objectives of the Project were implicit in the declared objective of building a flood free and well drained environment. The underlying objective was to accelerate agricultural production and thus to raise economic returns from agricultural production. The other objective was to save life and property from annual flooding by the Brahmaputra.

The economic gains of the Project were intended to come from increased crop production not only in the monsoon season paddy crop but also in the pre-monsoon and post-monsoon season paddy and other crops (IECO, 1962 and PP, 1985). This seems unrealistic because the Brahmaputra flood has been known to have adversely affected only the monsoon crops, mainly paddy.

The tangible and intangible benefits such as the protection of lives, property and infrastructure, and the improvement of road communication or the loss of capture fishery were not accounted for in the calculation of the costs and benefits in the Project documents.

## 11.3 DATA FOR ECONOMIC ASSESSMENT

The economic assessment has to be very approximate, as data on both costs and benefits are subject to wide ranges of error.

The economic assessment has treated "the Project" as the 1975 to 1985 rehabilitation of the BRE, rather than its original construction in the 1960s, for which cost and benefit data are even sketchier.

Data for pre- and post Project crop production are drawn from Chapter 4. The pre-Project period refers to the period preceding 1974 when the major rehabilitation of the Project started and the post-Project period refers to the period following 1985 when the construction was completed. Data with respect to inputs, outputs and prices were obtained from RRA field visits. The detailed sources of agricultural data are mentioned in Chapter 4. The costs of the Project are estimated from the actual expenditures provided in BWDB 1987, Table IV (see the method of computation discussed in Section 11.4).

## 11.4 ECONOMIC IMPACT OF THE PROJECT

### 11.4.1 Cost of the Project

There are two problems in estimating capital costs of BRE rehabilitation attributable to the Kazipur Reach. The first involves identifying the costs of the BRE, the second identifying the proportion of those attributable to the Kazipur Reach.

Table 11.1 presents estimates of the total capital and O&M costs of the BRE, based on the 1987 BWDB Project Completion Report. These have been corrected to 1990/91 prices and then converted to economic prices using FPCO Standard Conversion Factors.

In Chapter 1 the difficulty was noted in determining the gross and net areas benefited by the BRE. This, combined with three possible parameters for Kazipur Reach, compounds the difficulty in ascribing costs. There are a range of options:

| | | | |
|---|---|---|---|
| Based on embankment length: | 16 km out of 225 km | - | 7.1 per cent. |
| Based on gross area: | 10500 ha out of 122622 ha | - | 8.6 per cent |
| | 10500 ha out of 259409 ha | - | 4.0 per cent |
| Based on net cultivated area: | 8788 ha out of 72800 ha | - | 12.1 per cent |
| | 8788 ha out of 173209 ha | - | 5.1 per cent |

In the subsequent analysis the figure of 7.1 per cent is used for the basic analysis, and the sensitivity of the results to using the figures of 4 per cent and 12 per cent is tested.

The capital and O&M costs derived appear reasonable, using the 7.1 per cent assumption.

Financial capital costs, at 1991 prices, are Tk 47.995 million, or Tk.5461 a hectare (net benefitted area). O&M costs are Tk.199 a hectare a year, or 3.6 per cent of capital costs.

Table 11.1 Financial and Economic Capital and O&M Costs
BRE Rehabilitation

| | CAPITAL COSTS | | | | | OPERATION AND MAINTENANCE COSTS | | | | | TOTAL COSTS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Financial Costs in Current Prices (1) Tk '000 | Construction Cost index (2) 1969/70 = 100 | Financial Costs in 1990/91 Prices Tk '000 | Economic Conversion Factor (3) | Economic Costs in 1990/91 Prices Tk '000 | Financial Costs in Current Prices (1) Tk '000 | Construction Cost index 1969/70 = 100 | Financial Costs in 1990/91 Prices Tk '000 | Economic Conversion Factor (4) | Economic Costs in 1990/91 Prices Tk '000 | Financial Costs in 1990/91 Prices Tk '000 | Economic Costs in 1990/91 Prices Tk '000 |
| 1975/76 | 653 | 531 | 1889 | 0.778 | 1470 | | | | | | 0 | 1889 | 1470 |
| 1976/77 | 5087 | 474 | 16484 | 0.778 | 12825 | | | | | | 0 | 16484 | 12825 |
| 1977/78 | | 484 | | 0.778 | 0 | | | | | | 0 | 0 | 0 |
| 1978/79 | | 509 | | 0.778 | 0 | | | | | | 0 | 0 | 0 |
| 1979/80 | | 617 | | 0.778 | 0 | | | | | | 0 | 0 | 0 |
| 1980/81 | | 724 | | 0.778 | 0 | | | | | | 0 | 0 | 0 |
| 1981/82 | 217026 | 889 | 374974 | 0.778 | 291730 | | 889 | 0 | 0.71 | 0 | 0 | 374974 | 291730 |
| 1982/83 | 30652 | 833 | 56520 | 0.778 | 43973 | | 833 | 0 | 0.71 | 0 | 0 | 56520 | 43973 |
| 1983/84 | 14850 | 856 | 26647 | 0.778 | 20731 | | 856 | 0 | 0.71 | 0 | 0 | 26647 | 20731 |
| 1984/85 | 87709 | 960 | 140334 | 0.778 | 109180 | | 960 | 0 | 0.71 | 0 | 0 | 140334 | 109180 |
| 1985/86 | 40000 | 1039 | 59134 | 0.778 | 46006 | 25522 | 1039 | 37730 | 0.71 | 26789 | 96864 | 72795 | |
| 1986/87 + | | 1130 | 0 | 0.778 | | 25522 | 1130 | 34692 | 0.71 | 24631 | 34692 | 24631 | |
| 1990/91 | | 1536 | | | | | 1536 | 34692 | 0.71 | 24631 | 34692 | 24631 | |
| Total | 395977 | | 675983 | | 525915 | | | | | | | | |

Sources: (1) Project Completion Report, BWDB Bogra, 1987
(2) Construction Cost Index, Dhaka, from BBS, July 1991 and BBS, December 1984 (National)
(3) Weighted average usinq FPCO, July 1991

### 11.4.2 Benefits and Disbenefits from Crops

In order to evaluate the impact of BRE the with and without project scenarios need to be compared. In Chapter 4 pre and post project data for sampled villages are presented, (Table 4.4) and overall land use changes are estimated (Table 4.6).

The RRA has concluded that the BRE did not affect rabi crops as these are not at risk from Brahmaputra flooding. It has however led to cropping pattern changes - in particular from other monsoon paddy varieties to T. Aman (HYV). This has not increased output as much as might have been expected, as the crop suffers flood damage three years in five, reducing yields in those years from 3.02 t/ha to 2.27 t/ha.

In recent years some 234 ha of land in the Kazipur reach have been lost to the Brahmaputra due to river erosion (Table 4.6). This loss would have taken place even if the BRE had not been rehabilitated. The embankment can control flooding but cannot halt moves in the river bed.

The area under monsoon paddy crops has fallen by over 400 ha, probably both because of erosion and because sand deposition following BRE breaches has rendered some areas uncultivable. The latter is a BRE effect, because under a normal flooding regime heavy sand deposition does not occur.

It is therefore assumed that in the without project case the area of monsoon paddy would have only fallen by 234 ha, due to river erosion. Table 11.3 shows that the Project has achieved a moderate success in increasing paddy production by protecting the area from the monsoon floods from the Brahmaputra. 3276 metric tons of incremental output from major monsoon paddy crops are produced annually as a result of the Project.

The major source of this incremental output is the shift of the long stemmed B. Aman acreage to HYV T. Aman due to the protection from floods by the BRE. The major sources of negative changes in output are the decrease in area and production of mixed B. Aus - B. Aman and T. Aman (Local). The calculation of HYV T. Aman output has been weighted for the estimated 3 years in 5 flood damage risk (see Chapter 4).

The net financial incremental value of output (after deduction of production costs and net value of lost output) created by the Project has been estimated to be about Taka 13.2 million per annum at 1991 prices (Table 11.4). Again, the major contributor to the net value of incremental output is HYV T. Aman.

For calculation of the incremental economic value of crop output due to the Project, a shadow conversion factor (SCF) of 0.97 has been applied to output ( following FPCO 1991). Pre-Project production costs have been assigned an overall weighted SCF of 0.75, but post-Project costs are given an SCF of 0.85 in view of the growth in HYV T. Aman which uses larger amounts of fertilizer and chemicals. The net economic value of incremental crop output under these assumptions is TK. 13.2 million per year.

### 11.4.3 Disbenefits from Capture Fisheries

The Project has led to a substantial disbenefit in terms of annual loss of fish production, estimated in Chapter 6 at about 350 mt per year. This is a conservative figure as it excludes losses in the Jamuna River.

Fisheries losses are valued in Table 11.2.

**Table 11.2 : Unit Value of Fishery Losses**

| | 1991 Prices | |
|---|---|---|
| | Financial Tk/kg | Economic Tk/kg |
| Average value of fish caught | 55 | 55 |
| Depreciation of equipment | 10 | 7.1 |
| Labour involved | 30 | 21.3 |
| Net value of losses | 15 | 26.6 (say 27) |

Source : Consultant's estimates.

The economic value of the annual fish loss is therefore estimated at Tk. 9.45 million.

**Table 11.3: Kazipur reach - Monsoon paddy production before, without and with project.**

| Monsoon Paddy | Pre Project | | | Without Project | | | With Project | | |
|---|---|---|---|---|---|---|---|---|---|
| | Area (ha) | Yield (t/ha) | Output (mt) | Area (ha) | Yield (t/ha) | Output (mt) | Area (ha) | Yield (t/ha) | Output (mt) |
| Mixed B. Aus-B. Aman | 2207 | 1.56 | 3443 | 2131 | 1.56 | 3324 | 176 | 1.55 | 273 |
| T. Aman (local) | 3547 | 1.65 | 5853 | 3425 | 1.65 | 5651 | 1109 | 1.65 | 1830 |
| T. Aman (HYV) | 1033 | 2.95 | 3047 | 997 | 2.95 | 2941 | 5093 | 2.57[1] | 13089[1] |
| Total | 6787 | | 12343 | 6553 | | 11916 | 6378 | | 15192[1] |

Note: [1] Assumes flood damage three years in five
Source Tables 4.4, 4.6 and Consultants estimates (see Section 11.4.2)

**Table 11.4 : Value of Incremental Output from Major Monsoon Paddy Crops in BRE, Kazipur Reach at Constant 1991 Prices (Tk.'000).**

| Crops | Without Project | | | With Project | | | Net Incre--mental Value of Output |
|---|---|---|---|---|---|---|---|
| | Gross Value of Output | Cost of Produc-tion | Net value of Output | Gross Value of Output | Cost of Produc-tion | Net value of Output | |
| Mixed B. Aus-B. Aman | 24331 | 9375 | 14956 | 1997 | 985 | 1012 | -13944 |
| T. Aman (Local) | 46319 | 16779 | 29540 | 14987 | 5433 | 9554 | -19986 |
| T. Aman (HYV) | 20817 | 5868 | 14949 | 95261 | 30044 | 65217 | +50268 |
| Total Financial Values | 91467 | 32022 | 59445 | 112245 | 36462 | 75783 | +16338 |
| Total Economic Values | 88723 | 24017 | 64706 | 108878 | 30993 | 77885 | +13179 |

Note: i. Gross value of output includes value of both production and by-products.
ii. Prices of inputs and outputs are based on RRA, 1991.
iii. Hectares under different crops, yield and gross output figures are taken from Chapter 4, Table 4.4.

Source: RRA Results, 1991.

### 11.4.4 Analysis

In Table 11.5 the basic cost and benefit assumptions are analysed. The economic internal rate of return is positive, but very low and the project appears not have been viable.

In the circumstances various alternative assumptions were tested. The attribution of only 4 per cent of capital costs to the Kazipur Reach increases the EIRR to 8 per cent, but this is still unacceptably low. (Table 11.7).

It was therefore decided to find out what would have happened if the Kazipur Reach had succeeded in protecting T. Aman every year, increasing annual yields to an average of 3.02 mt/ha from the figure of 2.57 mt/ha used in the base analysis (Table 4.4).

In this case incremental paddy output increases to 5568 mt from 3276 mt (Table 11.3) and the economic value of net incremental output increases to Tk.29.4 million a year from the previous figure of Tk.13.2 million.

Table 11.5 shows that, again taking Kazipur costs at 7.1 per cent of BRE costs, an EIRR of 23 per cent would be achieved. This figure would rise to 33 per cent if Kazipur costs were only 4 per cent of BRE costs, and fall to 16 per cent if Kazipur costs were 12 per cent of BRE costs.

It is therefore clear that if the BRE had successfully protected the monsoon crop it would have been viable.

In Table 11.7 the results of the sensitivity analyses are presented. It is noticeable that the results are not sensitive to large changes in cost assumptions, and that the fisheries losses would have to be less than half those calculated before the project produced an EIRR of over 12 per cent. However the result is very sensitive to small changes in the crop yield figures - if the average yield assumed for T. Aman (HYV) had been only 6 per cent higher the EIRR would have exceeded 12 per cent.

### 11.4.5 Impact on Employment and Income Distribution

The Project has had some impact on creating additional employment in the construction, repair and maintenance of the embankment section. For example, a very rough estimation shows that the Kazipur Reach of the BRE (16 km.) should have received about 980 mt. of FFW wheat during the construction phase, assuming that the total allocation of 13785 mt. of wheat was uniformly used over the entire length of 225 km. of BRE. Assuming that 278 man-days of employment of unskilled labour in earthwork was created per metric ton of wheat, the total employment created by FFW wheat is likely to be about 746 man-years during the construction phase. Added to this is the employment of unskilled labour for repair and maintenance of the embankment sections, which is estimated to be about 56 man-years per annum for Kazipur Reach. These estimates are based only on assumed allocation of FFW, but there would be additional employment created for unskilled labour which was paid in cash as part of construction as well as under the O&M budget. It is important to note that the whole of this additional employment went to the poorer sections of the population.

The incremental output of major monsoon paddy crops as discussed in the previous section generated additional direct employment of about 80000 man-days (219 man-years) of employment a year (Table 11.8). As indicated earlier, the major source of this incremental employment was the additional production of T. Aman (HYV) in the post-Project period.

Table 11.5 Economic Analysis of Cash Flows - BRE Kazipur Reach
Basic assumptions
(All figures in 1991 economic prices and Tk'000)

| Year | Economic Costs of full BRE (1) | Cost attributed to Kazipur (2) | Agricultural Benefits (3) | Fisheries Losses (4) | Net Cash Flow |
|---|---|---|---|---|---|
| 1975 /76 | 1470 | 104 | | | -104 |
| 1976 /77 | 12825 | 911 | | | -911 |
| 1977 /78 | 0 | 0 | | | 0 |
| 1978 /79 | 0 | 0 | | | 0 |
| 1979 /80 | 0 | 0 | | | 0 |
| 1980 /81 | 0 | 0 | | | 0 |
| 1981 /82 | 291730 | 20713 | | | -20713 |
| 1982 /83 | 43973 | 3122 | | | -3122 |
| 1983 /84 | 20731 | 1472 | | | -1472 |
| 1984 /85 | 109180 | 7752 | | | -7752 |
| 1985 /86 | 72795 | 5168 | | | -5168 |
| 1986 /87 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1987 /88 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1988 /89 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1989 /90 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1990 /91 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1991 /92 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1992 /93 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1993 /94 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1994 /95 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1995 /96 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1996 /97 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1997 /98 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1998 /99 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 1999 / 0 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2000 / 1 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2001 / 2 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2002 / 3 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2003 / 4 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2004 / 5 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2005 / 6 | 24631 | 1749 | 13179 | 9450 | 1980 |
| 2006 / 7 | 24631 | 1749 | 13179 | 9450 | 1980 |

Calculations based on Kazipur Reach costs at 7.10 percent of BRE costs

Economic Internal Rate of Return (%) : 0.42
Net Present Value of Benefits at 12 % discount rate: 8106 Tk '000
Net Present Value of Costs at 12 % discount rate: 19764 Tk '000
Benefit Cost Ratio at 12 % discount rate 0.41

Source: (1) Table 11.1
(2) Kazipur Reach costs at 7.10 percent of BRE costs
(3) Table 11.3
(4) See text

kazirr1

Table 11.6 Economic Analysis of Cash Flows - BRE Kazipur Reach
High benefits assumption
(All figures in 1991 economic prices and Tk'000)

| Year | Economic Costs of full BRE (1) | Cost attributed to Kazipur (2) | Agricultural Benefits (3) | Fisheries Losses (4) | Net Cash Flow |
|---|---|---|---|---|---|
| 1975 /76 | 1470 | 104 | | | -104 |
| 1976 /77 | 12825 | 911 | | | -911 |
| 1977 /78 | 0 | 0 | | | 0 |
| 1978 /79 | 0 | 0 | | | 0 |
| 1979 /80 | 0 | 0 | | | 0 |
| 1980 /81 | 0 | 0 | | | 0 |
| 1981 /82 | 291730 | 20713 | | | -20713 |
| 1982 /83 | 43973 | 3122 | | | -3122 |
| 1983 /84 | 20731 | 1472 | | | -1472 |
| 1984 /85 | 109180 | 7752 | | | -7752 |
| 1985 /86 | 72795 | 5168 | | | -5168 |
| 1986 /87 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1987 /88 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1988 /89 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1989 /90 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1990 /91 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1991 /92 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1992 /93 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1993 /94 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1994 /95 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1995 /96 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1996 /97 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1997 /98 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1998 /99 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 1999 / 0 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2000 / 1 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2001 / 2 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2002 / 3 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2003 / 4 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2004 / 5 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2005 / 6 | 24631 | 1749 | 29359 | 9450 | 18160 |
| 2006 / 7 | 24631 | 1749 | 29359 | 9450 | 18160 |

Calculations based on Kazipur Reach costs at 7.10 percent of BRE costs

Economic Internal Rate of Return (%) : 23.20
Net Present Value of Benefits at 12 % discount rate: 43280 Tk '000
Net Present Value of Costs at 12 % discount rate: 19764 Tk '000
Benefit Cost Ratio at 12 % discount rate 2.19

Source: (1) Table 11.1
(2) Kazipur Reach costs at 7.10 percent of BRE costs
(3) Assumes no T. Aman flood losses (unrealistically high benefits)
(4) See text

**Table 11.7 : Kazipur reach - Sensitivity Analyses**

| Assumption | Per cent of BRE cost attributed to Kazipur | EIRR | BCR |
|---|---|---|---|
| Basic assumption (Table 11.4) | 7.1 | 0.42 | 0.41 |
| Low cost assumption | 4.0 | 7.88 | 0.73 |
| High benefits assumption (no flood losses, Table 11.5) | 7.1 | +23.20 | 2.19 |
| High benefits, high costs assumption | 12.0 | +15.51 | 1.30 |

SWITCHING VALUES

For the internal rate of return to exceed 12 per cent:

- either Kazipur costs would have to be 2.9 per cent or less of BRE costs;
- or annual agricultural benefits would have to be 41 per cent higher. This would have been achieved if average T. Aman harvested yields had averaged 2.72 ton/ha, instead of the figure of 2.57 ton/ha found by the RRA.
- or fisheries disbenefits would have to be less than 44 per cent of the amount assumed.

Source: Tables 11.5 and 11.6 and Consultant's analyses.

**Table 11.8 : Incremental employment from the major monsoon rice crops in BRE, Kazipur Reach.**

| Crops | Without Project | | | With Project | | | Incremental employment ('000 m-d.) |
|---|---|---|---|---|---|---|---|
| | ha. | m-d/ha. | Total m-d. ('000) | ha. | m-d/ha. | Total m-d. ('000) | |
| Mixed B.Aus-B. Aman | 2131 | 86 | 183 | 176 | 90 | 16 | -167 |
| T. Aman (Local) | 3425 | 122 | 418 | 1109 | 120 | 133 | -285 |
| T. Aman (HYV) | 997 | 130 | 130 | 5093 | 130 | 662 | +532 |
| Total | 6553 | - | 731 | 6378 | - | 811 | +80 |

m-d = Man-day

Source : RRA Results, 1991.

In addition, there would have been a significant increase in post-harvest employment, mainly in paddy processing. It was not possible to estimate what proportion of this additional employment went to which socio-economic groups in the Project area. However, although the RRA could not quantify the magnitude of such employment, it is clear that a significant proportion of additional post-harvest processing employment went to women of poorer households.

It was clear from the RRA that the loss of open-water capture fishery led to a substantial loss of employment of part-time and full-time fishermen, many of whom were forced to shift to other work at whatever wage they could get.

Although there has been some improvement in roads and transport due to the construction of BRE, the additional employment created in this sector appeared to be moderate. This is perhaps because the poorly maintained embankment section and the housing in most parts limited normal traffic.

## 11.5 CONCLUSIONS

The economic assessment of the Project suggests that the BRE Kazipur Reach has achieved a moderate increase in the incremental value of monsoon paddy production. However, because the Project also led to a large loss from capture fishery and because it fails to protect the T. Aman crop every year, the Project yields a low economic rate of return. If on the other hand the BRE had succeeded in protecting the T. Aman crop the investment would have been justified.

The Project has had a significant positive impact by creating substantial employment in the construction of the original embankment and construction and repair of retired embankments. The Project has also generated additional employment in the crop sector at an annual rate higher than the population growth rate.

The overall equity implications of the Project are not at all clear, although it was understood that a substantial portion of the additional employment created in the construction, repair and maintenance of the embankment sections went to the poorer sections of the population.

In the post-Project period, there have been heavy losses of infrastructure including the loss of the old Kazipur Upazila headquarters and shifting of the offices to a new site. The old Meghai bazar with a large number of shops and establishments and the Kazipur public hospital were in danger of being washed away at the time of the RRA. It was not possible to assess through this RRA how many buildings/houses were lost and how much money was spent for reconstruction or how many people were displaced due to river erosion, but there can be no doubt that the infrastructure losses have been huge in both economic and social terms. However, it was not at all clear whether these losses were entirely due to the Project. There are areas in Bangladesh where there are no FCD projects but property and infrastructure are being lost due to rapid erosion by big rivers.

# 12 THE PREVIOUS EVALUATIONS OF BRE

Three different previous reports contain discussions of the impact of the BRE. They are all associated with the completion of the Rehabilitation of BRE under IDA credit 864-BD, the first Drainage and Flood Control Project (DFC-1).

Only one of these reports was based on a field evaluation - the Evaluation Study by the Department of Economics of Dhaka University (DU, 1986). The FAO/World Bank Cooperative Programme used the Dhaka University data, and other information, in preparing a Project Completion Report (PCR) on DFC-1 (FAO, 1989). This material was then used by the World Bank Operations Evaluation Department in preparation of a Project Performance Audit Report (PPAR),(IBRD, 1990).

The Evaluation Study involved sample surveys in six purposively selected villages, three in the protected area and three in the "periphery". The logic in this is unclear. The "periphery" is presumably an area which was not threatened by flooding from the Brahmaputra. It is therefore by definition not a control area, as conditions there pre-project were totally different from those in the area that needed to be protected by the BRE. It may be argued that the objective of the BRE was to allow conditions (cropping intensities, cropping patterns) in the protected area to reach the same level as those in the periphery, but this is not explicit in the Evaluation Study. In practice the comparison of the project area and the periphery does not seem to have led to any firm conclusions about the impact of the BRE, although the DU team observed that in several key areas (cropping intensity in particular) the protected area had not yet reached the levels in the "periphery".

The main findings of the DU team on the impact of the BRE are:

- the proportion of the gross area cultivated had increased from 70 percent pre-project to 77 percent. This is a similar order of magnitude to the RRA figure (about 80 percent), but the Kazipur RRA did not find any increase in cultivated area;

- the cropping intensity had substantially increased, from a range of 138 to 155 percent to an average of 191 percent. This change in cropping intensity was mainly due to an increase in cultivation of Boro. The link between this and flood control is not discussed in the report;

- yields had increased, as had use of fertilisers and irrigation;

- there was a negative fisheries impact, which was not quantified.

The FAO PCR used the DU data to derive an EIRR for the BRE. This produced the conclusion that the EIRR was 31 percent. In this calculation almost all the benefits were associated with increases in rabi season output - 50 percent from increases in Boro and 47 percent from increases in other rabi crops. This was noted by the PPAR, and its rationale was queried. Their doubts would be shared by the RRA team, who consider that in the Kazipur area all BRE benefits relate to monsoon season cropping, as rabi crops are not threatened by flooding from the Brahmaputra.

The FAO PCR attempted to quantify the fisheries losses. As noted in Chapter 6 their estimates were far lower than those now being made.

Overall, as an Evaluation of BRE impact the DU study was methodologically weak (in rationale for use of the "periphery" sample, in actual sampling methodology, in analysis of the results, and crucially, in any elaboration of the characteristics of pre and post project flooding and their association with project impacts) and its results were inconclusive. The study states that the original benefited area was 580 000 acres (234 000 ha) but that this had declined to 303 000 acres (122 622 ha). Although an "actual physical survey" is referred to, no maps or other data are provided to support this vital conclusion (which was ignored by the FAO PCR in its calculation of benefits).

Nevertheless the study included a number of observations on the infrastructure which deserve mention;

- the regular embankment retirements in the face of erosion from the Teesta and the Brahmaputra mean that the BRE does not provide a permanent solution to flooding problems in the area. The DU team found the situation "alarming" and were concerned at the possibility of the Brahmaputra joining the Bangali and changing course substantially;

- the DU team made a number of specific engineering proposals, including groynes, cross bars, dredging, additional regulators and the introduction of surface and pumped irrigation facilities;

- the DU team, like the RRA team, were very concerned at the poor construction of the retired embankments - both in the quality of material used and in the lack of control over construction;

- the multiple uses of the embankment were observed. The DU team recommended that all illegal settlers be removed and resettled, and that bullock carts be banned from using the embankment;

- the value of the embankment as a road was noted and it was recommended that to facilitate this the crest width should be increased and that mechanical compaction techniques (road rollers) should be introduced;

- the harm done to navigation was also observed, and navigation locks were recommended;

- the low quality of O&M was observed and it was recommended that the procedures proposed in the O&M manual should be followed.

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