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

## BANGLADESH FLOOD ACTION PLAN

FAP 12

FCD/I AGRICULTURAL STUDY

14



## RAPID RURAL APPRAISAL OF IMPROVEMENT OF SAKUNIA BEEL

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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 (2 Volumes)

Project Impact Evaluation studies of:

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

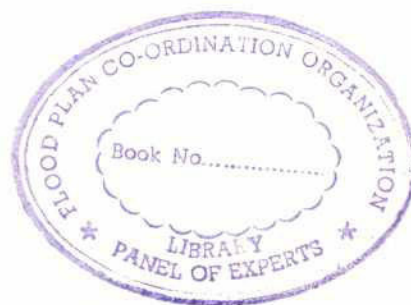
Rapid Rural Appraisal Studies of:

- \* Protappur Irrigation Project
- \* Nagor River Project
- \* Sonamukhi Bonmader 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 (2 Volumes)
- \* Final Report

Note: \* Report not yet available



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## SAKUNIA BEEL

### Project Summary Sheet

**Project Name** : Improvement of Sakunia Beel in P.S. Kotwali & Nagarkanda

**Project Type** : Flood Control and Drainage

**Location**

**FAP Region** : South-Central (in South West Regional Study)  
**District** : Faridpur

**Area (ha.)** : 5700 ha. (gross),  
4400 ha. (net)

**Funding Agency** : GOB

**Implementing Agency** : BWDB

**Construction started** : 1981-82

**Scheduled Completion** : 1983-84

**Actual Completion** : 1984-85

**Original Cost Estimate** : Tk 19.6 million

**Final Cost Estimate** : Tk 12.1 million

**Major Flood Damage:** : 1988

**Repair/rehabilitation in** : 1990-91

#### Major works still required for completion/rehabilitation:

Repair of embankment section damaged and breached by 1988 flood. Repair of cracked/failed wing wall of Bilnalia regulator. Re-excavation of some sections of drainage khals.





## IMPROVEMENT OF SAKUNIA BEEL

### SUMMARY OF FINDINGS

#### Introduction

The Project to improve Sakunia Beel is a flood control and drainage project located in Faridpur District in the south-centre of Bangladesh. The Project falls in the FAP South Central Region.

The Project covers a number of small beels including Sakunia as the main one. In the pre-Project situation this area of about 5700 ha was partly surrounded by roads. There were already embankments on the south-east and southern boundaries of the Project area along the Kumar and Gobrakhal Rivers which were not adequate to withstand flood water overflowing from the Kumar river. There were minor drainage channels from the Sakunia beel to the areas of Bakhundia, Beelnalua and Mridhadangi which were quite inadequate in draining out the monsoon water. Thus, drainage congestion was a chronic problem in that area. The build up of monsoon water started from mid-April, and remained up to October every year. This stagnant water sometimes caused severe damage to field crops.

It was possible to locate the PP, PCR and Index Map relating to the Project. The Project was clearly intended to provide flood control and drainage, presumably to protect the late Boro crop, Aus, Jute and Aman crops from flood damage.

There are substantial differences between the Project as planned in the Project Proforma and the Project as built, partly due to problems encountered during implementation. The Project comprised a total of 11.4 km flood embankment along the Kumar river, of which 8 km was actually constructed by the BWDB under the Project, two drainage regulators and excavation of 16 km of drainage channels.

The Project has not fully achieved its intended impacts due to changes in the Project as implemented, and subsequent deterioration in its condition. Parts of the beel have become better drained (or silted up) and HYV Boro can be grown in place of L Boro. However, drainage conditions are reported to be worse now in some parts of the Project than they were before. In some higher areas T. Aman has been protected from floods by the Project, but this is not true of all areas or all the Project life to date, since part of the embankment was never built and the remainder has suffered many breaches since 1988.

The major agricultural and economic change in the area has been rapid growth in HYV Boro cultivation, irrigated by a mixture of LLPs and tube-wells. It seems unlikely that this has been encouraged entirely by the Project since early flooding remains a risk (due to poor drainage of early rainfall), and in 1990 much of the Boro in the Sakunia beel area was lost just prior to harvest. There are, however, conflicting statements that lower parts of the beels can now grow HYV Boro due to improved drainage.

In addition to its main function, the embankment has been serving the purposes of a road from Joyjhap to Faridpur town via Bakhundia, although the previous boat transport has been disrupted partly due to low flow and water hyacinth infestation in the river.



However, against these mixed impacts must be counted a considerable loss of captured fish (perhaps a 75 per cent decline) in the Project area because the natural flooding of the beels has been ended.

## Engineering

The construction of the embankment had some positive impact on flood control during the normal flood years prior to the 1988 flood. During 1988, the Project area was flooded and many sections of the embankment were inundated. Sections of the embankment that were not inundated or breached, were used as flood shelters for people from both within and outside the Project.

Reduction of normal flood incidence, partly due to the embankment and partly due to large scale embankment along the Ganges, has reduced damage to the mixed B. Aus/Aman crop. However, there have not been any floods since 1988, so the impact of the embankment, which still has many unrepaired natural breaches and public cuts is not clearly known.

The number of sets of irrigation equipment (LLPs along the river Kumar and STWs inside the Project) and the total area covered by irrigation have increased, facilitating change of cropping patterns from the traditional mixed B. Aus/Aman - pulses/oilseeds to - local T. Aman HYV Boro.

The drainage objective of the Project has not been fully realized, and uncertainty of HYV paddy production in the Boro season still prevails in the Sakunia Beel areas. The Project was launched on the basis of inadequate designs in relation to capacity of regulators and provision for drainage requirements.

The 2.5 km embankment along the Gobrakhal from Joyjhap to Gotti bridge in the southernmost part of the Project was never completed. Another 8 km embankment constructed along the Kumar river from Bakhundia to Joyjhap has many breaches and public or rain cuts, which have not been repaired nor even taken account of by the BWDB, on the grounds that there are no funds for O&M.

The two drainage channels, including the lead channel from the Sakunia Beel, have silted up, causing drainage congestion in recent years, and these two channels were inadequately re-excavated in 1991. One of the two regulators collapsed immediately after construction, but has not been repaired since nor has any effective action been taken against the contractor. All the structures (embankment, drainage channels and sluice gates) are very poorly operated and maintained, and there is virtually no supervision of the structures, indicating inefficiency and lack of responsibility by BWDB.

## Agriculture

The primary objective of the Project has been realized to some extent by creating an increase in irrigated HYV Boro paddy production through:

- i. drainage of Sakunia Beel and bringing previously submerged land under cultivation;
- ii. replacement of local Boro by HYV Boro in the lower portion of the Beel;

- iii. replacement of mixed B. Aus/Aman by HYV Boro followed by local T. Aman in medium low and medium high land.

B. Aman production has declined since the Project was implemented because of:

- i. decrease in depths of water in the monsoon;
- ii. decrease in soil fertility due to non-availability of silts.

Pulse production has declined, because of the expansion of irrigated HYV paddy production in the Rabi season, a phenomenon commonly observed in areas where mechanized irrigation has been introduced, though oilseed production remained unchanged.

### **Livestock**

The cattle population has declined due to a shortage of cattle feeds, especially green feedstuffs. The incidence of parasitic diseases of cattle such as liver fluke has increased due to an apparent increase in the snail population.

Now that roads and communication facilities have improved as pre-conditions for socio-economic development, government and NGO programmes for income and employment generating activities such as goat rearing, cattle fattening and poultry raising have been promoted, although these are limited to high land villages, mainly in Kaijuri Union, which are closer to Faridpur town.

The goat and poultry populations have increased by 25-30 per cent as there are now more open access grazing lands on the slopes of the embankment and village roads, and NGO programmes are being taken up.

### **Fisheries**

Fisheries were not at all considered in the Project planning, since the Project was conceived of for promoting HYV Boro paddy production by draining beel water.

Open water fish production has dropped by about 75 per cent due to drying up of beels, rivers and canals. This has caused loss of employment and income of full time or part time fishermen, who constitute by and large the poorer section of rural households.

The Project has created opportunities for the expansion of pond fish culture through:

- i. reduction of flood risk to cultured fisheries;
- ii. increase in profitability from fish cultivation. However, these opportunities are not yet realized due to inadequate extension advice and support services from the relevant departments.

### **Health and Nutrition**

The nutritional status of the diet has declined due to:

- i. decrease in fish availability;





- ii. decrease in traditional sources of protein such as pulses.

This has affected the poor more severely than the richer households, because the former lost the opportunities for subsistence fish catches in the beels and rivers.

Peoples' eating habits, especially those of poor people, have changed, as more wheat/wheat flour is consumed now than before because of:

- i. distribution of wheat for the construction of embankment and drainage channels;
- ii. increase in wheat production within the Project area.

### **Women**

The Project has had a number of positive impacts on women as follows:

- i. increased rice production has increased employment of women in post-harvest activities;
- ii. women obtain some employment in re-excavation of drainage channels and earth work for the embankment;
- iii. improved road transport encouraged NGO programmes, most of which are directed towards women's development.

### **Social Impact**

The embankment, acting as a road, created social and economic infrastructure in the southern portion of the Project area, which facilitated movement of goods and services to and from these areas. It has also promoted diverse occupations such as rickshaw vans, machine repair facilities, petty trades, etc. However, the development of village roads has not been adequate to compensate for the decline in boat transport after the Project.

Re-excavation of drainage channels has not taken care of the need for small culverts and bridges, the absence of which has caused tremendous difficulties for trafficking animals across the very deep channels, especially in villages such as Bilnalia and Char Mongolkot.

There is public resentment and complaints about the efficacy of the drainage regulators, which in recent years were reported to have failed to clear drainage congestion from the Sakunia Beel and local depressions around the Bilnalia and Mongolkot areas.

In areas surrounding the Sakunia Beel, there has been some "psychological" improvement as people are conscious that their living conditions have improved, especially in the wet season.

The availability of drinking water has improved as a result of increased provision of HTWs and increased installation of STWs.



## Environment

The Project has had both positive and negative environmental impacts:

- i. reduction in flood inundation improved living conditions, especially in Sakunia beel areas;
- ii. reduced water hyacinth infestation caused a reduction in damage to the B. Aman crop, but the increased water hyacinth infestation blocked boat transports and boat fishing in the Kumar river;
- iii. decrease in wetlands has caused virtual disappearance of migratory birds;
- iv. silt deposition is stopped, causing a decline in Aman production;
- v. sanitation problems worsen, as the open-pit latrines are not washed away annually.

## Economic Impact

From a provisional and partial economic re-evaluation based on agricultural and fishery impacts only, the Project appears to have been non-viable. The estimated BCR is than unity and the EIRR is less than the assumed opportunity cost of capital (12 per cent). There are two main reasons for this poor performance:

- i. poor construction and lack of maintenance and rehabilitation have made the originally 50 year operating life estimated in the PP completely unrealistic. A 20 year life has been assumed instead;
- ii. the very substantial disbenefits to capture fisheries offset about 40 per cent of the net incremental value of crop production.

The level of employment has increased, due to:

- i. construction of the embankment and excavation/re-excavation of drainage channels;
- ii. increased Boro output, which has increased employment in areas with access to mechanized irrigation;
- iii. the move from B. Aman and Aus/Aman to T. Aman which has higher labour requirements.

Increase in employment appears to have benefited poor wage labour households and small holders because increased employment is available at a time which used to be an agriculturally lean period under the traditional cropping pattern.

Prices of land have increased three to four times in the Sakunia Beel, and the rate of increase has been more or less similar to that observed in other areas. The rate of increase in prices is higher for irrigated land than for non-irrigated land. In high land villages close to Faridpur town, a private market for power tiller hire services has also expanded. These changes are not ascribed to the result of the Project.

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## ABBREVIATIONS AND GLOSSARY

|          |  |
|----------|--|
| Aus      | Late dry season/early monsoon paddy crop                       |
| Aman     | Main monsoon season paddy crop                                 |
| BADC     | Bangladesh Agricultural Development Council                    |
| BBS      | Bangladesh Bureau of Statistics                                |
| BIDS     | Bangladesh Institute of Development Studies                    |
| Boro     | Winter dry season paddy crop                                   |
| BRAC     | Bangladesh Rural Advancement Committee                         |
| BRDB     | Bangladesh Rural Development Board                             |
| BRE      | Brahmaputra Right Bank Embankment                              |
| bund     | earthen embankment   |
| BWDB     | Bangladesh Water Development Board                             |
| DAE      | Directorate of Agricultural Extension                          |
| DLS      | Directorate of Livestock Services                              |
| DTW      | Deep Tubewells   |
| FAO      | Food Agriculture Organisation                                  |
| FAP      | Flood Action Plan  |
| FCD/I    | Flood Control, Drainage/Irrigation                             |
| FFW      | Food For Work  |
| ghani    | Oil crushing machine, usually powered by animal                |
| GOB      | Government of Bangladesh                                       |
| gur      | Brown sugar made from sugarcane juice                          |
| HTW      | Hand Tubewells   |
| HYV      | High Yielding Variety  |
| IDP      | Infrastructure Development Programme                           |
| IGVGDP   | Income Generation for Vulnerable Group Development Programme   |
| IMP      | Irrigation Management Programme                                |
| JICA     | Japanese International Organisation Agency                     |
| khal     | natural channel/minor river/tidal creek                        |
| kutchra  | locally made, not manufactured; earthen (of roads, structures) |
| LGEB     | Local Government Engineering Bureau                            |
| LLP      | Low-Lift Pumps   |
| matbars  | leaders  |
| maund    | 37.3 Kg  |
| mouza    | revenue village (many comprise several physical settlements)   |
| MPO      | Master Plan Organisation                                       |
| NGO      | Non-Government Organization                                    |
| O&M      | Operation and Maintenance (of Project)                         |
| ODA      | Overseas Development Administration                            |
| paposh   | mat  |
| Parishad | Elected Council  |
| PCR      | Project Completion Report                                      |
| PEP      | Productive Employment Programme                                |
| PIE      | Project Impact Evaluation                                      |
| PP       | Project Proforma   |
| RESP     | Rural Employment Sector Programme                              |
| Robi     | Winter cropping season   |
| RRA      | Rapid Rural Appraisal  |
| RRI      | River Research Institute                                       |

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|         |  |
|---------|--|
| sadar   | headquarters   |
| STW     | Shallow Tubewells  |
| UNDP    | United Nations Development Programme                             |
| Upazila | Administrative unit above Union & below Zila (460 in Bangladesh) |



## 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 being carried out by a group of international and Bangladeshi consulting organisations led by Hunting Technical Services Limited of the United Kingdom and comprising 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) techniques, and RRA is also being used for preliminary reconnaissance of the 5 PIE projects. The present report describes the findings of the RRA of Sakunia Beel Project.

### 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/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 than quantitative data, though it is generally possible to obtain fairly good quantified 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.

### 1.3 DESCRIPTION OF THE PROJECT

#### 1.3.1 Location

The Project location is shown in Figure 1.1. It lies about 8 km. to the south of Faridpur town, in the South-Central FAP Region, being located between 23°27.7' and 23°36', north latitude and 89°48' and 89°51.4' east longitude. The overall Project area is bounded by Faridpur - Jessore highway in the north, by the Sitalakhya/Kumar river in the south, by the Faridpur - Barisal highway in the east and by the Tambulkhana - Gotti herring-bone bond brick road in the west.

The Project covers 5,700 ha. of gross area and 4400 ha. of net area, and spreads over two Upazilas, 85 per cent in Faridpur Sadar Upazila and 15 per cent in Nagarkanda Upazila. Twenty five mouzas of two Unions, mainly Kaijuri Union and partly Greda Union, of Faridpur Sadar Upazila and 15 mouzas of Gotti Union of Nagarkanda Upazila fall within the Project boundary.

#### 1.3.2 Slope and Elevation

The Project area consists of a series of beels of different sizes, but the Sakunia beel which gives its name to the Project is the largest one. According to the Project proforma, the slope of the Project area is from north to south. Land elevation varies from R.L. 23.00 in the fringe of the north-east and west, to R.L. 15.00 in the south. The lowest point of the beels lies within R.L. 3.00 to 2.00. The depth of water in the Sakunia beel during the dry season was reported to be 5 feet (1.52 metre) in the PP.

#### 1.3.3 Flooding and Drainage

According to the PP, the entire Project area used to get 'acutely water congested' and was subject to 'over flooding' during the monsoon, which caused damage to 80 per cent of standing crops. As understood from the RRA field visits, the major crops affected by drainage congestion were B. Aus, mixed B. Aus/Aman, jute and Boro. In addition, at high stages of the river Kumar/Sitalakhya, over bank spillage of flood water used to flow back into the Project area, destroying B. Aus, B. Aman and jute completely according to the PP.

It was, however, gathered during the RRA that the construction of a large scale flood embankment along the Ganges, and installation of large capacity regulators at the mouth of the Kumar river some years ago, have remarkably reduced the water flow in the river and hence the incidence and severity of floods from the Kumar river in recent years. To what extent this was the case could not be confirmed in the RRA visits.

#### 1.3.4 1988 Flood

The big flood of 1988 caused severe inundation from the Kumar river. There were a number of natural breaches of the flood embankment sections between Beelnalia and Rasulpur, which still remain unrepaired. The drainage channels at Beelnalia were seriously silted up and the Beelnalia regulator was so badly affected as to have lost its functional capacity because a considerable portion of it was buried in the thick sand deposits from the river.



### 1.3.5 Soils and Crops

The soils of the Project area consist of a mixture of young and older Ganges meander flood plain, which are medium to fine textured and calcareous. The major crops grown are B. Aus and B. Aman as sole or mixed crops, jute, Local and HYV Boro, jute, sugarcane, wheat, pulses, oilseeds and onion seeds.

## 1.4 OBJECTIVE OF THE PROJECT

The overall objective of the Project, as outlined in the PP, was to remove the menace of water congestion during the monsoon and protect the Project area from over flooding by the river Kumar/Sitalakya. The remedial interventions implemented as Project components were as follows:

- i. re-excavation of about 12.5 miles (21 km.) of drainage channels;
- ii. construction of about 5 miles (8 km.) of flood protective embankment (PP proposed 11.5 km); and,
- iii. construction of 2 drainage regulators (PP proposed 3 drainage regulators).

## 1.5 THE SAKUNIA BEEL RRA PROCESS

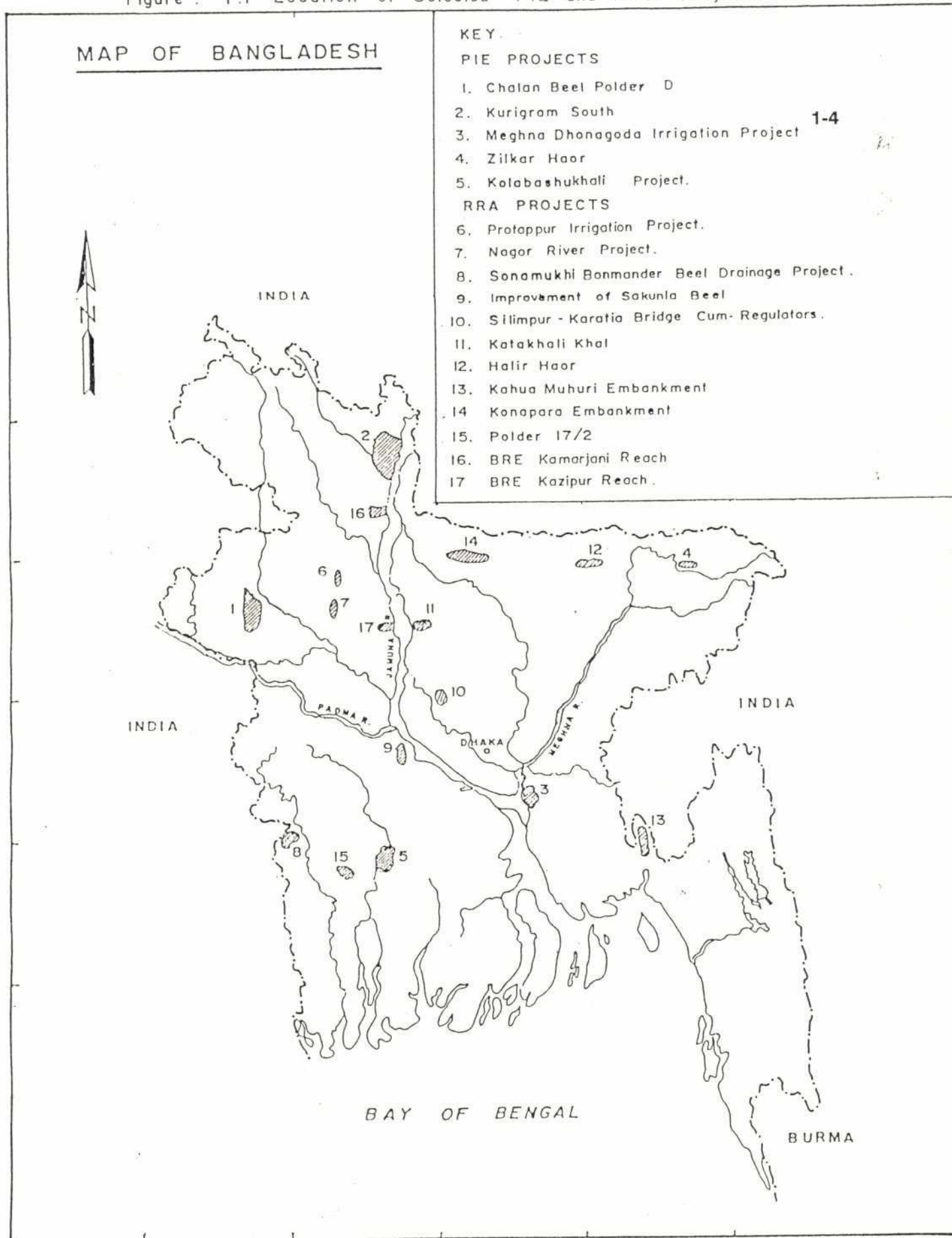
The RRA of Sakunia Beel Project was conducted during the period from 11 May to 16 May 1991, covering the afternoon of the first day for interviews and discussion with the BWDB officials at Faridpur and then 5 full days in the Project area. The RRA team consisted of an Agricultural Economist (Team Leader), Agronomist, Fisheries Specialist, Livestock Specialist, Engineer, Nutritionist and Sociologist.

The Project area is small by usual standards and it is very close to the Faridpur BWDB guest house, where the team members were provided accommodation. This allowed the team to conduct field visits in 24 out of the 40 mouzas of the 3 unions covered by the Project. Interviews and group discussions were held with the officials of BWDB, DAE, DLS, Fisheries, BRDB, BADC, RRI, NGO's and with farmers, fishermen, wage labourers, petty traders, rickshaw van drivers and women's groups. Detailed sources of RRA data are provided in individual chapters.

The team received a very warm reception and cooperation everywhere throughout the course of the field work. Especially, the Superintending Engineer and Executive Engineer of BWDB, Faridpur were extremely cooperative in providing the Project map and copies of the PP and PCR, which were not available from the BWDB office in Dhaka. The BWDB section officer's active assistance in personally accompanying the team in the first field day was very helpful.



Figure 1.1 Location of Selected PIE and RRA Projects



## 2 ENGINEERING DESIGN, IMPLEMENTATION AND PERFORMANCE

### 2.1 PRE-PROJECT SITUATION

The Project, Improvement of Sakunia Beel, consisted of a number of small beels including Sakunia as the main one. In the pre-Project situation this area of about 35.2 sq.km was surrounded by roads on the North-East, North-West and some portion on the South-Western part. There were embankments on the South-East and Southern parts of the Project area along the Kumar and Gobrakhal rivers which were not adequate in withstanding flood water or overflow from the Kumar river. There were minor drainage channels from the Sakunia beel to the areas of Bakhundia, Beelnalia and Mridhadangi which were quite inadequate in draining out the monsoon water. Thus, drainage congestion was a chronic problem in that area. The stagnation of monsoon water started from mid April, while pre-monsoon prevailed, and remained up to October every year. This stagnant water sometimes caused severe damage to field crops.

### 2.2 PROJECT OBJECTIVES

The Project was taken up departmentally by the Bangladesh Water Development Board to remove drainage congestion mainly caused by monsoon water and to prevent flood water intrusion into the Project area due to over flow from the nearby Sitalakhya/Kumar river, which flows from north to south along the Eastern boundary of the Project.

### 2.3 OVERVIEW OF THE PROJECT

#### 2.3.1 Planned And Actual Construction and Components

The Sakunia Beel Project was started in 1981-82 and completed in 1984-85. It is stated in the Project Proforma that survey, investigation and feasibility study of the Project was made departmentally, but neither any such document nor a full background description of the Project was available in the relevant BWDB office, and hence the genuine basis of the Project Proforma preparation could not be established. Major sources of information were the Project Proforma, Project Completion Report and interviews with beneficiaries and BWDB officials.

**Table 2.1: Major Works Proposed and Actually Completed**

| Sl. No. | Items of Construction             | Unit | Proposed | Actual |
|---------|-----------------------------------|------|----------|--------|
| i.      | Land acquisition                  | Ha   | 102      | 42     |
| ii.     | Functional Buildings              | Nos. | 3        | 0      |
| iii.    | Drainage Regulators               | Nos. | 3        | 2      |
| iv.     | Regulator Vents                   | Nos. | 8        | 5      |
| v.      | Flood Protective Embankment       | Km   | 8        | 8      |
| vi.     | Re-excavation of Drainage Channel | Km.  | 20       | 16     |

Source: PCR, Table 13



The physical works proposed in the PP were not fully implemented and no reasons for such deviation have been mentioned anywhere in the Project documentation. However, after discussions with BWDB officials, reviews of correspondence and interviews with local knowledgeable people, it was revealed that one part of the drainage channel from Kabirpur to Sakunia Beel was dropped due to objections raised by the local people, and another part from Sakunia Beel to Bakhundia was dropped due to high elevation difference between Sakunia Beel and the selected drainage regulator site at Bakhundia. The others were re-excavated. So, due to land acquisition problems and subsequent cancellation of the two above-mentioned drainage channels, the total acreage of land acquired was less than originally planned.

The estimated cost of the Project was Tk. 19.6 million as mentioned in the PP prepared in 1981-82, and Tk. 12.1 million was actually expended during implementation of the Project as indicated in PCR prepared in 1984-85.

### 2.3.2 Flood Embankment

The main features of the Project works as implemented are shown in Figure 2.1.

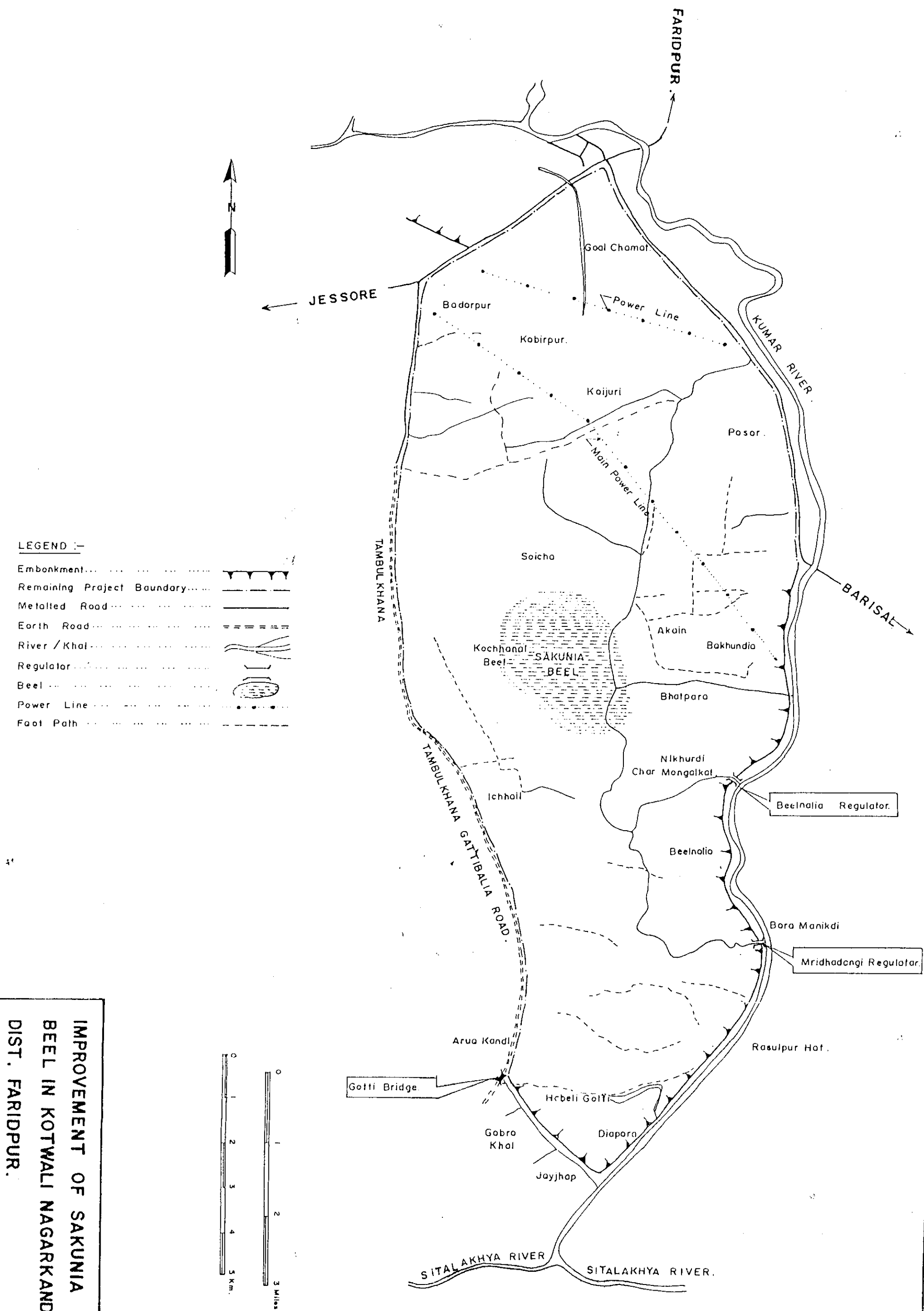
The total length of flood embankment from Bakhundia to Gotti bridge via Boughata Bazar and Joyjhap is 14.6 km. Out of this 11.4 km of the flood embankment is along the Kumar river from Bakhundia to Joyjhap and 3.2 km from Joyjhap to Gotti bridge is along the Gobrakhal. It may be mentioned that only 8 km of flood embankment between Bakhundia and Joyjhap was constructed under the Project. Almost 85 per cent of the embankment along the Kumar river is just on the neck of the river bank without any set back distance. This might have reduced land acquisition problems but obviously increased risk of embankment instability. The side slope of the embankment along the Kumar river was damaged in many places by flood water and/or by slope failure during monsoon showers.

During the 1988 flood the embankment was damaged at several places by water pressure from inside the Project area rather than by the nearby Kumar river. No effective measures have yet been taken up by BWDB to repair or rehabilitate the damaged portions after the 1988 flood. At present local people are using LLPs for lifting irrigation water from the Kumar river, and the placement of a few LLP discharge pipes is causing damage to the embankment as the discharge falls directly on the inside slope of the embankment. In addition to its planned function the flood embankment has been serving the purposes of a road from Joyjhap to Faridpur town via Bakhundia.

Even though the water level in the Kumar river is being controlled by a regulator on its upstream side at Faridpur town, it cannot be safely asserted that the existing flood embankment is adequate to withstand any further severe flood like the one in 1988. The embankment should be repaired or rehabilitated not only as a flood protective measure but also as an important mode of transportation for the South-Eastern part of the Project area.



Figure 2.1



The part of the flood embankment from Joyjhap to Gotti bridge is about 3.2 km. The background of its construction and/or re-construction could not be explored properly because of the contradictory statements made by BWDB officials and the local inhabitants. Whatever the case might be, it was revealed that this portion of the embankment, constructed with earth spoil during re-excavation of the adjacent canal, is incomplete, but it has been acting as a flood protective embankment, especially in preventing back water flow from the Sitalakhya rivers in their higher river stages. This part has not been considered by the BWDB as an effective part of the flood embankment of the Project.

### 2.3.3 Drainage Channels

Improvement of the drainage facilities of Sakunia Beel area was an important objective of the Project. It is evident from the Project documents that initially the planned drainage system consisted of five parts, a total of 20 km.. However during implementation two parts, one from Kabirpur to Sakunia Beel and the other from Sakunia Beel to Bakhundia were not implemented. The implemented parts (total of 10 km) have been partially re-excavated by Faridpur Sadar Upazila under the Food For Work Programme in 1991. The total length of re-excavation from Beelnalia regulator to Mridhadangi regulator was 5.5 km., and was not implemented according to the approved design. The main part of the channel that connects Sakunia Beel with Mongolkot, where the channel branches off in two directions, was not re-excavated due to Upazila FFW resource constraint for Kaijuri Union.

### 2.3.4 Drainage Regulators

It is stated in the PP that three drainage regulators were to be constructed, one 5-vent regulator at Mridhadangi, another 2-vent regulator at Beelnalia and the other 1-vent regulator at Bakhundia. The regulator at Bakhundia was not constructed as the drainage channel in that direction was dropped. The Mridhadangi regulator has been reduced from 5-vent to 3-vent, and no report or document in support of such a change was available. However, this regulator controls the flow of the channel that carries most of the drainage water from the Sakunia Beel, and has been found inadequate in reducing the drainage problems of the South-Eastern part of the Project area. This 3-vent regulator together with the other 2-vent Beelnalia regulator has not been successful in removing drainage congestion from the whole Project area, especially when there is a high volume of monsoon water run-off and inflow through the road structures, such as bridges and culverts on the North-East and North-west part of the Project area.

## 2.4 PROJECT ACHIEVEMENTS

### 2.4.1 Positive Aspects

The main objective of the Project, as indicated in the PP and which is obvious from its functional design, is the improvement of drainage conditions in the Sakunia Beel along with other small beels within the Project area. This primary objective has been realized to some extent through re-excavation of the main drainage channel from the Sakunia Beel to Mongolkot area and the branch channel up to Beelnalia and Mridhadangi from Mongolkot.

The drainage regulators at Beelnalia and Mridhadangi have been functioning well only in preventing any unwanted inflow from the nearby Kumar river at its higher stages.





The flood embankment constructed from Bakhundia to Joyjhap had functioned well during normal flood conditions prior to the severe flood in 1988. This embankment in addition to excluding flood water had been serving as the only mode of road transport from Joyjhap to Faridpur town via Bakhundia. Introduction of road transport in the South-Eastern part of the Project area has been found as a real achievement of the Project through construction of this flood protective embankment. This embankment, in association with other internal earthen roads, has improved village to village, village to market and village/market to Faridpur town road communication.

The partial success of the Project in removing drainage congestion in the Sakunia Beel area during the early monsoon has contributed to an expansion of HYV Boro cultivation in these lands. This has led to an increase in the number of STW and DTWs for irrigating HYV Boro.

#### 2.4.2 Negative Aspects

In the Project area there exists a gradual down slope from the North, North-East and North-West side towards the Sakunia Beel which is at the lowest elevation. From there, a few channel like depressions are directed towards the South-East and Southern parts of the Project area up to the flood protection embankment. Only two of these have been re-excavated and provided with regulators. During the monsoon all the rainfall run off, along with inflow through the peripheral bridges and culverts of the above-mentioned parts of the Project area, accumulates in the Sakunia Beel. This water then flows through the main drainage channel from Sakunia Beel which subsequently delivers the drainage water into the Kumar river through the Mridhadangi and Beelnalua regulators. In most of the high monsoon period these drainage channels overflow their sides and this overflow together with the rain water from the other parts of the Project area causes drainage congestion, especially in the Rasulpur area and the Southern part of the Project area. Sometimes the slow rate of drainage water discharge through the two regulators, mainly the Mridhadangi one, causes prolonged submergence of the Sakunia Beel and its surrounding areas.

It is important to note that initially 3 regulators with 8 vents were approved for this Project, but 2 regulators with 5 vents were implemented. This has been aggravating the drainage condition of the Project area. The 2-vent regulator at Beelnalua was constructed poorly and all four wing walls have cracked. Two of them have cracked severely and one failed just after completion. Although the failed wing wall has been supported by strutting against the opposite wing wall, this temporary protection should be replaced by a permanent one. Effective measures in this regard are yet to be taken by BWDB.

About 85 per cent of the length of the flood embankment from Bakhundia to Joyjhap along the Kumar river (about 11.4 km) was constructed without providing any set back distance. The side slopes are being damaged severely in some places which may cause a traffic hazard. Local people are damaging the embankment in some places during installation and operation of LLPs. The embankment along the Gobrakhal from Joyjhap to Gotti bridge seems never to have been re-constructed on the basis of physical observation and information from the BWDB officials. No measures have yet been taken up by BWDB in maintaining this embankment since the 1988 flood.

This flood embankment has been serving as a good mode of road transport from Joyjhap to Faridpur town, but due to lack of adequate maintenance this facility will be lost in the near future. The internal road networks, although providing a better mode of



transportation during the dry season, are not adequately compensating for the declining boat transport within and outside the Project area.

## 2.5 CONCLUSIONS

The improvement of Sakunia Beel had some positive impact on the major physical works, such as re-excavation of drainage channels, construction of regulators and re-construction of flood protective embankment. But none of them has fully realized its intended purpose, either due to lack of proper field investigations during the feasibility study or due to maladjustment of these important structural components during construction.

After implementation of the Project it was subjected to the severe 1988 flood which caused damage to the flood protective embankment in many places and further silted up the drainage channels. The drainage channel from Mridhadangi to Beelnalia has only been partially re-excavated by the Faridpur Sadar Upazila Parishad under its normal Food For Work Programme, but the main drainage channel up to the Sakunia Beel has not been re-excavated.

However, the Project is successful to some extent in alleviating drainage congestion. The benefits could be enhanced if other possible directions of drainage channel could be explored, especially in the Rasulpur area and Southern part of the Project area.

It is quite evident from the statements of BWDB officials and local people that BWDB is not actively engaged in maintenance of the drainage channels, flood protective embankment and repair or rehabilitation of the failed wing wall of the Beelnalia regulator. The main reason given by the BWDB officials was the lack of necessary funds for operation and maintenance of those infrastructures.

## 2.6 RECOMMENDATIONS

- very detailed study on the overall existing drainage conditions should be conducted properly within and outside the Project area.
- the flood embankment should be reconstructed at a safer location with sufficient set back distance, and the areas of the Project by the side of rivers and their connected channel/canal should be embanked properly.
- future possibilities for use of the embankment and its appurtenant structures as a road should be explored properly.

### 3 INSTITUTIONAL ASSESSMENT

#### 3.1 PROJECT INITIATION

The Project was initiated by the local BWDB under the block provision for small schemes in Faridpur district. There was hardly any consultation about the Project with the expected beneficiaries, nor was there any provision by BWDB for such consultation in the past days, especially in the case of such a small project.

As the PP mentions, the Project document was prepared on the basis of data collected by the lower level staff of the local BWDB office, but no record or document about this could be traced.

#### 3.2 PROJECT MANAGEMENT

The detailed discussions about the BWDB performance with respect to Project construction and O&M are presented in Chapters 2 and 11. The salient features of the BWDB roles in the management of the Project are pointed out below:

- a) Project construction was completed on 30 June 1985, a year later than proposed in the PP. The reason for the delay could not be established by talking to the officials;
- b) the actual construction deviated from the quantity of structures mentioned in the PP, but this also meant a reduction in actual expenditure from the original provision of Tk. 19.6 million to Tk. 12.1 million;
- c) BWDB's poor supervision at the construction stage was evident, because the 2 vent Beelnalia regulator was so poorly constructed that all four wing walls have had cracks and one collapsed just after completion;
- d) BWDB failed to take adequate measures to repair or replace the cracked walls, or to take any effective actions against the contractor who built the regulator walls;
- e) BWDB seems to have poor contact with the Project beneficiaries so that public resentment and confusion prevail with respect to the acquisition of land for the construction of the embankment and excavation/re-excavation of drainage channels;
- f) There is no repair and maintenance of the Project due to lack of funds, and the regulators, embankment and drainage channels are not at all supervised or visited by the senior officials of BWDB;
- g) It seems that once the Project was completed there was no provision for its maintenance. The present staff of BWDB Faridpur have little interest in it, because there is virtually no O&M budget provision for the Project. None of the BWDB engineers at present stationed at Faridpur had visited the Project on a single occasion. There are natural breaches and public cuts of embankment, but these were found unrepaired during the RRA visits;
- h) There is a khalashi appointed for the operation of the two regulators and his work is supervised by a section officer, who was involved in the Project planning and construction stage, and who has fairly good knowledge of the Project.



## 4. IMPACT ON AGRICULTURE

### 4.1 GENERAL

Sakunia Beel Project was initiated mainly as a drainage improvement project, but about 8 kilometers of flood protective embankment was also constructed to protect the Project area from overflow of the Kumar river during high stages. However, crop damage still occurs in lower areas of the Project. The drainage capacity proposed in the original plan of the Project Proforma was reduced during implementation of the Project by about half of the capacity and the constructed flood protection embankment has remained breached in several places since the 1988 flood. Therefore, in general the Project targets with respect to cropping intensity and crop yields have been attained mostly in the higher area of the Project, e.g. Kaijuri Union.

#### 4.1.1 Pre-Project Situation

According to the 1983-84 Agricultural Census, there were 5,008 farm households with an average farm size of 0.76 hectare. About 70 per cent of farm households were classified as small farm households (cultivated area less than one hectare).

The Project area has an elevation from 6.9 m above the mean sea level (MSL) to 3.0m MSL, and is classified into four categories of land by range of elevation (Table 4.1). Highland (6.9m to 5.4m) covers 38.8 per cent of the Project area, located mostly in the fringe of the upstream to midstream area. The other three categories of land, Medium Highland (4.8m to 5.4m), Medium Lowland (4.2m to 4.8m) and Lowland (less than 4.2m) cover respectively 21.8 per cent, 21.8 per cent and 17.6 per cent of the Project area. Since Highland and Medium Highland are not flooded or only shallowly flooded in a normal year, and since there are superior natural drainage conditions on these lands, compared other categories, the key to flood control and improvement of drainage congestion in the Project would be to solve the drainage congestion in the lower elevation area.

Two physiographic units are recognized according to the Reconnaissance Soil Survey Report, which are the mixture of young and older Ganges meander flood plain and the older Ganges meander floodplain. The location and the physiographic characteristics are as follows:

- i. Mixture of young and older Ganges meander floodplain, which occupies most of the upstream fringe land as well as the western half of the midstream and downstream areas; the landscape is formed by erosion of top soils through onrush of rivers and by superimposing of younger deposits on the older formations during the Ganges burst in the 16th century, AD.
- ii. Older Ganges meander floodplain, which occupies the remaining areas; the land consists of nearly level broad basins surrounded by low, nearly level, broad ridges.

#### 4.1.2 Flood Condition and Soils

Besides Highland, standing above normal flood levels, the remaining 61.2 per cent of the Project area used to be shallow to deep flooded (about 0.3m to 1.8m) seasonally every year as shown in Table 4.1. The seasonal flooding was caused by ponded water from heavy



high flood of the Kumar river also used to cause inundation of the Project area. The unusual flood in 1988 submerged almost all of the Project area including a considerable area of Highland.

The soils of the mixture of young and older Ganges meander flood plain are medium to fine textured and calcareous throughout and most of the soils are therefore very suitable for growing upland crops. However, the soils in the elevated land may be too permeable to hold soil moisture. The soils of the older Ganges meander floodplain are medium to very fine textured. Soils of the Highland areas are sandy loam to silty clay loam and some of the loam soils are highly permeable. The soils of other lands are silty clay to clay.

#### **4.1.3 Climate**

The climate of the Project area is not as dry as that of the adjacent climatic zone in the upper Ganges (which is a dry area), having an average annual rainfall of 1905 mm. However, the winter temperature is moderately low and very similar to that in the upper Ganges dry zone.

#### **4.1.4 Crops and Cropping Pattern**

Although the Feasibility Report of the Project is not available, it is estimated that due to flooding and drainage congestion about 68 per cent of the total cultivated area used to be covered by a single crop such as broadcast (B) Aman and the mixture of B. Aus and Aman. Such areas are mostly located in the Lowland and some parts of the Medium Lowland. Some double and triple cropping was done in some parts of the Highland and in higher parts of the Medium Highland.

#### **4.1.5 Input Use, Crop Management and Post Harvest Operations**

Under the pre-Project conditions the level of input use such as improved seeds, chemical fertilizers, and pesticides was very limited, except for the Highland areas. This was due to the insufficient and uncertain return from crop cultivation. The management of major crops like B. Aman, B. Aus and local Boro was inevitably extensive, and was subject to flooding and drainage congestion.

Farmers in the Project area follow traditional methods of post harvest operations such as manual threshing, winnowing, cleaning, sun drying and storing.

#### **4.1.6 Yield**

Within the limited area covered by HYV paddy, the Pre-project average yield of all types of paddy was as low as 1.4 mt. per hectare (Table 4.3). The yields of other major crops - wheat, jute and pulses - were also as low as 0.7 mt. per hectare, 1.1 mt. per hectare and 0.7 mt. per hectare respectively.

## 4.2 SOURCES OF DATA COLLECTION

The following sources of data were used in this appraisal:

- interviews with officials of the Upazila Agriculture Office and the Chief Engineer, Executive Engineer and Section Officer of BWDB;
- interviews with farmers in the sample mouzas which were selected in each category of land level, and with farmers in the mouzas which were visited during transect surveys;
- the Project Proforma on Improvement of Sakunia Beel in P.S. Kotwali and Nagarkanda, October 1981, BWDB;
- the Reconnaissance Soil Survey Report of Sadar and Goalundo Subdivisions, Faridpur District 1969, Soil Survey of Pakistan;
- Agro-ecological Regions of Bangladesh, UNDP/FAO 1988;
- 1983-84 Census of Agriculture, Faridpur District 1986, BBS.

## 4.3 THE VALUE AND FEASIBILITY OF PROJECT OBJECTIVES

The Sakunia Beel Project was planned to contribute mainly to agricultural development through the alleviation of two major constraints of flooding and drainage congestion by means of (i) flood control and (ii) drainage of cultivated land. Other components, for instance irrigation, were not included as a Project objective. According to the Project Proforma prepared in October, 1981, water congestion used to occur right from the middle of April. Due to this water congestion the standing crops, especially the shorter stemmed HYV paddy, used to be damaged with reduction of the normal yield. With increase of water level in the Sitalakhya river, flood water used to flow back into the project area. Finally, the Project area was filled by water and all types of standing crops like Aus, Aman and jute were severely damaged. The protection of these crops from damage by drainage congestion and flooding from over flowing of the Sitalakhya river was the most important purpose of the Project, in order to improve agricultural production.

## 4.4 PROJECT SUCCESS IN MEETING OBJECTIVES

The problems of drainage congestion and flooding have been successfully solved in the Medium Highland and in some parts of the Medium Lowland. There is a significant change in cropping pattern from extensive cultivation to intensive cultivation, with remarkable increase in yields and production of crops, especially paddy. However, the problems are not solved in considerable areas of the Medium Lowland and Lowland. This can be attributed to the fact that the original drainage work as proposed in the Project Proforma was not implemented (drainage canals as well as number of sluice gates were reduced by about 50 per cent during the Project implementation).



## 4.5 ACTUAL IMPACT

### 4.5.1 Positive Impacts

- a) The cultivated area has increased in the Lowland, where most of the culturable waste land or grazing land has probably been converted into cultivated land. The Boro cropped area has increased in the surrounding areas of the Beel because of earlier recession of inundation water under the flood control and drainage improvement Project.
- b) The cropped area of Boro paddy has increased not only in the Lowland but also in the most of the Medium Lowland due to the control of flooding. Recently, the local varieties of Boro paddy have been replaced by Boro HYVs almost throughout the Project with the control of pre-monsoon floods and an expansion of mechanized irrigation.
- c) During the Kharif season, the traditional cropping pattern of mixed B. Aus and B. Aman has been replaced by T. Aman LV in Medium Highland, where the flooding depth of three to four feet in the pre-Project period has decreased to one to two feet in the post-Project situation.
- d) It was estimated that the cropping intensity under post-Project conditions is about 178 per cent, whereas the revised estimate of the cropping intensity under pre-Project condition is 167 per cent (Table 4.2). But an estimate from this RRA also shows that the same level of cropping intensity (i.e. 178 per cent) would be achieved even without the Project (Table 4.4).
- e) Paddy production under post-Project conditions was estimated to have increased from about 7,000 mt. in pre-Project situation and from about 9,400 mt. in the without Project situation to about 10,700 mt. per year in the with-Project situation.
- f) The yield of total paddy has increased from 1.64 mt./ha in the without Project situation to about 1.89 mt/ha in with-Project situation.
- g) The yield of wheat was raised in the Medium High Land and Medium Lowland where timely sowing and transplantation has become possible due to earlier recession of inundation water.

### 4.5.2 Negative Impacts

- a) The production of upland crops such as jute and pulses has decreased significantly (Table 4.3 & 4.4). This change of production has resulted mainly from the replacement of Rabi crops like pulses by irrigated Boro HYV in the post-Project cropping patterns.



## 4.6 UNINTENDED IMPACTS

### 4.6.1 Negative Impacts

- a) The crop production in downstream areas (the area mostly located in Nagarkanda Upazila) as well as in most parts of the Lowland and Medium Lowland in Faridpur Sadar Upazila still suffers from drainage congestion, and the change in cropping pattern is not significant except for the irrigated area, because drainage facilities were either not installed or the limited drainage facilities served only a limited area. According to the opinion of the farmers in general, the problem of drainage congestion has been aggravated due to the construction of the flood embankment. It was reported that the water depth of the 1988 flood in the Project area was higher than the rivers by two to three feet and that the flood water stagnated for several days. Breaches of the embankment occurred in several places during the flood of 1988 and the breached embankment was left without repair.
- b) The exclusion of floods has obstructed silt deposition in the Project area, which has decreased soil fertility with the effect that farmers have to use more and more chemical fertilizers to intensify crop production.
- c) In downstream areas, farmers suffer from shortage of water for cultivation of B.Aman. This may be caused by the embankment and the reduction of inflow from the Ganges river.

## 4.7 RELATED OBSERVATIONS

- a) In evaluating FCD projects, there is a necessity to examine any negative impact on agriculture and identify the deviation of the implemented drainage improvement from the respective plan in the Project Proforma, because there are many farmers who suffered from the drainage congestion even in post-Project condition.
- b) There is poor participation by beneficiary groups, local Government (Upazila Parishad) and other Governmental agencies, Agricultural Extension Office and Fishery Offices) at any stage in the planning and implementation of the Project. This seems to be one of the significant reasons why there is no way to avoid adverse deviation. Also, this may result in less positive attitudes on the part of beneficiaries to repair of breached and raincut embankments as well as towards the operation and maintenance of the Project facilities. Also, the Project facilities are poorly maintained due to non-availability of resources.
- c) Fundamentally, the control over flood water and soil moisture have to be secured according to growth stage at each land level for the improvement of cropping patterns and increase of crop yields. It seems that this concept at any stage of the Project, which may bring about the reduction of drainage capacity from the planned one to implemented one.
- d) There are many farmers who receive no regular extension services although sufficient numbers of extension staff with area coverage of 360 ha to 480 ha per staff member are posted in the Project Unions. This may be caused not only by inadequate transportation facilities for the extension staff but also due to poor inter-agency coordination between BWDB and the concerned agencies for agricultural development from the initial Project stage. Under these circumstances, it is not expected that there

will be proper collaboration in removing specific bottlenecks on the agricultural development in the Project area.

- e) According to the information on crop damage in Rahutpara Mouza, the 1988 flood totally destroyed the standing crops in the Project area and the jute being retted was all washed away.
- f) No measures have been taken for retaining flood water or excess water which could be utilized for irrigation during the Rabi season. For instance, beels can be excavated to reserve water to utilize for irrigation during Rabi season.

#### 4.8 RECOMMENDATIONS

- a) The problems of drainage congestion in downstream areas (Lowland and Medium areas) have to be solved especially in the season when the water level in Kumar/Sitalakha river is low. It appears that the planning of drainage improvement was made without using any detailed contour map. If this is so, then the drainage plan may hardly meet the actual topographic conditions. Furthermore, only in a case where there could be proper participation of beneficiaries before the construction of facilities, would the drainage plan satisfy the actual demand for drainage in each locality. Therefore, the application of more practical planning and design procedures should be taken into account, including the participation of beneficiary groups and local government in the Project.
- b) The proper operation and maintenance of the embankment, regulators and drainage canals should be given due priority in order to avoid natural breaches, public cuts and sudden onrush of flood water. This will restore the confidence of beneficiaries in the Project and thus ensure the necessary participation of beneficiary groups and local government in the Project and in its operation and maintenance. Ultimately this will lead to a secure basis for increasing agricultural production.
- c) A comprehensive approach to utilise and retain flood water as much as possible for recharging of groundwater, and use of reserved surface water for fishery development in beel areas will be required. For instance, flood and rain water could be stored in excavated beels, khals and main drainage channels.
- d) Inter-agency coordination among the agencies related to agriculture, livestock and poultry, fishery and social forestry, is needed for comprehensive planning of the Project for the maximum utilization of local resources and for solving such inter-related problems as the use of beels for both irrigation and fish culture.



Table 4.1: Area by Flood Level and Submergence Period

| Land Level                        | Area<br>(ha) | %       | Pre-Project |   |   |   |   |   |   |   |   |   |   |   | Post-Project |   |   |   |   |   |   |   |   |   |   |   |
|-----------------------------------|--------------|---------|-------------|---|---|---|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|---|---|---|
|                                   |              |         |             |   |   |   |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |   |   |   |
|                                   |              |         | J           | F | M | A | M | J | J | A | S | O | N | D | J            | F | M | A | M | J | J | A | S | O | N | D |
| Highland<br>(6.9m to 5.4m MSL)    | 2,214        | (38.8)  |             |   |   |   |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |   |   |   |
| Medium Highland<br>(4.8m to 5.4m) | 1,240        | (21.8)  | =====       |   |   |   |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |   |   |   |
| Medium Lowland<br>(4.2m to 4.8m)  | 1,007        | (17.7)  | ==*****==   |   |   |   |   |   |   |   |   |   |   |   | =====*****== |   |   |   |   |   |   |   |   |   |   |   |
| Lowland<br>(Less than 4.2m)       | 1,239        | (21.7)  | ==*****==   |   |   |   |   |   |   |   |   |   |   |   | =====*****== |   |   |   |   |   |   |   |   |   |   |   |
| Total                             | 5,700        | (100.0) |             |   |   |   |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |   |   |   |

Legend      === Occasionally submerged  
                  \*\*\* Fully submerged

Source:      Tentatively estimated by the Consultants on the basis of contour map and BWDB data on water level in the Kumar River.

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Table 4.2: Estimated Land Use and Cropping Pattern

| Item                                   | Pre-Project (1) |       |       |       |       | Post-Project (2) |       |       |       |       |
|--|-----------------|-------|-------|-------|-------|------------------|-------|-------|-------|-------|
|  | Total           | H     | MH    | ML    | L     | Total            | H     | MH    | ML    | L     |
| 1. Total Area (2)                      | 5,700           | 2,210 | 1,240 | 1,240 | 1,010 | 5,700            | 2,210 | 1,240 | 1,240 | 1,010 |
| 2. Non-cultivated area                 | 1,300           |       |       |       |       | 1,300            |       |       |       |       |
| -Beels, and other water land           | 130             |       |       |       | 130   | 80               |       |       |       | 80    |
| -Homestead and others                  | 1120            | 1,120 |       |       |       | 1,120            | 1,120 |       |       |       |
| -Rights of way (Project)               | -               |       |       |       |       | 100              | 80    |       |       | 20    |
| 3. Cultivated area (1-2)               | 4,400           | 1,090 | 1,240 | 1,240 | 830   | 4,400            | 1,010 | 1,240 | 1,240 | 910   |
| -Irrigated by wells                    | 200             | 40    |       | 160   |       | 1,450            | 40    | 870   | 440   | 100   |
| -Irrigated by indigenous ways          |                 |       |       |       |       | 40               |       |       |       | 40    |
| -Rainfed                               |                 |       |       |       | 40    |                  |       |       |       |       |
| 4. Cropping pattern                    |                 |       |       |       |       |                  |       |       |       |       |
| (1) Single cropping (Total)            | 2,320           | 300   |       | 1,190 | 830   | 1,930            | 120   |       | 900   | 910   |
| - B. Aman                              | 1,820           |       |       | 1,030 | 790   | 1,230            |       |       | 460   | 770   |
| - T. Boro L                            | 40              |       |       |       | 40    | 40               |       |       |       | 40    |
| - T. Boro HYV                          | 160             |       |       | 160   |       | 540              |       |       | 440   | 100   |
| - Sugarcane                            | 200             | 200   |       |       |       | 120              | 120   |       |       |       |
| - Jute                                 | 100             | 100   |       |       |       |                  |       |       |       |       |
| (2) Double cropping                    | 1,210           | 540   | 620   | 50    |       | 1,510            | 640   | 870   |       |       |
| -T.Aman L + T.Boro HYV                 | 40              | 40    |       |       |       | 960              | 90    | 870   |       |       |
| - Jute + Rabi crops                    | 500             | 500   |       |       |       | 550              | 550   |       |       |       |
| - B. Aus/Aman (mix.)                   | 670             |       | 620   | 50    |       |                  |       |       |       |       |
| (3) Triple cropping                    | 870             | 250   | 620   |       |       | 960              | 250   | 370   | 340   |       |
| - B.Aus/Aman (mixture)<br>+ Rabi Crops | 870             | 250   | 620   |       |       | 960              | 250   | 370   | 340   |       |
| 5. Gross Cropped Area                  | 7,350           | 2,130 | 3,100 | 1,290 | 830   | 7830             | 2,150 | 2,850 | 1,920 | 910   |
| 6. Cropping Intensity<br>(%) (3)       | (147)<br>167    | 195   | 250   | 104   | 100   | (156)<br>178     | 213   | 230   | 155   | 100   |

- Notes:
- (1) Rabi crop include wheat, pulse, oilseeds, and vegetable etc.
  - (2) H=Highland, MH=Medium Highland, ML=Medium Lowland, L=Lowland
  - (3) The figures in the parenthesis indicate the cropping intensity where B. Aus/B. Aman (mixture) is counted as single crop.

- Source
- (1) estimated on the basis of data in the Project Proforma, but the cropped area by crop is revised, taking into account the estimated cropping pattern.
  - (2) Consultants' estimates, based on the result of field survey.





**TABLE 4.3 Estimated Production of Major Crops**

| Crop            | Pre-Project(1) |               |                 | Target (p/p) |               |                 | Post-Project(2) |               |                 |
|-----------------|----------------|---------------|-----------------|--------------|---------------|-----------------|-----------------|---------------|-----------------|
|                 | Area (ha)      | Yield (mt/ha) | Production (mt) | Area (ha)    | Yield (mt/ha) | Production (mt) | Area (ha)       | Yield (mt/ha) | Production (mt) |
| 1. Paddy(Total) | 5,180          | 1.37          | 7,085           | 5,050        | 1.75          | 8,822           | 5,650           | 1.89          | 10,753          |
| -B. Aus L       | 1,540          | 1.29          | 1,987           | 1,820        | 1.64          | 2,985           | 960             | 1.37          | 1,315           |
| -B. Aman L      | 3,360          | 1.29          | 4,334           | 200          | 1.46          | 292             | 2,190           | 1.29          | 2,825           |
| -T. Aman L      | 40             | 1.46          | 58              | 2,020        | 1.55          | 3,131           | 960             | 1.82          | 1,947           |
| -T. Aman HYV    | -              | -             | -               | 200          | 2.74          | 548             | -               | -             | -               |
| -Boro L         | 40             | 1.64          | 66              | 610          | 2.01          | 1,226           | 40              | 1.64          | 66              |
| -Boro HYV       | 200            | 3.20          | 640             | 200          | 3.20          | 640             | 1,500           | 3.20          | 4,800           |
| 2. Wheat(Total) | 120            | 0.73          | 88              | 610          | 1.06          | 646             | 620             | 1.37          | 849             |
| - Local         | 120            | 0.73          | 88              | 510          | 0.91          | 464             | -               | -             | -               |
| - HYV           | -              | -             | -               | 100          | 1.82          | 182             | 620             | 1.37          | 849             |
| 3. Jute         | 600            | 1.10          | 660             | 410          | 1.28          | 524             | 540             | 1.10          | 594             |
| 4. Sugarcane    | 200            | 27.40         | 5,480           | 280          | 32.00         | 8,960           | 120             | 27.40         | 3,288           |
| 5. Pulses       | 1,010          | 0.73          | 737             | 1,010        | 0.91          | 919             | 580             | 0.73          | 423             |
| 6. Oilseeds     | 200            | 0.55          | 110             | 200          | 0.73          | 146             | 200             | 0.55          | 110             |
| 7. Vegetables   | 40             | 2.74          | 110             | 120          | 3.65          | 438             | 120             | 2.74          | 329             |
| Total           | 7,350          |               |                 |              |               |                 | 7830            |               |                 |

Source: (1) estimated on the basis of data in the Project Proforma, but the cropped area by crop is revised, taking into account the estimated cropping pattern.

(2) Consultants' estimates, based on the result of field survey.

**Table 4.4 Estimated Production of Major Crops  
in Without Project Situation in 1990/91**

| Crop            | Area<br>(ha)   | Yield<br>(mt/ha) | Production<br>(mt) |
|-----------------|----------------|------------------|--------------------|
| 1. Paddy(Total) | 5,760          | 1.64             | 9,442              |
| -B. Aus L       | 1,070          | 1.29             | 1,380              |
| -B. Aman L      | 2,730          | 1.29             | 3,522              |
| -T. Aman L      | 960            | 1.46             | 1,402              |
| -T. Aman HYV    | -              | -                | -                  |
| -Boro L         | 40             | 1.64             | 66                 |
| -Boro HYV       | 960            | 3.20             | 3,072              |
| 2. Wheat(Total) | 420            | 1.23             | 517                |
| - Local         | -              | -                | -                  |
| - HYV           | 420            | 1.23             | 517                |
| 3. Jute         | 550            | 1.10             | 605                |
| 4. Sugarcane    | 120            | 27.40            | 3,288              |
| 5. Pulses       | 740            | 0.73             | 540                |
| 6. Oilseeds     | 200            | 0.55             | 110                |
| 7. Vegetables   | 60             | 2.74             | 164                |
| Total           | 7,850<br>(178) |                  |                    |

- Notes:
1. It was estimated that 540 ha. (440 ha of medium lowland and 100 ha of low lands) would not be available for HYV Boro cultivation without the Project. Thus, only 960 ha (60 ha of high land and 870 ha medium high land) of gross cropped area would be cultivated under HYV Boro in 'without project' conditions in 1991.
  2. The figure in parentheses shows the estimated cropping intensity under 'without project' conditions in 1991.

Source: Consultants' estimates, based on RRA results.



## 5 IMPACT ON LIVESTOCK

### 5.1 PRE-PROJECT SITUATION

In the Project documents there is very little information on the pre-Project situation of livestock production in the Project area. This report is therefore based on individual and group interview of farmers, officials and knowledgeable persons as well as personal observation during the RRA field visit.

Agriculture was the main occupation in the pre-Project area and about 75 per cent of all households were engaged in agriculture. As in all other parts of the country, livestock was an integral part of the farming system in the Project area. It was kept mainly as a supporting activity to crop production and as a secondary source of household income. About 58 per cent of all households and 70 per cent of all farm households had livestock (Table 5.1). In general, each household had a small number of livestock. The most important types of livestock in the area were cattle, goats, chickens and ducks. Buffaloes, horses and sheep were very rare. According to the Census of Agriculture and Livestock 1983/84 about 70 per cent of all farm households possessed cattle and 73 per cent had poultry birds.

Cattle were the most important livestock in the Project area. Bullocks were kept mainly for draft purpose and cows for producing milk and calves. Except under special circumstances cows were not used for draft purpose. In fact, there was no shortage of draft power in the area under the prevailing cropping practices.

Paddy straw, pulse straw and grasses were the main feedstuffs for cattle. However, a small quantity of oilcake, rice bran and salt was fed with the straw during the busy period of ploughing and land preparation, particularly by the conscious and rich farmers. B. Aus and B. Aman were the main sources of paddy straw. Road-side grasses, weeds from crop fields and fallow land were the main sources of green feedstuffs. However, sugarcane tops and pulses, which used to grow in the area, were also fed to the cattle as green feedstuffs.

Goats, the second most important ruminant in the area, were kept by all types of households. About 50 per cent of all farm households possessed goats. Sheep were rare in the area. In general, goats were more common in the northern areas of the Project, which are relatively high land. Most of the households kept one or two goats as scavenging animals. No special attention was given to their feeding and management.

Chickens were quite common in the Project area. About 73 per cent of all farm households possessed chickens. However, ducks were kept mostly in the beel areas, where more natural feeds for ducks were available. Both chickens and ducks were kept in small numbers as scavenging birds. Sometimes a handful of grain and waste food were fed to the birds. Diseases like Ranikhet and Fowl Cholera were quite common and took a heavy toll of life in every year.

### 5.2 OBJECTIVES

During the planning stage the possible impact of the Project on livestock was overlooked or not considered. In general, more and more fallow lands are brought under cultivation with FCD/I Projects which causes shortage of nutritious animal feeds. There is a general trend that the health and performance of cattle have deteriorated mainly due to feed

general trend that the health and performance of cattle have deteriorated mainly due to feed shortage, and the requirement of draft power has increased, especially in areas where crop intensification has taken place. The primary objective of the Project is to improve production through crop intensification. There is no explicit or implicit objective of the Project to develop livestock or to improve the draft power situation.

### 5.3 SOURCES OF DATA

For RRA, data were collected from farmers and knowledgeable persons of the area such as teachers and village leaders through individual and group interview. Information was also collected from District and Upazila officials such as the Livestock Officer, Statistical Officer, Agricultural Officer and UNO, as well as BWDB officials. Moreover, personal experience gained from physical observation of livestock, their management practices and performances in the Project area was also recorded.

### 5.4 PROJECT IMPACTS

Construction of the embankment and drainage structure as well as re-excavation of drainage canals have led to a change in the water regime and the ecosystem. Early drainage of water from the area has led to conversion of fallow land into cultivable land, and to changes in cropping pattern and cropping intensity. As a result feed resources as well as the livestock production system have been affected. The following are some of the important findings in the Project area, not all of which may be the direct impact of the Project.

#### 5.4.1 Positive Findings

##### a) Smallstock Population Increase

There are indications that the population of goats has increased by 20-25 per cent and of chickens by 30-35 per cent. However, cattle population has apparently decreased by 20-25 per cent. According to Census of Agriculture and Livestock 1983/84, about 48 per cent of the total households or 53 per cent of the all farm households had goats. Since the Project the number of goat holding households has increased. The increase in goat population and in goat holding households may be due to one or more of the following reasons:

- increased availability of goat feeds particularly green grasses on the roadside, embankment slopes and land boundary;
- low price of goats in comparison to cattle. Farmers who cannot afford to buy a cattle may able to buy a goat;
- maintenance of goats is easier than of cattle. No special attention is required; and,
- some NGOs are providing credit for livestock rearing.

The increased number of chickens and ducks in the Project area may be attributed to increased availability of foodgrains and insects in the homestead after the Project.



## b) NGO Livestock Development Activities

It was observed during the field visit that some interesting livestock development activities like cattle fattening, milk cow rearing, goat fattening, chicken rearing, urea treatment of straw and urea-molasses block making are going on in the Project area with the assistance of NGOs. The Productive Employment Programme of the Bangladesh Rural Development Board (PEP - BRDB) has been under way with the landless groups in Faridpur Sadar Upazila and has been providing credit and technical assistance for cattle fattening, goat fattening, and urea-molasses block making programmes. From July 1991 PEP-BRDB will expand its programme and will include milk cow rearing and chicken rearing.

BRAC has also been working with landless and destitute women in the Project area. They organize women's group, provide them with training on vaccination, chick rearing and laying hen rearing. They also provide them with credit, technical supervision and marketing facilities. Grameen Bank is also providing credit for cattle fattening and chicken rearing programmes in the Project area.

Urea molasses block making is an important development for cattle improvement. It contains 52 per cent molasses, 9 per cent urea, 8 per cent calcium, 26 per cent wheat bran and 5 per cent salt. Feeding urea-molasses block with paddy straw will not only improve nutrient (NPN and energy) intake of the cattle but also improve digestibility of the straw and thereby total nutrient intake of the animal. Urea treatment of straw is another development in this area. Urea treatment of straw enhances N-content and digestibility. In straw based rationing of cattle, urea treatment of straw will greatly help in improving total nutrient intake of cattle, and will thus exploit the increased straw production from successful FCD/I projects.

## 5.4.2 Negative Impacts

### a) Reduction of Green Feedstuffs

Availability of green feedstuffs has decreased due to reduction of fallow land and change in cropping pattern and cropping intensity. The total cultivable area for B. Aus and B. Aman crop has decreased and area under HYV-Boro and T. Aman has increased. Previously, a large quantity of weeds used to grow in the B. Aus and B. Aman field just after the rainfall in April/May. During weeding a significant quantity of rice plants and weeds were removed, which used to be one of the major sources of green feedstuff for the cattle. With the decrease in B. Aus and B. Aman cultivation and increase in HYV Boro and T. Aman cultivation the availability of green grasses has significantly been reduced.

### b) Instability of Paddy Straw Supply

Under favourable conditions the total production of straw in the area should have increased (Table 5.3). This is mainly due to increased cultivation of HYV Boro and T. Aman (LV) and reduced cultivation of B. Aus and B. Aman. It was learnt during the RRA field visit that the security of the crop could not be achieved with the Project, meaning by implication that the straw production has not been stable over the years. Early rainfall in April e.g. in 1990, caused drainage congestion in the area and damage to mature HYV Boro and immature B. Aus and B. Aman. Low water levels during the monsoon season cause poor growth of B. Aman plants and low yield of straw. Farmers informed the team that during the last two years they could not get adequate paddy crop and straw due to early rain and drainage congestion.

Straw production and straw availability for cattle in the pre-Project and post-Project conditions as well as with Project and without Project conditions was estimated (Table 5.3). There is, in fact, some increase in paddy straw production and straw availability for cattle. But the increased availability of straw can not offset the losses of green feedstuff caused by the Project.

**c) Paddy Straw Quality**

Straw of HYV Boro is low in digestibility and palatability due to the presence of high percentages of lignin and silicate. On the other hand the straw of B. Aus and B. Aman is better in digestibility and palatability. With the increased production of HYV Boro, the quality of straw has deteriorated significantly. Moreover, due to frequent rain, a large quantity of Boro straw is spoiled every year.

**d) Decline in Pulse and Oilseed Cultivation**

During the pre-Project period pulses and oilseeds were grown in the Medium High and Medium Low land, part of the production being used as green feeds for cattle. Since the Project Boro cultivation has increased, replacing pulse and oilseed cultivation in the area. The reduced cultivation of pulses and oilseeds leads to reduced availability of green plants, pulse straw, pulse bran and oilseed cake for cattle.

**e) Cattle Population**

It was stated by both farmers and livestock officials that the cattle population in the Project area has decreased by 20-25 per cent in the last 10 years. This decrease in cattle population is mainly due to decreased availability of nutritious feeds and increased incidence of diseases.

**f) Draft Animal Availability**

According to local farmers and livestock officials there is a decrease in cattle population in the Project area by 20-25 per cent. According to the Agricultural and Livestock Census 1983/84 there were about 1.79-2.06 heads of cattle per farm household with a net cultivable land of 2.12 acres (Table 5.1). Considering that 50-75 per cent of cattle are draft animals then 1.0 - 1.5 head of draft cattle were available for cultivation of the same area of land. Since one pair of good bullocks can cultivate on average 4.0 acres of land, there was apparently no overall shortage of draft power in the area. However, there was some shortage of draft power among the small farmers because 44 per cent of them did not have any cattle and they were dependent on hired ploughs for cultivation.

Since Project implementation the draft power situation has deteriorated due to decrease in cattle population on the one hand and increase in cultivable land and cropping intensity and thereby total requirement of draft power on the other hand. Smaller farmers are more affected by the draft power shortage, because they are dependent on hired ploughing, the costs of which have gone up. Recently some power tillers have been purchased in the area privately by some rich farmers who render services to other farmers on hire rental basis (Tk.300-400 per two cross plough per bigha, 1 bigha = 52 decimals) and thereby ease the draft power constraints to some extent.

**g) Parasitic infestation**



Parasitic infestation of cattle has apparently increased. Farmers complained that their animals passed loose stools and became emaciated. The Upazila Livestock Officer, Faridpur Sadar and Nagarkanda Upazilas and the District Livestock Officer of Faridpur, stated during the field visit that parasitic infestation, particularly liver fluke, has increased in the area. The increased incidence of liver fluke may be due to increased production of snails in the beels and shallow water bodies, which act as intermediate hosts for liver fluke.

#### **h) Cattle Health**

In general, the body condition of animals in the Project area has deteriorated, apparently due to scarcity of nutritious feeds and increased parasitic infestation. However, there is great variation in cattle between villages in the area and between households. Large farmers, who feed oilcake, rice bran and wheat bran together with paddy straw have better looking animals than those of the small and marginal farmers, who cannot afford to feed oilcake and bran to their cattle.

#### **5.4.3 1988 Flood Damage**

There are no accurate statistics on the extent of 1988 flood damage to livestock. According to farmers and officials there was no dry place available in the Project area except the flood embankment and a few roads. Farmers kept their animals on the embankment and saved them from flood damage. However, due to crop damage and shortage of cattle feeds a large number of animals were sold off after the flood. The exact number of cattle that were sold by the farmers was not available.

### **5.5 RECOMMENDATIONS:**

In general the FCD Project has had an adverse effect on livestock feeds through reducing fallow and grazing land and by changing cropping pattern. This has led to deterioration of livestock health and productivity. The following measures could be taken to overcome the adverse effect of the Project and to improve livestock production in the area:

- a) A programme could be undertaken to cultivate high biomass yielding forage crops such as Napier and Para grass on the slopes of embankment road sides and on homestead boundaries which will not only produce green feedstuff but also reduce soil erosion of the embankment. Para grass could be cultivated on the lower part of the embankment slopes and on the borrow pits. Normally Para grass has better growth on wet land.
- b) Some cultivable fallow land may be used for food and forage crop (maize, sorghum, khesari, cowpea) cultivation in order to minimize feed shortage.
- c) Pulse and oilseed cultivation could be encouraged through introduction of a crop diversification programme which will help in improving nutritional status of the people, providing nutritious cattle feed and increasing soil fertility.
- d) During selection of HYV paddy some consideration may be given to straw quality because straw of some HYV has higher digestibility than the other. This will help to improve straw quality along with increase in rice production.

- e) Paddy straw is the main feedstuff of cattle, and is low both in digestibility and nutrient content. It is established through research that urea treatment of straw improves both N-content and digestibility of straw. PEP - BRDB has already initiated a programme on urea treatment of straw in the Project area. A large scale extension programme may be undertaken to popularize urea treatment of straw for improving cattle nutrition in the Project area.
- f) A programme on introduction of urea-molasses blocks for feeding cattle with the straw ration may be taken. Urea molasses block is a good source of energy and nitrogen for rumen micro-organisms which in fact digest fibrous feeds. Moreover, rumen micro-organisms are a good source of protein for the ruminant. So feeding urea molasses block as supplemental feed for cattle on straw based ration will not only improve digestibility and palatability of straw but also improve total nutrient intake of the animal.
- g) The extension programme of the Department of Livestock Services should be extended and strengthened in the area under the FCD/I Project. Provision should be made to provide routine vaccination and mass anthelmintic doses in the Project area to protect animals against prevalent infectious and parasitic diseases.
- h) Because of closeness to the city and good market facilities at Faridpur, the Project area has potentiality for livestock development. It is recommended that the programme of cattle fattening, goats fattening, milk cow rearing and chicken rearing should be extended and strengthened in the Project area in order to improve incomes of the rural households.



Table 5.1 Cattle population in Faridpur Sadar and Nagarkanda Upazila and its Distribution According to Farm size.

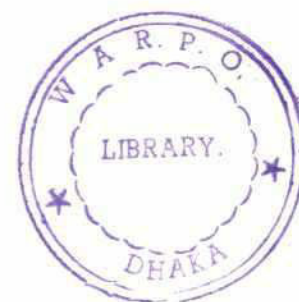
| Item                             | FARIDPUR SADAR UZ |             |            |                    |                    | NAGARKANDA UZ |             |            |                    |                    |
|----------------------------------|-------------------|-------------|------------|--------------------|--------------------|---------------|-------------|------------|--------------------|--------------------|
|                                  | Small Farm        | Medium Farm | Large Farm | All Farm Household | Non-Farm Household | Small Farm    | Medium Farm | Large Farm | All Farm Household | Non-Farm Household |
| No. of Households                | 17,505            | 7,405       | 1,462      | 26,372             | 9,606              | 21,911        | 8,969       | 1,626      | 32,506             | 9,685              |
| % Households                     | 48.6              | 20.6        | 4.1        | 73.3               | 26.7               | 51.9          | 21.3        | 3.85       | 77.05              | 22.95              |
| Household with cattle            | 10,027            | 7,108       | 1,440      | 18,575             | 2,315              | 12,198        | 8,362       | 1,587      | 22,147             | 1,613              |
| % of household with cattle       | 57.3              | 96.0        | 98.5       | 70.4               | 24.1               | 55.7          | 93.2        | 97.6       | 68.1               | 16.6               |
| No. of cattle                    | 21,416            | 24,462      | 88,362     | 54,240             | 3,916              | 24,459        | 25,585      | 8,034      | 58,078             | 2,615              |
| No. of cattle per household      | 1.22              | 3.30        | 5.72       | 2.06               | 0.41               | 1.12          | 2.85        | 4.94       | 1.79               | 0.27               |
| Net cultivable area (ac)/H. hold | 0.69              | 3.91        | 10.05      | 2.12               | --                 | 0.84          | 3.77        | 10.3       | 2.13               | --                 |

Source: BBS: Bangladesh Census of Agriculture and Livestock 1983/84, Zila Series: Faridpur

Table 5.2 Goats, Sheep and Poultry Population in Faridpur Sadar and Nagarkanda Upazila and their Distribution According to Farm Size

| Item                               | FARIDPUR SADAR UZ |             |            |                    |                    | NAGARKANDA UZ |             |            |                    |                    |
|------------------------------------|-------------------|-------------|------------|--------------------|--------------------|---------------|-------------|------------|--------------------|--------------------|
|                                    | Small Farm        | Medium Farm | Large Farm | All Farm Household | Non-Farm Household | Small Farm    | Medium Farm | Large Farm | All Farm Household | Non-Farm Household |
| No. of Households                  | 17,505            | 7,405       | 1,462      | 26,372             | 9,606              | 21,911        | 8,969       | 1,626      | 32,506             | 9,685              |
| H. holds with goats + sheep        | 8,345             | 4,616       | 990        | 13,951             | 3,218              | 9,071         | 4,544       | 934        | 14,549             | 2,464              |
| No. of goats+ sheep                | 19,590            | 12,328      | 3,157      | 35,075             | 6,634              | 19,735        | 11,433      | 2,872      | 34,040             | 4,831              |
| No. of goats + sheep per household | 1.12              | 1.66        | 2.16       | 1.33               | 0.69               | 0.90          | 1.24        | 1.77       | 1.05               | 0.50               |
| Household with poultry             | 11,862            | 6,033       | 1,272      | 19,167             | 4,800              | 15,544        | 7,255       | 1,394      | 24,193             | 4,770              |
| No. of poultry                     | 63,755            | 43,942      | 12,810     | 120,507            | 21,450             | 81,056        | 49,502      | 13,407     | 143,965            | 20,082             |
| No. of poultry per household       | 3.64              | 5.93        | 8.76       | 4.57               | 2.23               | 3.70          | 5.52        | 8.25       | 4.45               | 2.07               |

Source: BBS : Bangladesh Census of Agriculture and Livestock 1983/84, Zila Series-Faridpur.





**Table 5.3 Estimated Straw Production and Straw Availability for Livestock in the Project Area Before and After the Project.**

| Crop  | Area (ha) | Yield (Ton/ha) | Total Production (ton) | Grain to Straw Ratio * | Gross Straw Production | Approx. loss due to rain | Other Losses | Available Straw for Cattle |
|---|-----------|----------------|------------------------|------------------------|------------------------|--------------------------|--------------|----------------------------|
| Pre-Project Condition                           |           |                |                        |                        |                        |                          |              |                            |
| B. Aus L  | 1,540     | 1.29           | 1,987                  | 1:1.5                  | 2,981                  | 50%                      | 10%          | 1,192                      |
| B. Aman L                                       | 3,360     | 1.29           | 4,334                  | 1:1.2                  | 5,201                  | -                        | 10%          | 4,681                      |
| T. Aman L                                       | 40        | 1.46           | 58                     | 1:1                    | 58                     | -                        | 10%          | 52                         |
| T. Aman HYV                                     | -         | -              | -                      | 1:0.9                  | -                      | -                        | -            | -                          |
| Boro L  | 40        | 1.64           | 66                     | 1:1                    | 66                     | -                        | 10%          | 59                         |
| Boro HYV  | 200       | 3.20           | 640                    | 1:0.8                  | 512                    | 50%                      | 10%          | 256                        |
| Total   | 3,520     | -              | 7,085                  | -                      | 6,202                  | -                        | -            | 6,240                      |
| Post-Project Condition (With project condition) |           |                |                        |                        |                        |                          |              |                            |
| B. Aus  | 960       | 1.37           | 1,315                  | 1:1.5                  | 1,973                  | 50%                      | 10%          | 784                        |
| B. Aman L                                       | 2,190     | 1.29           | 2,825                  | 1:1.2                  | 3,390                  | -                        | 10%          | 3,051                      |
| T. Aman L                                       | 960       | 1.82           | 1,947                  | 1:1                    | 1,947                  | -                        | 10%          | 1,752                      |
| T. Aman HYV                                     | -         | -              | -                      | -                      | -                      | -                        | -            | -                          |
| Boro L  | 40        | 1.64           | 66                     | 1:1                    | 66                     | -                        | 10%          | 59                         |
| Boro HYV  | 1,500     | 3.20           | 4,800                  | 1:0.9                  | 4,320                  | 50%                      | 10%          | 1,728                      |
| Total   | 5,650     | 1.89           | 10,753                 | -                      | 11,696                 | -                        | -            | 7,379                      |
| Without Project Condition                       |           |                |                        |                        |                        |                          |              |                            |
| B. Aus L  | 1,070     | 1.29           | 1,380                  | 1:1.5                  | 2,070                  | 50%                      | 10%          | 828                        |
| B. Aman L                                       | 2,730     | 1.29           | 3,522                  | 1:1.2                  | 4,226                  | -                        | 10%          | 3,803                      |
| T. Aman L                                       | 960       | 1.46           | 1,402                  | 1:1                    | 1,402                  | -                        | 10%          | 1,262                      |
| T. Aman HYV                                     | -         | -              | -                      | -                      | -                      | -                        | -            | -                          |
| Boro L  | 40        | 1.64           | 66                     | 1:1                    | 66                     | -                        | 10%          | 59                         |
| Boro HYV  | 960       | 3.29           | 3,072                  | 1:0.8                  | 2,458                  | 50%                      | 10%          | 983                        |
| Total   | 5,760     | 1.64           | 9,442                  | -                      | 10,222                 | -                        | -            | 6,935                      |

Source: Estimations are based on the results of RRA field survey.

\* Grain to straw ratios used here are estimated by the consultant.

## 6 IMPACT ON FISHERIES

### 6.1 PRE-PROJECT SITUATION

As recorded in the PCR, the Project was initiated by BWDB in 1981/82 and was finally completed on the 30th June, 1985, about one year later than originally proposed. It might have been expected that a Feasibility cum Appraisal report would have included an appropriate base-line survey, inter alia covering the pre-Project fisheries situation, but in this case it was not possible to locate such a report and it is doubtful whether the report was ever produced. There is also no reference whatsoever to fish resources or to the communities depending on them, in either the PP or PCR.

The earliest comparable series of annual fisheries statistics for the general area commenced in 1983/84, when the Fisheries Department introduced a new system for data collection and analysis. A summary of Faridpur District fish production data from this source and for the period 1983/84 to 1987/88 inclusive is given in Table 6.2. Beyond this, and with the exception of the findings of a 1982 national pond survey, it was not possible to trace any other worthwhile information about fisheries in the Project area. Results of the 1982 pond survey, relating to the old Faridpur District area, are shown in Table 6.3, the principal item of interest being the percentage by number of derelict ponds, at 41.76 per cent.

Comments from fish traders and others during the RRA field visit suggested that during and prior to the 1970s, Faridpur was a surplus producer of fish, but that since then the decline in fish production, which is evident from Table 6.2, now necessitates the import of substantial quantities of fish from other parts of the country to satisfy local demand.

As a general rule the Indian carp species cannot breed naturally in still waters, so that sexually mature fish have to migrate from beels to rivers and travel considerable distances upstream in order to reach suitable spawning grounds. This takes place during the early flood, i.e. May and June. The masses of fertilised eggs (spawn) then drift back downstream, hatching out en route and as the floods continue to rise are swept from the rivers and distributed across the inundated flood plain where they grow, overwintering in perennial water bodies such as beels. Blockage of either the May/June spawning run or of the subsequent return of young fish, inevitably results in the decline and eventual extinction of such fish stocks from both the beel areas concerned and the rivers.

A range of species of other kinds of fish live permanently in static water and can breed in pools, flooded ditches or in the beels. This group also includes snake-heads (shol and gajar), catfish (including Magur, boal, and shingi) and anabas (Koi), which have accessory air breathing organs enabling them to survive in marshy conditions or even periods of semi-drought. Of secondary importance and low value in the past, these fish are now the principal components of the capture fisheries in FCD affected areas.

### 6.2 PROJECT OBJECTIVES

As already noted, the only available Project documentation was the PP and PCR, neither of which contained any reference to fisheries, let alone setting any specific objectives for fisheries development. None of the BWDB or Fisheries Department staff who were stationed in Faridpur at the time of Project planning were still there, and so were not available



for interview, but the record gives no indication that there was any consultation between the two agencies at any stage, and it is virtually certain that the interests of the fisheries sector were simply ignored when the Project was being planned and implemented.

### 6.3 RRA DATA SOURCES

A visit was made to Faridpur and Sakunia Beel, during six days from May 11th to 17th inclusive. Interviews and less formal discussions were held with BWDB officials and with the Faridpur District Fisheries Officer, the Faridpur Sadar Upazila Fishery Officer, fish hatchery staff at Faridpur and Gangabardi, with full time professional fishermen, fish pond owners, part-time fishermen, market fish traders and staff of the Faridpur Branch of the Productive Employment Programme (PEP) which is an NGO assisting small groups of fishermen and which is administered through BRDB.

The relatively small size of the Project and its network of perimeter and internal roads facilitated the field visits and no difficulty was experienced in contacting fishermen and fish pond owners. Summaries of current (1990) data on fisheries, as obtained from the Faridpur Sadar Upazila and Faridpur District Fishery Offices, are shown in Table 6.4, and fish price data are listed in Table 6.5.

### 6.4 POSITIVE EFFECTS ON FISHERIES

Pond owners in medium high areas, where FCD measures now protect their ponds from being overtopped by annual flooding, might be expected to become increasingly motivated to rehabilitate existing silted up ponds and to restock them each year with quality fish fingerlings, particularly in view of the close proximity of hatcheries at Faridpur and Gangabardi. The escalating shortage of fish supplies and consequent high market prices should also provide added economic encouragement to such pond owners.

Unfortunately, there is little sign as yet of this expected change taking place, although one or two cases of recent pond improvements were seen, notably the Posra Fish Cultivation Demonstration Farm near Sadhuhati, which is privately owned by a fairly wealthy family and which is being assisted to develop into a 3 or 4 pond fish farm complex by a joint FAO/Fisheries Dept. initiative. The PEP programme which is assisting small groups to lease and rehabilitate derelict ponds is also encouraging, but so far has been able to tackle only 20 ponds throughout the district. As far as is known none of these lie within the Project. The proportion of derelict ponds in Faridpur District and Faridpur Sadar Upazila in 1990 was 40.5 per cent and 41.60 per cent respectively, virtually unchanged since the 1982 pond survey showed that 41.76 per cent of ponds in the district were derelict.

The key elements which are lacking are an effective extension/demonstration service and provision for credit in approved cases to cover pond re-excavation costs.

### 6.5 NEGATIVE EFFECTS OF THE PROJECT ON FISHERIES

Drainage of Sakunia Beel and other smaller water bodies in the Project area, coupled with construction of the embankment along the Kumar River and operation of the Kumar River regulator at Faridpur have:

- a) blocked the annual spawning migration routes for carps to and from the river;
- b) greatly reduced the area of fishable open water in the beel from 120 ha to less than 20 ha<sup>1</sup> in the dry season;
- c) reduced riverine and beel fish stocks by the virtual extermination of carps consequent on (a) above;
- d) reduced catch rates, according to fishermen, to only 25 per cent of pre-Project levels;
- e) reduced fish production from the area, according to fish traders to only 25 per cent of pre-Project levels;
- f) caused many former full-time fishermen to migrate away from the area altogether, and others to seek alternative forms of at least part-time employment.
- g) forced the remaining full-time fishermen to concentrate only on river fish with a consequent increased risk of overfishing the riverine stocks;

Separate data for fish production from the Project area are not available and thus have to be deduced from Upazila records. Some 85 per cent of the Project lies within Faridpur Sadar Upazila which measures 380 sq. km.. The Project measures 56 sq. km. and including an allowance for the 15 per cent which lies within Nagarkanda Upazila, it suggests that Project area fish production should be about 20 per cent of the Faridpur Sadar Upazila total of 665 mt, i.e. about 133 mt. per year.

Pond fish production appears not to have been significantly affected by the Project, whereas the beel and riverine capture fisheries are claimed to be producing only about 25 per cent of pre-Project levels, thus:

**Table 6.1: Estimated Project Area Fishery Production**

| Upazila production 1/ |         | Project Production 2/ |
|-----------------------|---------|-----------------------|
| Pond -                | 462 mt  | 92 mt.                |
| Beels -               | 74 mt   | 15 mt.                |
| Rivers -              | 129 mt. | 26 mt.                |
|                       | 665 mt. | 133 mt.               |

Notes: 1/ From Table 6.3

2/ At 20% of Upazila production

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<sup>1</sup>The water area was nearer 40 ha at the time of visit, because the drainage channel is still silted up and in need of excavation.



On that basis the negative impact on fish production would be three times the Project total of beel and river production, times three i.e. 123 mt. of fish annually, which, if valued at only Tk. 20 per kg represents an annual loss of Tk 2.5 million to fisheries because of this Project. In reality, the lost fish are mostly major carp and would have much higher market values (See Table 6.5) so that both prices and the overall financial loss would be much greater.

Sakunia Beel has been but one of a series of FCD/FCDI projects which are forming a jig saw pattern of enclosures across the country. Notwithstanding their beneficial impacts in other respects, their cumulative effect on fisheries in the wider context of Faridpur District is shown in Table 6.2, where progressive reductions in catches from the rivers and floodlands are clearly apparent and where overall annual fish production has halved in the five years from 1983/84 to 1987/88, from nearly 31,700 metric tons to 16,500 mt. Reports from the District Fisheries Office suggest that the 1989/90 catch was even smaller, at only 11,400 mt.

There is no possibility of restoring the beel and flood plain areas to their former state and it is thus not feasible to take any action to correct or reverse the negative impacts of the Project on the natural fish stocks and capture fisheries. However, some measures may be possible to help mitigate some of these impacts.

Although there is some uncertainty about the ownership status of the remaining small area of permanent water in Sakunia Beel, to the extent that it may be "Khas" property it should be preserved against any further reduction in size and drainage. This may be achieved by at least partial excavation to create a submersible bund around its periphery both to mark its boundary and to increase the volume of stored water. The fishery should be leased in accordance with the New Fisheries Management Policy, to an association or group of bona fide fishermen with assistance if possible from PEP, and then restocked with a combination of carp species, tilapia and Magur or African catfish, with supervision and cropping management advice from Upazila/District and 3rd Fisheries Project staff.

It is also necessary to take greater advantage of the favourable climate for expanding fish farming in the area, by reinforcing the local fisheries extension service and organising a series of one day courses or demonstrations for prospective pond owners at the Gangabardi Hatchery and Training Centre, in an effort to reduce the very high proportion of derelict ponds in the area.

## 6.6 LESSONS

It is quite unacceptable that FCD type projects which have multi-sectoral impacts can be planned, approved and implemented without any consultation with the various agencies responsible for each sector. As regards fisheries it is essential, in future, that the aims for and effects of such projects on fish resources and fishing communities must be carefully planned from the outset and monitored throughout implementation. There must be close cooperation between the Fisheries Dept, BWDB and other agencies, who should all be represented on the project management team.

The use of a material resembling plastic mosquito gauze instead of conventional fish netting of larger mesh size for encircling fish and dragging them ashore, was observed at Nikhurdi in the Project area and elsewhere. Although not a Project related effect, the use of such fine mesh netting is very harmful to fish stocks in that even fish eggs and larvae are

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killed. Marketable sized fish can be more easily caught in nets of larger mesh size. If not already illegal, these mosquito gauge nets should be banned and more vigorous steps taken to enforce all fish conservation regulation.





**Table 6.2: Sakunia Beel FCD Project - Fish Production Trends in Faridpur District**  
(Metric Tons)

|                            | 1983/84      | 1984/85      | 1985/86      | 1986/87      | 1987/88      |
|----------------------------|--------------|--------------|--------------|--------------|--------------|
| <b>i. Riverine Catches</b> |              |              |              |              |              |
| Major carps                | 57           | 60           | 45           | 9            | 75           |
| Other carps                | 7            | 5            | -            | 1            | 1            |
| Catfish                    | 334          | 441          | 42           | 34           | 37           |
| Hilsa                      | 5816         | 4149         | 1269         | 1621         | 1605         |
| Shrimps                    | 136          | 223          | 9            | 33           | 172          |
| Misc. Spp.                 | <u>6676</u>  | <u>3234</u>  | <u>746</u>   | <u>1187</u>  | <u>997</u>   |
|                            | 12593        | 8112         | 2111         | 2885         | 2887         |
| <b>ii. Beel Fisheries</b>  |              |              |              |              |              |
| Mixed Spp.                 | 862          | 421          | 414          | 336          | 445          |
| <b>iii. Flood lands</b>    |              |              |              |              |              |
| Mixed Spp.                 | 14375        | 12541        | 11481        | 10041        | 7451         |
| <b>vi. Ponds</b>           |              |              |              |              |              |
| Mainly carps               | 3727         | 3414         | 4599         | 6145         | 5573         |
| <b>v. Baors</b>            |              |              |              |              |              |
| Mixed Spp.                 | 130          | 169          | 125          | 172          | 162          |
| <b>Total</b>               | <b>31687</b> | <b>24657</b> | <b>18730</b> | <b>19579</b> | <b>16518</b> |

Source: Dept. of Fisheries, Annual Fish Catch Statistics Reports.

Table 6.3 Sakunia Beel FCD Project - 1982 Pond Survey Results (Old Faridpur District)

|  |                               |
|--|-------------------------------|
| Number of Mauzas surveyed  | 101                           |
| Number of ponds studied  | 939                           |
| Estimated total no. of ponds   | 81,333                        |
| Av. no. of ponds per Mauza   | 23.1                          |
| Av. no. of ponds per Upazila   | 3012                          |
| Number (%) of Derelict ponds   | 33965 (41.76 per cent)        |
| Number (%) of Non-derelict ponds   | 47368 (58.24 per cent)        |
| Average area of non-derelict ponds                                       | 0.26 acres                    |
| Total area of non- derelict ponds  | 12316 acres                   |
| Estimated production of formed fish<br>equal to                          | 128,440 maunds<br>4790.8 m.t. |
| Average catch per pond = 108.43 seers =                                  | 101.18 kg.                    |
| Average catch per acre = 419.37 seers =<br>or, about 967 kg per hectare. | 391.31 kg.                    |

Note: Faridpur District comprised 3644 Mauzas in 27 Upazilas pre-1982

Source : Bangladesh Bureau of Statistics : Report on the survey of ponds, 1982



**Table 6.4: Sakunia Beel FCD Project - Background Information on Fish Farming and Capture Fisheries in the General Area, 1990**

**1. Fish Farming:**

Item Faridpur District Sadar Upazila  
No. Area No. Area

|                          |               |             |      |       |
|--------------------------|---------------|-------------|------|-------|
| Private ponds-cultivated | 47511842 acre | 956341 acre |      |       |
| -cultivable              | -             | -           | 716  | 350 " |
| -derelict                | 3870          | 1571 "      | 1221 | 216 " |
| Khas ponds               | 918           | 442         | 42   | 10 "  |
| Totals                   | 9539          | 3855 "      | 2935 | 917 " |

Derelict ponds (%) 40.57% 40.75% 41.60% 23.55%

Productivity :

Non-derelict ponds na 1628 kg/ha

**2. Estimated catch - ponds**

- beels na 462 mt.

- rivers na 74 mt.

- rivers na 129 mt.

Total 11376 mt. 665 mt.

Estimated demand 19712 mt. 2818 mt.

**3. Effort - fishing villages**

- fishermen families na 23

- fishermen families 5431 560

- fishing cooperations 51 7

- coop. membership na 829

Source: Faridpur District Fisheries Officer, and Faridpur Sadar Upazila Fisheries Officer.

Table 6.5: Sakunia Beel FCD Project - Faridpur Market Fish Prices, 15th May 1991

|                                  |                 |
|----------------------------------|-----------------|
| Mirror Carp - Small (300gm)      | TK. 15 each.    |
| Silver Carp - Medium             | Tk. 50 per kg.  |
| Rui - Large                      | Tk. 100 per kg. |
| Rui - Small                      | Tk. 80 per kg.  |
| Katla - Medium                   | Tk. 70 per kg.  |
| Mrigal - Small                   | Tk. 90 per kg.  |
| Hilsa - iced ex-Barisal          | Tk. 50 per kg.  |
| Magur - Medium                   | Tk. 100 per kg. |
| Boal - Very large (3 kg)         | Tk. 70 per kg.  |
| Singri - Small                   | Tk. 50 per kg.  |
| Koi - Small                      | Tk. 100 per kg. |
| Shol - Medium                    | Tk. 75 per kg.  |
| Shrimp - Large                   | Tk. 150 per kg. |
| Misc.very small fish             |                 |
| @ Tk 5 per 200gm approx. portion | Tk. 25 per kg.  |

Source : RRA Results.



Table 6.6: Sakunia Beel FCD Project - Project Impact by Fish Species

A. Fish species reported as adversely affected by ecological changes consequent on FCD works.

1. Major Carps:

|                          |   |          |
|--------------------------|---|----------|
| <u>Labeo rohita</u>      | - | Rui      |
| <u>Labeo calbasu</u>     | - | Kalibaus |
| <u>Cirrhirus mrigala</u> | - | Mrigal   |
| <u>Catla catla</u>       | - | Katal    |

2. Minor Carps:

|                       |   |                               |
|-----------------------|---|-------------------------------|
| <u>Labeo</u> spp.     | - | Bata, Goni, Bhangar           |
| <u>Cirrhinus reba</u> | - | Tatkin, Laacho                |
| <u>Puntius</u> spp.   | - | Sarpunti, Titpunti, Jat punti |

3. Catfish:

|                     |   |      |
|---------------------|---|------|
| <u>Wallago attu</u> | - | Boal |
|---------------------|---|------|

B. Fish Species relatively unaffected by FCD works

4. Snake Heads:

|                        |   |                   |
|------------------------|---|-------------------|
| <u>Channa striatus</u> | - | Shol              |
| <u>Channa marulius</u> | - | Gajal             |
| Other Channa spp.      | - | Pipla, Lata, Raga |

5. Catfish:

|                                |   |        |
|--------------------------------|---|--------|
| <u>Clarius batrachus</u>       | - | Magur  |
| <u>Heteropneustes fossilis</u> | - | Shingi |

6. Anabas testudineus - Koi

Source: RRA Results

## 7 NON FARM ECONOMIC IMPACT

### 7.1 PRE PROJECT SITUATION

There was no mention of possible impact of the Project on non-farm economic activities in the Project Proforma or Project Completion Report. Therefore, no background information was available with respect to the type and extent of non-farm economic activities in the pre-Project period.

The Census of Agriculture and Livestock, 1983-84, (Faridpur Zila series) produces tables with respect to the existence of cottage industries by size of holdings. The reference period of these statistics (i.e. 1983-84), more or less coincides with the period of construction of the Project. The cottage industries mentioned for the Unions of Faridpur Sadar Upazila are handloom weaving, blacksmithing, pottery, bamboo and canework, carpentry and ghani (oil crushing). In Kaijuri Union, which covers most of the Project area, only 1 per cent of total households had one or more of these non-farm activities.

During the RRA, group discussions and interviews revealed that there were also other non-farm economic activities such as rickshaw pulling, petty trades, boat plying, fishing and extraction of juice from date palm and palm trees for "gur" making.

### 7.2 PROJECT OBJECTIVE

The Project proforma did not have any reference to non-farm economic objectives of the Project. Therefore, any impact of this type would have been treated as unintended and unplanned benefits. Since, the intended benefits of the Project in terms of increased agricultural production should have generated non-farm economic activities as backward and forward linkages, an explicit objective of enhancing non-farm activities could have been incorporated in planning the Project.

### 7.3 SOURCES OF DATA

The data relevant to this subject were obtained through interviews with rickshaw pullers, rickshaw van drivers, fishermen-cum-boatmen, petty traders, paikers (bulk purchasers), and knowledgeable persons. Unfortunately, shortage of time for the RRA did not allow the team to cover the details of non-farm activities nor was it possible to gather information on income changes from these activities due to the Project.

### 7.4 PROJECT IMPACT

#### 7.4.1 Positive

Table 7.1 gives an account of non-farm economic activities before and after the Project.

- i. The earthwork involved in excavation and re-excavation of two drainage channels and construction of the flood embankment created productive employment and income for the poorer section of the people. For example, in Kaijuri Union, the Food for Works Programme in 1991 allocated a total of 211 metric tons of wheat, of which 113 metric tons were used for re-excavation of the Sakunia Beel-Nikhurdi drainage channel. This amount of wheat provided, at 60kg/1000 cft earthwork, about 86 man-years of

employment for unskilled labour, assuming that an average of 60 cft of earthwork was done per person per day.

- ii. The construction of the flood embankment cum road appeared to be an important addition to the physical and economic infrastructure in the southern areas of the Project, where the transport and communication systems were very poor before the Project. This created opportunities for many poor households to take up rickshaw and rickshaw van driving as a regular source of income.
- iii. This transport system has, as a second round change, induced petty trades, in foodgrains, jute, vegetables, pulses, eggs and other commodities from and to the area. Many farias now come from Faridpur town to the weekly hats (market) of the Project area to buy rice, wheat and jute and transport to the town by the vans.
- iv. The increased production of rice as a result of the Project has also remarkably increased the volume of trade in fertilizers, diesel fuel and spare parts for irrigation tubewells and pumps, rice mills and petrol supplies for power tillers. For example, the number of fertilizer sellers in the Beelnalia and Bakhundia area, the centre villages of the Project area, has increased 10 times since the Project. There has been an increase in the number of people who work as mechanics for irrigation pumps and power tillers, and some of them have taken up power tiller hire services as an income earning activity. This latter activity is concentrated in the highland villages of Kaijuri Union which is closer to Faridpur town.
- v. Many poor households of the villages along the Faridpur-Bakhundia highway have taken up cattle fattening, goat rearing and poultry raising activities with support from NGOs. With increasing awareness about cattle health, two groups of landless men and women took up manufacturing of urea molasses blocks under the Productive Employment Programme of BRDB. For more information on women's activities, see Chapters 5 and 9.

#### 7.4.2 Negative

- i. The construction of the embankment and the reduction of inundation in the Project area reduced boat transport significantly and hence those who had boat plying as a secure source of income lost it almost completely. This has also adversely affected the activities of the boat carpenters, living in the low lying villages in the southern portion of the Project.
- ii. The cottage industry of pottery is on the verge of extinction, but the reason is not attributed to the operation of the Project, except that the expansion of irrigated HYV rice production has made it difficult for potters to get the right type of soils. There has also been a qualitative change in the pottery industry so that the pottery is now limited to making "Hari" (pots which are used for collecting date-palm juices), whereas in the past cooking utensils and crockery were the main items.
- iii. Part-time and full time fishing have been drastically reduced due to drainage of beels and obstruction of fish migration by the drainage regulators, resulting in loss of employment and seasonal migration of professional fishermen (for details on this point, see Chapter 6).



## 7.5 SUGGESTIONS

There are reasons to believe that the increase in agricultural output will subsequently promote non-farm economic activities as backward and forward linkage effects. This then warrants improvement of the drainage and flood protection efforts so that intensive cultivation of rice as well as non-rice crops becomes possible. This may also suggest a case for institutional support to facilitate installation of local workshops for repair and maintenance of small machines such as irrigation pumps, power tillers, rice and flour mills. The expansion of rural electrification will be particularly helpful in this regard.

Table 7.1 Pre and Post-Project Non-farm Economic Activities

| Activities                 | Pre-Project | Post-Project | Change |
|----------------------------|-------------|--------------|--------|
| Earthwork                  | Y           | Y            | +2     |
| Rickshaw                   | Y           | Y            | +1     |
| Rickshaw van               | X           | Y            | +2     |
| Blacksmith                 | Y           | Y            | 0      |
| Pottery                    | Y           | Y            | -2     |
| Boat                       | Y           | Y            | -2     |
| Fishing                    | Y           | Y            | -2     |
| Petty traders              | Y           | Y            | +2     |
| Fert and diesel dealer     | Y           | Y            | +2     |
| Power-tiller hire service  | X           | Y            | +1     |
| Date-Palm `gur'making      | Y           | Y            | +1     |
| Rice milling               | Y           | Y            | +1     |
| Urea molasses block making | X           | Y            | +1     |

Note: Y = Yes X = No +1 = Moderate increase;  
+2 = Large increase -1 = Moderate decrease  
-2 = Large decrease 0 = No change

Source: Field interviews during RRA, 1991.



## 8. IMPACT ON NUTRITION

### 8.1 PRE - PROJECT SITUATION

Information on the status of nutrition in the Project area could not be drawn from documentary sources. Nutritional surveys conducted previously did not include the Faridpur area. Therefore, comments on the pre-Project situation on the basis of statistical or census data could not be made, and the RRA depended entirely on direct observation and interview for data regarding the pre-Project situation.

From interviews within the Project area it was generally agreed by most of the villagers that nutritional status was better in the pre-Project time. During pre-Project period most families used to consume three meals a day. Consumption of wheat was not common among the villagers. Higher intake of pulses, fish and other protein sources was reported because of the households better economic status, and fruits were more abundant during this period.

Child health was also reported as better in the pre-Project period. This could be due to the higher amount and larger variety of food available per person. General health of the children looked better in the pre-Project period, although during this time primary health care was less available, and therefore fewer children were inoculated or vaccinated. Safe drinking water was scarce, and cooking was mostly done using water from the nearby rivers, ponds and beels.

### 8.2 OBJECTIVES

No explicit objectives regarding nutritional impacts of the Sakunia Beel Project could be drawn from the PP or other documents. However, an implicit objective of the Project could have been improving health and nutritional status by increasing food production of the population within the Project area.

### 8.3 SOURCES OF DATA

Sources used during the RRA comprised interviews with concerned officials, village men and women, and personal observation of the age group concerned (0-15 years).

Villagers interviewed were unable to quantifying their food intake. It also seems that food intake is highly seasonal and very much dependent on the level of food production and income of household. Therefore in some cases there was contradiction of responses in this regard. To overcome this the questions had to be repeated in different manners in order to find out their usual type of food intake.

### 8.4 BENEFITS OF THE PROJECT

The Project was successful in terms of raising the production of paddy by bringing more area under cultivation, changing cropping pattern and increased fertilizer use. As a result there is an increase in the amount of foodgrains available. But this does not necessarily mean that per capita food availability has improved nor that there has been an increase in the availability of foodgrains in all the households or over all the Project life to date.

In terms of changing food habits the Project played an important role. People living



within the Project area, especially in the south, show an increasing trend to wheat consumption. This change was facilitated by the food for work, (FFW) programme which distributed 55 kg of wheat for 1000 cft of earth done on the embankment. Recently FFW undertook a canal re-excavation programme for wheat which has motivated disadvantaged families to change their food habits. An increase in the production of wheat was also noted within the Project area. This has encouraged some families to substitute wheat for rice in the morning meal.

An increase in the consumption of vegetables, especially the leafy vegetables, was also noted within the Project area. How much of this was due to an increase in vegetable production could not be ascertained. This change in behaviour was possibly influenced by the media. Village women seem to know that vegetables are good for the children through media propaganda.

As regards health and nutrition there was greater availability of safe drinking water. As more HTWs and STWs are installed for irrigation and other purposes, access to safe drinking water has become easier. All villagers within the Project area mentioned that they used tubewell water for drinking and occasionally for cooking. Most people do not use tubewell water for cooking because it changes food colour. However, the Project did not seem to have led to this improvement of drinking water supplies.

## 8.5 NEGATIVE EFFECTS

Planned and unplanned positive impacts of the Project were not able to elevate the status of nutrition of the population living within the Project area. There are some negative effects of the Project on the nutritional status of the villagers, which will be discussed below.

First, there was a decline in protein food sources. Consumption of traditional sources of protein (e.g. pulses and fish) has declined in the post-Project period. This has affected children more than adults. Also poorer households were more severely affected than the richer households.

From informal interviews with village women it was gathered that pulse consumption has declined from every day to four or five times a week. In poorer households this decline was more severe because the higher prices of pulses were beyond the purchasing power of these households. This was partly caused by a decline in pulse production by the farmers in the Project area. Decline in pulse production is generally caused by the expansion of irrigated HYV paddy production in the Rabi season which is more profitable than pulse production.

Fish, another source of protein for the rural people, is also less available due to the Project. Draining of the beel water resulted in decline of fish production by 75 per cent within the Project area. Because of this drying up of beels and canals a large number of people also lost the opportunity for subsistence fishing. This has resulted in reduction of fish consumption, especially by the poor people who cannot afford to spend Tk. 45 for about 400 grams of small fish.

Consumption of other sources of protein (i.e. meat and milk) was only observed in well-off households. Overall a decline in meat and milk consumption was noted. This was caused by the decline in the cattle population in the post-Project period. Despite an increase in goat and chicken production as reported in Chapter 5, per capita consumption of eggs and meat seems to have declined.

Second, there is an increase in population within the Project area which has adversely affected nutritional status. As a result the increase in the production of food grains cannot keep up with the population increase. The Upazillas under the Project area are food deficient in terms of the amount of food grains recommended per person (1/2 kg/person/day). Faridpur Sadar and Nagarkanda Upazilas as a whole show a deficit of 19,788 metric ton and 9,466 metric ton respectively. This gives an indication of reduced calorific intake for the population of those two Upazillas.

For the normal growth and development of the human body adequate amount of food, both in terms of calories and protein, are needed. When the consumption of calories and protein are inadequate, it is reflected in growth retardation and malnutrition. This situation was observed frequently among the children living in the southern part of the Project area. Children from low-income families or landless families consume less food and therefore have less energy and proteins available to them than children from well-off families. These children are shorter for their age, bone structure appears normal but thinner and their triceps indicated lack of body fat.

Although there is no evidence that any consideration has been given to the impact of this Project on nutritional status, these effects should have been foreseen at the planning and design stage. Since such projects are usually taken up to increase agricultural production consideration should be given to the overall impact of such projects.

## 8.6 MEASURES TO CORRECT NEGATIVE IMPACTS

In terms of the FCD Project the measures that could be taken to correct the negative impacts are :

- a) encouragement of pond fish culture and promotion of consumption of sea fish. Adequate extension service is required from the DOF to encourage villagers to develop pond fish culture and for promotion of sea fish and dry fish as alternatives; and,
- b) to increase production of pulses and legumes more high yielding varieties of these crops should be introduced so that these can favourably compete with HYV Boro in financial terms.

These measures would not result in giving up the benefits or positive effects of the Project, but would probably enhance the positive effects of the Project.

## 8.7 LESSONS LEARNED

Lessons that were learned from this RRA are:

- a) if the long term goal of any FCD project is to improve the standard of living of the population within the project area, then it should consider all aspects of improvement within that area. Since nutritional status is closely associated with food production, both quantity and quality of food production should be considered by the planners;
- b) the Sakunia Beel Project of BWDB only dealt with the construction of the embankment without any consideration of the long term effects of this Project. As such, after the



completion of the Project they did not get involved with the upkeep and maintenance of the Project. From the observation of the Project area a need for regular monitoring of the effects of the Project is evident;

- c) agricultural extension work needs to be more diversified. More help should be provided to the farmers to encourage production of different Rabi crops. Emphasis should be placed upon pulse production. Increase in pond fish culture also needs to be emphasized. Embankments should be used as in such a way that they can provide opportunities for growing feeds for livestock. Encouragement should be given by concerned authorities on goat and chicken rearing, which already show an increase in number; and,
- d) village women need more knowledge regarding child health. Some extension work could be geared toward expansion of basic health care education and educating village women in more healthy weaning practice. For this another extension worker might be needed to spread this knowledge among villagers.



## 9. IMPACT ON WOMEN

### 9.1 PRE-PROJECT SITUATION

The situation of women in the pre-Project period could not be drawn from any documentary sources, and therefore information on pre-Project situation of women was drawn only from direct observation and interviews during the RRA.

The fieldwork involved four Unions of Kotwali and Nagarkanda Upazilas of Faridpur. Forty-two villages within these four Unions were influenced by the Sakunia Beel Project. Within these villages income generating opportunities available to women in the pre-Project period were few (as reported by the school teachers, concerned officials and others interviewed).

#### 9.1.1 Women's involvement in agriculture

The pre-Project situation regarding women's role in the agricultural sector was not encouraging. There was less cultivable land in the Sakunia Beel and cropping intensity was lower than post-Project. Women's involvement during this period was only limited to winnowing, parboiling, drying and milling paddy within the homestead. These operations were performed by two classes of women: women within the family and wage labourer women. Within the Project area the number of wage labourers was small in the pre-Project period and they were responsible for processing a smaller part of the total crop. However the earnings from these types of employment were often their only source of income and therefore critical for their family welfare. The traditional method of husking, i.e. dheki (a foot operated mortar and pestle), was more common in the pre-Project time. Big farmers usually engaged wage labourers for doing dheki work, which was largely replaced by husking machines in the post-Project period.

#### 9.1.2 Other occupational opportunities for women

In the pre-Project period traditional views on working women were such that a woman needed to perform her task within the homestead. As a consequence women were not allowed to work outside the home unless they were destitute. In that case they have usually worked as wage labourers in exchange for wages in paddy and their daily food. Other sources of employment were not available to these women. Within the homestead women were involved in mat weaving which is still a very common skill among the village women and sometimes used for generating income.

#### 9.1.3 Educational opportunities for women

A strong traditional outlook in the pre-Project period discouraged women from attending schools. Also poor communication between villages contributed to the lower attendance of girls in village schools. Early marriage was more common in this period. This encouraged the parents to teach girls in household activities so that they could be perfect wives and mothers. Those who had an opportunity to attend school were only able to get Islamic education.

## 9.2 OBJECTIVES

No explicit or implicit objectives in the area of women's development could be drawn from the PP or any other documentary sources. If the aim of the FCD Project was to encourage and facilitate changes in different aspects of development then it should be stated as such. Such statements about the long range effects of the Project will enable us to understand the extent to which the Project was able to achieve those goals and judge the Project not only from engineering and structural points but also from the point of human resource development. As the Project entirely lacked objectives regarding Project impact on women's issues, the value of the objectives can not be discussed in the light of Project feasibility.

## 9.3 SOURCES OF DATA

Sources used during the RRA comprised information from interviews with concerned officials, village men and women, Union Chairmen and personal observation within the Project area.

Because of the absence of key officials during the office visit, collection of accurate information was impossible as lower staff were not trained enough to discuss women's involvement in income generating issues. Even womenfolk upon whom the team relied for information failed to provide useful data. This may be due to prevailing general ignorance on the subject by women. NGO introduced activities were limited to certain selected areas and groups; this has also hampered widespread knowledge regarding their programmes.

## 9.4 POSITIVE EFFECTS

Opportunities for employment have increased within the Project area as a result of the FCD Project. This increase has mostly benefited wage labour households and landless people. Because of the change in cropping pattern and increase in cropped land post-harvest activities (e.g. winnowing, parboiling, drying and milling) have increased (Table 9.1). This has created a higher female workload and also provided better wage earning opportunities for wage labour women. These women work in exchange for food, cloth and paddy or food and cash (Table 9.2). In some areas women were involved in seed bedding on a smaller scale. For an approximate area of seven sq. feet of seed bed they get Tk.6.

Another occasional source of employment is the FCD Project itself. From time to time a number of female workers have participated in the canal reexcavation and in earthwork for the embankment taken up by the Food For Work programme. FFW paid 3 kg. of wheat per day for earthwork.

As a secondary effect of the Project a number of government and NGO programmes for income and employment have been promoted in the post-Project period. This was facilitated by better road communication within the Project area. Women's cooperatives of BRDB were seen in the Project area. These cooperative members save Tk.10 each month in the local bank. Also some of these members are selected and trained (leadership development) in the thana training and development center and in turn go back and work with other members of the village to promote education, savings, income generation, family planning and other activities. There was an increase in self awareness as a result of these programmes.





BRAC's Rural Development programme has also provided income generating activities within the Project area. Their programmes were geared toward VGD card holders. Women members were involved in poultry raising. BRAC supplied these women with two chicks for a cost of Tk.8 each. These chicks were raised by the members for eight weeks (or two months) and sold to other members for Tk.35.

Women were also involved in the road maintenance programme of IDP (Infrastructure Development Programme), which is under the supervision of local government. The working hours are from 8 a.m. to 3 p.m. and the wage is around Tk.25 per day. Some of these women are the principal wage earners in the family.

Another program of the local government is the PEP (Productive Employment Programme). Under this programme women were involved in poultry raising, goat rearing and cattle fattening activities. PEP provided animals to these women on a loan basis, which involved paying back in instalments. Those who can pay back their loans on time are entitled to receive larger loans in the next phase.

Such activities were found primarily in the northern part of Kaijuri Union, which is closer to Faridpur town.

#### **9.5 NEGATIVE EFFECTS**

No significant negative effects of the Project on women were detected by the RRA.

#### **9.6 LESSONS AND RECOMMENDATIONS**

Since a large majority of families in rural Bangladesh are poor there is a great need for the participation of women in income generating activities. The non-inclusion of women's issues needs to be regarded in the light prevailing economic condition in the rural areas. Women's activities need to be oriented and geared toward improving their socio-economic status. Some of the recommendations that could be made in this regard are:

- a) this type of project should involve more women workers. From informal interviews it was gathered that very few women were involved in the reexcavation of canals because of the traditional views on working outside the homestead. Therefore women must be actively encouraged to find employment in non-traditional areas;
- b) NGOs working within the Project area need to be involved in the planning stage and provide their input to women's development. They can encourage their existing groups of women in Project work, collective investment and income generating activities; and,
- c) appropriate extension channels for women need to be set up within the Project area. Through extension women should be encouraged both in vegetable production and kitchen gardening. As women are involved in taking care of livestock it seems sensible to teach them new techniques in feeding (e.g. straw treatment) and care of the animals. In the case of smaller animals and poultry the need for teaching in proper care (e.g. inoculation of chicks) of these animals is even stronger.



Table 9.1 Activities of Women in Pre and Post-Project Situation.

| Activity               | Pre-Project<br>(If present) | Post-Project<br>(If present) | Change |
|------------------------|-----------------------------|------------------------------|--------|
| Winnowing              | ✓                           | ✓                            | ↑      |
| Parboiling             | ✓                           | ✓                            | ↑      |
| Drying                 | ✓                           | ✓                            | ↑      |
| Hulling                | ✓                           | ✓                            | ↓      |
| Kitchen gardening      | ✓                           | ✓                            | ↑      |
| Care of poultry        | ✓                           | ✓                            | ↑      |
| Care of livestock      | ✓                           | ✓                            | ↓      |
| Mat weaving            | ✓                           | ✓                            | Δ      |
| Road Maintenance (IDP) | X                           | ✓                            | ↑      |
| Earth work (FFW)       | X                           | ✓                            | ↑      |
| Society membership     | X                           | ✓                            | ↑      |
| Seed bedding           | X                           | ✓                            | ↑      |

Note:      ✓ = Yes      X = No

↑ = Increased,      ↓ = Decreased,      Δ = No change

Source:      Consultants' estimates

Table 9.2 Wages for Post-Harvest Work, 1991

| Activity                 | Types of wage    |       |                 |          |
|--------------------------|------------------|-------|-----------------|----------|
|                          | Cash             | Cloth | Food            | Paddy    |
| Post harvest work:       |                  |       |                 |          |
| Upto 150 maunds of paddy | X                | ✓     | 2 meals         | 1 maunds |
| Upto 400 maunds of paddy | X                | ✓     | 2 meals         | 2 maunds |
| Month wise wage          | 100-200 Tk       | X     | X               | X        |
| Seed bedding             | 6.00/bed         | X     | X               | X        |
| FFW Earth work           | X                | X     | 33 kg/<br>wheat | X        |
| Poultry projects (BRAC)  | 27.00/<br>chick* | X     | X               | X        |
| IDP Road maintenance     | 25.00<br>/day**  | X     | X               | X        |

\* Profit per chick

\*\* Wage per day

Source: Consultants' estimates



## 10 ENVIRONMENTAL IMPACT

### 10.1 PRE-PROJECT SITUATION

About 62 per cent of the 5100 ha Project area used to be water congested occasionally or regularly during the monsoon. Medium Lowland and Lowland, which together constitute about 40 per cent of the Project area, used to remain fully submerged for five months from July to November every year (for further details see Table 4.1). At the high stages of water flow in the Kumar and Sitalakhya rivers, flood water used to flow back into the Project area through river bank spill-over.

The major beel, Sakunia, used to have at least 5 feet of water in the dry season and this used to be one of the major public fishing grounds. The older villagers of the Project area said by way of lamentation that in the past a particular date of public fishing used to be announced by beating a drum in winter and hundreds of people from distant places used to come fishing in the beel. This was a sort of celebration in the community.

According to the PP and field interviews with a cross-section of people the major effects of such serious long-term drainage congestion were :

- damage to standing Aus/Aman and Boro crops;
- partial or complete damage to vegetation especially due to inundation in the fields;
- infestation of water hyacinth which used to flow with flood water from the rivers;
- disruption of communication and misery in human and animal living conditions; and
- acute shortage of clean domestic water supplies and consequent high incidence of health hazards.

### 10.2 PROJECT OBJECTIVES

There was no explicit objective of the Project for improving the environmental conditions in the Project area. However, the attainment of the major declared objective of the Project (removal of drainage congestion) should have alleviated the environmental problems mentioned above.

### 10.3 SOURCES OF DATA

The environmental impact of the Project was appraised on the basis of qualitative data collected through a series of group interviews with a cross section of people, and personal observation of different sites of the Project. In particular, Sakunia Beel, where major hydrological changes took place, was visited several times from different directions and long village roads were traversed around the beel to directly observe the physical conditions.

## 10.4 PROJECT IMPACTS

Major environmental changes took place due to changes in the hydrological regime, which are the consequences of the construction of 8 km flood embankment, installation of two regulators on the mouth of the two major drainage channels, excavation of 16 km drainage channels, and silting up and subsequent re-excavation of these drainage channels. Additionally, one should also take into consideration the fact that the construction of large scale flood embankments along the Ganges, and the installation of large capacity regulators, has brought about remarkable hydrological changes in terms of reduced flow in the Kumar river and perhaps reduced incidence of floods.

Some of the hydrological changes that took place have positive impacts, while others have been responsible for environmental degradation.

### 10.4.1 Positive Aspects

- a) a reduction in drainage congestion problems in the Medium High and Medium Low and Low land area has led to an increase in area under cultivation. This has contributed to increased production in the boro season;
- b) in normal flood conditions, severity of inundation has been reduced, meaning that there has been an improvement in the living conditions of the human and animal population. This has also contributed to the improvement of the social environment, especially in the Sakunia Beel area (see chapter 11 for details on this point);
- c) the flood embankment in the low lying south-eastern portion is acting as the only road for transport from Joyjhap to Faridpur town via Bakhundia. The unbleached sections of the embankment in the extreme southern portion were used as flood shelters during the 1988 flood; and
- d) the reduction in the severity of drainage congestion and flood inundation has created new opportunities for pond excavation. Ponds may be utilized for fish culture as well as for supplying clean water for domestic use. Increased installation of hand tubewells has already improved the supplies of clean drinking water, but this is not considered as an impact of the Project.

### 10.4.2 Negative Impacts

- a) during the big 1988 floods, the embankment failed to protect the area from severe inundation. In the southern portion of the Project area, water congestion was prolonged because the unbleached sections of the embankment and the two regulators obstructed normal drainage of inundated water. The miseries of human and animal lives were further aggravated during the 1988 floods because people did not have boats, the number of which had decreased by about 75 per cent since the inception of the Project;
- b) the early recession of inundation water from the beels and the reduction of water depth in the beels has been responsible for a significant decline in natural fish stocks and to the virtual disappearance of migratory birds, especially from Sakunia Beel;



- c) shallow depth of water in the beels and depressions has increased the growth of snails, which act as a host of liver fluke;
- d) now that there is very little or no flood, the quality of water in the ponds and beels has deteriorated. There were complaints about parasitic insect bites from polluted water (pani poka);
- e) a number of new weeds are now seen in the crop fields. Some of these are locally called Sechi ghash (Moucha) and Deshi Kochu (local Arum). It was complained by farmers in Beelnalia villages, where there are still some drainage congestion problems, that some of these weeds fed to animals cause a new type of disease, called "cattle shivering";
- f) as there is very little flooding of crop fields in the normal years, no silt is deposited, reducing (according to farmers), the level of natural fertility of soils;
- g) while there has been a reduction of water hyacinth infestation in the B. Aman crop fields due to reduced flooding, water hyacinth has grown profusely in the Kumar river which has stagnant water, except for a few months in the rainy season. This infestation from water hyacinth obstructs boat transport from the southern areas to Bakhundia and virtually stopped boat fishing in the river; and,
- h) the condition of sanitation has worsened compared to the pre-Project situation because due to reduced flooding human excreta from the open-pit latrines cannot be washed away annually.

## 10.5 SUGGESTIONS

- a) since the potential of capture fisheries has been decreased because regulators obstruct fish migration to and from the rivers, the opportunities provided by the improved environment for pond fisheries should be utilised. One encouraging feature is that the number of ponds in the Sakunia Beel itself has increased from 2 in the pre-Project period to about 20 in the recent years;
- b) to compensate for the reduction of soil fertility due to disappearance of silts, agricultural extension programmes need to be geared up to popularize suitable cropping patterns and fertilizer applications;
- c) as regards sanitary problems, the Department of Public Health should strengthen its works for promoting low-cost sanitary latrines. NGO's should also sponsor their landless poor groups to take up manufacturing of low-cost sanitary latrines; and,
- d) the quality of water in ponds should be improved through low-cost water treatment techniques, and the Department of Public Health should also make a contribution in this regard.





## 11 SOCIAL AND INSTITUTIONAL IMPACT

### 11.1 PRE-PROJECT SITUATION

Land ownership in the Project area was highly unequally distributed as elsewhere in Bangladesh. Table 11.1 shows that 66.38 per cent farm holdings are small, 18.08 per cent are medium and 5.54 per cent are large in Faridpur Sadar Upazila, while these figures are 67.41 per cent, 27.59 per cent and 5.00 per cent respectively in Nagarkanda Upazila. The average farm size was 0.86 ha. (2.12 acres).

This was a labour surplus area. There was out-migration of labour from the Project area to the districts of Dhaka, Manikganj and Munshiganj. The wage rate differed from season to season. In most cases labourers were fed twice or three times a day as a social tradition. It was not customary to employ labour without meals. The wage rates were Tk. 15 to 20 with 3 meals. It should be mentioned here that the labourers paid in cash plus food worked morning to evening and those paid in cash without food worked up to the afternoon (local time limit is up to Zohr namaj, meaning mid-day prayer). Sometimes labourers also worked on a contract basis. Paradoxically there was some in-migration of labourers to the Project area from the district of Kushtia. A group of migratory labourers were found working in Kaijuri and Alalpur Mouzas of Kaijuri Union of Faridpur Sadar Upazila. There is a traditional labour market for in-migratory labourers in Faridpur town near the Alimuzzaman bridge.

These labourers work for a period of 2 to 3 weeks. Their actual payment depends on both parties' satisfaction. Their contract with the employer farmers turns into an informal social relation. The farmers said "They work for us and we make them satisfied on their way back home". Female wage labour for agricultural work was not practiced in the area.

At least 20 per cent of the land was under share-cropping, the arrangement being 50-50 output without any cost shared by the landowners in the case of traditional crops. In case of HYV the share cropping is 1/3 for inputs, 1/3 for landowners and 1/3 for share-croppers.

The village affairs were managed by the village Matbars (Leaders) who were members of the big land holding and traditional families. The Union Parishad was a formal institution. In Kaijuri Union the Chairman was elected alternately from two traditional families.

As it was a flood prone and lowlying beel area there was no good road infra-structure in the area. Boats were the main means of communication in the monsoon for domestic and other purposes. In other seasons earth roads were the means of communication.

There were a few formal and informal educational institutions in the Project area. There were 16 co-operative societies with 665 members under the Irrigation Management Programme (IMP) in 1984-85 covering 931 acres of land within Faridpur Sadar Upazila. There were some Farmers' Cooperative Societies, and landless Co-operative Societies organized by BRDB. Some NGOs including Palli Progoti Shahayak Samity and Bonogram-Saptagram Nari Swanirvar Samity have started working there since 1981-82. Their programmes included health, sanitation, drinking water, income generation activities like making mats and paposh, sewing and tali making. Their beneficiaries were distressed women and landless groups.

Table 11.1 Distribution of holdings and land area

| Items                           | Small Farm | Medium Farm | Large Farm | All farm holdings | NO n-farm holdings | Total Holdings |
|---------------------------------|------------|-------------|------------|-------------------|--------------------|----------------|
| <b>FARIDPUR SADAR</b>           |            |             |            |                   |                    |                |
| Number                          | 17505      | 7405        | 1462       | 26372.00          | 9606.00            |                |
| %                               | 66.38      | 28.08       | 5.54       | 73.30             | 26.70              | 100.00         |
| Owned area (ac)                 | 0.97       | 3.68        | 10.84      | 2.28              | 0.28               |                |
| % area (operated)               | 23.54      | 50.49       | 25.97      | 98.57             | 1.43               | 100.00         |
| Homestead (ac)                  | 0.08       | 0.13        | 0.19       | 0.10              | 0.05               |                |
| Net Cult.area (ac)              | 0.69       | 3.91        | 10.05      | 2.12              | -                  |                |
| Irrig. area (ac)                | 0.04       | 0.24        | 0.64       | 0.13              | -                  |                |
| % irrigated to cultivated area  | 5.14       | 6.07        | 6.37       | 5.95              | -                  |                |
| * Ag. labour households: 42.54% |            |             |            |                   |                    |                |
| <b>NAGARKANDA</b>               |            |             |            |                   |                    |                |
| Number                          | 21911      | 8969        | 1626       | 32506             | 9685               |                |
| %                               | 67.41      | 27.59       | 5.00       | 77.04             | 32.96              | 100.00         |
| Owned area (ac)                 | 1.07       | 3.71        | 10.91      | 2.30              | 0.28               |                |
| % area (operated)               | 27.73      | 47.61       | 24.66      | 98.86             | 1.14               | 100.00         |
| Homestead (ac)                  | 0.07       | 0.12        | 0.17       | 0.09              | 0.05               |                |
| Net cult.area (ac)              | 0.84       | 3.77        | 10.32      | 2.13              | -                  |                |
| Irrig. area (ac)                | 0.06       | 0.25        | 0.71       | 0.15              | -                  |                |
| % irrigated to cultivated area  | 7.05       | 6.74        | 6.92       | 6.87              | -                  |                |
| * Ag. labour households: 48.9%  |            |             |            |                   |                    |                |

Source: BBS: Census of Ag. and Livestock - 1983/84 zila series, Faridpur, pp. 33 and 35.



## 11.2 OBJECTIVES OF THE PROJECT

There was no explicit objective in the Project for improving social and rural institutions. Nevertheless there was an expectation that due to the removal of water logging and construction of embankment and irrigation facilities, rural infrastructure including communication facilities, educational institutions, farmers organization, co-operatives, informal organizations and community services would be developed for overall development of the Project area.

## 11.3 SOURCES OF DATA

The RRA data were collected from both primary and secondary sources. Primary sources included interviews and discussions with the officials of BWDB, BRDB and NGOs. Secondary sources included Project documents, maps, Government statistical publications, NGO documents and BWDB and Local Government records.

The team visited the following Mouzas and sites: Nikhurdi, Mridhadangi, Bakhundia, Mongolkot, Ichail, Bhatpara, Goradhah, Rahut Para, Chandrspara, Joyjhap, Diapara, Rasulpur, Aura Kandi, Kaijuri, Alalpur, Piarpur and Tigatia. The regulators at Beelnalia and Mridhadangi and two drainage channels were visited.

## 11.4 IMPACT OF THE PROJECT

Since the completion of the flood embankment and drainage channels, both positive and negative impacts were observed in the Project area. The impacts are highlighted below:

### 11.4.1 Positive Impacts

- a) to the extent that the draining of Sakunia Beel has contributed to an increase in HYV boro paddy production, the socio-economic condition of the villagers around Sakunia beel has also been improved to some extent;
- b) the Project also led to some 'psychological' improvement of the villagers around the Sakunia Beel. They now feel confident due to the improvement of agriculture in terms of acreage and production. There is also a subsequent development of kutchra roads in the area. In the pre-Project period the people around the Sakunia Beel felt neglected, compared to the adjacent villages. They say "Now we can marry in better terms. Earlier the people from other areas showed apathy to make any matrimonial relations with us";
- c) some positive attitudes toward the removal of drainage congestion were seen to have taken place through the re-excavation of Mirdadangi Khal by the local government of Upazila Parishad;
- d) land price has increased in Highland and Medium Highland, which may indicate that farmers' demand for production loans will have gone up and that the negotiation for institutional credit might have been easier;



- e) the improved road communications have facilitated occupational diversification into jobs such as rickshaw van puller, petty trades, rice husking, and mechanics;
- f) the improved communication system has also facilitated some social development services initiated by both government and non-government agencies. In Piarpur primary school in Kaijuri Union 386 out of 438 students were found attending classes, but this may not be attributed to as a Project impact because this area was not affected by floods to any great extent. The number of co-operatives and NGO groups has been increasing according to the reports from Faridpur Upazila Co-operative Office.

The following co-operative societies are working in region:

|    |                                 |     |
|----|---------------------------------|-----|
| a) | Union Multipurpose co-operative | 11  |
| b) | Special co-operative            | 06  |
| c) | Saving and lending co-operative | 11  |
| d) | Women co-operative              | 13  |
| e) | Fishermen co-operative          | 06  |
| f) | Autorickshaw                    | 01  |
| g) | Farmer's co-operative           | 70  |
| h) | Weavers' co-operative           | 02  |
| i) | Land Mortgage Bank              | 01  |
| j) | BRDB                            | 140 |

The figures for the pre-Project period could not be provided by the office, except that there were 8 fishermen cooperatives and 6 weavers cooperatives. This shows a decline in the community of fishermen and weavers. But for other societies it is reported to be increasing.

- g) the BRDB-LGEB activities of IDP and PEP under RSEP increased. Their groups were found working on the Tambul Khana-Gatti road. PEP activities include goat rearing, cattle fattening, fish rearing, sewing, family planning and vegetable production. Such a group was found in Sadhur hat. There were 24 Krishak Shomobaya Samities and 13 Bittaheen Shomobaya Samities (BSS) and 12 Mahila Shomobaya Samities (MSS) under PEP in Kaijuri Union. The local NGOs of Palli Pragoti Shahayok Samity and Bonogram-Saptagram have extended their activities in the Project area. They are running 15 primary schools for their groups. The BRAC Programme is known as Income Generation for Vulnerable Group Development Programme (IGVGDP). In Kaijuri Union there are 311 IGVGDP card holders. The programme is mostly concentrated on poultry. There was a chick rearing unit for Kaijuri Union. Grameen Bank formed 800 groups in the whole of Faridpur District. The bank provides loans for small trade, cattle fattening, threshed rice/muri preparation, and rice husking. Such a group was found in Char Hossainpur Mouza and Char Bakhundia.

#### 11.4.2 Negative Impacts

- a) there is public resentment regarding the reduced drainage of congested water through the regulators which have less capacity than planned. Farmers complained that they could not harvest Boro from Sakunia Beel in 1990 because of excessive rain;

- b) the reduction in boat plying during the monsoon because of the construction of the embankment caused reduction in employment of boatmen and boat makers;
- c) the reduction in open water capture fisheries led to a significant reduction in employment and income of part time and full-time fishermen;
- d) there is dissatisfaction about the absence of culverts or small bridges over the reexcavated drainage channels. This means that trafficking animals and movement of people to and from the fields have been very difficult. It was reported that 5 cattle died last year trying to cross the 10 to 12 feet deep canals in the Beelnalia and Mongolkot Mouzas; and,
- e) there is public resentment and confusion regarding the acquisition of land for the construction of embankments and excavation of drainage channels. Some portions were not acquired as they were constructed or excavated under the Food For Works Programme. In Beelnalia area, the villagers complained of new acquisition but the BWDB could not clarify the situation. The compensation money was paid but there were some problems of non-payment, especially where titles to land were not clear.

#### 11.5 SUGGESTIONS

- a) provisions should be made to develop co-operatives, credit institutions, village markets, educational institutions, community services and facilities for income generating activities in the Project area;
- b) there is virtually no public participation at any level of construction or implementation. Local formal and informal institutions within the Project area should be involved in the maintenance of the structures. There should be provision for maintenance and repair of the Project works on self-help basis by the beneficiaries; and,
- c) there is a need to involve government and NGO agencies to fully exploit the potential of the embankment as a social forestry development and as a source of employment to both distressed men and women;

#### 11.6 LESSONS LEARNED

- a) the social cost of the Project was not kept in mind at the time of planning and execution. There is no provision to address the disbenefits arising out of the Project, such as obstruction of normal movement of villagers and animals across the deep drainage channels or the loss of profession by fishermen. Any future Project should take these factors into consideration before implementation; and,
- b) in spite of the negative impacts, the Project has improved the general living conditions in the area to some extent. In general, the beneficiaries seemed to have a feeling that the Project has had some beneficial impacts, but much more benefits could be achieved by fully removing the drainage problem and by maintaining the embankment properly.





## 12 ECONOMIC IMPACT

### 12.1 PRE-PROJECT CONDITIONS

Prior to the implementation of the Sakunia Beel Project the major part of the farm income used to come from the production of B. Aus, B. Aman jute and a combination of both high and low value pulses. The cropping intensity was as low as 128 per cent as calculated from the PP. The average return per hectare of net cropped area was estimated to be Taka 2987 at 1981-82 prices, the year when the Project was being initiated.

Open water capture fishing in the river Kumar and the beels was a major source of income for the professional fishermen and the only grounds for subsistence fishing by the villages.

Being a low lying area in general, the southern portion of the Project area did not have any internal road communication and the only means of transport in the rainy season was the muscle powered country boats.

### 12.2 PROJECT OBJECTIVES

As understood from the PP, the economic objective of the Project was only implicit in the declared objective of removing drainage congestion of the Sakunia beel area and controlling floods from the Kumar/Sitalakhya river. The economic gains of the Project were intended implicitly in terms of increased production, employment and farmers income. Other forms of tangible and intangible benefits from improvement of road communication and expansion of petty trades or disbenefits from loss of captured fishery were not considered in the benefit-cost calculation.

### 12.3 DATA FOR ECONOMIC ASSESSMENT

The economic assessment has been based on the estimation of crop area and output provided in Chapter 4. These calculations are again based on the PP and PCR and extensive field visits. Data with respect to input, output and prices were drawn mainly from RRA field visits, but some were also obtained from MPO tables. The detailed sources of agricultural data are shown in Chapter 4.

### 12.4 ECONOMIC IMPACT OF THE PROJECT

#### 12.4.1 Cost of the Project

The initial investment cost of the Sakunia Beel Project was Taka 12.1 million, split over the four year period from 1981/82 through 1984/85. The cost was 38 per cent lower than proposed in the PP (PCR, Table 10, P3). This reduction in costs was due to a number of deviations from the PP including:



- i. the acquisition of 42 ha. of land against 102 ha.;
- ii. cancellation of functional building;
- iii. construction of 2 regulators instead of 3;
- iv. construction of a 5-vent regulator instead of an 8-vent regulator; and
- v. excavation of 16 km of drainage channels instead of 19 km.

As regards O&M, virtually no costs have been incurred, except that a khalashi is paid a small salary of Taka 24000 per year to operate the two regulators. As a part of major rehabilitation in 1990-91, an allocation of 113 MT of wheat (worth about Taka 0.6 million at 1991 prices) was used under the FFW programme to reexcavate part of the length of the two drainage channels.

The defective construction of Nikurdi regulator and the neglect of regular O&M has reduced the efficacy of the Project and has meant that the economic life of the Project is very likely to be far less than 50 years as proposed in the PP. Section 12.4.4 shows that the BCR and IRR of the Project appear to be low due to shorter Project life than expected in the PP.

#### 12.4.2 Benefits and Disbenefits from crops

The Project has achieved its primary goal of increasing food crops such as paddy, wheat and also vegetables (Table 12.1). The incremental output of paddy in 1990-91 is 1311 metric tons, which is about 14 per cent higher than the without Project situation. What is notable is that this increase in paddy output has exceeded the Project target as mentioned in the PP and PCR. This incremental output of paddy comes partly from about 25 per cent increase in yield of T. Aman and partly through the expansion of HYV Boro production in the Low and Medium Low areas, except where drainage congestion problem still prevails or has increased, especially in years of early heavy rainfall. The increase in HYV Boro output from High and Medium High land is not considered in this calculation of incremental benefit because that would anyhow have increased with the expansion of TWs and LLP irrigation in general.

The net incremental value (after deduction of production costs and net value of lost output) created by the Project has been equivalent to Taka 4.5 million per annum at 1990-91 prices, of which 95 per cent comes from paddy alone (Table 12.2). Again, the major contributors to the net value of incremental output are T. Aman and HYV Boro.

The major sources of negative incremental value are the decrease in area and production of B. Aman and pulses, which are jointly responsible for a reduction of about Taka 2.1 million annually.

#### 12.4.3 Disbenefits from captured Fisheries

It has been estimated in chapter 6 that the Project has been responsible for an annual loss of 123 metric tons of fish. This represents gross loss of Taka 2.5 million at 1991 prices and a net loss of Taka 1.93 million after deduction of Taka 578,100 as the cost of fish catch (at the rate of Taka 4700 per metric tons as per calculation made by the fisheries specialist). This represents about 43 per cent of the net value of the incremental production of the crop sector.

The reduction of overtopping of ponds by annual flooding has created opportunities for promoting pond fish culture. But the lack of institutional supports such as credit and extension advisory services has been responsible for very little investment in this respect, although the prices of usual pond fishes in the local market were high enough to give high profits.

#### 12.4.4 Comparison of Costs and Benefits

In this section an attempt is made to carry out a very simplistic financial analysis of the costs and benefits streams of the Project. Cost and benefits streams are derived using data available from the PP, PCR and the RRA results and shown in Appendix Table 12.5. The cost stream includes an initial investment of Tk. 12.1 million split over four years, O&M cost of Tk. 24000 per annum and reexcavation cost of Tk 0.616 million. The benefits achieved are assumed to be low in the initial years and gradually rising to their maximum level in the 8-10th year.

The benefits to be achieved from 10th year of the Project (i.e. 1990-91) were assumed constant at Taka 2.6 million (Taka 4.5 million from crop sector minus a loss of Taka 1.9 million from fisheries).

The analysis is done considering two options and the results are presented in Tables 12.3 and 12.4. In option A, Project life is considered to be 20 years and an investment of Tk. 0.616 million is anticipated in the 16th year for the reexcavation of drainage channels. In option B, Project life is considered to be 16 years, and no additional investment for repairing of structures is anticipated. The reason for assuming shorter Project life than 50 years as proposed in the PP is that one of the regulators, the main structure of the Project, has been constructed poorly so that its wing walls cracked and fell down soon after the construction, implying a shorter life of only 20 years (a detailed discussion about the quality of construction is presented in (Chapter 2).

The results of the economic analysis show that the Project gives a negative net present value under both the options, the benefit-cost ratios are less than unity and the EIRRs are lower than the opportunity cost of capital (12 per cent). The Project does not appear to be feasible from an investment point of view. The benefits of the Project were reduced significantly due to a loss of about Taka 1.9 million from open water fisheries.

These estimates of BCR and IRR are lower than the BCR of 1.36 and IRR of 19.6 per cent as estimated in the PP (p. 25). One main explanation for these differences in BCR and IRR is that the PP assumed 50 years Project life and considered only benefits from crop production, disregarding the disbenefits from capture fisheries.

#### 12.4.5 Impact on Employment and Income Distribution

The Project has achieved its employment objective to a moderate extent, compared to the without Project situation. An estimate done for the purpose of this RRA shows that 23.8 million cft of earthwork done at the construction stage, as mentioned in the PCR, created about 917 man-years of employment. In 1990-91, the re-excavation of the drainage channels at the cost of 113 metric tons of wheat created another 86 man-years of employment. The benefits of this 1003 man-years of employment accrued directly to the poorer sections of the people.



An increase in crop sector output as discussed in the previous sections generated incremental employment of about 60,000 man-days a year, (equivalent to 164 man-year, assuming 365 man-days as a full man-year) (Table 12.4). The major sources of their incremental employment are the incremental production of HYV Boro, wheat and pulses. It is understood that additional employment created for the post-harvest processing of these crops, especially the employment created in increased vegetable production, went by and large to the women members of the households, but the RRA could not quantify the magnitude of such employment.

As the fish production has been lost due to the Project, so has there been an annual loss of about 52 man-years of employment of professional or casual fishermen (as estimated on the basis of data provided by the fisheries specialist). This loss accounts for about 32 per cent of net incremental employment created in the crop sector. Added to this is the loss of employment of boatmen and the carpenters who made boats for fishing or transport purposes. Indeed, such loss of employment has an important income distribution impact, because fishermen, boatmen and carpenters who are badly affected are members of the poorer households and they are forced to take up any work at whatever wages they can get.

One positive aspect of the Project is that the improvement of road transport by means of the embankment-cum-road has opened up self-employment opportunities in non-farm economic activities, which has differential impact for different income groups. The relatively richer sections have benefitted largely from trades in agricultural commodities, fertilizer, machine spare parts, diesel and rice milling, while the poor have benefitted from petty trades and from driving rickshaw vans, especially to and from the southern portion of the Project area. However, the RRA could not arrive at any estimate of additional employment created in these activities.

#### 12.4.6 Impact on Wage Rates and Land Market

Although the cash wage rate for casual labour has increased from Tk. 20-25 to Tk. 30-40 during the Project period, this is not impacted by the implementation of the Project. Similar wage rates were also reported in the adjacent areas not influenced by this or other FCD projects. The Project had some impact with respect to increase in prices of land as the drainage improvement (drying up of beels) increased the productive value of lowlands, except in some pockets where the drainage congestion problem persists. For other areas the increase in land prices is due to increased production opportunities created by irrigation technologies.

#### 12.5 SUGGESTIONS

There is further scope for improving the benefits of the Project through a number of interrelated actions, such as further improvement of drainage provisions, repair of breached or damaged portion of the flood embankment, repair of the Nikhurdi regulator wing walls and strengthening of the agricultural extension services to encourage growing of HYV T. Aman. A regular O&M programme, which is virtually non-existent now, would also create regular employment opportunities for the poor. To minimize economic effect of the the loss of capture fisheries, the opportunities already created for culture pond fisheries should be utilized.

Table 12.1 Physical output of crops  
(in metric tons)

| Crops      | Pre-Project<br>as PP<br>1 | Expected as<br>PP<br>2 | Without Project<br>in 1990/91<br>3 | With<br>Project in<br>1990/91<br>4 | Increme<br>ntal<br>output<br>(4-3) |
|------------|---------------------------|------------------------|------------------------------------|------------------------------------|------------------------------------|
| Paddy      | 7085                      | 8822                   | 9442                               | 10753                              | +1311                              |
| Wheat      | 88                        | 646                    | 517                                | 849                                | +332                               |
| Jute       | 660                       | 524                    | 605                                | 594                                | -11                                |
| S. Cane    | 5480                      | 8960                   | 3288                               | 3288                               | 0                                  |
| Pulses     | 737                       | 916                    | 540                                | 423                                | -117                               |
| Oilseeds   | 110                       | 146                    | 110                                | 110                                | 0                                  |
| Vegetables | 110                       | 438                    | 164                                | 329                                | +165                               |

Source: i. PP and PCR  
ii. Tables 4.3 and 4.4 of Chapter 4.



**Table 12.2 Value of Incremental output  
('000 Taka at 1991 prices)**

| Crops       | Without Project             |                       |                        | With Project                |                       |                        | Net<br>Incremental<br>output Tk.<br>'000 |
|-------------|-----------------------------|-----------------------|------------------------|-----------------------------|-----------------------|------------------------|--|
|             | Gross<br>value of<br>output | Cost of<br>production | Net value<br>of output | Gross<br>value of<br>output | Cost of<br>production | Net value<br>of output |  |
| B. Aus      | 10211                       | 9710                  | 501                    | 9614                        | 8712                  | 902                    | + 401                                    |
| B. Aman     | 25986                       | 19547                 | 6439                   | 20844                       | 15680                 | 5164                   | -1275                                    |
| T. Aman (L) | 11783                       | 7728                  | 4055                   | 13996                       | 7728                  | 6268                   | +2213                                    |
| Boro (L)    | 522                         | 350                   | 172                    | 522                         | 350                   | 172                    | 0  |
| Boro (HYV)  | 20118                       | 14617                 | 5601                   | 31434                       | 22839                 | 8595                   | +2994                                    |
| Total Paddy |                             |                       |                        |                             |                       |                        | +4333                                    |
| Wheat       | 2935                        | 2601                  | 334                    | 4801                        | 3840                  | 961                    | +627                                     |
| Jute        | 7061                        | 6457                  | 604                    | 6932                        | 6340                  | 592                    | - 12                                     |
| S. Cane     | 2750                        | 2348                  | 402                    | 2750                        | 2348                  | 402                    | 0  |
| Pulses      | 6710                        | 3012                  | 3698                   | 5250                        | 2360                  | 2890                   | -888                                     |
| Oilseeds    | 1626                        | 1039                  | 587                    | 1626                        | 1039                  | 587                    | 0  |
| Vegetables  | 1640                        | 1135                  | 505                    | 3290                        | 2270                  | 1020                   | +515                                     |
| All crops   |                             |                       |                        |                             |                       |                        | +4575                                    |

- Note : i. Gross value of output includes both products and by product value.
- ii. Prices of inputs and output are based on RRA, 1991.
- iii. Hectares under different crops, yield and gross output figures are taken from chapter 4, Tables 4.3 & 4.4.

Table 12.3: Discounted Economic Cash Flow Analysis - Option A (20-yr. Project life)  
(Tk. '000)

| Project<br>Year | Financial<br>Year | Construct-<br>ion<br>(current) | O&M<br>(current) | Re-<br>excavation<br>(current) | Total<br>Economic<br>Costs<br>(constant<br>1991) | Total<br>Economic<br>Benefits<br>(constant<br>1991) | Net<br>Economic<br>Benefits<br>(constant<br>1991) |
|-----------------|-------------------|--------------------------------|------------------|--------------------------------|--|---|---|
| 1               | 1981/2            | 1341                           |                  |                                | 2753   |   | -2753   |
| 2               | 1982/3            | 2059                           |                  |                                | 3885   |   | -3885   |
| 3               | 1983/4            | 3266                           |                  |                                | 5536   |   | -5536   |
| 4               | 1984/5            | 1917                           |                  |                                | 2861   |   | -2861   |
| 5               | 1985/6            |                                |                  | 17                             | 25   | 1500  | 1475  |
| 6               | 1986/7            |                                |                  | 17                             | 21   | 2000  | 1979  |
| 7               | 1987/8            |                                |                  | 17                             | 20   | 2200  | 2180  |
| 8               | 1988/9            |                                |                  | 17                             | 18   | 2400  | 2382  |
| 9               | 1989/90           |                                |                  | 17                             | 17   | 2400  | 2383  |
| 10              | 1990/1            |                                |                  | 17                             | 616  | 2600  | 1967  |
| 11              | 1991/2            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 12              | 1992/3            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 13              | 1993/4            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 14              | 1994/5            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 15              | 1995/6            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 16              | 1996/7            |                                |                  | 17                             | 616  | 2600  | 1967  |
| 17              | 1997/8            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 18              | 1998/9            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 19              | 1999/2000         |                                |                  | 17                             | 17   | 2600  | 2583  |
| 20              | 2000/1            |                                |                  | 17                             | 17   | 2600  | 2583  |

ECONOMIC PERFORMANCE INDICATORS: EIRR %: 10.21

NPV @ 12%: -1606.97

BCR @ 12%: 0.667172

Notes: 1/ Costs before 1990-91 are adjusted to constant 1990-91 prices using the Consumer Price Index (CPI) for rural families (BBS 1990, Table 10.13).

Sources: 2/ Investment cost profile from PCR of the Sakunia Beel Project (BWDB 1985).  
O&M and re-excavation costs from Consultants' estimates during IRIA.



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Table 12.4: Discounted Economic Cash Flow Analysis - Option B (16-yr. Project life)  
(Tk.'000)

| Project<br>Year | Financial<br>Year | Construct-<br>ion<br>(current) | O&M<br>(current) | Re-<br>excavation<br>(current) | Total<br>Economic<br>Costs<br>(constant<br>1991) | Total<br>Economic<br>Benefits<br>(constant<br>1991) | Net<br>Economic<br>Benefits<br>(constant<br>1991) |
|-----------------|-------------------|--------------------------------|------------------|--------------------------------|--|---|---|
| 1               | 1981/2            | 1341                           |                  |                                | 2753   |   | -2753   |
| 2               | 1982/3            | 2059                           |                  |                                | 3885   |   | -3885   |
| 3               | 1983/4            | 3266                           |                  |                                | 5536   |   | -5536   |
| 4               | 1984/5            | 1917                           |                  |                                | 2861   |   | -2861   |
| 5               | 1985/6            |                                |                  | 17                             | 25   | 1500  | 1475  |
| 6               | 1986/7            |                                |                  | 17                             | 21   | 2000  | 1979  |
| 7               | 1987/8            |                                |                  | 17                             | 20   | 2200  | 2180  |
| 8               | 1988/9            |                                |                  | 17                             | 18   | 2400  | 2382  |
| 9               | 1989/90           |                                |                  | 17                             | 17   | 2400  | 2383  |
| 10              | 1990/1            |                                |                  | 17                             | 616  | 2600  | 1967  |
| 11              | 1991/2            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 12              | 1992/3            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 13              | 1993/4            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 14              | 1994/5            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 15              | 1995/6            |                                |                  | 17                             | 17   | 2600  | 2583  |
| 16              | 1996/7            |                                |                  | 17                             | 17   | 2600  | 2583  |

ECONOMIC PERFORMANCE INDICATORS: EIRR %: 8.08

NPV @ 12%: -2927.77

BCR @ 12%: 0.562271

Notes: 1/ Costs before 1990-91 are adjusted to constant 1990-91 prices using the Consumer Price Index (CPI) for rural families (BBS 1990, Table 10.13).

Sources: 2/ Investment cost profile from PCR of the Sakunia Beel Project (BWDB 1985).  
O&M and re-excavation costs from Consultants' estimates during RRA.

Table 12.5 Incremental employment from the crop sector

| Crops       | Without Project |       |                  | With Project |       |                  | Incremental employment (1000) |
|-------------|-----------------|-------|------------------|--------------|-------|------------------|-------------------------------|
|             | Hectare         | Md/ha | Total Md/ (1000) | Hectare      | Md/ha | Total Md. (1000) |                               |
| B. Aus(L)   | 1070            | 146   | 166              | 960          | 146   | 140              | -26                           |
| B. Aman(L)  | 2730            | 104   | 284              | 2190         | 104   | 228              | -56                           |
| T. Aman (L) | 960             | 133   | 128              | 960          | 133   | 128              | 0                             |
| Boro(L)     | 40              | 156   | 6                | 40           | 156   | 6                | 0                             |
| Boro (HYV)  | 960             | 214   | 205              | 1500         | 214   | 321              | +116                          |
| Wheat       | 420             | 88    | 37               | 620          | 88    | 55               | +18                           |
| Jute        | 550             | 213   | 117              | 540          | 213   | 115              | -2                            |
| S. Cane     | 120             | 215   | 26               | 120          | 215   | 26               | 0                             |
| Pulses      | 740             | 44    | 32               | 580          | 44    | 26               | -6                            |
| Oilseeds    | 200             | 68    | 14               | 200          | 68    | 14               | 0                             |
| Vegetables  | 60              | 270   | 16               | 120          | 270   | 32               | +16                           |
| Total       |                 |       | 1031             |              |       | 1091             | +60 (164 man year)            |

Note: 1 full man-year is assumed to be equivalent to 365 man-days.

Source: Estimated by the consultant based on Tables 4.3 & 4.4 and labour coefficients provided by MPO.



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