

COMPARTMENTALIZATION PILOT PROJECT

Implementing Agency	<i>Bangladesh Water Development Board (BWDB)</i>
Collaborating GOB Agencies	<i>LGED, DAI, DoF, BRDB, DoL, Local Govt., BADC, R&H, BWDB(O&M)</i>
Coordinating Agency	<i>Flood Plan Coordination Organization (FPCO)</i>
Consultants	<i>Euroconsult, Lahmeyer International, Bangladesh Engineering & Technological Services, House of Consultants</i>
Funding Partners	<i>Bangladesh Government, Directorate General Internationale Samenwerking (Government of the Netherlands), Kreditanstalt für Wiederaufbau (Federal Republic of Germany)</i>

COMPARTMENTS

TANGAIL

Location	Left side of the Brahmaputra river 24°-24.25°N and 90°-90.25°E
Coverage	40% of Tangail Sadar, 11% of Delduar 2% of Basail and 0.6% of Kalihati Thanas of Tangail District
Unions involved	12
Number of villages	202
Gross area (ha)	13305
Net cultivable area (NCA) (ha)	9427
No. of sub-compartments	17
Total Households (1991 census)	46990 (Rural 27789, Urban 19201)
Total Population (1991 census)	259019
Annual Rainfall (mm)	1550
Temperature (°C)	Maximum 38, Minimum 11
Rivers of Direct Influence	Dhaleswari, Lohajang, Elanjani and Punli of Jamuna
No. of Beels	46 (21 perennial)
No. of Canals	46
Existing Peripheral Embankment	55 km
Existing Peripheral Regulators	5
Land Types (% of net cultivable area)	
High (F0)	6
Medium High (F1)	30
Medium (F2)	52
Low (F3)	12
Present Cropping Intensity	203
Projected Cropping Intensity	220

PROJECT BACKGROUND

The floods in Bangladesh in the monsoon of 1987 and 1988 were on a catastrophic scale. Many people lost their life, many thousands became homeless, crops in the fields were destroyed and infrastructures severely damaged all over Bangladesh including in Tangail District.

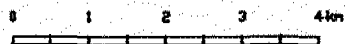
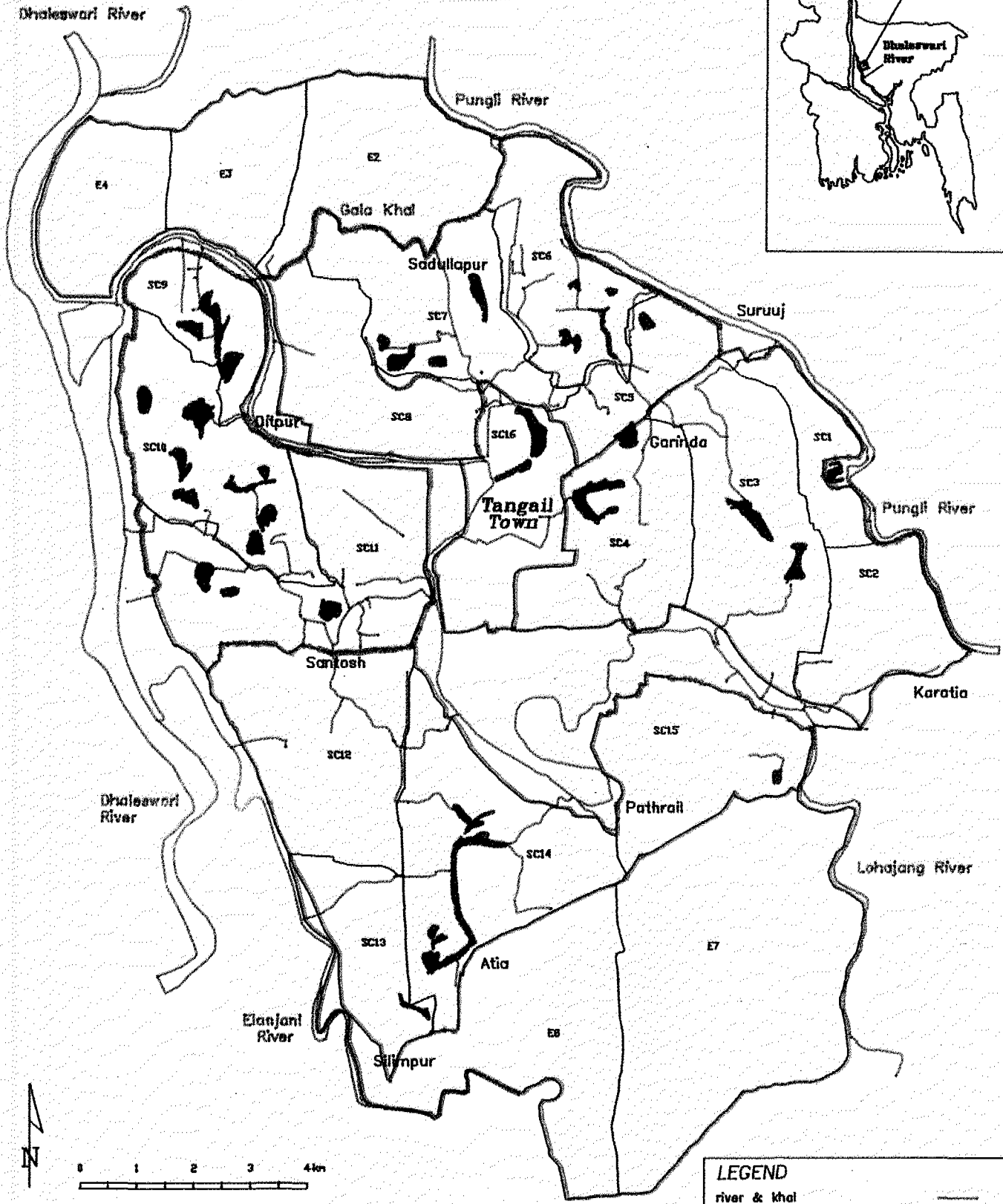
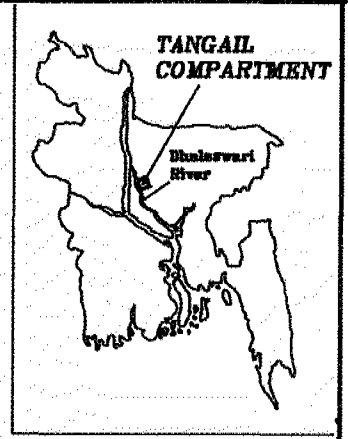
Immediately after the 1988 flood disaster, several studies were carried out by the international community to find a lasting solution to the flood problem. In June 1989, the World Bank agreed with the Government of Bangladesh to coordinate the various flood control & related initiatives. The Compartmentalization Pilot Project (CPP), approved on September 28, 1989 is one of them. This project was formally commissioned on October 21, 1991.

THE CONCEPT OF COMPARTMENTALIZATION

A compartment is surrounded by embankments with gated openings mainly at the upstream side and ungated openings mainly at the downstream side through which the in-and outflow of the flood water can be controlled. Inside the compartment, a system of channels and khals has the function of transporting the water. Natural ridges, roads and paths subdivide the compartment into hydrological units called sub-compartments. Regulators and minor structures in these roads control the distribution of water over sub-compartments. The aim is to develop, in consultation with the local population and institutions, an integrated water management system accommodating the water requirements of various sectors such as agriculture, fisheries and human habitation. During the lifetime of the compartment, these requirements may change, imposing an adjustment to the system. Therefore, the design of the compartment's structural and non-structural components requires flexible operation.

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LEGEND

river & khal	
subcompartment boundary	
cluster boundary	

C
FAP 20
P

MINISTRY OF IRRIGATION, WATER DEVELOPMENT AND FLOOD CONTROL
 BANGLADESH WATER DEVELOPMENT BOARD
 FLOOD PLAN COORDINATION ORGANISATION
COMPARTMENTALIZATION PILOT PROJECT
 Consultant: Euroconsult, Lehmayr Int. Bets Ltd., HCL

TANGAIL COMPARTMENT

THE PROJECT AREA

The area is bounded by an existing horse-shoe shaped embankment, popularly known as Karatia-Silimpur Embankment developed over a period of two decades by various agencies, along the Dhaleswari and Elanjani rivers in the west, the Lohajang and Gala khal in the north and the Pungli river in the east. The southern boundary is formed by an existing earthen feeder road between Silimpur and Karatia.

Most of the land goes under water in the monsoon season. Flooding of depressions normally begins in May-June with the onset of the pre-monsoon rainfall normally reaching its peak in July-August. Depressions are submerged 1-3 meter deep. Lohajang river flows through the middle of the project area. Several khals, such as Binnafair, Fatehpur, Suruj, Sadullahpur, Rasulpur, maintain inflow into the area from Dhaleswari river in the west, from Pungli river in the east and Gala in the north. All these rivers and khals are seasonal i.e. remain dry during winter. The main outflow is through the Lohajang river and through overland flow in the south.

GENERAL OBJECTIVE

The general objective is to provide a more secure and sustainable environment for intensive agriculture, fisheries and rural/urban development through integrated water management, and thereby improve the economic security and quality of life of the flood plain population. Specifically this will entail the testing of the water management system in the compartment under real operating conditions, addressing the relevant socio-economic, institutional and environmental issues.

OBJECTIVE: A
ESTABLISH APPROPRIATE WATER
MANAGEMENT SYSTEMS FOR THE
DEVELOPMENT OF PROTECTED AREAS.

Output 1

Establishing an **achievable** water management system;

1.1 *Physical* objectives:

- 1.1.1 controlled flooding into and within compartments
- 1.1.2 controlled drainage within compartments and between neighbouring compartments
- 1.1.3 improving agriculture and irrigation
- 1.1.4 improving fisheries and aquaculture
- 1.1.5 improving communications

1.2 *Social* objectives:

- 1.2.1 involving beneficiaries in planning, design, operation and maintenance of works
- 1.2.2 providing disadvantaged groups, particularly women, with employment opportunities

Output 2

Establishing a **sustainable** water management system;

2.1 *Environmental* objectives:

- 2.1.1 preventing environmental degradation
- 2.1.2 enhancing the environment

2.2 *Institutional* objectives:

- 2.2.1 providing appropriate local organizations
- 2.2.2 providing appropriate central organizations

Output 3

Establishing a **feasible** water management system;

3.1 *Multi-criteria* objectives:

- 3.1.1 assessing the costs, both monetary, social and environmental of compartmentalization
- 3.1.2 assessing the potential benefits, both monetary, social and environmental of compartmentalization

OBJECTIVE: B
POLICIES AND GUIDELINES FOR THE
DEVELOPMENT OF PROTECTED AREA
IN THE FAP.

Output 1

Documents and plans regarding the **structural** elements of compartmentalization;

1.1 Documents and plans on *compartmentalization systems design:*

planning procedures, outline designs, construction systems, operation and maintenance.

1.2 Special sectorial reports on *additional policies and guidelines:*

agriculture, fisheries, markets, communication including waterways

Output 2

Policies and guidelines regarding **non-structural** elements of compartmentalization;

2.1 Special reports on *social aspects:*

2.2 Special reports on *environmental provisions*

2.3 Special reports on *institutional arrangements*

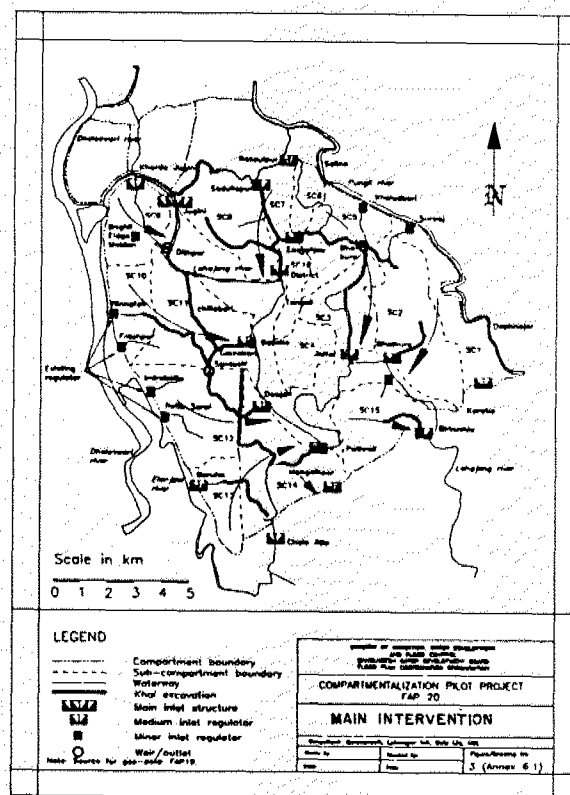
2.4 Special reports on *economic (multi-criteria) analysis*

SPECIFIC PROJECT OBJECTIVES AND ACTIONS

Primary Flood Protection

In Tangail, the existing peripheral embankment will be upgraded to 1988 flood level (1:45 year return period) plus freeboard of 0.3 m only. This level approximately equals a return period of 1:7 years with a freeboard of 90 cm. Improvement of existing embankment includes some new constructions, closing of existing breaches and retiring of some sections.

- Main inlet regulator will be a gated 5 vent structure with provision for fish migration. Possibility for navigation of small boats. Additional mitigation for navigation by development of an access road to Tangail town.
- Additional peripheral regulators will be provided at strategic locations (Khorda Jugini, Sadullapur, Rasulpur and Baruha etc.).
- Modification of existing regulators.



Drainage Improvement

- Removal of drainage congestion in pre- and post-monsoon within the framework of water management system with excavation of link canals, reexcavation of existing canals and construction of minor structures etc.
- Total length of excavation and re-excavation of all the prominent khals within the project area is assessed as approximately 120 km.
- Construction of new canals linking water congested areas to existing drainage system.
- Restoration of some unused silted up khals, such as Kalibari khal, Fatehpur khal etc.

Field Level Water Management

- Pre-and post-monsoon drainage to ensure harvesting of Boro and early planting of rabi crop, whereby in beel areas water will be retained to minimize damage to beel fisheries.
- Stabilizing monsoon season flood by controlled flooding and controlled drainage to minimize crop damage and increase higher yielding T. Aman cultivation.
- Adjustment of sill levels of khals connected to a perennial beel to enhance beel fisheries.
- To establish field level water management, each of the sub-compartments is again divided into smaller field units or chawks using the existing network of roads. Chawks are characterized by existing water bodies, water inlets and outlets, source of water for irrigation etc. A phasewise development is planned.
- A total of 32 systems comprising about 250 chawks could be identified to establish a field-based water management system.
- All the available water control structures, existing and proposed, are linked in an integrated plan.

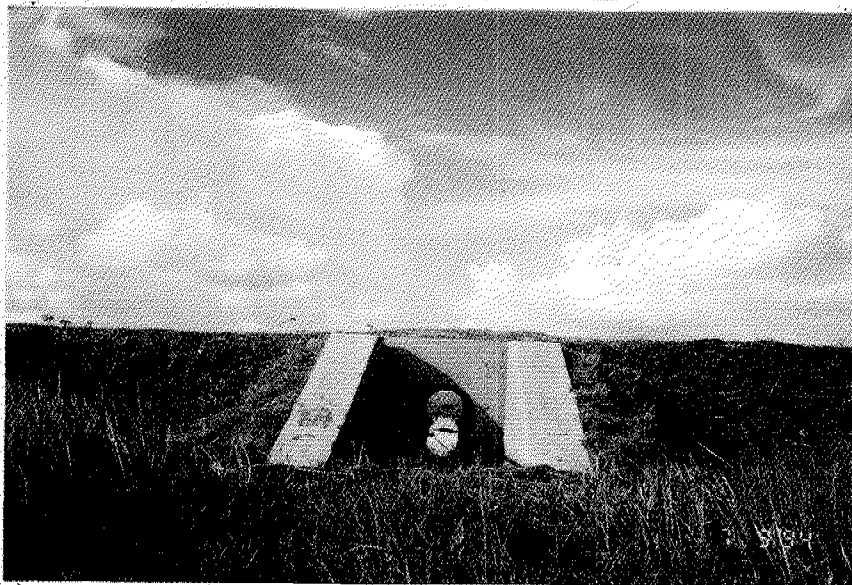
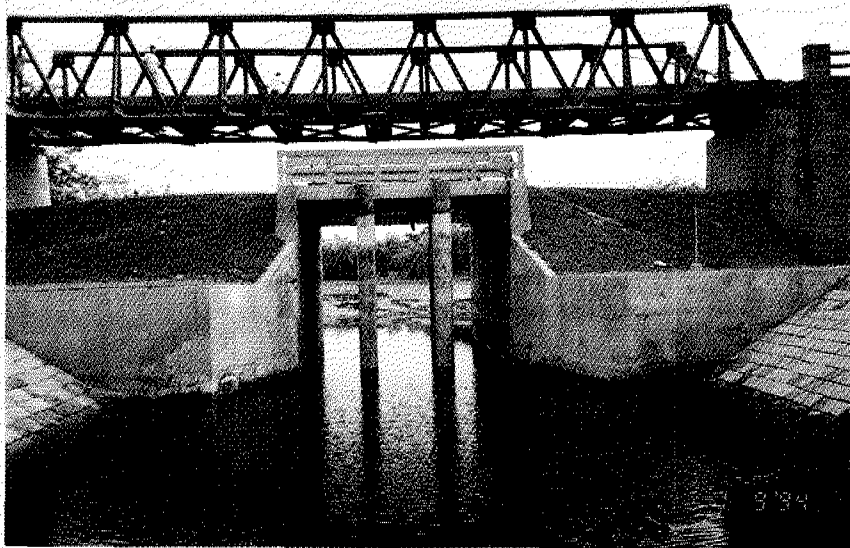
Water Retention

Water retention plays a considerable role in the overall watermanagement practices in the CPP area. The objective is to retain rainfall run-off in a specific area and gradually release into the next sub-compartment. Water retention measures may be performed by:

- the construction of bunds on the fields; and/or
- by construction of water retention structures in order to create a storage of surface water.

Associated communication improvement

A total of 80 km. of compartmental or sub-compartmental embankment upgrading is planned. These embankments also serve as network of the road system. Provision for additional 95 bridges and culverts is made.

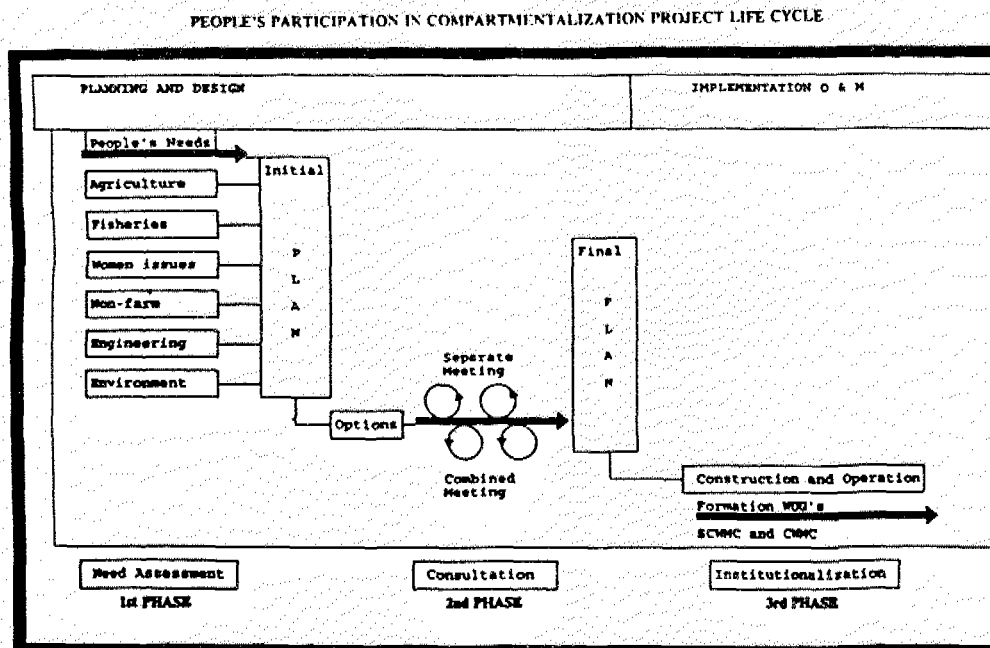


PEOPLE'S PARTICIPATION

General

Nowadays, people's participation is advocated by all major development agencies and policy makers. Nevertheless there is often confusion about the concrete meaning of this concept i.e. about who should participate in what and when. Moreover while there is a widespread consensus about the importance of people's participation, there is often a paucity of clear strategies and of an institutional framework to make people's participation a continuous process.

The strategies developed in CPP Tangail, as described below, start with identification of objective oriented interest groups and their involvement in different phases of project cycle.



Interest Groups

CPP has identified four different interest groups in the rural area; farmers, fishermen, landless, women. The household survey carried out in 1992 described their situation.

Farmers (Farming Household) : Farming households are those that operate 50 decimals or more farming land. They make up slightly less than 30% of rural households and 36% of the rural population. Of all farm households 4.5% are pure share-croppers, 23.5% are marginal farmers, 51.5% are small farmers, 15.2% medium farmers and 5.3% large farmers. Farmers evidently have a strong interest in day to day decisions regarding water management as they are expected to reap the main benefits when the situation will secure their investments and yields in agriculture.

Fishermen : There are about 325 professional and 930 part time and/or occasional fishermen households in the Tangail CPP rural area. The CPP survey reveals that 65% of rural households are involved in subsistence fishery which would represent more than 17.000 families, many at the lower end of the social strata. The management of the flood plain and beels is of general importance to the group of professional/part time fishermen and directly affects the occasional fishermen for whom the seasonal catches are important to balance their diet.

Landless (Non-Farming Household) : Landless households compose the large majority of the population in the rural area (around 70% of non farming households) and depend on employment opportunities. Landless (agriculture laborers) are expected to benefit indirectly through additional employment in the agricultural sector. Besides, the landless households will benefit from flood protection of their homesteads. The project will generate also new job opportunities for operation and maintenance of physical works.

Women : They make up slightly less than half of the population in the area. Their interests related to water management are multiple and are influenced by the household's socio-economic status and main source of income. Besides interests related to performing their traditional household tasks (drinking water, health), interests can be identified to income related activities and employment opportunities.

Participation during Planning Phase

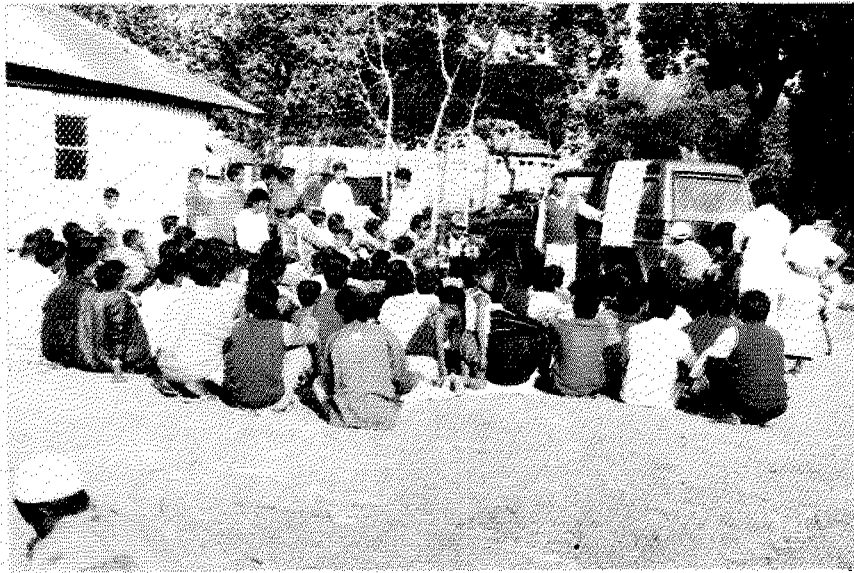
Participation at this phase is considered vital for the sustainability of a project. The project has already involved interest groups described above in stages of needs assessment and consultation process meetings.

Needs assessment : To identify people's needs and opinions a needs assessment survey by a multidisciplinary team of professionals including an engineer, agriculturist, environmentalist, sociologist and fisheries specialist was carried out. This survey aimed at identifying the ideas of different interest groups about the present situation, the existing problems and their thoughts about potential solutions. To get a direct view of the real situation, it was considered necessary to focus on water management issues which are directly and indirectly related to water resources.

The output from the needs assessment was used to draw up a number of interventions (needs assessment intervention or NAI matrix) for developing the water management system of the compartment. This matrix is discussed in more structured consultation process meetings.

Consultation Process Meetings : These meetings of the different interest groups are organized in close cooperation with relevant GOB departments (BRDB, DAE, LGED, DOF etc.) and NGOs. These are requested to invite their group members to attend the relevant consultation meetings. A meeting with each interest group covering 3-4 villages is organized and facilitated by one or more project sociologists assisted by an engineer and/or other sector specialist. In the meeting, the NAI matrix is explained followed by an open discussion.

The series of meetings with interest groups are followed by a combined meeting, one in each subcompartment, with representatives of the interest groups, elected representatives and other officials of different organizations in the sub-compartment. These meetings are usually held in the office of the elected representative. In this meeting, decisions on infrastructural interventions are finally taken.



The output from the consultation process is fed back into planning and design. Technical interventions are adjusted and fine-tuned on the basis of recommendations by these meetings.

Modification of planning as a continuous process : Modification as a result of consultation is normally accommodated in planning for implementation. Change of alignment of embankment, for example Ramdevpur, or of canals, for example Charpara; change of structure location, for example Fatehpur culvert or total scrapping of intervention, for example non-reexcavation of Singerkona-Dhalan link canal are all accomodating the wish of the people of the locality.

The wider dissemination of information through consultation often leads to new proposals or objections not foreseen initially. The transparency and flexibility of the project gives scope for better responses and exchange with the people concerned.

Participation in Implementation

In general, participation in implementation is through certain programs where involvement of disadvantaged sections of the population in implementation is guaranteed, thereby ensuring direct benefit.

Implementation by **Landless Contracting Societies**: It is proposed that of the construction work will be carried out by manual labour as much as possible. Of the manual labour, 30% to 50% will be awarded to Landless Contracting Societies(LCS), if available, preferably from the area itself. Of the labour awarded to the LCS, at least half will be reserved for female LCSs.

The Landless Contracting Societies (LCSs) are mobilized through either BRDB or national NGOs. The LCS would be registered as D-class contractor and one LCS will consist of 40 to 60 laborers, to be selected and trained jointly by CPP/BWDB and the affiliating agency; i.e. BRDB/NGO.



Participation in the Operation & Maintenance

Operation is defined as those activities that make use of the compartment's structures to control the in- and out-flow of water to the optimum benefit of the people concerned. The involvement of all people concerned in operation is deemed crucial to the success and sustainability of compartmentalization. It is at this stage that people's participation is institutionalized.

Because the beneficiaries themselves are given the chance to operate compartments and are likely to reap considerable benefits, they are expected to take a direct interest in maintaining the infrastructure provided, and will be encouraged to take over the responsibility for proper maintenance. Meanwhile, EMGs are formed to support routine maintenance of embankments.

Embankment Maintenance Groups (EMGs) : In the routine embankment maintenance, female laborers can be suitably employed. The project takes this opportunity to intervene in the highly segregated labour market, by protecting this newly generated employment opportunity for women. Thus, while the main objective of EMGs is to ensure preventive maintenance, it also needs to be appreciated as a strategy to support poor women's socio-economic development.

An EMG consists of maximum 10 female members, depending on the nature, size and length of the embankment reach to which the EMG is assigned. One EMG member is responsible for an embankment reach of maximum 500 m. An agreement has been reached with Grameen Bank to operate the payment to the women.

Institutional development strategy

- * A three tier system of representation and management within a hydrologically defined area;
- * Four parties are recognized, encouraged to participate and contribute: a) interest groups b) technical departments c) local government d) non-governmental organisations;

- * The foundation of all arrangements are the users of water and they will have the largest share in terms of numbers and, possibly, in terms of influence;
- * The arrangements will reflect the principle of "subsidiarity": what can be done, managed and decided at a lower level will **not** be done or decided at a higher level;
- * All proposed institutions should be such that they could, ultimately, be attached to **existing** government agencies. This does not mean that they will necessarily become government agencies. It means that GOB can allocate administrative, financial and regulatory responsibilities vis-a-vis such institutions to an existing Department, Board or Council.

More specifically the following arrangements are proposed:

- * Water Users Groups (WUGs) made up by a functionally and socio-economically defined category of people (farmers, fishermen, women and landless). Essentially these are relatively homogeneous groups, as far as their interest in water management is concerned. This does not exclude differences at other levels. Within one Sub-Compartment a considerable number (between 5 and 20) of Water Users Groups can exist.
- * Sub-Compartmental Water Management Committees (SCWMCs): made up by representatives of the above WUGs, selected field staff of Government and Non-Govt. agencies and 3 Union Parishad Members. This Committee will essentially be in charge of water management at this level, will facilitate local resource mobilization and upward representation;
- * A Compartmental Water Management Committee (CWMC) will be in charge of water management at the compartmental level. It will comprise representatives of the SCWMCs, technical departments, NGOs and local government. The CWMC will initially be preceded by a temporary institution: the Initial Compartmental Water Management Committee. This Committee will oversee and facilitate project implementation, interorganisational collaboration and it will advise the Project.



**CPP
AND
AGRICULTURE**



পাটমেন্টলাইজেশনপাইলট প্রজেক্ট (সি পি পি)
CPP-FAP 20/DAE CROP DEMONSTRATION
প্রদর্শনী ক্ষেত্র: উফশী রোপা আমন
চারিত্র নাম : মোঃ আলতাফ হোসেন
ধানের জাত : কিরণ (বি.আর-২২)
রোপনের তারিখ : ১৩/৯/১৩ ইং
সিনি বারবন্দনা ও ফসল উন্নয়নে গাম্ভীর্য

AGRICULTURE

Agriculture in the project area is dominated by rice crops. The dry season irrigation within the area is intensive. As a result, irrigated Boro HYV is the main crop, at present producing 50-60% of the total rice production. In years of early rainfall, Boro HYV grown on lower elevations cannot be harvested and the total rice production is hampered. In contrast, land utilization in monsoon season is minimum with 40% of the lower land remaining fallow. Low yielding Deep Water Aman predominates whereas only 5% of the net cultivable area is covered with high yielding Aman varieties. Uncontrolled floods from river water and impeded drainage are the major limitations for further enhancement of agricultural development.

Water management for agriculture :

There are four distinct agro-hydrological periods: pre-monsoon, monsoon, post-monsoon and the dry season.

Pre-monsoon (May-June): During this period the Boro is harvested. It is cultivated from low land upto high land areas. This crop may be damaged by water logging caused by excessive early rainfall or an early high stage of the river.

- Protection against river floods can be secured by the peripheral embankment along rivers. Internal road cum embankments within the project area could attenuate the flows and possibly redirect the volume of flood water.
- Protection against flooding due to rainfall can be secured by an improved drainage system enabling excess water to be drained out of the fields towards main natural drains and ultimately to the rivers. Internal sub-compartment road-cum embankments could be used for delaying the drainage process by storing a greater proportion of water than at present, both on the fields and by making use of possible storage in beels. This would reduce the water depth in low lying areas.

Monsoon (July-September): A variety of crops is grown that can tolerate different levels of flooding. Long-term aim of the project is to increase the area planted to T. Aman (HYV).

Due to the risk of high water levels from mid-July onwards, the existing situation does hardly permit the cultivation of HYV Aman. In order to improve this situation, the water levels within the compartment should be lowered.

In order to get lower water levels during monsoon within the compartment, the following elements are considered:

- Peripheral control
- Control between the Lohajang (the main drain system in the Tangail compartment) and the sub-compartments (controlled flooding and drainage)
- Control between the sub-compartments (controlled flooding and drainage)
- Water retention on the higher grounds, especially high land and medium high land.

These measures may effectively "control" a high flood situation. The high rainfall situation cannot be dealt with so effectively because after mid-July the outside areas may have a higher water level than the inside areas.

Post-monsoon (October-December): During this period the land should be drained as early as possible in order to permit the cultivation of rabi season crops from November onwards. The required water management element is the drainage of the low lying areas (not the permanent beels). This can be effected by improving the drainage system.

Dry-season (January-April): The dominant activity during this period is the irrigation of the Boro crop by means of shallow and deep tubewells. Early drainage will enable timely sowing of Boro and a slight increase in the potential area.

Agricultural Activities

Crop Demonstration Program: This programme is a core work in on-farm development in demonstrating the farm new technology adaptable to watermanagement system. This is a joint CPP-DAE collaborative effort and accomodates training of both plot operator and their wives.

Irrigation Survey: This survey gathers information on the number of existing DTWs, STWs, LLP and other made of irrigation system and their coverages, groups, ownerships, rental problems etc. This survey, already executed once, is to be repeated every two years to monitor changes in trends.

Test of Crop Suitability under development WM system: This objective is to execute the test on farmers' fields under farmers' management condition. The farms will be used to explain his operation to fellow farmers.

Crop Diversification Program: In collaboration in CDP and the DAE, demonstration of diversified crops, their importance & usage is planned.

FISHERIES

A total of 522 tons of fish is produced annually in the CPP Tangail area, of which 74% comes from beels and floodplain. Culture based fisheries is not developed and this area is one of the lowest inland fish producers of Bangladesh.

Special Fisheries Studies

A detailed 2 year study looked into four aspects of fisheries production:

Catch assessment: Catch in the area was assessed by the 'Catch per Unit Effort' method at seven different locals; 3 beels, one river and two khals.

Reproductive behaviour of beel dependant fish: This study attempted to know the time and stimulating factor for spawning of beel dependent fish species. It has been indicated that the reproduction of 'Puti' is triggered by a increase in water level of more than one meter above minimum dry season water level.

Hatchling migration: This study establish migration route of hatchlings from Dhaleswari river to the compartment via Lohajang river. This also indicated bottleneck in hatchling recruitment.

Pond survey: The results from preliminary survey of existing ponds in the project area was used in establishing the aquaculture extension program.

Water management for fisheries : The existing situation is favourable for floodplain and beel fisheries. There is free access from the major rivers into the khal, floodplains and beels for fish migration. Controlled flooding and drainage will impair this situation in two manners:

- the migration of fish is hampered by (gated) structures
- the inundated area within the compartment where the fish can feed and spawn is reduced.

A slight compensation for the generally negative effect for beel fish is obtained when the highest water level after August is maintained throughout the monsoon season by controlled drainage, thus partly maintaining the feeding ground for beel fish. This is also beneficial in years with a very modest river flood.

The water management elements as required for agriculture are adjusted in order to minimize the negative impact for fish. Some of the key control structures are designed to make them fish friendly. Moreover, proposals are made (described below) to develop pond culture fisheries to mitigate the production loss.

ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is based on the Environmental Impact Assessment (EIA) Case Study and the adjusted EIA matrix for Tangail CPP. This EMP is made up of four main elements, namely Environmental Protection Plan, Environmental Monitoring Plan, Public Participation Programmes and Implementation framework. The Environmental Protection Plan (EPP) is the key element of the EMP and this includes

- Anticipatory Planning for environmentally sound planning and management for construction, operation, and maintenance of physical structures, and sustainable development for agriculture and fisheries;

- Mitigation Planning to reduce the adverse impacts to a minimum for agriculture, fisheries and navigation;
- Contingency Planning to prevent accidental events or to minimize natural hazards,
- Compensation Planning for land acquisition for construction sites and community wetland conservation; and
- Resources Management Plan regarding social forestry on embankments/roads and homesteads, waste treatment in village ponds and canals, and fisheries development through aquaculture.

Other issues relevant for environmental management are covered by activities of other sections such as engineering, agriculture, fisheries, institution and women in development. This Environmental Management Plan therefore gives special emphasis on the following issues :

- * Implementation of Community Wetland in one or two beel areas (Bara Beel/Gharinda Beel/Jugini Beel)
- * Social Forestry Programme in approximately 20 kms of embankment/road and in two pilot areas of homesteads
- * Waste Treatment Programme in some pilot areas of village pond/canal and handloom factory effluent
- * Soil Fertility Monitoring in some selected sites inside the compartment with and without flood water inundation and outside the compartment under natural conditions
- * Groundwater Availability Monitoring in some selected sites of BWDB/BADC/DPHE groundwater observation wells
- * Water Pollution Monitoring in 7 key sites e.g. Tangail khal, Baruha khal, Darun beel, Jugini beel, Santosh dighi and two tubewell waters

SPECIAL SOCIO-ECONOMIC FOCUS

Women in development aspects

- In the Planning and Design phases, Household and Needs Assessment Surveys have been conducted where women's position and interest were given special attention.
- Organised Women's groups were explicitly involved in the consultation process to share experience on technical and possible institutional interventions.
- In cooperation with EIP, a WID gender-planning training was conducted.
- Landless poor, including women, have been organized in Landless Contracting Society (LCS). They will also be organised as Embankment Maintenance Groups (EMG) to be involved in maintenance works on embankments.
- Women representatives are members of the Sub-Compartmental Water Management Committees (SCWMC).
- A training course for women (female farmers and wives of farmers) with interest in agricultural production has been organised in cooperation with the DAE.

Land acquisition & resettlement

In the project, an estimated 190 hectares of land will be acquired with due compensation. A study is examining how land owners are affected by land acquisition, to assess the extent of resettlement pattern, immediate effect and impact of the land acquisition and to know the nature of utilization of the compensation money towards resettlement.

Human resources development through training

The project is executing a wide range of human resources development training programs covering policy planners, field level extension personnel and PAPs (Project Affected People). The training activities of PAPs focus on occupational need based activities i.e. technical

aspects of water management, conflict management through group discussion, crop diversification, integrated pest management, aquaculture training for fish pond owners and other socio-economic dimensions.

Bilateral Associates from the Netherlands are gaining on-field work experience of multi-faceted aspects of a water sector project. They are also sharing their expertise with national counterparts.

The project also hosts to academic research work to Bangladeshi and Dutch students. Three students completed their thesis : one for Dhaka University and two for Wageningen Agricultural University. Besides, one BUET graduate is working as a fellow to specialise on GIS and its applications.

SPECIAL SUPPORT STUDIES

Flood management and structure operation modelling

The purpose of hydrological modelling exercises is to obtain estimates of expected changes in water level through operation of proposed structural interventions in a computer simulation. Based on expected changes, further refinement in operation of structures will be developed. A general water management plan for the entire Tangail compartment has been the basis for the design of the main structural interventions.

Tangail town integrated WM and development study

This study aims at the formulation of a comprehensive development plan for Tangail town, based on the identification and solution of water-related problems. Development scenarios are made for all aspects concerning flood protection, water congestion, water pollution and related aspects like roads and water ways, water supply, sanitation and waste disposal.

From a number of recommended proposals, the project plans to implement the following in active cooperation with the Tangail Pourashava:

- a) Conversion of Tangail khal partly into pucca 2m wide drain (1.7 km) and the remaining earthen drain (5.0 km) connected to drainage system of Jalphai regulator.
- b) Construction of flushing unit at the connection of Tangail khal and Lohajang river to facilitate flushing of Tangail khal.
- c) Construction of four outfalls with link drainage for removal of water congestion in certain areas of the town.

Tangail transport and market study

The main objective of this study is to undertake an assessment of priority development and investment needs with respect to infrastructure particularly in the areas of the communication network of people and merchandise, and the accessibility and physical environment of markets and growth centres in order to facilitate rural economic activities through easy inflow and outflow of commodities and unhindered mobility of the people.

MONITORING & EVALUATION

Monitoring & Evaluation of the project activities and impacts are important. The project at this stage, enters into the phase of establishing an integrated system of monitoring. The general plan is to establish:

A. Progress evaluation

- Physical
- Financial

B. System establishment and operation monitoring

- Institutional
- Operating
- Maintenance

C. Impact assessment monitoring (as part of multi-criteria analysis)

- Socio-economic
- Environmental
- Institutional

Results of these and associated studies will be the basis for recommendation on the concept of compartmentalization for possible replication elsewhere in the floodplain of Bangladesh.

DIRECT PROJECT IMPACTS

Positive impacts

- Primary flood protection measures will prevent damages of physical infrastructure, private property and crop production worth of about Tk. 1.0 crore annually.
- An integrated water management system will be available at the field level.
- The cropping intensity will gradually rise from 200% to 220%.
- There will be expansion of T.Aman (HYV) area from 500 ha to more than 2000 ha.
- Incremental rice production is estimated to be 9000 tons annually.
- Opportunities for employment generation will be increased. The manual labour requirement to implement structural measures alone is estimated to be 20,000 man years. Additional employment in agriculture will be available.
- Communication network developed with additional culverts and bridges.
- Technical training to PAPs.

Negative impacts

- Based on a two-year 'Special Fisheries Study' the fish production is estimated at 522 tons/year. A loss of fishing area within the compartment is expected and estimated to incur a loss of 97 tons of fish production annually if no mitigation measures would be taken.
- Land acquisition of 190 ha will be required to implement structural interventions, resectioning of embankment, construction of link canal etc. Affected land owners will be duly compensated.

In Tangail, navigation for all kinds of smaller country boats is only possible from late June to mid-October (3.5 months). Gated structures will hamper the free movement of boats with the exception of the Main inlet and Sadullahpur.

MITIGATION MEASURES

The need for mitigation measures arises when projects interventions have a negative impact on the area. Mitigation measures have been proposed so far for the following sectors.

Fisheries

It is estimated that with additional activities on floodplain fisheries, by implementing the beel concept and through development of aquaculture, these losses will not only be mitigated but an additional 105 tons of fish production can be obtained annually. The measures are :

A. Increased natural recruitment : The objective is the restoration and facilitation of the migrating route for the riverain species to the floodplain. This increased recruitment is possible quite easily. A sand rim at the mouth of the Lohajang river from Paikmuri to Ramdebpur is probably the obstacle. The proposal to excavate this section in construction year 1993-94 was delayed due to land acquisition procedures.

B. Aquaculture extension programme : To ensure estimated fish production through aquaculture, a comprehensive extension programme has been drawn including inventory, motivation, training and demonstrations. It is planned that ponds of the whole Tangail compartment will be brought under this programme in three years in line with the schedule of physical development. This programme is now being executed in SCs 9, 10 and 11.

C. The beel concept : Results of the Special Fisheries Study indicated that the reproduction of Puti (*Puntius sophore*) is triggered by an increase in water level in the beel and that a water level rise of more than one meter is needed. It is proposed to maintain this water level rise in the beel through the introduction of a sill level which is 1.5 m above the average minimum dry season water level. Introduction of the beel concept will allow the beel dependent fish to reproduce in time and thereby guarantee the recruitment of beel dependent species to the floodplain.

Boat navigation

A detailed boat traffic survey was conducted on two major navigation routes. Based on results, the following measures are being implemented :

- a) The vent size of the main inlet is kept 3 m wide, enough for passing of small boats
- b) All the gates will be kept open till mid-July or later depending on the flooding situation of the year
- c) Improvement of road connecting the main inlet and the Tangail town.
- d) Improvement of alternative access road such as Ramdebpur - Jugini hat - Tangail road has been done
- e) Construction of mooring places for loading and unloading of cargo at Ramdevpur & other places.

Tangail adjacent areas including refuge sites in combination with Dhaleswari Mitigation Plan

Areas adjacent to Tangail compartment have been subdivided into six smaller units, E1 through to E7 excluding E5. E1 has recently been incorporated within the compartment. E2, E3 and E4 are northern and E6 and E7 are southern sub-compartments.

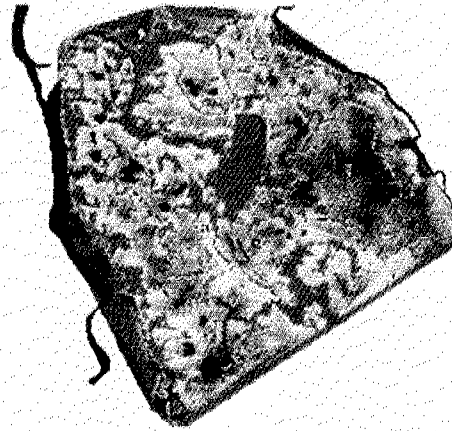
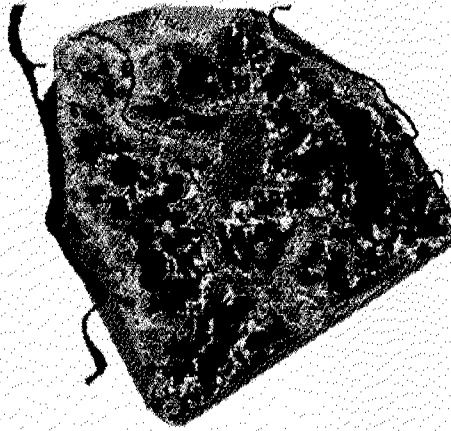
From model simulation, the following can be concluded for areas outside the compartment:

- a) The highest rise of waterlevel is in the area just upstream of the compartment (40 to 50cm). A higher flood gives a relatively lower rise in waterlevel. The latter phenomenon is found for all areas.
- b) The impact on the Pungli floodplain is considerable. At the confluence of the Pungli with the Gala khal a rise of 30 to 35cm is found. The rise in waterlevel extends up to some 10 km in up- and downstream directions with normal slope.
- c) The impact on the Dhaleswari river is modest; ranging from 5 to 7cm while the effect extends about 10 km in up- and downstream direction.
- d) There is no effect on the waterlevels on the southern boundary.
- e) The Dhaleswari mitigation plan has been established based on the expected impact from the construction of the Jamuna bridge over the Brahmaputra river, north from the Tangail compartment. It is expected that closure of one of the intakes from the Jamuna river to the Dhaleswari floodplain, will decrease the annual maximum waterlevels, which would mitigate the above mentioned effect.

After a thorough investigation, physical survey and consultation with local people including the Chairmen of the area, 17 refuge sites have been recommended for development. Refuge sites will be used as shelter space in the event of higher water level rise. Refuge sites are proposed for construction in the FY 1994-95 under the FFW program of the O&M Division of the BWDB.

Simulated Impact on Flood Levels - 1987

- Depth (m)
- 0.00 - 0.50
 - 0.50 - 1.00
 - 1.00 - 1.50
 - 1.50 - 2.00
 - 2.00 - 2.50
 - 2.50 - 3.00
 - Above 3.00
 - Flood Free



August 20, 1987 (Without Project)

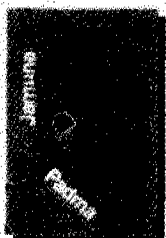
August 20, 1987 (With Project)

- Flood Level Change
- None/Slight
 - Increase (m)
 - Above 0.40
 - 0.30 to 0.40
 - 0.20 to 0.30
 - Decrease (m)
 - 0.20 to -0.50
 - 0.50 to -0.80
 - 0.80 to -1.10
 - 1.10 to -1.40
 - Below -1.40
 - Now Dry
 - Now Wet
 - Flood Free
 - Sub-Compartment



Change in Flood Levels Because of Project

(Red shades show an increase in flood level
Purple shades show a decrease in flood level)



INTER-ORGANIZATIONAL COOPERATION

Six other GoB departments, DAE, BRDB, DoF, BADC, DoL and LGED and the Tangail Municipality are cooperating partners. They work as an extended project team and discuss project progress and problems as and when necessary. Collaborative activities are going on more with DAE, BRDB and DoF. Similarly also cooperation with NGOs are also developing. A number of activities and studies are being executed through them.

INFORMATION DISSEMINATION

Annual review workshop

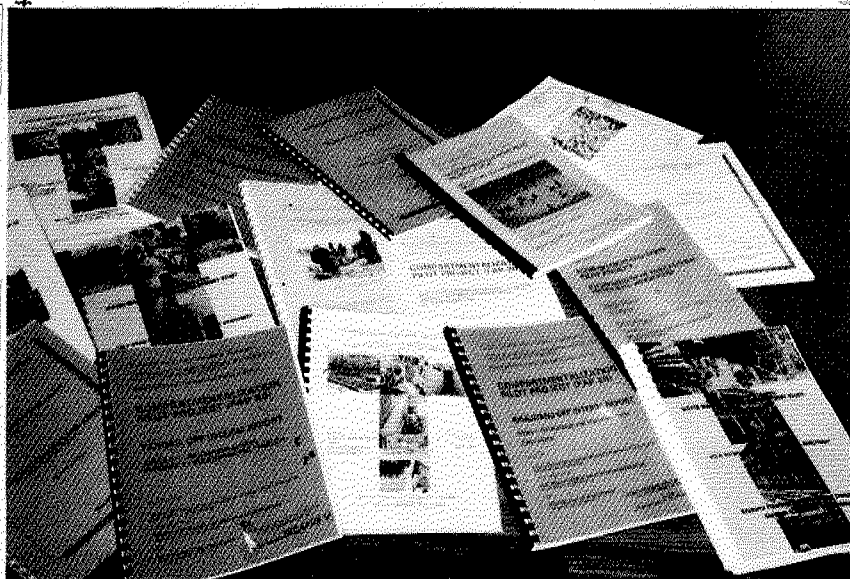
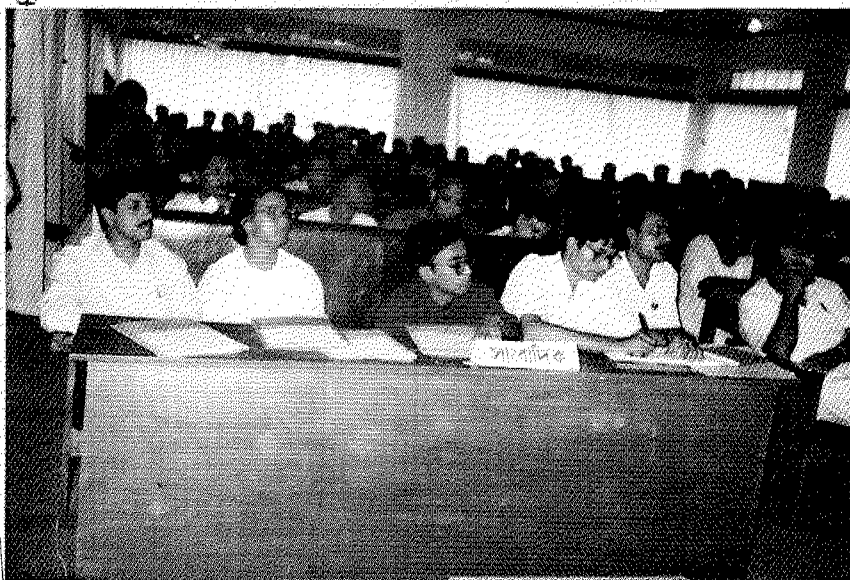
Annual review workshops were organized, both in 1992 and 1993 at the Tangail District Council Auditorium. Participants included Local Minister, Local MPs, UP Chairmen, Journalists, Intellectuals, Professionals and District & Thana level Govt-officials. In these meetings progress, programs and bottlenecks are presented. Sufficient time is always reserved for questions & answers. A similar meeting is scheduled in December 1994.

Publications

The output of the project includes a series of reports, guidelines & manuals. The project has submitted interim reports covering Baseline Survey, Topographical & Hydrological Survey, Needs Assessment Survey and subjects covering agriculture, fisheries & aquaculture, mathematical modelling, institutional aspects & training programme & environmental impact assessment. Apart from Annual Reports, Quarterly Progress Reports, various sectorial reports, regular series of technical notes and working papers are produced & distributed to related professionals. Copies of these reports are available on request. The list of publications is updated regularly.

Information dissemination centre

The project has opened a Information Dissemination Centre of CPP to undertake the responsibilities of information preparation, presentation, production, dissemination and

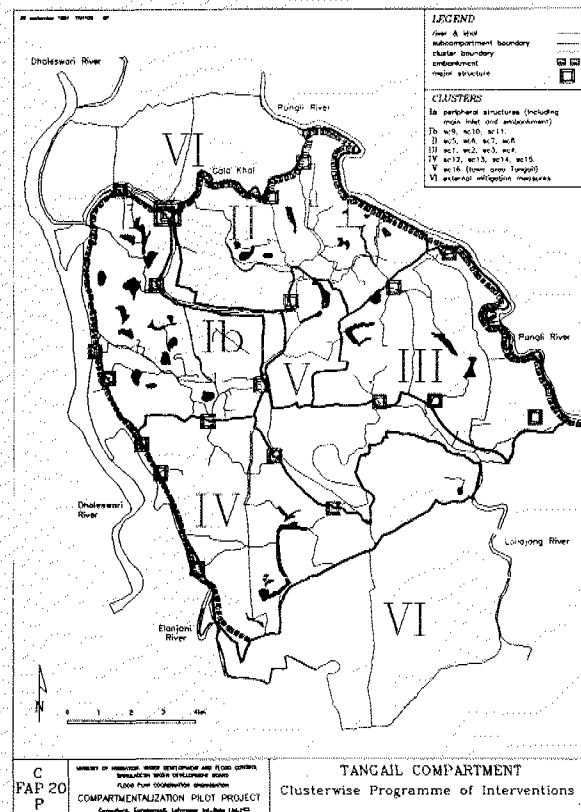
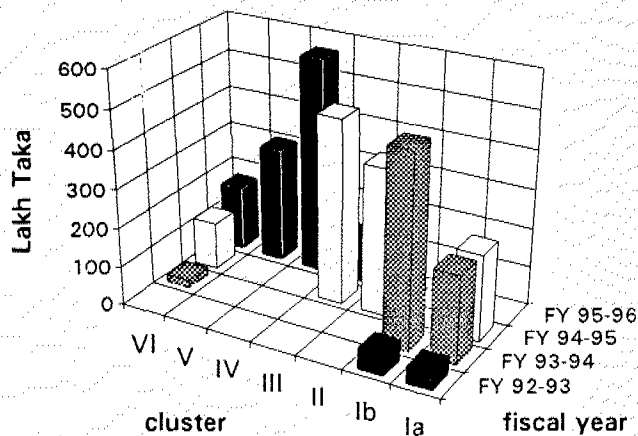


feedback including monthly publication of a newsletter. IDC will mainly cater to the need of residents of Tangail town including journalists & visitors to Tangail. The centre is enriched with maps, display materials, photographs depicting activities and others. A 15 minute video presentation of the project is made on the hour every day.

PROJECT COSTS

The approximate physical intervention cost for the period August 1991-December 1997 amounts to approx. Tk.36 crore (equivalent to approx. US\$ 9 million).

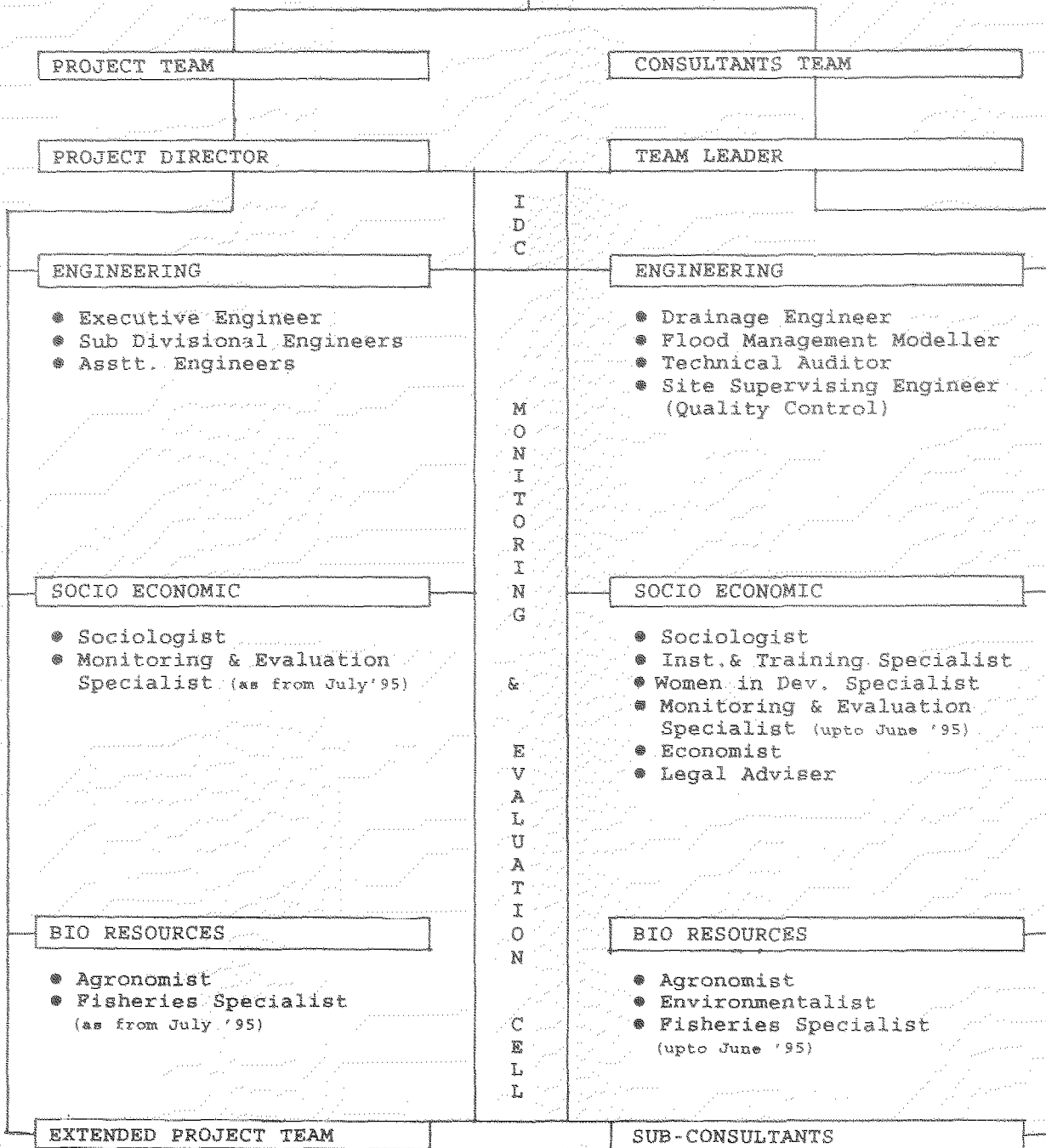
These costs are financed through external contributions from the German and Dutch government, while the local costs will be borne by GOB.



CPP : "MILESTONES" IN DECISION MAKING PROCESS

SEPTEMBER 1989	APPROVAL OF THE PROJECT
AUGUST 1991	START
OCTOBER 1991	OFFICIAL OPENING IN THE PRESENCE OF SEVERAL MINISTERS, INCLUDING MR. JAN PRONK, MINISTER FOR DEVELOPMENT COOPERATION FROM THE NETHERLANDS
DECEMBER 1991	DRAFT INCEPTION REPORT
APRIL 1992	REVISED INCEPTION REPORT WITH ADJUSTED TA UPTO JUNE 1993
JUNE 1992	FPCO MEETING. CONFIRMATION THAT ACCORDING TO TOR OPTIONS FOR TESTING THE CONCEPT WILL ONLY BE CONSIDERED FOR PROTECTED AREAS. DECISION THAT FOR TANGAIL CPP PROTECTION WILL BE PROVIDED BY (UPGRADED) EXISTING HORSESHOE SHAPED KARATIA-SILIMPUR EMBANKMENT
JULY 1992	FIRST REVISED TAPP CIRCULATED
SEPTEMBER 1992	INTERIM REPORT CPP TANGAIL
OCTOBER 1992	PA MATRIX DISCUSSION IN TANGAIL
OCTOBER 1992	DONOR REVIEW MISSION, WITH RESULTING REQUEST TO PREPARE REVISED MANNING SCHEDULE AND RELATED COST ESTIMATE
DECEMBER 1992	13 DONOR REPRESENTATIVES VISIT TANGAIL INCLUDING AMBASSADORS OF NETHERLANDS, GERMANY & UNITED STATES AND CHIEF OF MISSION OF THE WORLD BANK
DECEMBER 1992	GENERAL INFORMATION MEETING MP'S AND OTHERS IN TANGAIL
JUNE 1993	TECHNICAL COMMITTEE APPROVES TANGAIL INTERIM REPORT
SEPTEMBER 1993	"DEMONSTRATIONS" ORGANIZED BY ANTI-FAP ACTIVISTS FROM <u>OUTSIDE</u> TANGAIL
OCTOBER 1993	CONFIRMATION BY POLITICAL LEADERS PEOPLE'S REPRESENTATIVES, LOCAL PROFESSIONALS, INTELLECTUALS AND JOURNALISTS, THAT CPP SHOULD BE IMPLEMENTED WITHOUT DELAYS
OCTOBER 1993	DONOR REVIEW MISSION, RESULTING IN MOU. REQUEST TO PREPARE REALISTIC COST ESTIMATE BASED ON REALISTIC PLANNING
DECEMBER 1993	SUBMISSION INTEGRAL PLANNING AND CONSTRUCTION COST ESTIMATES TANGAIL+SIRAJGANJ
DECEMBER 1993	1ST STEERING COMMITTEE MEETING
JANUARY 1994	FPCO SENT INTEGRAL PLANNING REPORT TO DONORS
JANUARY 1994	ANNUAL REPORTS 1992/1993 SUBMITTED
MARCH 1994	REVISED TAPP APPROVED
JUNE 1994	DONOR REVIEW MISSION, RESULTING IN MOU. DECISION TO SPLIT PROJECT INTO TWO COMPONENTS: CPP TANGAIL AND CPP SIRAJGANJ
OCTOBER 1994	REVISED PROJECT DOCUMENTS SUBMITTED. FOR CPP TANGAIL (1995-1997) AND FOR SIRAJGANJ (1995-1998)
NOVEMBER 1994	VISIT MISSION ROYAL NETHERLANDS EMBASSY
DECEMBER 1994	THIRD REVIEW MEETING. OPENING INFORMATION DISSEMINATION CENTRE. VISIT HIGH-LEVEL MISSION OF FEDERAL REPUBLIC OF GERMANY.

CPP



District level officers of
DAE, BRDB, DoF, DoL, BADC,
LGED & MUNICIPALITY

On contract basis as
required

CPP Multi-disciplinary Team

- *Project Background*
- *The Concept of Compartmentalization*
- *The Project Area*
- *General Objective*
- *Specific Project Objectives and Actions*
- *People's Participation*
 - Interest groups*
 - Participation in planning phase*
 - Needs Assessment*
 - Consultation Process Meetings*
 - Participation in Implementation*
 - Landless Contracting Societies (LCS)*
 - Participation in Operation & Maintenance*
 - Embankment Maintenance Groups (EMG)*
 - Institutionalization of Participation*
 - Institution Development Strategy*
 - Institutional Arrangement*
- *Agriculture*
 - Water Management for Agriculture*
 - Agricultural Activities*
- *Fisheries*
 - Special Fisheries Studies*
 - Water Management for Fisheries*
- *Environmental Management Plan*
- *Special Socio-economic Focus*
 - Women in development aspects*
 - Land acquisition & resettlement*
 - Human resources development through training*
- *Special Support Studies*
 - Flood Management and Structure operation Modelling*
 - Tangail Town Integrated WM & Development Study*
 - Tangail Transport & Market Study*
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 - Negative impacts*
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 - Tangail adjacent areas including refuge sites in combination with Dhaleswari Mitigation Plan*
- *Inter-organizational Cooperation*
- *Information Dissemination*
 - Annual review Workshop*
 - Publications*
 - Information Dissemination Centre*
- *Project Costs*

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