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Government of the People's Republic of Bangladesh

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

BANGLADESH ACTION PLAN FOR FLOOD CONTROL

COMPARTMENTALIZATION PILOT PROJECT (FAP 20)

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INCEPTION REPORT MAIN VOLUME

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Government of the People's Republic of Bangladesh

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COMPARTMENTALIZATION PILOT PROJECT
FAP 20

Ministry of Irrigation, Water Development and Flood Control

PROJECT OFFICE :
B.B. Girls High School Road, Akur Takur Para, Tangail

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15 April 1992

TO: The Chief Engineer of the
Flood Plan Co-Ordination Organization
72, Green Road
Dhaka-1215

Our reference : 1101/182
Regarding : **Inception Report**
Enclosures : 30 copies

Dear Sir,

We have the pleasure to herewith submit to you 30 copies of the revised and updated version of FAP 20's Inception Report (Main Volume and Annexes Volume).

A copy of the Inception Report has been sent to the people and organizations mentioned on the attached distribution list. We understand that you will distribute copies to the relevant FAP-projects and BWDB organizations.

Yours sincerely,

Md. Obaidur Rahman,
Project Director

Paul Zijderveld,
Team Leader

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April 1992

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i EXECUTIVE SUMMARY

Regarding the objectives of the Compartmentalization Pilot Project (FAP 20) the Terms of Reference (TOR) state the following:

> *"The overall objective is to establish appropriate watermanagement systems for the development of protected areas so that criteria and principles for design, implementation and operation can be made available for the Action Plan. Specifically this will entail the testing of the compartmentalisation concept in the field under real operating conditions, addressing all the relevant socio-economic, institutional and environmental issues, and trying out water control works and water management system."* [TOR, page 4]

As specific objectives are mentioned the establishment of watermanagement systems which are feasible, achievable and sustainable by examining physical, social, environmental institutional and economic aspects.

Two areas have been selected to test the compartmentalization concept; one near Tangail, in the un-protected flood plain and facing drainage congestion and flood damage, the other near Sirajganj, an area behind the Brahmaputra Right Embankment. This area is now facing serious flooding problems due to breaches in the embankment. The project officially started on the 12th of August 1991, and will continue for a period of 4.5 years.

It is of fundamental importance that compartmentalization leads to a sustainable development. This implies:

- proper resource management,
- people's participation,
- focus on the disadvantaged,
- proper institutional setting,
- feasibility,
- flexibility.

Those elements are addressed in this report and are central in the programme.

The reconnaissance, preliminary and baseline surveys are the base for planning the compartments. The surveys have been formulated, initiated, and some completed. Baseline surveys comprise household surveys, hydrological surveys, sub-compartmental surveys and institutional surveys. These surveys run up to October 1992 for Tangail and up to March 1993 for Sirajganj. An exception to this are the hydrological surveys; 14 (later 30) gauges in Tangail and 20 in Sirajganj will be observed throughout the project period.

A basic input for the development of the compartments is the multi-disciplinary sub-compartmental survey. The compartment has been divided into hydrological sub-units (in Tangail: 16 and the flood plain of the Lohajang) and through a rapid rural appraisal approach, the present situation and the development needs, as perceived by the people are assessed. Then the targets for the development of the compartment will be formulated,

possible technical interventions and the required institutional arrangements will be defined. After screening the options, a manageable set of scenarios for the development of the compartment will be formulated. One of these alternative scenarios will be chosen at the end of the consultation and decision making process. Besides the resectioning of the embankments where required, they include the following physical options, and combinations of those:

- drainage improvement;
- semi-controlled floodwater management (throttled inlets);
- controlled floodwater management (gated inlets);
- sub-compartmentalization.

To these scenarios will be added the "zero option" as a reference and to justify the viability of the other options.

For each of these scenarios, the hydrological effects of the physical interventions will be investigated, amongst others with the help of mathematical models. The model for the Tangail compartment (based on Mike 11) is already operational; the one for Serajganj will be operational by December 1992. Historical hydrological data have been rated on flood damage effect; (1987 is flood-damage-exceeded in 1:10 years). Selected years with certain probable flood damage effect will be used for model runs. For those years, the effects of flooding in the compartment under the various development scenarios is analyzed, and, in particular, the development potential on agriculture and fisheries under revised flooding conditions assessed and quantified. Costs and benefits will be quantified for each intervention and the social, environmental and institutional implications will be valuated as far as possible. Based on a multi-criteria analyses, the scenarios will be weighted, and a selected number (2 or 3) will be presented for feedback to the relevant local GOB departments, elected officials, and, most important, to the people living in the compartment (sub-compartmental meetings). This consultation process will take a period of three months. The weighted scenarios for the Tangail compartment will be presented by the end of June 1992. By early October the final development scenario will be recommended.

Implementation of physical works, rehabilitation of river banks, was intended to start during FY 1992 - 1993, but could not be materialized due to non-inclusion of river training works in the TAPP and due to land acquisition problems. Works will be implemented from December 1992 onwards, divided over 2-3 dry seasons. An O&M programme, following guidelines of the Systems Rehabilitation Project and a programme on monitoring and evaluation, both to be defined later on in 1992, will run parallel.

Special Studies will support the programme. They have to be accommodated under TA financing, although at present, available funding is a constraint. A first study, on fisheries, has been defined and will be implemented in cooperation with FAP 16 and FAP 17, the FAP projects on environment and fisheries. The study will start in May 1992, after approval, and will continue for a year. Major attention will be given to a forgotten fisheries sector, the "miscellaneous" fish, good for 70% of the catch and protein consumption in the floodplains, and essential particularly for the landless and small farmers. In the technical field solutions will be found so that early (limited) rise of water will take place in beels, and for that reason spawning will be in time and will reduce "miscellaneous" beel fish to fall pry to river fish, entering the plains during floods. Other

possible studies are indicated in the report as well. In the Interim Report, due by October 1992, some of them will be included as a proposal.

Construction of the Jamuna bridge will have far reaching consequences, also for the Tangail compartment. Under the Dhaleswari Mitigation Plan, various options for handling the Dhaleswari water have been looked into and the closing of the Northern Intake jointly with the construction of a 22 km-long guide embankment has been recommended. It is the opinion of FAP 20 that certain major consequences have been overlooked in this plan. FAP 20 has strong reservations for reason of probable sedimentation at the northern and main Dhaleswari intakes and its consequences (drainage congestion!), as well as to the probable social effects of this option. Mean annual peak water levels at the northern intake of the Tangail compartment will fall by 1.40 m, which will reduce the area flooded by more than half. FAP 20 has proposed FPCO to advise the competent authorities to assess the extent of morphological changes that will result from this mitigation option and to investigate an alternative plan.

The Project Team, responsible for the implementation of the project, is not yet complete. The non-engineers (2 socio-economists, 2 agronomists) still did not join. To fill up this gap, arrangements have been made to augment the PT with national consultants. In Tangail also experts from other departments will strengthen the Project Team. For this, government orders have been issued.

The multi-disciplinary PT will do the implementation of the baseline survey and other project activities in the Sirajganj Compartment. Actually this has already been started with the placement of the gauges and the supervision over the topographical survey in CPP Sirajganj.

In the original time planning, the major input of the Consultants Team would be finalized before the end of 1992. Then the Project Team would have taken over all of the implementation tasks. Partly due to the complexity of the project, partly due to the late start of the Project Team and the fact that this team was not complete, this aim will not be reached. In discussions, the donors suggested to extend the period of full time consultancy involvement with a period of six months, up to 1 July 1993. A revised manning schedule is proposed, and presented in this report.

ii ISSUES

TORs and TAPP (section 9.4.2.2)

The FAP 20 teams has been provided with different versions of the Terms of Reference (TOR). The Project Team (PT) used a version dated June 1990, while the Consultants Team (CT) has used a slightly different version "updated and amplified for the guidance of the Consultants", dated November 1990.

The Technical Assistance Project Proforma (TAPP) deviates from both TORs. So it appeared not to be possible for the BWDB to pay the activities of the baseline survey, which could be financed under the Financial Assistance (FA).

In favour of the progress, the TAPP needs urgently to be in conformity with the Project Document (TOR) dated November 1990. After all, this forms the legal basis of the project as is stated in Article VII of the Administrative Arrangement between the GOB and the GON, which was signed on the 21st of August 1991.

Financing (section 9.4.2.2)

In the TAPP provisions for payment of baseline surveys and augmentation of the PT with consultancy were not taken into account. However, according to the TOR these expenditures could be financed under Financial Assistance; firstly paid by the BWDB and after that reimbursed. The TAPP has to be adjusted before this procedure can be used.

The necessary action for this adjustment has been started already and before the 1st of July it is expected to be completed. Meanwhile payments for the baseline survey and extra consultancy for the PT will be pre-financed from the TA-budget. This implies more complicate procedures.

Staffing of the Project Team (section 9.2.2)

In FAP 20 the Project Team (PT) and the Consultants Team (CT) co-operate, each with each own task. According to the TOR the PT has an implementation role and the CT an advisory/assistance one. In this way both teams should together achieve the aim: integrated water management. In the beginning the CT would give an intensive input in advising and planning; after 1.5 years the CT would have been almost phased out, leaving the PT with the further implementation of the project.

This process is hampered because of an incompleteness of the PT staff in the first period of the project. As a consequence the CT has been overloaded with implementation of the baseline surveys, etc., which crowded out the activities necessary to fulfil their advisory and innovative tasks.

At the beginning of 1992 the PT was an uni-disciplinary team made up of employees of the BWDB. As the TOR indicate, from GOB side also agronomists, sociologists, a fisheries specialist and a livestock and an infrastructure specialist should be added to the

PT. It was intended to do this, partly by incorporating full time team members of these disciplines, partly by a co-operation with representatives on District level of the concerned ministries.

The posts of agronomists (2) and socio-economists (2) are still vacant. The Project Director was informed in February 1992, that the BWDB was not able to fill these posts. These posts will now be filled by national consultants; they will be placed in the PT and will work under direct supervision of the Project Director.

The fisheries specialist, livestock specialist and the infra-structural specialist are expected to be made available from the concerned Ministries on part time basis only (1 week a month each). For this purpose Government orders have been issued already. It can be expected that they soon will start their work in the PT.

These developments imply, amongst others, that for the future activities in the Sirajganj Compartment, the multi-disciplinary PT can take the full responsibility for the implementation of the project activities, including the baseline surveys.

In Tangail the co-operation with the other ministries is in a starting phase. Especially for the institutional side of the project this is essential.

Staffing of the Consultants Team (section 9.2.3)

To complete the development process for the Sirajganj Compartment with full support of the CT and together with a multi-disciplinary PT, it is suggested to extend the period of full consultancy up to 1 July 1993. This conclusion, made during a discussion with the representatives of the donor countries, is one of the reasons for a modification of the work schedule.

A donor review mission, expected by September/October 1992, will give an independent advice about the planning of the activities and the required staffing of the CT after 1July 1993.

People's participation (section 4.2)

In Appendix 5 of the TOR the following is stated about the Institutional aspects of compartmentalization:

"Under the Compartmentalization Pilot Project , it will be important:

- ....
- ....
- *to ensure a close consultation between officials of BWDB and Upazilas, and between them and beneficiaries, to ensure that compartments are planned, designed, implemented, operated and maintained in ways that meet beneficiaries' needs and minimise the kinds of conflicts between groups in the area that can adversely affect project performance*

- *to educate project beneficiaries as to their responsibilities in respect of operation and maintenance, in particular the payment of water charges*
- *to enforce legislation regarding the payment of water rates by the farmers."*

FAP 20 fully agrees with the emphasis on institutionalizing people's participation in compartmentalization. The project will put much emphasis on people's participation in needs assessment, project formulation, design and planning. The assumption behind this is that the involvement of the population in operation and maintenance and possible payment of water rates is more likely to be achieved where they feel a sense of "ownership" of the project than through "education" and "law enforcement".

Institutional aspects (chapter 7)

Institutionalization is a rather sensitive subject in the water sector. As FAP 26, Institutional Development has not yet started, FAP 20 cannot draw on its recommendations.

Contacts will be made with the relevant GOB departments and NGO's in the compartments. On the basis of those contacts FAP 20 will experiment with different institutional approaches. The outcome of this will then feed into the FAP 26 study. Until FAP 26 comes with guidelines on institutionalization, FAP 20 will start working on setting up a Project Implementation and Coordination Committee (PICC). This Committee will represent the various interests and expertise relevant to water management and will facilitate coordination and involvement of the various institutions.

With regard to the institutionalization in the Tangail Compartment it is proposed that the bottom-up method will be followed and that various methods of mobilizing and establishing local institutions will be developed. Part of this is a training programme for all the involved officials and for the people in the compartment (Sub-compartmental Water Committees)

This rather ambitious program requires extra attention for the financing of activities of the other governmental and non-governmental agencies than the BWDB. Partly this can be done through the FA financing of the PT activities, partly through the NGO funds of the embassy.

Flexibility (section 4.4)

The elements experimentation, people's participation and cooperation with other FAP projects call for an even more flexible approach to the implementation schedule, the budget and the concept than envisaged in the TOR.

Attempting to integrate true people's participation in FAP 20 implies that a choice had to be made for:

- a flexible implementation schedule that allows for the rather unpredictable (usually slow) speed of the participatory approach, in stead of a fixed scheme with less freedom for changes in the planning;

- a flexible budget (with a ceiling, but less defined time and item wise) determined by the developing felt needs and the willingness to cooperate of the people above a fixed budget that "forces" to implement the planned measures;

- a flexible concept which allows different localized solutions in stead of a "neat and tidy" one, which must be applied uniformly throughout the country.

As flexibility is required, certain measure points need to be set in order to establish if progress in the implementation is or has been attained. Therefore FAP 20 will expand the contents of the periodical reports by adding continually updating on developments. If in due course further changes are considered to be necessary in the programme, the quarterly and annual reports will be used to share these with the FPCO/POE and the donors. Firm plans will then be put forward annually.

Contributions by the beneficiaries (section 5.8)

Also for the works at sub-compartmental level, there should be a flexible approach regarding the timing of the implementation so as to guarantee people's participation at this level for both implementation and O&M. A basic proof that planning and design are based on the needs of the local people is their participation by contributing in cash or kind during implementation. If such participation is not forthcoming, this may even mean that a particular work will not be implemented at all. A proposal for the practical implementation of this principle will be presented in the interim report for each compartment.

Environmental concern (section 5.11.1)

According to the TOR FAP 20 [page 12] will conduct an "Environmental Impact Assessments to assess the effect of the interventions."

FAP 20 wholeheartedly agrees with the environmental concern expressed. However there seems to be a contradiction between the expressed need to conduct an EIA and the FPCO/POE decision to use the multi-criteria "Guidelines for Project Assessment" as well. Both are assessment but each has its own frame of reference and basic philosophy. The situation is further complicated by unclarity about the meaning of the word "environment" as such. To some this is little more than nature or wildlife, to others it encompasses all of life including mankind and economics.

These unclarities and the limited knowledge about the environment in Bangladesh are the main reasons why FAP 20 has not yet been able to clarify satisfactory how it will deal with the environment in its approach. Other FAP projects may have similar problems in this area.

Meanwhile FAP 20 will follow both assessments, the "Guidelines for Project Assessment" and the EIA. Concerning the environmental aspects the contacts with FAP 16 will be beneficial to both, FAP 16 and FAP 20. FAP 20 will contribute field experience and FAP

16 knowledge. FAP 16 will conduct an EIA in the Tangail Compartment as one of their case studies.

Regional drainage congestion and compartmentalization

Compartmentalization might in due course be implemented in complete regions of Bangladesh. The concept is to be tested with this in mind. Retention of rain or river water in one compartment might help to solve flooding problems in the "downstream" compartments.

However, as pointed out at the FAP Team Leaders meeting at FPCO on August 29, 1991, in this way compartmentalization in CPP Tangail may be ineffective. Firstly a solution must be found for the drainage problems in the southern parts of the North-Central and North-Western Regions. This is unlikely to be the case before the CPP becomes operational. It is understood that FAP 20 will however be implemented and operated in such a way that what is best for the CPP areas can be done, taking into account the adjacent areas, but for the time being disregarding the consequences in the most southern areas of the regions.

Controlled flooding

FAP 20 will be experimenting with a compartment on the fully protected right bank of the Brahmaputra and with one on the unprotected left bank. In the Tangail compartment the concept of "controlled flooding and drainage" can be fully tried out. In the Sirajganj compartment "controlled drainage" is likely to get more emphasis because of the BRE, although controlled flooding may be introduced by constructing structures in the main embankment.

The policy of the FAP is based on "controlled flooding and drainage" instead of "full flood protection". FAP 20 fully supports this emphasis as it seems most relevant to the present needs of the people in the flood plain. However, it may be of interest for the long term future of compartmentalization and of the FAP, to find out the parameters that determine when, if at all, water management in an area might move from controlled flooding and drainage in the direction of full protection. One obvious parameter is the degree of urbanisation in the compartment. If this happens the water management in the compartment must easily be adjusted.

To define the parameters that determine the technical, financial, economical, social and environmental feasibility of a shift from controlled flooding and drainage to full flood protection a multi-disciplinary comparative study might be done in an other context. One way to do this is by comparing the situation of the not protected left floodplain of the Jamuna with the full protection situation on the right floodplain before the recent spur of breaches.

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Brahmaputra Right Embankment (section 3.3.2)

A negative point of the selection of the compartment area directly North of Sirajganj is the instability of the Jamuna right bank in this area. In the last few years, several breaches in the main embankment caused unexpected flooding. As a consequence, the local people lost their confidence in this embankment.

A secure main embankment can be seen as one of the pre-conditions for a successful operation in the CPP. However, the strengthening and maintenance of the main embankment is beyond the task of FAP 20. FAP 1 has to produce a plan to increase the security of the BRE. The BWDB is responsible for the maintenance and for a timely retirement of the embankment, if needed. In the TOR (Appendix 4) it is assumed that measures will be taken to eliminate the hazard of flood damage resulting from breaching of the BRE.

At the time of writing this report the people behind the BRE near Sirajganj consider the embankment to be instable. As a result the Sirajganj compartment faces two problems:

- it will be difficult to evaluate the impact of compartmentalization on the area after completion of FAP 20 because of an instable baseline situation, a likely instable post-project situation and also it will be difficult if not impossible to separate the impact of the strengthening of the BRE from that of compartmentalization,
- it will be difficult to focus people's participation on compartmentalization (i.e. the water management of the area behind the BRE) as their overriding demand is likely to be strengthening of the BRE.

During a meeting at FPCO about these concerns, these constraints were acknowledged. For various reasons no other - more suitable - area behind the BRE could be found. Therefore it was decided to continue with the Sirajganj area.

Jamuna Bridge Project (section 5.4.2.4)

It is anticipated that the implementation of the Jamuna Bridge Project and in particular the closure of the Northern intake of the Dhaleswari River will result in a major lowering of the Median Peak Water Level in the Tangail Project Area.

Since the impact of the closure of the Northern intake of the Dhaleswari is expected to have a very prominent impact on the Tangail Pilot Project the major consequences are elaborated in section 5.4.2.4 more in detail. Certain major consequences have been overlooked in the Dhaleswari Mitigation Plan. Comments have been sent to the FPCO and certain mitigation options are recommended.

FAP 20 will study an alternative implementation schedule for the Tangail Project area with the help of the relevant data from the Dhaleswari Mathematical Model for input in the mathematical model of Tangail.

iii ABBREVIATIONS

BETS	Bangladesh Engineering & Technological Services
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BLE	Brahmaputra Left Embankment
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRE	Brahmaputra Right Embankment
BRRI	Bangladesh Rice Research Institute
BS	Block supervisor
BWDB	Bangladesh Water Development Board
CPP	Compartmentalization Pilot Project
CT	Consultants Team
CWMB	Compartmental Water Management Board
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DGIS	Directorate General for International Cooperation
DDP	Delta Development Project
DHI	Danish Hydraulic Institute
DMP	Dhaleswari Mitigation Plan
EIA	Environment Impact Assessment
EIP	Early Implementation Projects
FA	Financial Assistance
FAP	Flood Action Plan
FCD/I	Flood Control, Drainage and Irrigation
FFW	Food for Work
FMM	Flood Management Model
FMMCC	Flood Modelling/Management Coordinating Committee
FPCO	Flood Plan Co-ordination Organization
FY	Financial Year
G-7	Group of Seven Industrialized Countries
GIS	Geographical Information System
GOB	Government of Bangladesh
GTZ	Gesellschaft fuer Technische Zusammenarbeit
HA	Hectares
HH	Household
HYV	High Yielding Variety
JPPS	Jamalpur Priority Pilot Study
LCS	Landless Contracting Society
LGEB	Local Government Engineering Bureau
LWMB	Local Water Management Board
MDSC	Multi-Disciplinary Sub-Compartment survey
MIWDFC	Ministry of Irrigation, Water Development and Flood Control
MPO	Master Plan Organisation (now WARPO)
NAM	Rainfall-runoff module of MIKE 11

NCRS	North Central Regional Study
NGO	Non-Governmental Organization
NWMB	National Water Management Board
NWRS	North West Regional Study
O&M	Operation and Maintenance
PA	Participants Activities (matrix)
PD	Project Director
PHE	Public Health Engineering
PICC	Project Implementation and Coordination Committee
POE	Panel of Experts
PP	Project Proforma
PT	Project Team
PWD	Public Works Department
R&H	Roads and Highways
RWMB	Regional Water Management Board
SDE	Sub-Divisional Engineer
SMO	Subject Matter Officer
SMS	Subject Matter Specialist
SRD	Soil Research Department
SRP	Systems Rehabilitation Project
TA	Technical Assistance
TADP	Tangail Agricultural Development Project
TAPP	Technical Assistance Project Proforma
TL	Team Leader
TOR	Terms of Reference
TP	Technical Proposal
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WARPO	Water Resources Planning Organisation

iv GLOSSARY

Aquaculture	-	Artificial and commercial cultivation of aquatic products.
Aus	-	Rice planted during the pre-monsoon season and harvested in the monsoon season.
Baseline survey	-	A survey with the aim to provide and verify data on hydrological, engineering, agricultural, socio-economic and environmental aspects prior to, during and on completion of the pilot project.
Beel	-	Small lake, low-lying depression, a permanent body of water in a floodplain or a body of water created by rains or floods.
Boro	-	Rice planted in winter and harvested during April to June.
Compartment	-	An area in which effective water management, particularly through controlled flooding and controlled drainage, is made possible through structural and institutional arrangements. A compartment can be subdivided into sub-compartments.
Compartmentalization	-	The spreading of the flood water over the flood plains by establishing interlinked compartments, with the objective to provide a more secure environment for agriculture, fisheries and integrated rural and urban development through water management (controlled flooding and drainage) .
Controlled drainage	-	The control of the water flow out of a (sub)compartment according to the local or regional requirements.
Controlled flooding	-	The spreading of the flood over the land in a (semi) controlled way with the help of provisions incorporated in compartments, embankments, roads, etc.
Deep water Aman	-	Rice broadcasted (B) or transplanted (T) during the pre-monsoon or early monsoon with the ability to grow along with the rising water and harvested in November or December.
Fully-controlled structure	-	A structure through which the water flow can be fully regulated.
Khal	-	A natural channel.

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Mauza	-	Revenue village with a separate Jurisdiction List Number, area and a map.
Multi-criteria analysis	-	An analysis and display of the impacts of proposed structural and non-structural works in which a wide range of criteria are used, such as social, environmental and economic. Impacts can be quantified in financial terms or may be evaluated using a scale from -5 to +5. Those items that cannot even be rated on such a scale will be dealt with in a descriptive way.
Pagard	-	A small water body, generally excavated near a home stead, which is used for fish stocking as well as for household activities.
PA-Matrix	-	A relational matrix, depicting links between participants and activities in a certain process.
Parishad	-	Elected Council
Rapid Rural Appraisal	-	A systematic, but semi-structured activity carried out in the field by a multi-disciplinary team and designed to quickly acquire information on, and new hypotheses for integrated rural development.
Semi-controlled structure	-	An ungated structure that can not be regulated.
Sub-Compartment	-	A sub-unit of a compartment, in which to a certain extent the water management can be controlled by the people living in the area represented in a Water Committee. The sub-compartment is mostly separated from the adjoining ones by embankments or roads provided with (semi)controlled structures.
T.Aman	-	Rice transplanted during the pre-monsoon or early monsoon which can only stand about 2-3 feet (60-90 cm) water depth and harvested in November or December.
Union	-	Smallest electoral unit of areas outside municipalities comprising several mauzas (or villages), and generally divided into three wards. It has an Union Parishad (council).
Upazila	-	Local government administrative unit, comprising about 10 Unions, and mainly staffed by delegated central government officials.
...ter management:	-	Controlled management of surface and ground water.

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1 INTRODUCTION

The Bangladesh Action Plan for Flood control (FAP) comprises a phased programme of flood control activities, supported by special studies, surveys and pilot projects.

The Compartmentalization Pilot Project (CPP) FAP 20 is a key component of this plan and has been conceived to test the concept of compartmentalization and to develop criteria and guidelines for planning and designing the first full scale projects. In pursuance of these objectives the Consultants Team (CT) and the Project Team (PT) started working in the project areas.

This Inception Report is a revised version of a first draft, drawn up by the CT, submitted in December 1991. On this draft extensive comments were received and discussed with the donors and the FPCO. Many comments were useful and have been taken into consideration when writing this report. Thus this inception report reflects the latest ideas not only of both the CPP teams, but also of the donors and the FPCO about the concept of compartmentalization and about the way the TOR has to be fulfilled. Since the experiences of the past months have been taken into account, more actual information could be included.

The report is the result of cross-fertilization between local people and professionals. It must be mentioned that, to the extent that this report reflects the reality of rural life in the Brahmaputra flood plains, it is due to their readiness to freely share their time and knowledge.

1.1 Objectives of the report

The objective of the Inception Report is to update the Technical Proposal (TP) submitted by the Consultant and to firm up the activities in the project areas. Suggestions are made in case changes are required in the approach or in the planning given in the TOR and the TP. It should however be pointed out that due to the pilot project nature of the CPP, also in future changes might be suggested.

This Report deals mainly with the general issues related to the CPP. Items related to the specific compartments (e.g. planning and costing of the works and the non-structural aspects) will be more detailed covered in the Interim Reports concerning the Tangail and Sirajganj Compartments. These are planned to be submitted respectively at the end of September 1992 and May 1993.

1.2 Organization of the report

The following two chapters are organized in such a way that it goes from the more general to the more specific.

Chapter 2 deals with the background of the Flood Action Plan (FAP). First of all water management in the region is described from a historic perspective. Distinct phases in that history are described, leading to the inception of the Flood Action Plan.

In chapter 3 the outline of the Compartmentalization Pilot Project itself are dealt with. With as starting point the objective of the project, the concepts of water management and compartmentalization are discussed, followed by a description of the project areas. Finally, an indication of the steps to be taken in the project is presented.

Chapter 4 describes the proposed methodology to be adopted to achieve a sustainable development of the water management in the compartments. This chapter contains the rationale for the approaches to be used for conducting the people's participation and various surveys and studies. The need for flexibility is highlighted and the special emphasis on the disadvantaged, particularly women, is explained.

In the chapters 5, 6 and 7 the application of the methodology is presented. The principles of the methodology described earlier are worked out in relation to the different types of surveys, studies, monitoring and evaluation (ch.5), the design of a development model (ch.6), and the institutional framework (ch.7).

Chapter 8 covers the plans for cooperation with other FAP projects and other, non FAP water sector programmes.

Chapter 9 contains a detailed work planning of the first period until 1 July, 1993, and a more tentative one for the second period covering the work from 1 July, 1993 till November 30, 1995. Based on this planning the consequences for the staffing and the cost are discussed.

The annexes in a separate volume give more detailed information over the various notes and reports of FAP 20, the organisations and institutions contacted, and more detailed information over for the relevant subjects, as well as the job descriptions of the members of the Consultants Team.

2 THE FLOOD ACTION PLAN

2.1 Water management in historic perspective

> "If you embank the rivers and prevent their overflowing altogether and leave no openings in the banks, you doom the country to malaria and impoverishment of soil; but that is not all the harm you do. By confining high floods to their river channels, you congest the rivers to bursting point and expose the country to very serious inundation and devastation." [Willcocks, p.29 and 30]

In Bengal controlled flooding and in a certain way compartmentalization were practised in the past.

Centuries ago the farmers in the delta area of Bengal organised themselves to cope with their environment. They did this without much support or interference from a central government. They built embankments in which they cut openings to irrigate their land and which they closed again before the next flood. Together they maintained the embankments and the channels. One can actually say that the people were engaged in a sort of integrated water management in which flood protection, drainage and irrigation were handled in an consolidated way. The rivers and *khals* brought fish fry to the fields. The farmers profited from the fertile influence of the flooding of their land. At that time Bengal was apparently a rich country in which the people made full use of its position at the lower reach of major rivers.

This situation has changed in such a way that the major attention was diverted from monsoon irrigation to flood protection. The first national water master plan following the Krug mission, the IECO Master Plan of 1964, gave major emphasis on flood protection. A foreign concept - the polder - was introduced. Quite a few projects were carried out based on this idea. However, by going for full protection, the negative effects of floods were reduced within the polder, but also the beneficial effects of the floods. Isolated polders give solutions for the polders themselves, but often they create problems, physical as well as psychological, in the surrounding, because of higher water levels. As a consequence, people from outside the polders frequently cut the embankments.

Following the floods of 1987 and 1988 several studies were undertaken to investigate how to protect the country against the devastating effects of the floods. The results showed alternatives, with on the one side 'full protection' and on the other side 'living with the floods'.

2.2 The Flood Action Plan

Bangladesh adopted the outlines of an Action Plan for flood control and drainage in June 1989, and requested the World Bank to develop and co-ordinate its first phase (1990-1995). This was endorsed at the G7 Summit held in Paris in July, 1989.

The Flood Action Plan (FAP) was prepared by the World Bank in close co-operation with the Government of Bangladesh. It was formally endorsed at a meeting of the Government

of Bangladesh and donor representatives in London, which the World Bank chaired, in December, 1989.

The FAP comprises a number of studies and pilot projects which are expected to lead to water resource management and related projects, with an emphasis on flood control and drainage. In the first two years of the Plan, 1990-92, regional water resource development planning studies are being undertaken to identify alternative water resource management strategies for different regions of the country. These will be followed by feasibility studies for priority investment projects. A number of complementary socio-economic and environmental studies are being carried out in order to improve understanding of the impact of flooding and to recommend economic, social and environmental guidelines and criteria appropriate for use in planning and implementing such projects.The Action Plan comprises twenty-six components and supporting activities.The Compartmentalization Pilot Project is one of them.

The main focus of the Flood Action Plan is that defined by the Government of Bangladesh in the Eleven Guiding Principles which are listed on the following page. Emphasis is given on 'controlled flooding' and 'controlled drainage'. Floods would be controlled in such a way that maximum profit can be achieved from the beneficial effects of river water flooding, while minimizing the disadvantages.

THE ELEVEN GUIDING PRINCIPLES

1. *Phased implementation of comprehensive Flood Plan aimed at:*

   - *protection of urban, rural, commercial, industrial and public utility centres and communication networks;*

   - *controlled flooding, wherever possible and appropriate, to meet the needs of agriculture, fisheries, navigation, urban flushing, soil productivity and recharging the surface water/groundwater resource with minimum dislocation of the environment.*

2. *Effective land and water management of protected and unprotected areas, involving compartmentalization, drainage, irrigation, drainage decongestion, land use, cropping patterns, environment ecology, erosion/sedimentation control etc.*

3. *Strengthening and equipping the disaster management machinery including building infrastructure for quick and effective communication and transmission during disasters.*

4. *Improvement of the flood forecasting system and establishment of a reliable and comprehensive flood warning system with adequate lead times and at the same time evolving techniques for dissemination.*

5. *Safe conveyance of the large cross-boundary flow to the Bay of Bengal by channelling it through the major rivers with the help of embankments on both sides.*

6. *Effective river training works for the protection of embankments, infrastructure and population centres, linked wherever possible with the reclamation of land in the active river flood plain.*

7. *Reduction or distribution of load on the main rivers through diversion of flows into major distributaries or interception of local runoff/local rivers by channelling through major tributaries or special diversions.*

8. *Improvement of the conveyance capacity of the river networks to ensure efficient drainage through appropriate channel improvements and ancillary structures to provide regulation and conservation.*

9. *Development of flood plain zoning as a flexible instrument to accommodate necessary engineering measures and allocate space for habitation patterns, economic activities and environmental assets.*

10. *Coordinated planning and construction of all rural roads, highways and railway embankments with provision for unimpeded drainage.*

11. *Encouraging maximum possible popular participation by beneficiaries in the planning implementation, operation and maintenance of flood protection infrastructure and facilities.*

3 THE COMPARTMENTALIZATION PILOT PROJECT

> A recollection of the history of water management before the colonial intervention provides ample evidence to suggest that it was the community which managed the water resources. As a result, drainage and irrigation was not much of a problem. [Ahmed Kamal]

3.1 The objective

The overall objective of FAP 20 is:

> *"... to establish appropriate watermanagement systems for the development of protected areas so that criteria and principles for design, implementation and operation can be made available for the Action Plan."* [TOR, page 4].

Specifically this will entail the

> *"... testing of the compartmentalization concept in the field under real operating conditions, addressing all the relevant socio-economic, institutional and environmental issues and trying out water control works and water management systems."* [TOR, page 4].

FAP 20 has to produce not only the structural works and an institutional set-up for the compartments Tangail and Sirajganj, but also criteria, guidelines, manuals and a training and demonstration programme for the establishment of other compartments.

3.2 The concepts

3.2.1 Water management concept

Based on the experience in the water sector in Bangladesh, water management projects must not only take the needs of agriculture into account, but also:

- the needs of the non-crop sectors such as fisheries, livestock, transport and industry (rural as well as urban);
- the conflicting interests, such as between low- and high land farmers, between farmers and landless people and between those inside and outside the boundaries of the project; and
- the need for widespread popular support through people's participation, so as to facilitate input into design, planning, operation and maintenance of structures, including embankments.

In FAP 20, water management is therefore defined in an integrated way:

> Water management is the controlled usage of water, including early, late and deep flooding, irrigation and drainage, surface and ground water quantity and quality, water use in agricultural, fisheries, transport, sanitation and for domestic and industrial purposes.

Water management ideally is a continuous process in which the people concerned participate. It starts with the identification of the existing water related problems and possibilities, followed by planning, design, construction and operation and maintenance. Water management includes reconciling competing interests and it should lead to sustainable development.

From this point of view it is necessary to institutionalize the people's participation in water management. This will not be easy after decades of centralized state control.

This water-management-related institutionalization will have to be initiated at the local level, but will ultimately have to extend all the way up to the national and even the international level. It will also have to include legislation, including the formulation of bye-laws, defining rules and regulations about the privileges and duties of the people concerned. Here again it is necessary that these are sustainable, and accepted as legitimate by the people.

3.2.2 Compartmentalization concept

The concept of compartmentalization is instrumental for the implementation of water management as described in the preceding section.

> A compartment is an area in which effective water management, particularly through controlled flooding and controlled drainage, is made possible through structural and institutional arrangements. Compartmentalization is linked to area development with sound water management as the main agent. A compartment can be sub-divided into sub-compartments.

On the **regional level**, a series of compartments is complementary to the main river system in that they may buffer the excess water from the local rainfall and the river system on a temporary basis.

In order to implement this function, provisions must be made to regulate the water movement between the main rivers and the compartments, where minor rivers may function as flooding or drainage channels for one or more compartments.

The management at this level can be entrusted to a National Water Management Board that consults several Regional Water Management Boards.

On the **compartment level**, the main purpose is related to the satisfaction of local objectives e.g. by controlled flooding and drainage or possibly water retention.

Therefore the compartment may be surrounded by embankments with gated or ungated openings through which the in- and outflow of the water can be regulated. In order to improve on the water control, the sub-compartment has been introduced. Here on a smaller scale the same concept is repeated (embankment, in- and outlets and flooding and drainage channels).

The management at the compartment level can be entrusted to a Local Water Management Board. This Board will represent the various interests and expertise relevant to water management and will facilitate coordination and involvement of the various institutions.

At the level of sub-compartments water management will be entrusted to Sub-Compartmental Water Committees, which will ensure that local interests are properly represented.

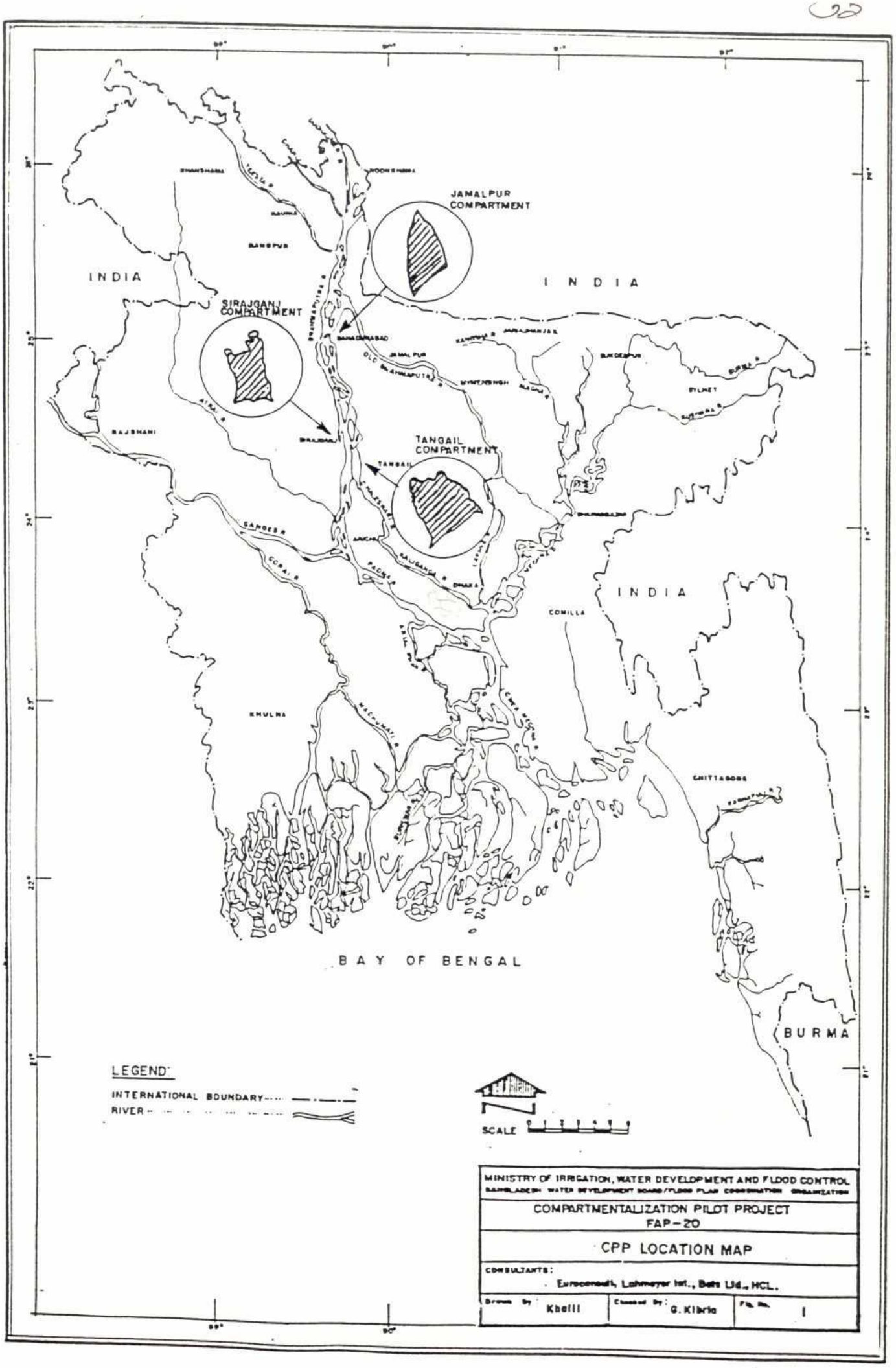
Although normal flooding is in general a positive phenomenon in the natural environment of the floodplains of Bangladesh, the satisfaction of the regional as well as the local objectives may be conflicting.

With the present circumstances of drainage congestion, particularly around Dhaka and South of Sirajganj, the interests at the regional and at the local level definitely do not match. These drainage congestions exclude the option for satisfactory drainage of the southern compartments during most of the monsoon season. One could assume that this drainage congestions could be eased by water retention in the more North situated compartments. However, the impact of this will not be significant and not in the interest of the local interests. Other solutions must be found to solve these regional drainage bottlenecks.

It is due to this circumstance that the concept of compartmentalization can only be tested in such a way that only the local interests will be taken into account, as long as the down-stream drainage congestions are not solved.

3.3 The project areas

As indicated before, the project is divided into three components: the Tangail Pilot Project, the Sirajganj Pilot Project and the Jamalpur Pilot Study (figure 1). In the first two areas, compartments will be realised under FAP 20; these areas are described briefly below. The Jamalpur Pilot Project will be constructed under the FAP, but under a different programme. For that project FAP 20 will provide only advice, based on its experience (section 5.10).



MINISTRY OF IRRIGATION, WATER DEVELOPMENT AND FLOOD CONTROL BANGLADESH WATER DEVELOPMENT BOARD/FLOOD PLAN COORDINATION ORGANIZATION		
COMPARTMENTALIZATION PILOT PROJECT FAP-20		
CPP LOCATION MAP		
CONSULTANTS: Euroconsult, Lahmeyer Int., Bats Ltd., HCL.		
Drawn by: Khalil	Checked by: G. Kiberia	Fig. No. 1

3.3.1 The Tangail Pilot Project

The Tangail Pilot Project area is located on the left bank of the Brahmaputra, in the vicinity of Tangail town (figure 2). The area is bounded by a horse-shoe embankment 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 earthen road between Silimpur and Karatia. The project area comprises 13,765 ha, divided over three Upazilas of Tangail District : Tangail (83%), Delduar (14%) and Basail (3%). Homesteads make up 19% of the area and 81% is cultivable land. The population is around 265,000 out of which 105,000 do live in Tangail town.

Most probably a rather small extension of the compartment in the North East will be proposed in the interim report, because of its hydrologically and socially linkage.

The pilot area occupies part of the Young Brahmaputra Floodplain. Overall drainage is away from the Brahmaputra (Jamuna) and Dhaleswari rivers towards low-lying land in the South-East. Overall land elevation is rather flat with contours varying between 7.5 and 12.5 m +PWD. However, in detail, the relief comprises a complex network of ridges, basins (beels) and old channels.

Much of the land goes under water in the monsoon season. Flooding is by rainwater (mean annual rainfall 1550 mm) and by river water. Flooding of depressions normally begins in May-June with the onset of the pre-monsoon rainfall. Flooding becomes more extensive, normally reaching its peak in July-August. In 'normal' flood years depressions are submerged, 1-2 m deep. In years with high river floods, ridges are submerged and depressions are flooded up to 3 m and more. Surface flood water enters the area through four intakes and 3 intakes/breaches in the West; through the Lohajang river and several branch channels, entering the project area in the North; through overland flow from the North and through an unstructured inlet from the Pungli river in the East. The main outflow is through the Lohajang river and though overland flow in the South. Most of the land becomes free from flood water by mid-November, but drainage channels are silted up and depressions stay wet, some throughout the dry season.

Agriculture in the project area is dominated by rice crops. Irrigation within the project boundary has a high intensity. As a result, irrigated Boro HYV is the main rice crop, producing 50-60% of the total rice production. Aus and deep water Aman (B.Aman) produce 15-20% each; T.Aman takes care of 10% of the production. Other relatively important crops are jute, wheat, mustard, sugar cane and pulses. Of the cultivated area 42% is triple cropped. The overall cropping intensity is high. Floods from rain and river water and impeded drainage are the major limitations for agricultural development. Much of the lower land presently remains fallow in the rainy season because of the risk that rapidly rising floodwater in June might drown Aman seedlings.

Livestock lacks sufficient qualitative and quantitative supply of fodder. The number of draught animals is no longer sufficient. As far as providing draught power is concerned, power tillers are filling up the deficit.

The average farm size is slightly above 2 acres. The marketing margin of agricultural produce is in the order of 20% on average, but as 45% live in an urban setting, the area is technically facing food deficiency.

Captured fisheries activities and productions are determined by the seasonal fluctuation of the flood regime. In the dry season, professional fishermen are operating with seine and cast nets mainly in the beels and pagards. Based on existing "traditional rights", the professional fishermen share their catch with the owners of the beels. Subsistence fisheries, using scoop nets, traps, baskets and hand picking can be carried out freely in all the beels. The majority of the fish caught this way belongs to the so called "miscellaneous" or "small" fish. During the flood period this segregation disappears and both professional and subsistence fishing is carried out freely over the floodplain. The blockage of migration routes for major carps by means of embankments, regulators, etc, resulted in a serious decline of the production of these species.

Culture of the high valued carps has expanded within the last decade. The production levels are low (500-900 kg/ha/yr) due to the use of improper culture techniques.

Illiteracy rate is relatively high in the area (84% ; 1981).

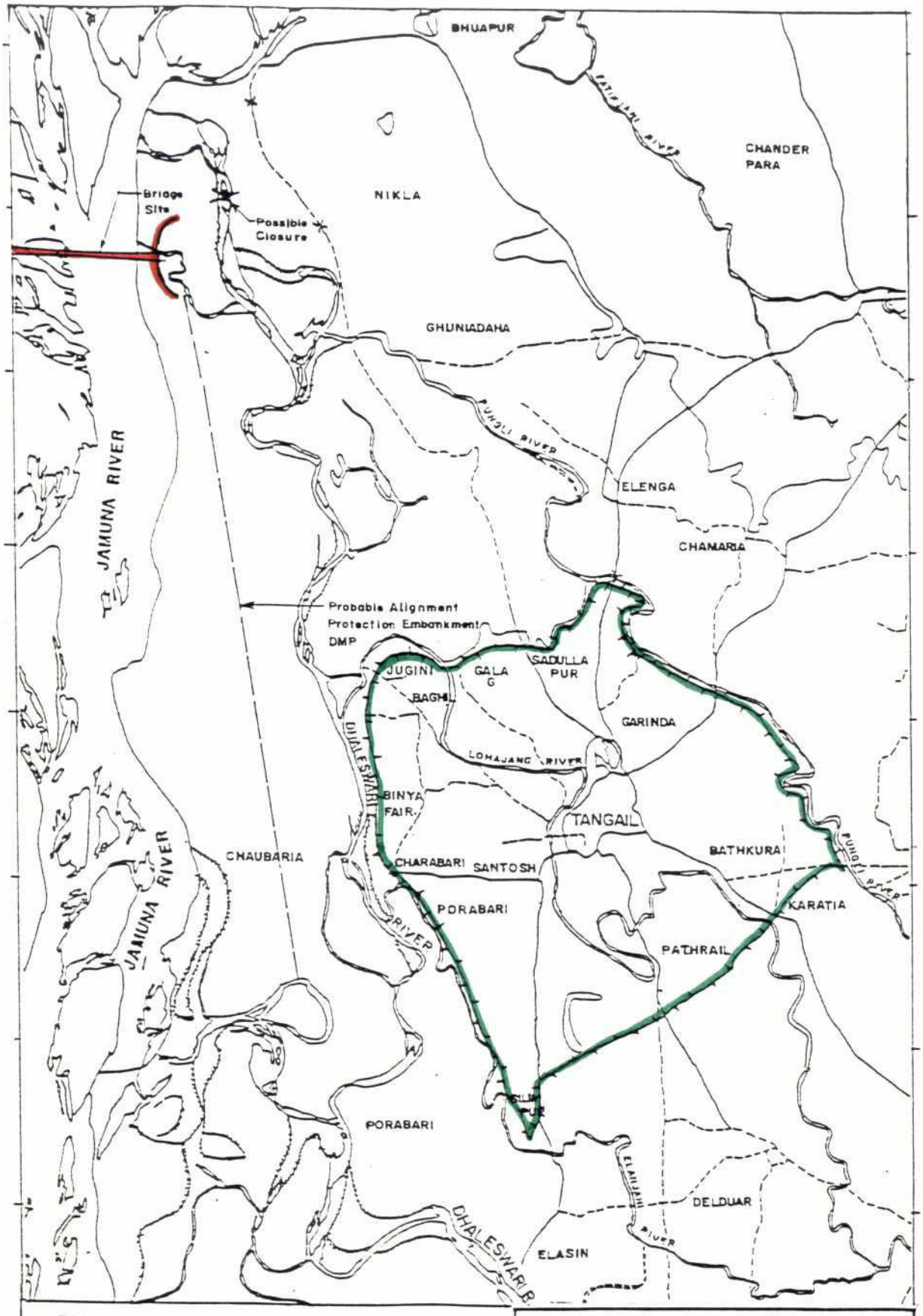
3.3.2 The Sirajganj Pilot Project

The Sirajganj Pilot Project area lies on the right bank of the Brahmaputra river, North of Sirajganj town and South of Bahuka (figure 3). The eastern boundary is formed by the Brahmaputra Right Embankment (BRE); the western, northern and southern boundaries remain to be defined precisely, but it is envisaged that they will include an area of approximately 10,000 ha, North of the new Bogra road and East of the Ichamati river. The project area is located on relatively higher land than the Tangail pilot area; soils are more sandy.

The area has a generally smooth relief, although in detail, it comprises a complex network of ridges, old channels and basins of a former braided river landscape, with 1-3 m difference in between the ridge tops and adjoining beels.

In the sixties, the BRE was constructed. The embankment was completely rehabilitated during the late seventies. Construction of this embankment prevented flooding from the Brahmaputra river and the seasonal flooding in the project area was mainly reduced to rainwater flooding. Rainfall (1790 mm annually on average) and local run-off accumulates in depressions, starting during May. Flooding reaches its peak in July-August. Ridge tops remain above normal flood levels, whereas depressions are flooded 1-2 m deep. Overland drainage is impeded by the low overall gradient, local roads, silted up khals and back water from the South. After August-September, water gradually drains off the land into the Hurasagar and Ichamati rivers and most of the land is free from floodwater by mid-November. Beels stay wet for a longer time, some throughout the dry season.

In exceptional years, like 1987, the area is flooded 1 m deeper due to heavy rainfall and overland inflow from the upstream catchments of the Karatoya and Bangali rivers.



LEGEND

Existing Embankment/Raised Road... (Project Boundary)

Highway

Local Road

River & Khal

Bridge

MINISTRY OF IRRIGATION, WATER DEVELOPMENT AND FLOOD CONTROL
BANGLADESH WATER DEVELOPMENT BOARD/FLOOD PLAN COORDINATION ORGANIZATION

COMPARTMENTALIZATION PILOT PROJECT
FAP 20

CPP TANGAIL LOCATION MAP

CONSULTANTS:
Euroconsult, Lahmeyer Int., Bats Ltd., HCL.

Drawn By	Checked By	Fig. No.
Khalil	G. Kibria	2

Due to the construction of the BRE, the right bank floodplain was protected for a period of 20 years. Before the recent series of breaches, the area had developed an intensive cropping system, with sugar cane, Aus, jute and vegetables on the higher and sandier land, and with transplanted Aman and Boro rice on the relatively low land. Most of the agricultural land was triple cropped. However, much of the lower land remained fallow in the rainy season because of the risk that rapidly rising floodwater in June might drown Aman seedlings. Irrigation by tubewells has increased substantially.

The BRE protected the area quite satisfactory but not more so since 1987. Farmers lost their confidence in flood protection due to frequent breaches and several had to return to pre-BRE agricultural practices. In addition, there has been limited demand for controlled flooding in the area. River flooding in this area is less of a need for agricultural development than in Tangail, and more of a damaging factor. Main demand is for a reliable flood protection. Drainage congestion is a second constraint for agricultural development.

> "Between construction and 1984 the primary flood protection objective [of the BRE] was achieved. since 1984 however, there have been frequent embankment breaches due to erosion by the Jamuna (Brahmaputra) River. The area is now subject to severe and unpredictable floods and is probably worse off than in the pre-project situation." [FAP 12, p.A 17-2]

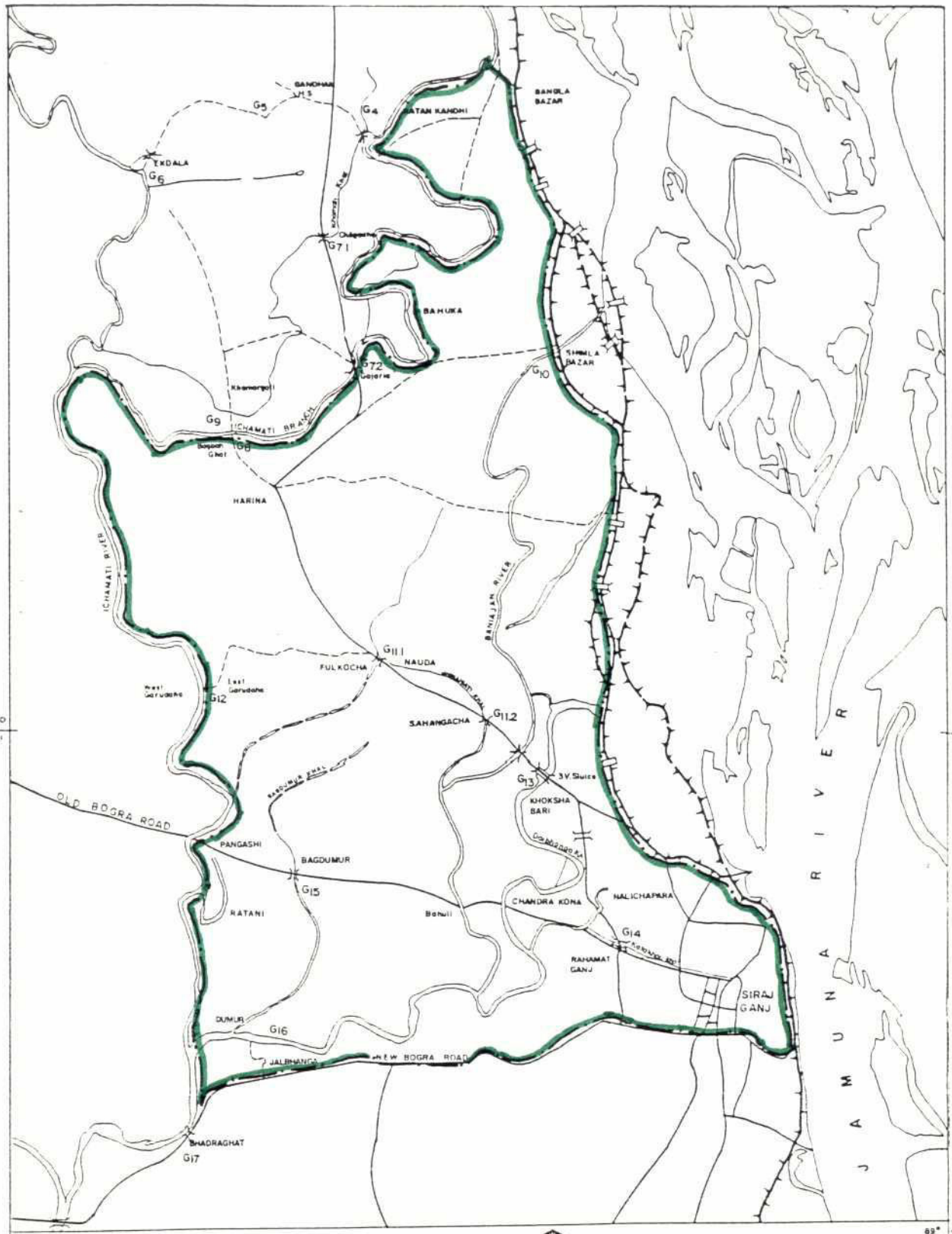
In Sirajganj the preliminary survey has started recently. At this moment no detailed information about fisheries is available.

Selection of the area

A reconnaissance survey has been carried out by the PT and CT in the area North of Sirajganj to establish the boundaries of the compartment. The main impression about this area was its dependency on the main embankment. Therefore the main objective of the Sirajganj part of the CPP will be to find out how to establish and manage a compartment behind a main embankment, which has been there for a long time.

From this point of view it is logical to choose the compartment parallel to the embankment. The hydrological characteristics of the area between Sirajganj and Kazipur are more or less similar. So there is no special reason to deviate from the suggestion given in the TOR and to select the area directly North of Sirajganj (figure 3). A positive point is the presence of the town Sirajganj in the compartment, which will stress the diversity in this pilot compartment.

Contrary to the Tangail compartment, one of the suggested boundaries is a river without embankments (Ichamati river on the West side). Actually a river can be seen as a division between two hydrological units. As such it satisfies the definition of a compartment (section 3.2.2). A discussion point may be the possibility of controlled flooding in absence of embankments along the bordering river. Clarity can only be given after the hydrological and topographical survey. Moreover the experiences of the inhabitants regarding the present situation is relevant. At the moment it is felt that normally - without a breach in the main embankment - the flooding from the Ichamati will be acceptable.



MINISTRY OF IRRIGATION, WATER DEVELOPMENT AND FLOOD CONTROL
BANGLADESH WATER DEVELOPMENT BOARD/FLOOD PLAN COORDINATION ORGANIZATION

COMPARTMENTALIZATION PILOT PROJECT FAP-20

CPP SIRAJGANJ LOCATION MAP

CONSULTANTS: Euroconsult, Lahmeyer Int., Bets Ltd., HCL.

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Khalil	G. Kibria	3

A negative point of the selection of the above mentioned area is the instability of the Jamuna right bank in this area. In the past years several breaches in the main embankment caused unexpected flooding. As a consequence the local people lost their confidence in this embankment.

> The level of confidence of people in the efficacy of the BRE has been diminished to a minimum and this has a number of negative implications, as follows:
>
> a) people's participation in O&M of the existing BRE is highly unlikely;
>
> b) people's cooperation in sacrificing land and allowing construction of retired embankments has been minimal;
>
> c) there is no long-term investment in land, tree plantations, housing or business installations in the vicinity of the embankment. Major public investments, (i.e. Kazipur Hospital) are now in great danger.
>
> [FAP 12, p.A 17-5]

A secure main embankment can be seen as one of the pre-conditions for a successful operation in the CPP. However, the strengthening and maintenance of the main embankment is beyond the task of FAP 20. FAP 1 has to produce a plan to increase the security of the BRE. The BWDB is responsible for the maintenance and for a timely retirement of the embankment, if needed. In the TOR (Appendix 4) it is assumed that measures will be taken to eliminate the hazard of flood damage resulting from breaching of embankments.

As this is not yet the case FAP 20 has the following observations about the suitability of the Sirajganj area as a pilot project for testing compartmentalization.

Analyzing the impact of compartmentalization in the Sirajganj area.

Testing assumes that the impact of compartmentalization can be measured. This requires a stable baseline situation against which project-induced change can be measured. The situation of the Sirajganj site proposed in the TOR, between Sirajganj town and Kazipur, has been unstable since 1984 (FAP 12, page A 17-2) but particularly since 1988. As no definite baseline can be determined it will be difficult if not impossible to evaluate the impact of compartmentalization after completion of the CPP.

It is expected that in the next few years the BRE between Sirajganj and Kazipur will be strengthened. If that happens it will take a few years before the confidence of the local people in the BRE is re-established. The socio-economic impact of the strengthening of the BRE will however lag behind its physical implementation. The result is that the socio-economic survey after completion of the CPP will again be that of an unstable situation.

Even if the pre and post compartmentalization surveys were to give relevant and reliable data, it will be extremely difficult to distinguish between the impact of compartmentalization and of strengthening the BRE.

The effect of people's participation on the CPP in Sirajganj

FAP 20 attempts the "bottom-up" approach to project design and planning. One of the means is a Multi-Disciplinary Sub-Compartmental survey. During this survey the people

of the locality are enabled to voice their opinion on the water management related problems and the potential solutions. FAP 20 reconnaissance surveys indicate that the single most important and overruling concern is the lack of security behind the BRE. If this concern were to be taken up, the compartmentalization concept would most likely become irrelevant and the project would become main embankment oriented.

Another element of FAP 20 is people's participation in the decision making process following the identification of alternative structural and non-structural solutions. Here again it is highly unlikely that anything but securing the BRE would be of interest to the people in the originally proposed Sirajganj site. This again would draw attention away from compartmentalization to the main embankment.

On the basis of the above, FAP 20 requested the FPCO to reconsider the suitability of the Sirajganj site. While recognizing the constraints mentioned above, the FPCO decided that for various reasons no other more suitable site is available. FAP 20 will therefore continue with the Sirajganj site.

One of the special objectives of compartmentalization in this area will be to minimize the impact of possible future breaches of the main embankment.

In Sirajganj the preliminary survey will start in May 1992 followed by the baseline survey. Before the implementation plan is submitted, a full monsoon period will be used to achieve an impression about the hydrological situation.

3.4 Application

In the life cycle of a compartment four phases can be recognized:

- surveys and studies;
- planning of the development of the compartment;
- execution of the works and establishment of the institutions;
- operation and maintenance.

Surveys and studies.

In the very beginning a short reconnaissance survey is made for a first identification of the compartment (boundaries, character of the area, etc.).

The preliminary survey is the next step. In this survey all the relevant data are collected in the field and from official agencies. This is done by a multi-disciplinary team.

With the help of these data the outline of the baseline survey could be designed. This survey will provide the knowledge required for the development of a number of scenarios in the following phase. Furthermore it will be used as a reference for the post-project evaluation. The survey is sub-divided into four components: a household survey, a

hydrological survey, a multi-disciplinary sub-compartmental survey and an institutional survey. The sub-compartmental survey is actually the first step in involving the local people in the process of developing the compartment.

The objectives, approaches and outputs of these surveys are described in chapter 5.

During this phase special in-depths studies could be needed, such as an institutional study. However, also in the following phases special studies will be performed.

Planning of the development of the compartment.

At the end of the development phase a decision about the model for the development of the compartment has to be made. In this model structural as well as non-structural measures are included. The process, leading from the development of a number of options to one selected scenario, is described in chapter 6. The way the people and the institutions are involved in the decision making process id described in chapter 7.

Execution of the works and establishment of the institutions.

Already before the decision about the development model has been made, the design of some general works, which has to be executed anyway, could start. However, most of the activities in the construction phase can only start after the decision making process. The components in this phase are the design, the tendering and the execution of the works, as well as a first set-up of the organisation for the water management. These activities would be accompanied by a training in water management of all people concerned. In the sections 5.7, 5.8 and in annex 4 the execution of the works are discussed. Chapter 7 deals with the institutionalisation. Detailed information will be given in the interim reports of both the compartments.

Operation and maintenance.

Immediately after the completion of the works the operation and maintenance must start. This process in which the beneficiaries have to be involved, is described in a special study report and in the interim reports.
During this stage certainly some additional works have to be executed, if an adjustment of the water management is needed, or if the results of the former works does not give the output as expected.

The different steps are summarized in next blocks.

SURVEYS AND STUDIES: **SECTION 5.4**

- Reconnaissance Survey
- Preliminary Survey
- Baseline Survey
  - . Household Survey
  - . Hydrological Survey
  - . Sub-Compartmental Survey
  - . Institutional Survey
- Special Studies

PLANNING OF THE DEVELOPMENT OF THE COMPARTMENT: Chapters 6 and 7

- Investigation of the targets
- Development of the options
- Screening of the scenarios
- Selection of the recommended scenario
- Decision making

EXECUTION OF THE WORKS AND ESTABLISHMENT OF THE INSTITUTIONS: **SECTIONS 5.8, 5.9 AND 7**

- Design
- Tendering
- Execution of the works
- Proposal institutionalisation
- Establishment of the institutions
- Training programme

OPERATION AND MAINTENANCE: **SECTION 5.8**

- Operation of the gated structures
- Maintenance of the water management works
- Adjustment of the watermanagement structure, if needed

4 SUSTAINABLE DEVELOPMENT AND APPROACH

It is of fundamental importance that compartmentalization leads to a sustainable development. This implies the following:

- Resource management: the resources are to be used in a rational and renewable way while adverse impacts (direct and indirect) are reduced to a minimum and do not accumulate.

- People's participation: the results are developed with and accepted and supported by the population concerned.

- Focus on the disadvantaged: aiming at social sustainability.

- Feasibility: the economic consequences are justifiable, based on a broad cost-benefit analysis.

- Flexibility: in planning and implementation; in budgeting and in the formulation and application of concepts.

The economic and financial aspects will certainly be taken into account, but will not be further discussed here. The other items will be discussed in the sections below.

4.1 Resource management

The resources of the natural environment are mainly dictated by its climate, soils, and geologic, geographic, hydrologic, botanic, zoologic and human resources. Mankind has developed activities within this framework that affect these resources to some extent (e.g. agriculture, fisheries, infrastructure, animal production etc.).

Resource management aims at preventing unwanted, uncontrolled or irreversible changes in the resources of the natural environment by means of (a combination of) these human activities. In a more offensive sense: resource management aims at protection and enhancement of the economic base and social well being of all project-area residents. Due to the far-reaching interrelations in the natural environment this is an extremely complex field of study.

With regard to the project activities the following items are of special interest:

- Increased **agricultural production** is one of the main aims of an improvement of the water management in the compartments. This will be reached by risk reduction (stimulating investments), by changes in cropping patterns and practises and increased availability of cultivable soils (increase in cropping intensity). To which degree the cropping patterns and farming systems will change depends also on developments in the input-output markets.

- **Livestock** developments will be monitored and taken into account because of their importance for traction, dung (as fertilizer and fuel) and food products.

- The decline in **captured fisheries** is a field of major concern. Any negative impact on the important but already declining fish stocks should be limited as much as possible. Captured fisheries production depends to a large extent on the migration of adult and larval fish. Any improvement of these migration patterns, that lies within the scope of the project, will be stimulated.

- **Cultured fisheries**, is a tool in order to increase total fish production. The actual status will be monitored and, where possible, improvement and expansion of this activity will be stimulated

- Soil quality and eventual factors of degradation will be studied and monitored to promote, where possible, that agricultural development will not stimulate the degradation of its own basic resource.

- The **quality of surface and ground water** will be dealt with to avoid or rectify any negative impacts caused by agriculture, industry, transport, human wastes and others, that may be stimulated by the improved conditions created by a change in water management.

- The impact on the **natural environment** will be studied and monitored to avoid unnecessary losses of species and habitats (wetlands notably) and if possible to increase its quality and diversity. Its role in causing harm to man and its properties (insect pests, disease factors, rats, mice, poisonous snakes, etc) will be studied and taken into account in the planning of the water management of the compartment.

- About **health**, great care will be taken to avoid negative consequences in the long term of the improved water management. Study of the relevant factors will be necessary.

- **Water transport** is, at least in the wet season, an important means of transport and travel. The project will, as far as possible, look for an infrastructure organization in the compartment that is optimal for water transport.

4.2 People's participation

> "Lord Cromer's magic formula saved Egyptian irrigation; it will save Bengal irrigation"... "What do the fellaheen (Ed. note; = farmers) want"... "Do what the fellaheen want, have them behind you, and you will pull through." [Willcocks, p.28]

Different types of people's participation

Within the FAP there are great expectations about people's participation. Whether those hopes will be fulfilled depends to a large extent on what is actually meant by "people's participation". That in turn will be most clear from what will be proposed and done to achieve it.

Participatory development has a wide range of definitions. On the one hand there are programmes conceived, designed, implemented and operated by outsiders who, for one reason or the other, want to involve people in these programmes. In such cases people's participation can only be attempted through a "salesman type" of approach. On the other hand there are cases where the people concerned define the problem(s), the solution(s) and implement the programmes, using their own resources. One could describe this as "grassroots" type participation.

The types of people's participation described above are the extremes along a continuum. Both approaches have their pros and cons. The "salesman type" assumes the outsiders know best, and that the ultimate benefit of the intended beneficiaries and the urgency of the task justifies this top-down approach. In reality outsiders often lack insight in the actual situation and project interventions become irrelevant or even worse, negative.

The strength of grassroots development is that it is locally sustainable. The major weakness is that local solutions often lack dynamism. The reason is that they do not normally take into account regional, national or worldwide developments nor make use of other than local resources.

FAP 20 is obviously not involved in a grassroots type of people's participation, nor does the Flood Action Plan or the FAP 20 TOR favour a salesman type of approach. FAP 20 will follow an approach in between these two extremes, seeking a cross-fertilization of local and outside knowledge, resources and effort (for more details on this see chapter 6 (Design of development model)).

The need to emphasize the bottom-up approach

While recognizing the need for combining local and outside inputs, it is proposed to emphasize the involvement of the local people in all stages of the project, starting with project formulation. The reasons for this are the following;

- Traditionally governmental programmes, including those of the BWDB, have been of the salesman type (top-down). Recently there have been a few innovative attempts to involve the people affected in project formulation and design i.e., a more bottom-up approach. There is a need for more experimentation in this field, taking into account the activities of SRP (Systems Rehabilitation Project) and other projects involved in this field.

- The nature of FAP 20 is experimental. Experiments should be designed in such a way that the likely outcome would be in either direction of the position(s) implemented. In the case of people's participation this calls for a wholehearted attempt, i.e. to get as close as possible practicable to a grassroots approach.

- One of the pre-conditions for achieving a sustainable water management project is for the beneficiaries to have a sense of "ownership" of the project. Only then is it likely that they will be effectively involved in operation and maintenance. For such a sense of ownership to develop, the people have to be involved as much as possible in the project planning, design, implementation, operation and maintenance process.

Consequences of stressing people's participation

Attempting a bottom-up type of participation in a governmental project, such as FAP 20, is quite a challenge. As the people's participation centred approach is fundamentally different from the traditional top-down type of development, it will require change on the side of all those involved in the development system.

Government staff will have to approach people as their teachers, their clients, rather than their subordinates. Development specialists, both national and international, will have to get off their pedestal and learn from the people. The implementing agency will have to live with the fact that projects with people's participation usually take more time to gain momentum than top-down projects. Those at planning and policy making level will need an unusual degree of flexibility to adjust and improve plans as people have their input. Finally the funding partners will have to come to terms with the fact that in projects with a major people's participation component, disbursement rates may no longer be a valid criteria for evaluation.

Involving the people in a compartment furthermore implies that all the different interest groups must be involved. These include farmers, unskilled and skilled labourers, fishermen, boat operators, women etc. Also the potential disadvantaged have to participate in this process. These include those living outside the CPP area who might experience higher water levels.

Finally all the relevant GOB ministries will have to work together to produce the maximum possible development. With people's participation at the centre the integrated nature of life in the flood plain will demand nothing less than full coordination of all GOB services.

4.3 Focus on the disadvantaged

The approach of FAP 20 is characterized by a focus on the disadvantaged. This emphasis reflects the stated aim of the Government of Bangladesh as well as of the donors of the FAP. It is based on the understanding that the socio-economic structures throughout the world are such that they almost automatically make the rich richer, and the poor poorer. Although recognizing the need for a balanced approach to social and economic development, projects must therefore aim at countering this trend and alleviate poverty. This section deals with the FAP 20 proposed approach.

The disadvantaged

It is now recognized that many development programmes have tended to benefit the better-off much more than the disadvantaged. The GOB and donors alike aim at redressing the balance through programmes and measures targeted specifically at the poor.

In Bangladesh, as in many other countries, the situation of women is almost always worse than that of men of the same social class. This is reflected in a lower social status as well as less access to resources such as food, medical care, education etc. It results in, among others, a lower life expectancy for women. Therefore programmes have been designed

aimed specifically at improving the situation of women. The stated aim of poverty alleviation will therefore have to focus on improving the situation of women, both through service type programmes and through structural improvements. The latter is most often income generating in nature and therefore relevant to compartmentalization.

By definition the poor have few resources except their labour power. Programmes aiming at poverty alleviation (apart from those delivering social services) seek to capitalize on the ability of the poor to sell their labour.

Distribution of long-term benefits

The planned advantages from compartmentalization can be divided into temporary and long-term benefits. During the design phase the major decisions will be made as to how much each section of the society will benefit from the project. A reduction of flood damage will help stabilize the position of the share-croppers and even more so of the marginal farmers. Given the focus on the disadvantaged, alternative development options might be prioritized on the basis of the resulting long-term increase in labour demand.

The most obvious long-term benefit will be increased agricultural production. This will mean an immediate increase in the capital value of land but above all added seasonal returns to those involved in farming. The increase in the value of land will benefit those who own land in direct relation to the amount of land they own. In case of land owned, the additional seasonal returns will also directly benefit the landowner. In case of land share-cropped, roughly half of the increase in gross seasonal production will go to the landowner and half to the sharecropper.

Other long-term benefits are those related to operation and maintenance (O&M). The focus of FAP 20 on the disadvantaged will be translated into a labour intensive O&M. O&M activities done by "un-skilled" labour will certainly benefit the disadvantaged. In so far as O&M requires skilled personnel (the more simple the structures are, the less skilled labour will be needed) the positive effects are likely to accrue to the better-off in society. As the project beneficiaries are expected to pay towards O&M,for the landowners and the farmers this will increase their expenditures. The benefits from O&M for the "unskilled labour" are however likely to be only a fraction of the total agricultural benefits that compartmentalization is expected to produce.

O&M of the embankment would be awarded to women groups as already practised by CARE and in line with the national strategy underlying the SRP. Special studies will be made to find out which of the experimental ways of benefitting the landless, such as leasing of borrow pits, embankment slopes etc. can be used in the CPP. In this respect, the options for multi-purpose use of embankments will be examined as well. The existing practice integrates the function of a water dividing and water retention with transport, housing, grazing land, crop production (fodder, vegetables, fruit etc), tree production (fuel, fruit, timber) and other functions (market places, etc).

In the present agricultural structure, labour selling households can possibly gain long-term benefit indirectly through an increased demand for labour, resulting from a change in the cropping pattern/intensity and less damage (more harvesting).

Non-labour selling (landless) households such as those involved in agro-business, transport, trade, commerce, workshops and other economic activities, would also benefit secondarily through a growth of the rural economy and the related increased demand for their services and products.

Distribution of temporary benefits of the project

During implementation, temporary benefits are distributed in the form of wages and other implementation costs. It is proposed that as much as possible of the construction work will be carried out using manual labour. Of the manual labour, 30% to 50% will be awarded to Labour 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.

On the side of the consultants, temporary benefits are distributed between the national and foreign firms and their staff. In this aspect the policy is to keep the expatriate component as low as possible.

4.4 Flexibility in the approach

> "The practical point of the greatest importance in the restoration of the ancient irrigation of Bengal is the fact that every work proposed for execution can be started in a small way in a dozen different localities, and each work can be added to year by year until finality is reached. The lessons learnt in one year will be available for the next year, and those learnt in one locality will be available for all other localities." [Willcocks, p.58].

One of the consequences of an experimental and a people's participatory type of approach is the need for an unusually high degree of flexibility. This flexible approach is recognized in the TOR, where it is stated that

> *"It will be important to maintain a flexible approach and (construction) programme, linked to the non-structural activities"* [TOR, page 7].

However this may come in conflict with the fact that FAP 20 is a "project", with a fixed time frame and budget. This tension is aggravated because FAP 20 is part of a larger network of present and future FAP projects.

Experiments and cooperation with other projects in and outside the FAP implies that the knowledge base will grow over the time. At each stage in the projects life cycle, planning will have to be done on the basis of existing information. As and when new data and insights become available, the time schedule and the direction of the project might have to be adjusted.

Even more so than for reasons of incorporating results from experiments and from other projects, involvement of the people requires the implementation of FAP 20 to be flexible. In fact, attempting to integrate people's participation in FAP 20 implies that a choice has to be made for:

- a flexible implementation schedule that allows for the rather unpredictable (usually slow) speed of the participatory approach, instead of a fixed scheme with less freedom for changes in the planning;

- a flexible budget (with a ceiling, but less defined time and item-wise) determined by the developing felt needs and the willingness of the people to cooperate instead of a fixed budget that "forces" one to implement planned measures;

- a flexible concept which allows different localized solutions instead of a "neat and tidy" one, which must be applied uniformly throughout the country.

It is proposed that the suggested flexibility and its consequences are accepted as this is deemed crucial to the success of FAP 20. On its part FAP 20 will expand the contents of quarterly reports by adding continually up-dating on developments. Firm plans will be made on a year to year basis in the annual report.

5 SURVEYS AND STUDIES

The pilot project nature of the project calls for an overall experimental type of approach. FAP 20 therefore needs both detailed and extensive information on the existing and the post-project situation. To gather this information, FAP 20 will conduct rather extensive surveys. The results of these surveys will be used in two ways. First of all the results will feed into the design phase of the compartments. Secondly the information gathered will be used in monitoring and ultimately in the post-project evaluation.

A number of surveys, each with specific aims and objectives, have been planned. Some of these are combined in the baseline survey (section 5.4).

The experimental nature of the project calls for in-depth special studies to supplement the broad surveys. The reason is that there are areas, relevant to compartmentalization, where existing practices are clearly ineffective, as well as areas about which little is known and/or where there are few if any solutions. FAP 20 will deal with both i.e, study the existing practices and experiment with potential alternatives.

Due to the wide variety of special studies, no single methodology can be described for this. Where possible, the studies will be carried out in cooperation with other FAP projects. In section 5.11, themes to be studied are mentioned, but no detailed programmes have been presented. In the interim reports, proposals for the execution of the special studies will be submitted.

5.1 Reconnaissance survey

In November 1990, while preparing the Technical Proposal for the CPP, the Consultant conducted a short survey of the two main pilot project areas, Tangail and Sirajganj. These surveys showed that in both areas rainfed flooding and water logging were considered to be the main flood related problems.

These findings as well as others were included in the Technical Proposal. Since that time further investigations in Tangail (in April 1991) and in Sirajganj (in October and November 1991) have basically confirmed the findings of the first visit. However the origin of the problems is different for each project area.

In Tangail the internal drainage problems are very clear. In Sirajganj the drainage situation is now overshadowed by the overriding concern created by the uncertainty of the protection by the Brahmaputra Right Embankment. Following the reconnaissance survey of Sirajganj the suitability of the area for a compartmentalization pilot projects was raised. The issue has been dealt with in detail in section 3.3.2.

5.2 Preliminary survey

For FAP 20 it is important to get an integrated, overall view of the actual situation in the compartment areas. One way of stimulating this has been to locate the office and the residences of the CPP team members in Tangail town. Another way to get this view as soon

as possible, is to conduct a rapid preliminary survey of the area including all the team members.

The major findings of the preliminary survey of the Tangail CPP area were, that the area is already rather well developed, that local drainage problems require an in-depth survey of sub-compartments, that region-wide compartmentalization would require drainage congestion around Dhaka to be solved and that about one third of the people live in Tangail town. These and other findings were summarized in the *SUMMARY OF PRELIMINARY SURVEY OF TANGAIL COMPARTMENT* (Techn. note 91/13) and presented for discussion at the FAP Team Leaders meeting on 29 August, 1991. A similar survey is planned for the Sirajganj area. The results of the preliminary survey form the basis for the different components of the baseline survey.

5.3 Mapping, aerial photography, satellite imagery and topographic survey

The topographical data, available to the project comprise

- topographical maps; scale 1:50,000; 1964; updated in 1991; no contours;
- spot image; scale 1:50,000; 1989; pixel size 10,000 m;
- spot image; scale 1:50,000; 1990; false colour composite; pixel size 20,000 m;
- irrigation maps; 8" to 1 mile; 1964; contours 1 foot;
- Mauza maps.

The maps are available for both the Tangail and the Sirajganj project area.

As indicated above, the elevation data have been assessed in the year 1964. Such needs confirmation, especially in areas where erosion and sedimentation processes have been active. Under FAP 20 and under other programmes, topographical surveys of waterways and floodplains have been made to cope with this lack of recent data.

FAP 20 is eagerly expecting the results of FAP 18," Topographic Mapping".

5.4 Baseline Survey

The TOR mention the following about the main objective of the baseline survey:

> *"Provide and verify data on hydrological, engineering, agricultural, socio-economic and environmental aspects prior to, during and on completion of the pilot project."* [TOR, page 9].

To evaluate the impact of compartmentalization on the people and their socio-economic situation a baseline study will be conducted in the CPP areas before the start of the physical works. It will be repeated at the end of the project. The baseline survey has four

components: a household survey, a hydrological survey, an institutional survey and a multi-disciplinary survey of each provisional sub-compartment. The institutional, the hydrological and the multi-disciplinary sub-compartmental survey will be conducted by the CPP team members while the household survey will be done by a specialized national firm.

The focus of each component of the baseline survey is as follows.

- The **household survey** is designed to provide statistically valid baseline data mainly covering social, economic, agricultural, fisheries and urban issues. The survey will be of the questionnaire type. These data will be used to some extent in the planning process, but the main use of these data will be in the multi-criteria analysis of the alternatives, and the post-project evaluation.

- The **hydrological survey** will provide vital information for the planning, the mathematical modelling and the post-project evaluation. This survey will include levelling, recording water levels and discharge measurements.

- The focus of the **multi-disciplinary sub-compartmental survey** will be on the opinion of people from different interest groups about the water management related situation, the problems and what they see as the solutions. This survey will also deal with the interrelation between the history of the area, environment, transport, fisheries, rural industry, hydrological situation, agricultural status etc. The information will be collected using a Rapid Rural Appraisal approach. The main use of the information will be in planning and design. At the post-project evaluation stage the data may again prove useful as descriptive baseline information.

- Through the **institutional survey** information will be gathered at the compartmental level regarding the institutions relevant to water management. The information will be gathered using open ended checklist questionnaires. The data will feed into the design and implementation of the institutional development. A preliminary institutional survey has been carried out already and is summarized in the report on institutional aspects.

On the basis of the outcome of the baseline survey a monitoring programme will be designed measuring key indicators on a regular basis throughout the project lifetime. The baseline information will also be used to check and if necessary adjust the tentative list of special studies designed to gather in-depth information on relevant environmental issues such as agriculture, fisheries and social aspects.

In the following sections, the four components of the baseline survey are discussed.

5.4.1 Household survey

Geographic coverage

The household survey will cover three basically different geographic areas. The first one is the area inside the main borders of the CPP. This is the area that is expected to benefit

from the project. However, in spite of all-out efforts to prevent this from happening, it is likely that at least some in this area will be dis-benefitted; for instance through land acquisition, loss of boat transport facilities or access to common capture fisheries resources.

The second area to be influenced by the CPP and therefore to be covered by the household baseline survey, is the area adjacent to the project boundary but hydrologically or socio-economically linked to it. The impact in some parts of this area could be negative.

As per the "Guidelines for Project Assessment" of the FPCO, the baseline survey must include a third distinct area, the "control area". This is an area, presently similar to the project area, but not influenced by the CPP. It will facilitate the distinction between project impact and impacts from more general developments in the region. FAP 12 elaborated on the growing difficulty of finding a suitable, "undisturbed" area that can fulfil this role.

In consultation with FAP 3 (NCRS), the decision has been made to use the Kalihati Upazila, North of the Tangail CPP, as a control area for the Tangail CPP household survey. Although the implementation of the Jamuna Bridge may well render this area unsuitable, there is no better control area. A suitable control area for the Sirajganj CPP might be the area North of the Sirajganj CPP, up to Kazipur. This will be discussed with FAP 2 (NWRS).

Basic approach to the household survey

The main effect of compartmentalization will be on the timing of flooding, the speed of water level changes and possibly water levels. Because the main direct impacts of compartmentalization will be on agriculture, livestock and fisheries, the bulk of the survey households (the main household survey) will be randomly selected from the rural area. Besides the main household survey, two supplementary household surveys will be executed.

It is proposed to do the main household survey, using probability sampling. This will allow to measure sampling errors and to test the statistical significance of trends as well as differences between localities and social groups. FAP 12's methodology, as detailed in their *METHODOLOGY REPORT (MAIN VOLUME)*, will be followed whenever possible.

The basic stratification is as mentioned above, i.e. the area inside the project area, the adjacent area and a control area. It has been decided to stratify the study area further by making a distinction between rural and urban areas. As the main impact of compartmentalization will be on the rural area, the main household survey will only cover that part of the three study areas.

Within the rural area, the farm households are distinct from the non-farm households. The former are likely to obtain most of the long term and direct benefits. The non-farm households are likely to only receive temporary and secondary benefits. Therefore both groups will have to be seen as distinct populations, with their own domain and therefore coverage.

The process of urbanization is likely to continue in the decades to come. Therefore the needs of the urban section of the society must be taken into account in the FAP. CPP will therefore cover the urban population through supplementary household surveys.

Fishermen communities are concentrated in a few specific villages/paras. They might be under-represented in the main household survey. Therefore, they too will be covered through supplementary household surveys.

Because of problems related to simple random sampling, cluster sampling will be adopted in the household survey. Annex 3 shows the details about the sample size and frame and about the manning schedule. To ensure the quality of the household survey as well as the replaceability, it has been decided to get it done by a specialized national consultant.

5.4.2 Hydrological survey and hydro-modelling

The main objective of the survey is to assess the hydrological environment in relation to the population in the present situation. This will allow the projection of changes in the hydrological environment due to the introduction of compartmentalization in general, and, more specifically, the implementation of precise structural and non-structural measures.

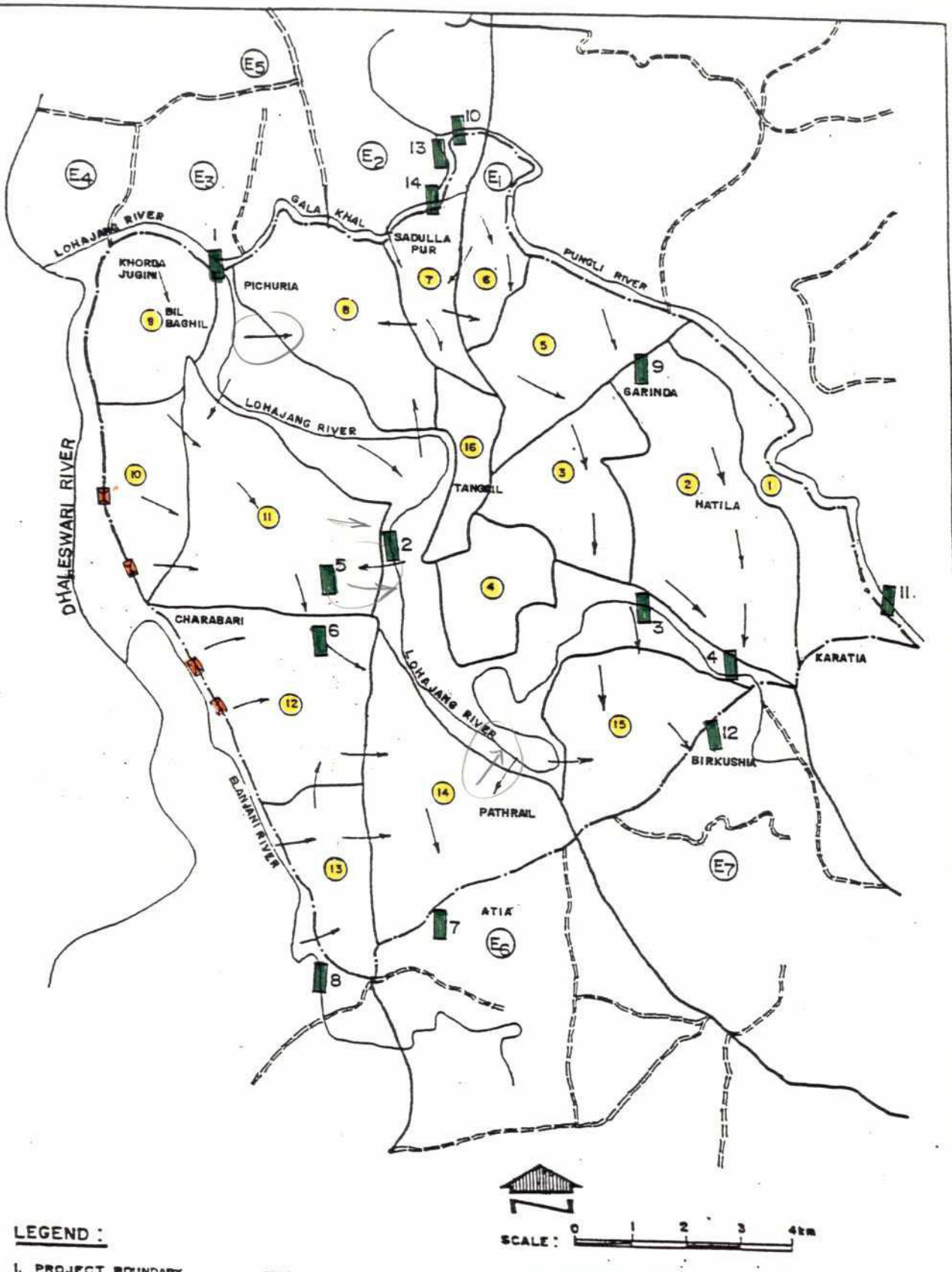
Naturally, the principal study area will be the compartment. However the geographical coverage will go beyond the compartment boundaries because the water resources (river and overland flow, groundwater flow) can not be considered on a compartment scale only and the introduction of compartmentalization will affect the water regime of adjacent areas.

Key problems in the Tangail area are related to an uncontrolled flood level during the monsoon and drainage congestion during the pre- and post-monsoon periods. The compartmentalization concept will be directed towards a solution of these problems (flood and drainage management). For the Sirajganj area, the implementation will adopt more clear the characteristics of a drainage management scheme.

5.4.2.1 Approach

The approach followed for the hydrological survey is

- assessment of requirements under existing conditions with respect to water use and safety for different water users like (irrigated) agriculture, human water consumption, fisheries, navigation etc;
- assessment of fulfilment of these requirements under the present situation. This will lead to constraint-formulation under the present condition;
- development of (possible) new situations under various scenarios. The fulfilment of the requirements under the new situation(s) will be tested and compared with the present situation.



LEGEND :

1. PROJECT BOUNDARY
2. SUB COMPARTMENT BOUNDARY
3. RIVER
4. REGULATOR
5. SUB COMPARTMENT
6. FLOOD FLOW DIRECTION
7. GAUGE LOCATION

N

SCALE : 0 1 2 3 4km

MINISTRY OF IRRIGATION, WATER DEVELOPMENT AND FLOOD CONTROL
BANGLADESH WATER DEVELOPMENT BOARD/FLOOD PLAN COORDINATION ORGANIZATION

COMPARTMENTALIZATION PILOT PROJECT
FAP-20

SUB-COMPARTMENT LOCATION MAP TANGAIL

CONSULTANTS :
Euroconsult, Lahmeyer Int., Bets Ltd., HCL.

Drawn By :	Checked By :	Fig. No. 4

External development options that might interfere with the present as well as future conditions will be considered in a study of the field data collected during the hydrological survey.

One of the tools in this study is the mathematical model; this will be described in the next section.

5.4.2.2 Mathematical modelling (MIKE 11)

The hydrological environment is simulated with the help of rainfall-runoff and hydrodynamic modules. The rainfall-runoff or NAM module simulates a water balance composed of rainfall, evapotranspiration, groundwater recharge/depletion and runoff. The hydrodynamic module simulates the unsteady flow conditions of the surface water in the floodplains and channels, resulting from local runoff (NAM) and a set of boundary conditions.

For the hydrological survey as well as the modelling, the sub-compartment has been introduced. The justification for this unit is at this stage purely hydrological and based on the (hydrological) function that a specific area has, e.g. water storage and/or flow. The boundaries of sub-compartments follow embankments, bunds and roads usually. For the Tangail area, 17 sub-compartments (incl. the flood plain of the Lohajang) have been identified with 8 adjacent areas (figure 4). Each area has a size of 200 - 1200 ha. The division in sub-compartments might be modified later in order to satisfy specific management strategies and to form appropriate boundaries for appropriate institutional units within the compartment. For the Sirajganj compartment, no sub-compartments have been indicated yet.

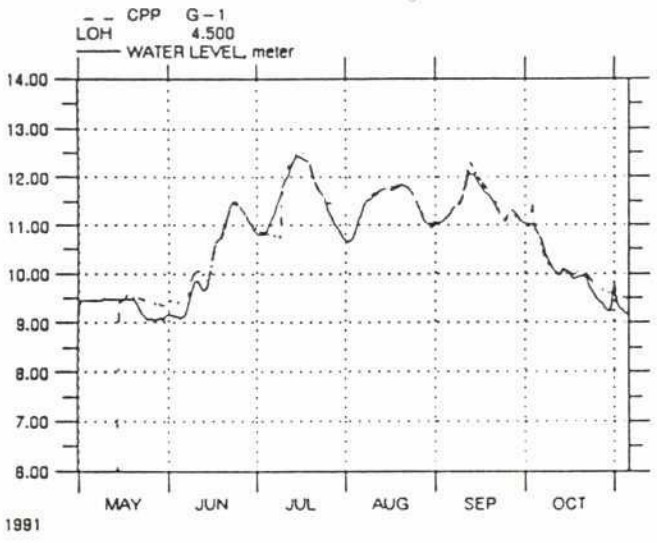
A further subdivision, the flood-cell, has been introduced for the purpose of the mathematical model only. It serves the refinement of flooding and inundation within the sub-compartments and prevents instability of the model with lower water levels.

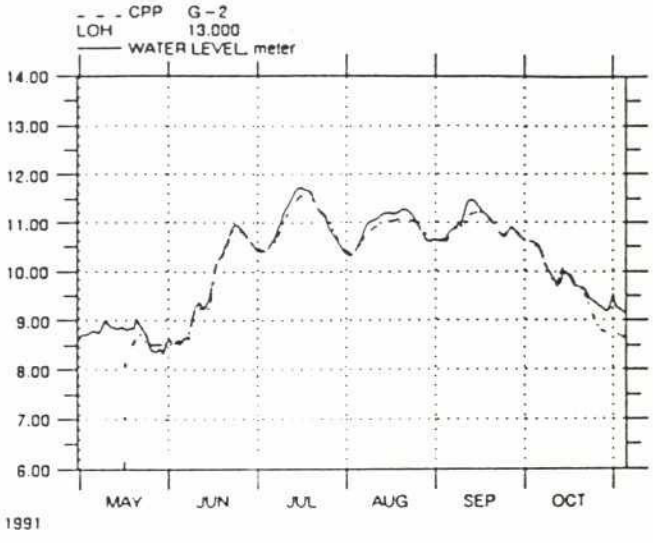
The basic aim of the modelling process is to facilitate the design of the compartment and t the watermanagement thereafter for the benefit and protection of human settlements, agriculture, fisheries, navigation, water supply, industries etc. This is a three step approach:

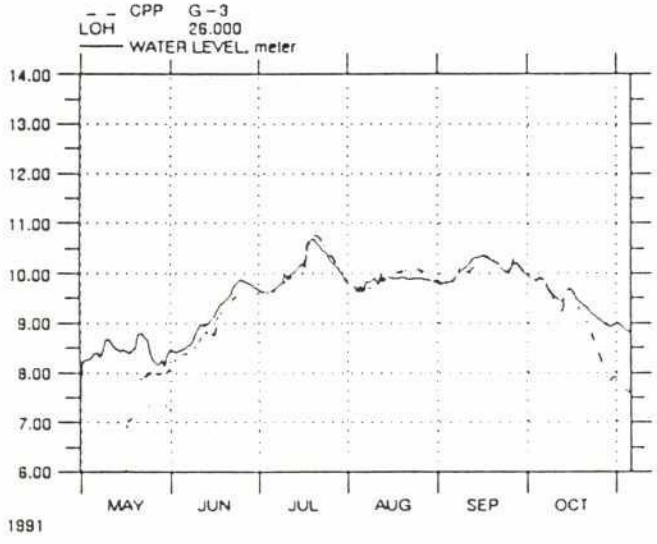
a. simulation of the existing situation;

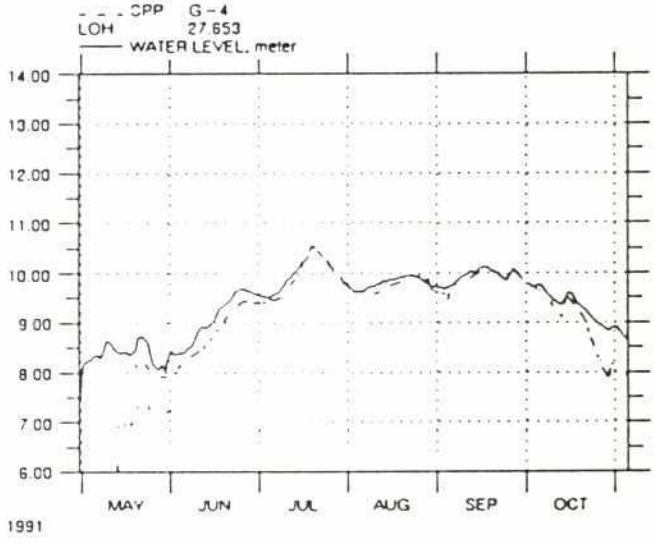
b. simulation of structural interventions that may be implemented in order to obtain desired hydrological conditions. The basic design criteria for the structures come as additional result from this process;
c. simulation of operational procedures for the structural interventions in order to reach desired hydrological conditions.

The calibration process aims at an adjustment of the simulated data towards the observed situation.



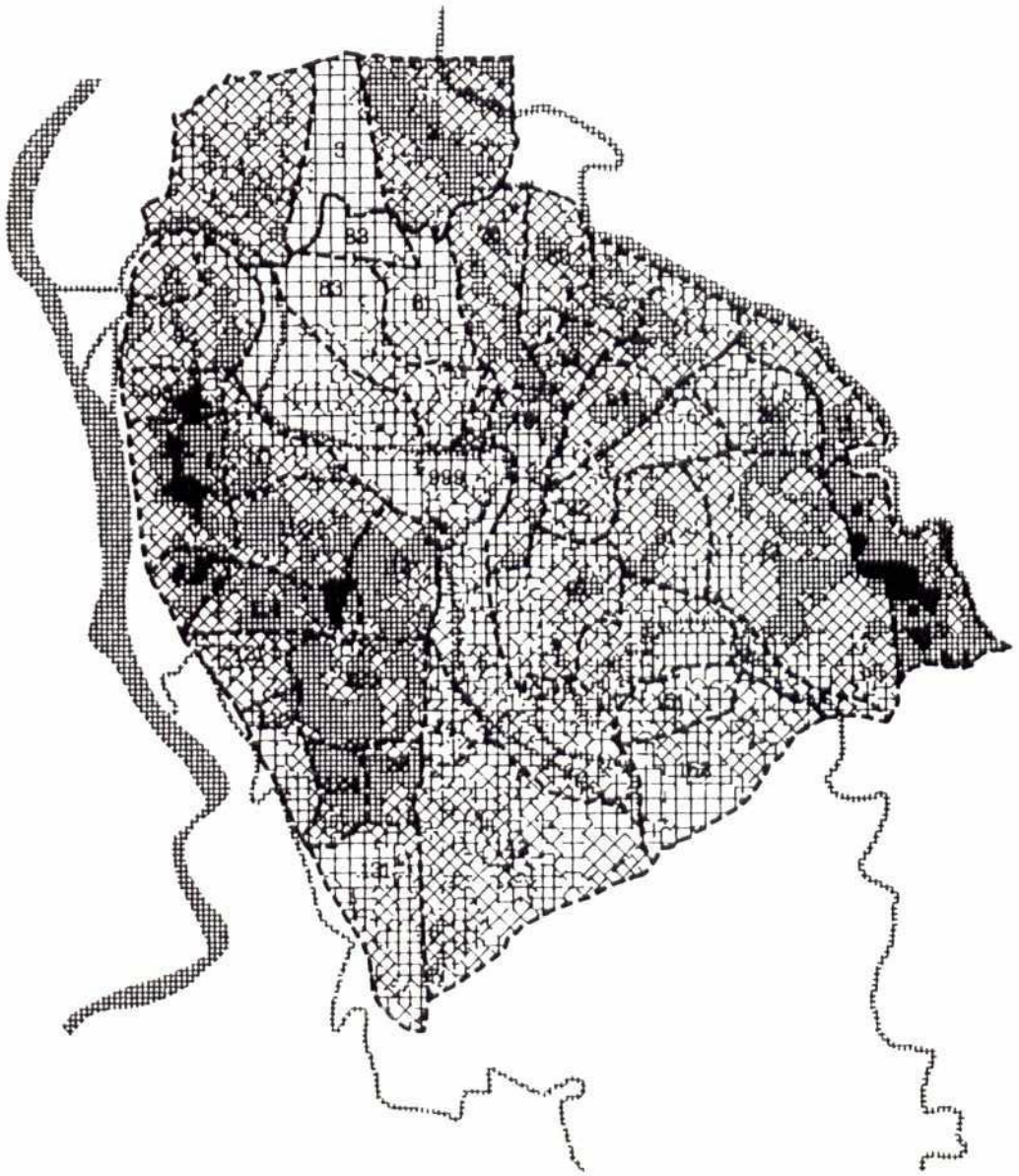


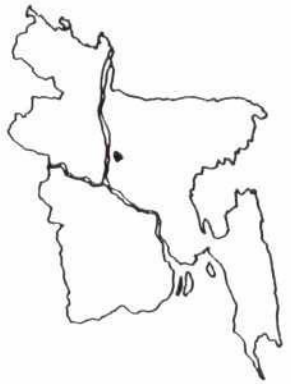




FAP 20	Compartmentalization Pilot Project Computed waterlevel compared with measured waterlevel
DATA FILE : CPP.RDF RESULT FILE : BASESITU.RRF	BOUNDARY FILE : CPP.BSF
	MIKE 11
	Fig.no. 5

FLOOD DEPTH MAP





Tangail Compartment

15 th July 1991

Model Result

Legend

	< 0.0 cm
	0.0 – 29.9 cm
	30.0 – 89.9 cm
	90.0 – 179.9 cm
	180.0 – 299.9 cm
	>= 300.0 cm

Fig. no. 6

The Tangail model has been calibrated against the 1991 situation starting from May up to the end of November. There are altogether 14 water level measuring stations available for the Tangail project area against which the model results can be checked (figure 4).

Figure 5 presents some typical hydrographs of the calibration process. Generally speaking the fit between the observed and the calculated data on the rivers and in the flood-cells is good except for the Elanjani river. The compatibility between the Tangail and the North Central regional model has been maintained.

As a result the flood depths can be calculated for each required situation, and with the help of GIS a flood dephts map can be drawn (figure 6).

A further important feature of the modelling process is the assessment of the probability of hydrological events. This is normally done by means of historical runs. It has been decided not to go for this process in Tangail both for reasons of time constraints as well as for the fact that especially the Dhaleswari and the Lohajang rivers have undergone major morphological changes in the recent past that would have been very difficult to track down.

A detailed analyses of the Jugini hydrograph (Lohajang intake from Dhaleswari) with respect to flood level, duration and speed of rise has been extrapolated in the compartment in order to assess flooding characteristics. The potential damage of the flooding inside the compartment has been given a rating between 0 and 1, related to the potentially damaged cropped area for the years between 1952 and 1991. The years for the simulation will be chosen according to the return period of the potential damage.

For Tangail the following return periods have been assessed:

1989; rating less then 0.04; damage exceeded 2 out of 3 years
1991; rating less then 0.08; damage exceeded 1 out of 2 years
1983; rating less then 0.20; damage exceeded 1 out of 3 years
1965; rating less then 0.24; damage exceeded 1 out of 5 years
1987; rating less then 0.28; damage exceeded 1 out of 10 years

The hydrographs of the maximum 3-day mean per decade for these years are presented in Figure 7. For the Sirajganj model, the same approach will be followed.

The next step in this process is the simulation of the impact of physical interventions (see section 5.7). The size of structures will be based on the requirements as expressed by different users. Some of the possible scenarios to develop are:

- existing situation ("zero option")
- drainage improvement
- drainage improvement combined with semi-controlled structures
- drainage improvement combined with controlled structures
- drainage improvement combined with controlled structures and regulating structures on sub-compartment level
- other options.

A short description of these scenarios is presented in annex 5

The basic work for the development of scenarios will be based on the year 1991. When refining the scenarios, the other years will also be simulated in order to study the effect of proposed measures in different years, ranging from a year with low floods (1989) to a year with high flooding (1987).

One of the modules within the MIKE 11 package is the sediment transport module. This module will be used to assess the impact of structures on the sedimentation processes within the compartment.

In order to become acquainted with the model, a modelling engineer joined the Project Team.

5.4.2.3 Interactions of the model

The main fields for interaction of the model are agriculture and fisheries.

The following procedure will be followed:

- The period from the 1st of May up to the 31st of November will be divided into 21 decades.

- The maximum 3 day-mean water level for each decade will be calculated.

- The resulting flood depth per sub-compartment according to the WL0 to WL5 classification (0/30/70/100/150/300 cm division) will be presented for each decade.

For agriculture, the deepest flooding at specific key-periods of the cropping calendar will determine the potential agricultural output at a specific year for the existing situation and a series of scenarios.

Also for fisheries, the flood depth and extent determine the potential output. In addition the influx of fish from the rivers into the floodplains at the early monsoon is a prerequisite for fish production in the floodplains.

This procedure, which permit that economic values can be given to specific hydrological years, will be followed for a number of scenarios. Thus the additional benefits for a certain scenario can be compared with the additional costs involved.

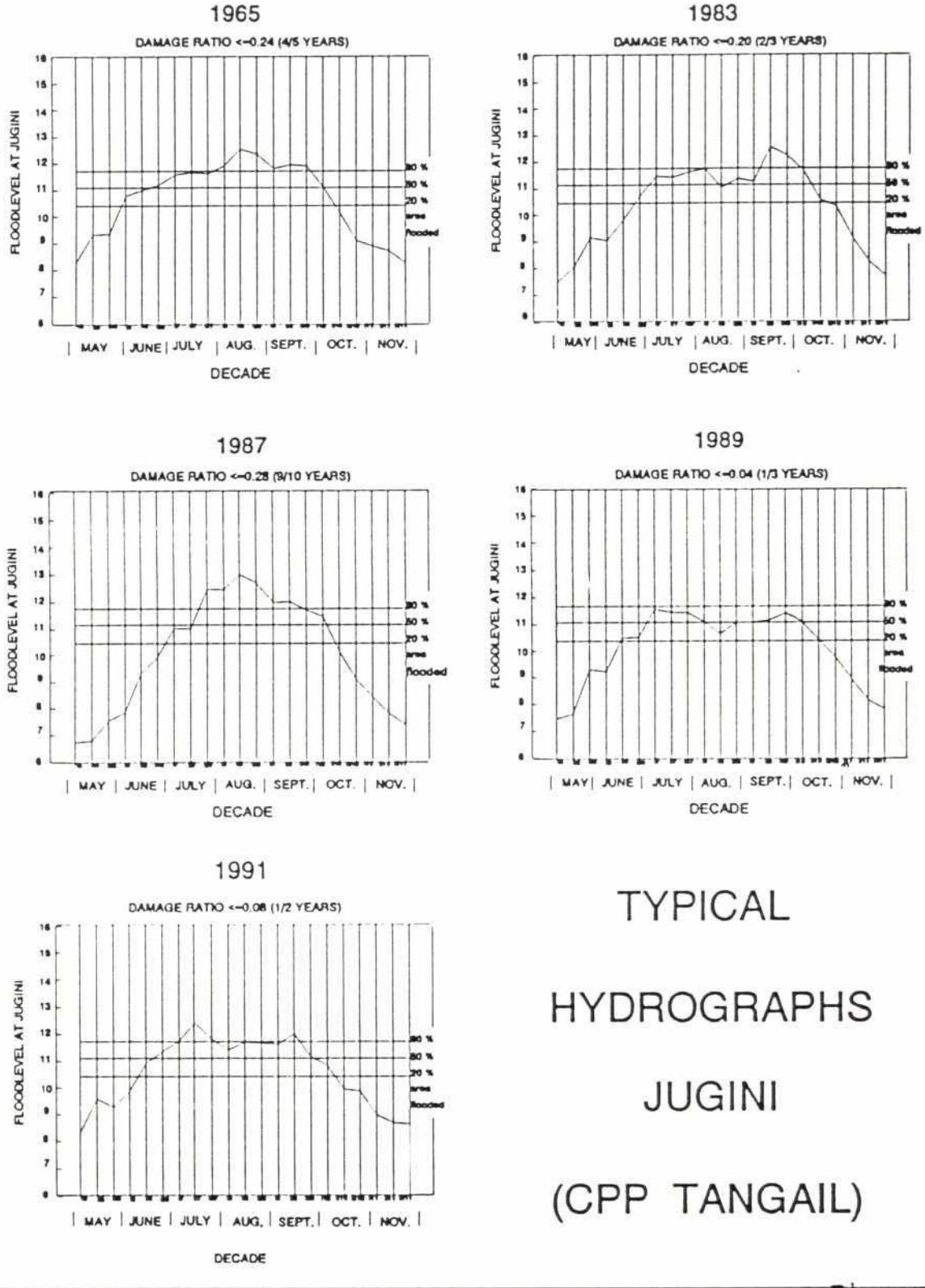

1965
DAMAGE RATIO <=0.24 (4/5 YEARS)
FLOODLEVEL AT JUGINI
| MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. |
DECADE
1983
DAMAGE RATIO <=0.20 (2/3 YEARS)
FLOODLEVEL AT JUGINI
| MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. |
DECADE
1987
DAMAGE RATIO <=0.28 (9/10 YEARS)
FLOODLEVEL AT JUGINI
| MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. |
DECADE
1989
DAMAGE RATIO <=0.04 (1/3 YEARS)
FLOODLEVEL AT JUGINI
| MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. |
DECADE
1991
DAMAGE RATIO <=0.08 (1/2 YEARS)
FLOODLEVEL AT JUGINI
| MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. |
DECADE
TYPICAL
HYDROGRAPHS
JUGINI
(CPP TANGAIL)

Figure 7

5.4.2.4 External development options - The Dhaleswari Mitigation Plan

The main external development interventions with a major bearing on the compartment development are

- for the Sirajganj compartment, the reconstruction of the Brahmaputra Right Embankment (BRE), and
- for the Tangail compartment, the Dhaleswari Mitigation Plan and the construction of the Brahmaputra Left Embankment (BLE).
- for both compartments the (re)construction of the BRE and BLE.

The relevance of the construction of the BRE for the Sirajganj compartment has been indicated in section 3.3.2. Reconstruction of this embankment is generally accepted and waits for the final outcome of FAP 1 and (donor) funding. For Tangail, the external interventions have not yet been decided; those will be discussed in this section.

The main external development options for the Tangail compartment are the following.

- The construction of the Jamuna Bridge project with the possible closure of the northern Dhaleswari intake (the Dhaleswari Mitigation Plan). There are a number of variants. Depending on the variant chosen, the mean annual peak water levels might be lowered by 0.5 to 1.5 m. Both extreme variants will be taken into account.
- The construction of the BLE with a possible rise of peak water levels up to 1.2 m in the Dhaleswari. This option will be taken into account as well.
- The combined effect of the construction of the BLE with the closure of the northern Dhaleswari; this will result in a slightly higher water level as compared to the closure alone.

Since the closure of the northern Dhaleswari is an external development option with a very prominent impact on the Tangail pilot project, the major consequences are elaborated in this section more into detail. Certain major consequences have been overlooked in the Dhaleswari Mitigation Plan. Comments have been sent to FPCO separately in early February 1992 for study and action.

By and large the following options for the closure are possible; effects are mentioned.

I Retention of northern Dhaleswari intake.

- No change in water levels.
- No change in river discharges and velocities.
- High implementation cost.
- Long term stability not assured.
- No social interference.

II Closure of northern Dhaleswari intake.

- Major changes in water levels in affected area (up to -1.0 m of the mean annual peak water level at the Pungli intake and -0.4 m at the Lohajang intake).
- Strong sedimentation in the northern Dhaleswari at the confluence with the main Dhaleswari; this will decrease water levels and flow velocities even more and will affect drainage patterns along the Dhaleswari and the northern Pungli rivers (drainage congestion in low and medium low land).
- Substantially reduced implementation cost as compared to option I.
- Long term stability of the area between the Jamuna and the Dhaleswari downstream of the bridge site will not be guaranteed due to expected erosion and increased head difference between the two rivers. This will greatly decrease the quality of life of the population living in this area.
- Social interference through increased value of (medium) high land and possibly decreased value of (medium) low land.

III Closure of northern intake with guide embankment from the bridge site to the southern Dhaleswari intake (22 km).

- Major change in water levels in impact area (up to -2.0 m for mean annual peak water levels at the Pungli intake and -1.5 m at the Lohajang intake).
- Excessive sedimentation in the northern Dhaleswari at the confluence with the main Dhaleswari (and further decreased water levels and flow velocities). This will influence the drainage patterns along the Dhaleswari, the northern Pungli, the Lohajang and the Elanjani rivers, and will induce drainage congested low and medium low land.
- Substantially reduced implementation cost as compared to option I.
- Long term stability is assured of the area between the Jamuna and the Dhaleswari rivers downstream the bridge site as well as of the bridge site itself. Long term stability of the impact area has not been assessed.
- Social interference through changes in land value (as under II) and land acquisition.

IV Enlargement of southern intake.

This option has approximately the same effects as option II (closure of northern intake) with probably a slight effect on the reduced water levels in the initial stage. This option has been rejected by the DMP.

V Provision of an alternative intake channel (development of the northern spill-channel downstream of the bridge site).

- Water levels will not change significally under this option.
- It is not expected that river discharges and flow velocities will change dramatically.
- Less implementation costs as compared with option I.
- Long term stability not assured.
- No social interference, except land acquisition for channel.

Recommendations with respect to the mitigation measures for the closure of the northern Dhaleswari.

FAP 20 has expressed the following recommendations:

A. In view of the regional effects

The Dhaleswari Mitigation Plan recommends the closure of the northern Dhaleswari intake with a guide embankment (option III). Arguments are the expected long term stability and favourable economic conditions.

FAP 20 has strong reservations for reason of probable sedimentation at the confluence of the northern and main Dhaleswari rivers and its consequences, as well as to the probable social effects of this option.

Option V (development of an alternative intake) has been rejected by the DMP, as the long term stability will than not be assured. FAP 20 is not in a position to judge this conclusion. However, it is not fully understood why the guide embankment with increased head difference between the Jamuna and the Dhaleswari rivers is considered stable, whereas the development of an existing spillway channel downstream of the bridge is considered unstable; under this last option the head difference will be substantially reduced (though additional protection works might be necessary).

FAP 20 strongly recommends the following steps to be taken:

- Assess the extent of the morphological changes that will result from mitigation option number III (closure with guide embankment downstream of the bridge).

- Investigate the measures needed to assure long term stability of mitigation option V (development of the existing spill-channel south of the bridge site).

B. In view of the effects on the Tangail compartment

The testing of the concept of compartmentalization will be threatened if the mean annual peak water level will be reduced by 1.5 m (Lohajang intake with option III).

As the maximum area flooded during the year 1991 (a median year) was around 85 % of the total compartment, this figure would have been cut down to less than half by a mean peak water level reduction by 1.5 m. The testing of controlled flooding and drainage in Tangail under option III (closure of the northern Dhaleswari intake with guide embankment) will then not be relevant if not totally impossible.

For the pilot project to continue in Tangail, the selection of one of the following mitigation options is imperative:

- I Retention of the northern Dhaleswari intake.
- II Closure of the northern Dhaleswari intake without guide embankment downstream of the bridge site.
- V Development of a spill-channel downstream of the bridge site.

Final selection of any of the options under the DMP should be based on a re-assessment of the regional and local consequences.

5.4.2.5 Data collection

For the hydrological survey and modelling, data are required on:

- Topography
- Water levels and discharges
- Groundwater levels
- Climatological data
- Soil data

Topography

Modelling requires: levelling of gauges, canal cross-sections, data of existing structures, area elevation mapping and mapping of relevant embankments (assessment of high flood spilling pattern related to the 1988 flood). In addition, the erosion and sedimentation processes have to be monitored. The primary survey work has been estimated at eight crew-months per compartment (300 to 400 km of levelling in each). The monitoring of erosion/sedimentation will take one month per compartment per year.

The relevant cross-sections of the Dhaleswari, Elanjani and Pungli rivers (Tangail pilot area) have been collected from FAP 3. All other rivers and khals that contribute significantly to the surface water flow within the Tangail compartment were surveyed by FAP 20, starting from November 1991.

For the Sirajganj area, FAP 2 will provide cross-sections of the Ichamati river. Most other waterways will be surveyed under FAP 20 from March 1992 onwards.

To verify the topographic data of floodplains (1964 topo data), the survey parties will make a number of checks.

Water levels and discharges

There are four existing water level stations that are relevant for the Tangail area (Sirajganj, Mirzapur, Jugini and Porabari) and three near the Sirajganj compartment (Sirajganj, Dhunot and Ullapara). Data go back to the early fifties. In addition, 14 staff gauges have been installed in the Tangail compartment during the 1991 monsoon season. Figure 4 shows the location of the stations.

For the 1992 monsoon season, 30 and 20 gauges will be installed in the Tangail and Sirajganj areas respectively in order to assess the existing situation and to observe the modified flow patterns in future. All gauges will be read throughout the project period.

To measure the dampening of floods due to openings in embankments and certain structures, three automatic water level recorders (Presslogs) will be installed in each of the compartments.

Annex 6 presents discharge data as measured by FAP 3 during 1990 (Pungli, Lohajang and Elanjani rivers only). Additional observations under FAP 20 are required inside the project areas to assess the flows and to calibrate the mathematical models. This programme will start during 1992. About five annual observations at ten gauging stations per compartment are required during the duration of the project.

Groundwater data

Groundwater data have been obtained from the Groundwater Department of BWDB. Data from observation well TA09 (in Tangail town) was used to check on consistency with the simulated data of the surface run-off model for the year 1991.
For Sirajganj a groundwater observation well has not yet been identified.

Climatological data

Rainfall data have been collected from the BWDB Hydrology Department. Data of Atia station in Tangail town (R002) are available since 1962, and are adequate for modelling and to assess the design criteria for drainage (World Bank criteria relating to 3 days submergence with a 5 years return period gives 27 mm/day for Tangail compartment). For the Sirajganj compartment, data will be used from Sirajganj rainfall station.

Evaporation data have been collected from the Water Resources Planning Organisation (WARPO). The mean monthly ETp's, calculated for Mymensingh, have been used for the calibration of the Tangail model. The same data will also be used for Sirajganj, since Mymensingh is the nearest station with observed evaporation data.

Soil data

Relevant soil data for Tangail were collected from the WARPO. Infiltration rates and specific yields according to soil classes are used as an input to the models.

5.4.3 Multi-disciplinary sub-compartmental survey

> "Where a project concept came from a local demand, or was built on local works, the project appears to have been appropriate and there has been more interest from beneficiaries in seeing that it works. Other projects have been imposed with no local consultation. In such cases, and particularly where they do not give clear benefits, there is no local interest in O&M."
> [FAP 12, p.3-13]

The Tangail CPP preliminary survey gave an overview type of information on the compartment. It also showed that within the area there is a wide variety in hydrological, agricultural and socio-economic conditions. This variety is also found in the sub-compartments. It became clear that more detailed and location specific information is needed for the purpose of planning and design of structural and institutional measures. This will help to define the actual problems and potential solutions. For that reason a Multi-Disciplinary Sub-Compartmental Survey (MDSC) will be conducted in each provisionally defined sub-compartment, both inside the CPP area (17 in the Tangail CPP) and adjacent to the

project (8 near Tangail CPP). This MDSC-survey is actually the first step in involving the people in the process of developing the compartment.

The sub-compartmental survey will be conducted by a team of CPP specialists from the Project and Consultants Team. This team is made up of a drainage engineer, a male and a female sociologist, an agronomist and a fisheries expert-cum-ecologist. The Rapid Rural Appraisal methodology will be followed, with checklists guiding the team. It will take the team three days to cover each sub-compartment; two days fieldwork and one day report writing.

The outcome of the MDSC-surveys will be the starting point for deciding on alternative development options for Tangail and Sirajganj CPP. Alongside the alternative(s) as indicated by the MDSC-survey, specialists in the CPP team will suggest other development options from their respective disciplines. For more details on this see chapter 6.

Thus the main aim of these surveys is to provide information for planning and implementation of compartmentalization related water management. In due course the information will also be used to draw up special guidelines on how to fully develop agriculture, fisheries etc. within a compartment. At the end of the project the MDSC-surveys can be repeated to be used in the post-project impact assessment.

5.4.4. Compartmental institutional survey

The project will build on existing institutions as much as possible. These include institutions of local government, the various government agencies and NGOs. In order to have a better understanding of the strengths, weaknesses and potential of these various institutions, a survey will be carried out in Tangail and Sirajganj areas. A preliminary survey has been carried out in the Tangail area. An in-depth survey of resources and relationships in other areas will be carried out in the course of 1992. The results from the institutional survey will assist in the construction of a PA matrix (participants-activities matrix), which will serve to describe and review the division of responsibilities in the various stages of the project.

5.5 Land resources and land use

Reconnaissance work on land resources and land use has been concentrated in the Tangail project area up to now.

Soils

The **Tangail pilot project area** is situated in 2 floodplains; the Young Jamuna Flood plain in the western part of the area with relative shallow soils over stratified alluvium, covering about 50% of the area and the Older Jamuna Floodplain in the eastern and southern parts with soils developed to depths of 60-150 cm. Almost all soils are poorly drained and seasonally flooded. Both chemically and physically the soils appear to be among the best in Bangladesh. Planted to local varieties of food crops, these soils, being flooded every year by silty river floods, produced fair crops continuously since long

without using fertilizers. In spite of sometimes severe dry seasons, dry land crops do grow well and the soil is moist for months without rain, probably by capillary recharge from groundwater (Reconnaissance Soil Survey, Tangail District, Directorate of Soil Survey, East Pakistan, Dacca, 1967).

Only when HYVs were introduced, additional use of fertilizer was required. The rapid development of irrigation through tubewells in recent years has been changing the general cropping patterns in both floodplains. Boro-rice has become the main producing rice crop, reducing the areas planted to Aus and B.Aman.

Farmers do not want a full protection against flood. They face drainage congestion and are looking for security against early and flash floods, depositing sand and damage caused to crops by fast rising water levels and erosion. What they really want are the muddy, silty river floods to inundate their fields. By providing controlled flooding and drainage, crop security will be increased, offering the possibility to change from local to HYV-T.Aman, protecting the occasionally late Boro crops and allowing for inundation of farmers fields by silty river water.

In the project area, three soil associations can be identified, each one with its own potentials and limitations. Details are described in Annex 7.

A land use map of the pilot project area has been produced by the North Central Region Study (FAP 3), using satellite imagery interpretation. This map will be used during the planning process of the project. There is very much a correlation between the land use patterns and the flooding situation. The cropping patterns in the area are adjusted to the flood risks.

The **Sirajganj Pilot Project area** is mainly situated in the Younger Karatia Floodplain, with only in the eastern part a narrow strip of land of 500-2500 m wide in the Younger Karatia and the very Young Jamuna Floodplain. Most of the soils are silty loam and silty clay loam. The land is mainly triple cropped.

In the project area, 4 soil associations can be identified. Details are described in Annex 7.

Agriculture

Agriculture in the **Tangail Pilot Project area** is dominated by the various rice crops. Irrigation within the project boundaries has a high density. As a result, irrigated Boro HYV is the main rice crop, producing 50-60% of the total rice production. Aus and Deep water Aman (B.Aman) are covering 15-20% each and finally T.Aman is taking care of 10% of the rice production. Other relatively important crops are jute, wheat, mustard, sugar cane, vegetables and pulses. Data on land utilisation and irrigation per sub-compartment in the year 1991-92 is presented in Annex 8.

As mentioned before, floods from rain and river water and impeded drainage are the major limitations for agricultural development. By supplying controlled flooding and drainage improvement, the total output can be raised. In more detail, improved water management may have the following impacts:

Rainfed agriculture

- Land which becomes WL0* or WL1 land, will be planted to Aus or Jute, followed by T.Aman, sometimes succeeded by rabi crops.
- There will be a shift from local T.Aman to HYV T.Aman and from B.Aus to T.Aus.
- In the WL2 and WL3 lands, the area under transplanted deep water Aman will increase.
- In WL3 lands, mixed Aus and B.Aman will be grown or jute followed by rabi crops.
- In WL4 lands, B.Aman will remain the crop to be grown, sometimes to be followed by rabi crops.

Irrigated agriculture

- WL0 and WL1 land will be planted to Boro HYV or Aus HYV, followed by HYV T.Aman and after that sometimes pulses or mustard.
- In WL2 and WL3 land, Boro HYV will be followed by deepwater Aman.
- On WL4 land, only local or HYV Boro will be grown, occasionally preceded by a short duration rabi crop.
- Boro HYV area will increase due to an increase in irrigation facilities, reducing the area planted to Aus.

The objective to provide the conditions to enable farmers to improve crop production, outside simple damage reduction, will require an involvement of different institutions rendering services to farmers and the involvement and cooperation of the local population. The Ministry of Agriculture has to organize the delivery of research findings and crop information to farmers through the Department of Agricultural Extension. Credit facilities must be available to enable farmers to timely purchase necessary inputs as seeds, chemicals, fertilizers and to hire additional labour or animal/mechanised traction.

To reach the ultimate objective **in both the pilot project areas**,the following approach has been developed:

- Field visits and collection of information on the areas. This will include data on areas, production and yields of the major crops in each project area. Data collection will be done union wise. Additional data will be collected per growing season on agricultural practises, inputs, irrigation practises and facilities, marketing and storage, production costs and returns.

The Water Level depth classification WL0 - WL5 corresponds to the 0/30/70/100/150/300 cm division*

- In the Tangail Survey, data, supplied by the North Central Region Study (FAP 3), are being included in the collected information. The same applies for data to be supplied by the North West Regional Study (FAP 2) about the Sirajganj area.

- After a reconnaissance and a preliminary survey, a sub-compartment survey has started in February 1992 and is finishing in April 1992 in the Tangail Pilot Project area. This survey does give due attention to agriculture and related issues, like crops and cropping patterns, labour supply and wages, landownership and share cropping, irrigation management and costs, flood levels and damages, marketing and storage, credit and input supply, farmers preferences and constraints, the role of women in agriculture and livestock, etc. The same approach has been planned for the Sirajganj Pilot Project, starting in October 1992.

- The collected information will be assessed and analyzed in such a way, that the results can be used in the planning process, when selecting and developing possible scenarios; this information is required as reference material as well to measure future development.

- Agricultural activities, as demonstration plots, have to be organized through the responsible Government organisation, the Department of Agricultural Extension (DAE). This requires the involvement of both the agronomists of the Project Team and personnel of DAE, such as the local Block Supervisors (BS) and the Subject Matter Officers or Specialists (SMO or SMS).

Livestock

In the context of the overall planning, the role of livestock is not very great in the Tangail Pilot Project area. One of the important limiting factors is the lack of a sufficient qualitative and quantitative supply of fodder. Since the introduction of the short stemmed rice HYVs, which are less palatable for cattle, there is a growing shortage in fodder supply. The number of draught animals in the Tangail region is no longer sufficient, as the quality and stamina are rapidly decreasing. In the nearby future it can be envisaged that the draught animal population can no longer cope with the rising demand caused by higher cropping intensities. Like in other regions, power tillers will increasingly be used to supply the traction needed for land cultivation. A negative impact will be the reduced production of manure, used as a source of fuel and as organic fertilizer.

However, a possible positive development could be the extension of the number of dairy cattle. There is a growing demand for dairy products as milk, butter, ghee and meat. Recent developments near other urban areas in Bangladesh like Dhaka and Narayanganj show an increased importance of the dairy industry by keeping dairy cattle on zero-grazing systems, feeding them with cultivated fodder crops, using embankments and road sides, and concentrates. With a tendency of rising milk prices, this can be a profitable undertaking.

The growing urbanisation will create higher demand for poultry and eggs. The number of poultry farms near the bigger urban areas are most probably going to increase to fulfil these demands.

These aspects will be addressed during the course of the ongoing study phase.

Forestry

Natural forests in both the project areas are non-existent. The use of homestead and roadside plantations will be assessed by the project. The present and future requirements of timber and fuel wood will be examined from the collected baseline survey information. Expanding tree planting, using fast growing species will be assessed, taking into account the reduced animal manure production.

5.6 Fisheries

A preliminary survey in the Tangail Pilot Project area, executed in the dry season of March 1991 highlighted the following patterns.

The fish species can be divided into two groups when their reproductive behaviour is taken into account:

- **River fish**, such as the major carps (Katla, Rui, Mrigal),are spawning upstream in the major rivers at the beginning of the rainy season. The eggs, larvae fingerlings and some adults of these species are flowing with the water current into the Dhaleswari and Pungli river, finally entering the floodplains of the project area from the north side, through the Lohajang River and Sadullahpur Khal at the end of June. The inundated floodplain provides the carps all the nutrients needed for growth. The carps are migrating passively back to the main river as soon as the water recedes from the floodplain.

- **Beel fish**, such as snakeheads (Taki, shol), catfish (Magur), climbing perch (Koi), gouramies (Kailsha), barb (puti) etc, can survive the harsh environmental condition of the floodplain during the dry season. This group reproduces in the pre-monsoon as soon as the water level in the beel rises. First nursing takes place in the inundated areas adjacent to the beels; later on they disperse all over the floodplain, once the river flood water enters. With the receding waters this group migrates back or get trapped in the low lying beels and pagards.

The current availability of fish for Bangladesh is estimated at 7-8 kg/capita/year when total population and total fish production is taken into account. For the project area it would mean a consumption of approximately 2,000 mt/year. However, according to the statistics, the total of Tangail district, which is much larger than the CPP area, produces only 6600 mt/year. A preliminary survey of FAP 16 within the project area indicated, that especially the beel fish are major contributors to the daily fish consumption during the dry season. An underestimation of this group could explain the discrepancy between production and consumption.

The captured fisheries production of both groups declined during the last decade. For carps, the reasons are blockage of migration routes, reduction of habitats by FCD, increased fishing intensity and probably the massive capture of fry for aquaculture purpose in the Jamuna and Dhaleswari rivers. For beel fish the cause is the disease,

known as Epizootic Ulcerative Syndrome, which spread over Bangladesh from 1988 and severely infected the beel fishes. A quick examination of fish from several beels within the project indicated an infection rate of 23 %.

The main fishing activities in the project area can be divided into three classes:

- **Professional fishermen**: There are approximately 1000 fishermen, mostly Hindus, within the project area; their occupation is only fishing throughout the year. They mainly use cast nets and seine nets combined with gill nets. During the monsoon, fishing takes place in the rivers, beels and pagards. Most of the fishing in beels and pagards takes place on a sharing base due to the fact that almost all of these fishing grounds are privately owned or are claimed to be, and a traditional usufruct exists. A preliminary survey indicated an average catch of 1.8 kg/net/day and 17.8 kg/net/day for respectively castnets and seine nets during the dry season.

- **Part-time fishermen**: These fishermen, most of them muslim, have an alternative occupation, apart from fishing. They mainly use cast nets.

- **Occasional fishermen or subsistence fisheries**: In the majority of the households within the project area some form of fishing takes place for home consumption at some time during the year, with peaks during the monsoon. These activities can be carried out freely in the rivers and beels using scoop nets, baskets, traps, lift nets, etc. A preliminary survey indicated an average catch of 140 g/day for all types during the dry season.

The objective of the fisheries component of the CPP pilot project is to increase the availability of fish by securing captured fisheries production and by improving cultured fisheries (aquaculture).

It is assumed, that the consumption of fish within the rural areas consists largely of the so called "small" or "miscellaneous" species, which actually represent almost 70% of the floodplain catch (see annex 9). Within all developments, next to the high priced carps, also this group of fish should be taken into consideration seriously. The special study, elaborated in section 5.11.3, will put a heavy emphasis on this group of fish.

5.7 Flood control and drainage structures

Flood control and drainage structures include the following works:

- resectioning and reconstruction of existing embankments and roads; construction of new embankments;
- re-excavation of existing khals and excavation of new ones;
- repair of existing regulating structures and construction of new ones (major, medium and minor size);
- reconstruction and repair of existing bridges and culverts and construction of new ones;

- protection of embankments and roads against erosion by river training or by retiring the embankments and roads.

In this section general considerations on these structures are presented.

Embankments and roads

The existing embankments and bunds/roads will be included in the water regulating system as much as possible. Sometimes an other alignment has to be chosen in order to minimize an interference of a settlement. Depending on their function (protection against river flooding or as a water divide between neighbouring sub-compartments), design criteria will be assessed in compliance with standard BWDB procedures. Also the secondary function of the embankment as a "flood free" road, amongst others needed for the maintenance, would be taken into account.

The crest height of the embankments generally are assessed on a 20 year flood return period with 0.9 m freeboard (BWDB practice applied to interior and marginal embankments). An attempt will be made to justify or adjust the return period with respect to additional benefits and additional costs within a range from 5 to 50 years return period. However, it should be born in mind that the formulation of a certain crest level of an embankment is extremely difficult to justify, if at all possible. The value of prevented damage is hard to assess because it includes significant social costs which can not be quantified economically.

When defining the safety of an embankment for overtopping, special attention will be given to the aspect of what will happen when a major flood occurs which can not be prevented by the embankment, and how potential damage can be minimized, e.g. by constructing controlled breaching zones at specific locations where also drainage can be provided.

A further issue to be tackled, is, whether protection against major flood events should be provided on compartmental level or not. Since the protected area of a compartment is in the order of 10,000 ha, it seems economically justified that main protection will be provided at the level of the main rivers by means of main embankments, major structures, flood by-pass canals and the like. FAP 3 recommended to use the western embankment of the Tangail Compartment as the main embankment. However, on this recommendation can not be anticipated.

These aspects will be considered in relation with probable regional development options for the project areas like the closure of the northern Dhaleswari river for the Tangail area etc. These and other outside development options, which are not directly under control of FAP 20, will also be taken into consideration when defining the safety for overtopping.

Implementation of works will be done by contractors, but also by Landless Contracting Societies (LCSs); an important part will be reserved for women groups. Compaction will receive full attention. During the first construction year, a section of an embankment will be compacted intensively, while another part will be rehabilitated as done usually under the BWDB. Both these sections will be monitored. By 1993 the results of the SRP

compaction trials will be known as well, and will be taken into consideration when deciding on compaction measures to be taken in the years to come.

Combination of functions of an embankment will be studied. The profile of the embankment will be adapted to facilitate transport (crest width; access ramps) or to support productive use and housing facilities at certain places where land acquisition does not constitute an obstacle and landless have to be settled.

It will be considered seriously to pay royalties to contractors for acquiring earth to resection embankments. This would reduce the need for land acquisition.

Channels

It is expected that many of the existing channels are to be re-excavated in order to improve their conveyance capacity for efficient drainage of the area (especially at the confluence of a minor channel and a major one). The design of channel cross-sections will be determined by applying the standard design run-off rates recommended by the World Bank (3 days submergence with a 5 year return period). Special attention will be paid to the timing of drainage problems as well as the interrelation with fisheries.

Re-excavation of existing channels may require considerable land acquisition if the channels need to be enlarged. If the spoils are to be heaped on both banks or on either bank, keeping an appropriate berm, it will entail land acquisition all along the channel. This will involve loss of farmland, orchards and even homesteads in living areas. Opposition and resentments from the affected people may create problems during execution.

For this reason, it is proposed that, as far as possible within the project design, including the stability of slopes, the top width of the existing channels be retained and re-excavation be done to increase the depth. If the excavated material is not sand but silt, the spoils may be spread over a large adjoining area at reasonable height of 20 - 40 cm. This maybe is acceptable to the landowners due to its obvious advantages. The cost estimate should include additional funds to cover the increased lead and one year crop compensation. This approach will exclude the need for land acquisition. In case of an existing road besides a channel planned for re-excavation, priority should be given to resectioning of the road.

Structures

The number of regulating structures existing in the compartments is quite small. It is expected that if a separate control will have to be provided for each sub-compartment, an important number of medium and especially minor structures has to be constructed. Regulating structures may become conflicting when there are conflicting interests at local, regional and national level. Therefore semi-controlled structures will be proposed if the hydrological situation and the project lay-out so permit.

In particular, for main inlet and outlet structures, a stepwise implementation plan would likely be followed. In the first construction period, the abutments, wing walls and piers would be constructed in accordance with design in- and outflow characteristics. During the first monsoon period, the behaviour and impact of the structures on the compartment

can be assessed. If needed, the structure can be modified in a fully controlled structure by placement of gates (stoplogs, flap gates or lift gates) in consecutive dry seasons. The viability of the construction of ship locks will be investigated.

For new structures, the need for an integrated approach (fisheries/ transport/ agriculture/ environment) must be guaranteed. If no special requirement can be formulated, the design standards will comply with BWDB standards. However it is expected that the requirements of fisheries will call for the development of a special type of structure that is more "fish-friendly" then the existing ones. Its main feature might probably be that the water surface be free during the early monsoon flood since most fish migration takes place in the surface layers. The design of this structures will be done in cooperation with FAP 17 (Fisheries)

Since the pilot areas are to be developed for the testing of the compartmentalization concept, it is probable that the number of structures as well as the dimensioning of the structures will be more flexible then usual. Structures will be executed under standard tendering procedures.

Erosion control

Most khals in the compartments are unstable. Erosion combined with sedimentation is a natural phenomenon. Nevertheless, the protection of embankments and structures in urban areas by means of river training works will be considered. As costs are very high (annual maintenance costs = 10% of the construction costs), steps for implementation will be taken carefully. Measures may include the following:

- flow deflecting measures like groins, porcupines;
- bank protection measures like mattressing with boulders, geo-textile, brickwork, concrete blocks;
- biological protection with vegetation like turf (vetiver grass) as both a means of flow deflection as a means of soil protection.

Measures will be based on a detailed investigation of flow patterns and canal cross sections at various sites. Retirement of embankments will be considered as an alternative.

Urban development

The urban development requires a separate approach. Here, issues as protection against flooding, water quality and protection against erosion of the rivers play a more important role than in the rural areas. This will be worked out in the interim reports.

5.8 Sub-compartmental works

The development of sub-compartmental works depend on the need for a differentiated water management in different sub-compartments.

The findings in the Tangail Compartment indicate that the topographic distribution of higher and lower land is not changing from the compartment level to the sub-compartment level e.g. a certain distribution of high and low land on compartmental level is likely to result in almost the same distribution for the sub-compartments.

In this context, sub-compartmental water management can only aim at additional retention of water at certain periods of the year. This may be required to reduce the accumulation of water in the lower fields. The need for this option will be investigated.

The natural process of flood reduction is such that a flood wave is dampened when it passes from a major river to a minor one, and from a minor river to a khal and into a floodplain. The existing bunds/roads between the sub-compartments take each their part of this systematic dampening of flood waves.

For the Tangail compartment, any additional sub-compartmental works will enhance this dampening function by reducing or controlling the flow between sub-compartments. Construction of sub-compartments will also aim at the interruption of long drainage lines during recession flow. The works as such will be limited to resectioning and construction of bunds/roads and to the implementation of mainly semi-controlled structures.

In the Sirajganj area, the surface water system is dominated by local rainfall and, under "normal" conditions, not directly linked with a major river. There are hardly any sub-compartmental water divides. It will be studied whether the implementation of sub-compartmental works like embankments and (semi-controlled structures is required and functional for enhancing safety in case of flood calamities.

For the works at sub-compartmental level, there should be a flexible approach regarding the timing of the implementation so as to guarantee people's participation at this level for both implementation and O&M. A basic proof for people's participation is that the beneficiaries contribute in cash or kind during implementation. If such participation is not forthcoming, this may even mean that a particular work will not be implemented at all. A proposal for the practical implementation of this principle will be presented in the interim report for each compartment.

5.9 Infrastructure and communications

The project is likely to have a major impact on boat transport and navigation. Especially the implementation of structures will obstruct existing transport patterns. The following mitigation measures will be considered:

- The construction of locks. This is unlikely to be viable.

- The construction of boat crossings. Two ramps with a 1:10 slope and wooden trunks (bullahs) will permit that smaller boats can be pulled over the embankment. This might be complemented with a landing site to load and unload larger country boats.

The infrastructure for overland transport will be improved as part of the development of sub-compartments (boundaries) and when improving the embankments (ramps). All structures will be connected with the road system.

5.10 Jamalpur Priority Project

As per TOR, it is the task of FAP 20 to "carry out a reconnaissance of the low lying areas in the Jamalpur compartment area" and "recommend whether or not (a part of) the Jamalpur area be developed into a pilot management area (compartment, including the necessary management structure)".

Much of the Jamalpur Priority Project Study (JPPS) area is relatively flood free; FAP 20 will only conduct a survey of some low sample tracts. The flooding and drainage characteristics of those tracts will be looked into, as well as their use (agriculture, fisheries, environment).

FAP 3.1 (JPPS) will conduct a feasibility study of the full scale development of the Jamalpur compartment, using input from FAP 20 on basic design criteria, operation and management. The original Schedule of Activities for the FAP allowed for an 18 month gap between the start of FAP 20 and FAP 3.1. This would then allow FAP 3.1 to use the tentative guidelines produced by FAP 20 while designing the Jamalpur Priority Project.

Due to a delay of about 16 months in the start of FAP 20 this timing has been disrupted. The result could be that two concepts and practices of compartmentalization develop which might be in conflict with each other; one by FAP 3.1 and one by FAP 20. In a letter to the FPCO the following has been suggested:

> *"Theoretically this problem could be solved by FAP 3.1 delaying its feasibility study until December 1992. This would give FAP 20 the original 18 months time to produce tentative guidelines for the development of compartments. We realize that this would not be an easy thing to do. On the other hand if FAP 3.1's feasibility study goes ahead without guidelines from FAP 20, or with tentative guidelines developed within one-third of the time originally deemed necessary, there could be serious consequences for the FAP as a whole. We think in particular of the fact that FAP 3.1 is the first feasibility study under the FAP. Another reason why FAP 3.1's position in the FAP process is vital is that it incorporates the most northern section of the BLE as well as the first compartment. For these reasons FAP 3.1 will set the tone of what will follow.* (Letter dated November 6, 1991 to FPCO regarding FAP 3.1 Inception Report).

However, the FAP 3.1 feasibility study cannot be delayed. The following procedure is therefore suggested, to make the most of the existing situation.

- FAP 3.1 take into account the FAP 20 Inception Report;
- a FAP 20 team conduct a preliminary multi-disciplinary survey of the JPPS area in May 1992 so as to produce an advice for FAP 3.1 by mid 1992."

5.11 Special studies

> "I have learnt from these men why the peasantry long for the old days when the rice fields and tanks and pools were full of the fish which Bernier said were in abundance. They crave for the fish which were the food of the poor in old days, but which the poor so seldom see to-day. I have learnt moreover from these same men one of the reasons why flood water, and especially early flood water, combats malaria." [Willcocks, p.59]

Compartmentalization is a "new" concept and is therefore likely to produce new questions. The TOR allow for these issues to be looked into in-depth through special studies. These studies will contribute to special reports covering agriculture, fisheries, livestock, markets and communications. The special reports will suggest additional policies and guidelines for the development of these areas under compartmentalization.

Based on the preliminary survey and discussions with other FAP projects, issues have been tentatively prioritised for further research. These issues are summed up in the next sections.

Whether or not the studies mentioned will be implemented depends mainly on three factors. First of all the baseline studies might indicate other, more relevant areas for further research. Secondly other FAP projects might in due course be willing and able to cover some of the areas mentioned. Finally the available man power and budget may force prioritization.

Therefore only an indication is given of the aspects worthwhile to be studied. A more elaborate study plan will be presented in the interim reports.

5.11.1 Environmental studies

The baseline study is predominantly oriented towards directly human related issues and hydrology. It does not cover the physical, biological and ecological aspects of the environment, that can not be revealed in the contacts with the population. The baseline study is also not appropriate for more time consuming studies, often including aspects of monitoring. This will be dealt with in the special studies.

It should be realized that there is such a limited basic information concerning the natural environment as a resource base that only preliminary information can be expected from these surveys.

Several relevant subjects will be covered by the FAP 16 project as part of their approach. FAP 16 does prepare an Environmental Impact Assessment for the Tangail Pilot Project area during 1992. Results are expected by December 1992. Given the limited available manpower, FAP 20 should profit as much as possible from their studies. In this cooperation, FAP 20 can concentrate on those subjects that are not or insufficiently taken into account by FAP 16 or that cover a longer life span, like all monitoring.

Special items that might be studied are the following:

Quality of ground and surface water

The expected impact of the project on the water quality, instrumental via changes in agricultural practice, might be considerable (pesticides, fertilizers, reduced flooding). On the base of the results of a first study will be decided which aspects may need further attention through monitoring and further investigation.

Rats

Rats cause damage to embankments, field crops and food stocks. The embankments deteriorate as a consequence of their nests and tunnels. German and USAID funded studies have been implemented under DAE. The Ministry of Agriculture has a programme to control rats by paying money for each rat tail handed in. The BWDB has no such programme.

From the results of an inventory to be included in the sub-compartmental survey it will be decided if further steps will be taken. One of these could be a study of the life cycle of rats and habitat requirements, specially in relation to inundation, and the possible impacts of the proposed measures. Previous studies, if available, will be studied first. If the need for control is demonstrated, the possibility of practical, ecologically sound, integrated control measures should be investigated.

Wetlands

The objective of the FAP makes it possible to preserve wetlands, if needed. Their importance for fish fry and small fish is recognized but details are not available. Their role for soil fertility, wild plant and animal life (frogs, migratory birds, disease factors, livestock etc.), water quality, natural gas production (methane escaping into the air), groundwater recharge, transportation, etc. are much less understood, especial in their mutual relationship.

Dependent on the role wetlands will play in the scenarios for the compartments, a study will be carried out. FAP 16 will be consulted.

Soil quality

A study may be made of physical, chemical and, if possible, biological soil conditions of farmlands (fertility and structure) in relation to inundation and to the cropping practises on these farmlands (ploughing, dung and fertilizer use, type of crops). The results of this study may give useful directions for the way the water regime in the compartments must

be managed. The Bangladesh Agricultural Research Council (BARC), the Soil Research Department (SRD) and the Bangladesh Agricultural University (BAU) will be consulted.

Common resources management

The baseline survey will already give an impression about the way the population handles common resources, such as wild fish populations. As this is an important aspect for the success of the project, a study concerning the existing attitudes towards use and management of those common resources may be undertaken as a follow up of the baseline study. The outcome of that would help find relevant and adequate management structures. Where possible, ways will be indicated to benefit the poor in having access to common resources.

Rural households depend heavily on biological material for cooking. Changing flood regimes and cropping patterns will affect the availability of the different types of fuel. The information on the effects of changes on fuel availability is not easily accessible. Yet it may be needed to propose possible mitigation measures.

5.11.2 Agricultural studies

At this stage the following agricultural studies are foreseen. Just like the studies mentioned above, these too will be worked out in the interim reports.

Farming systems management

Although a full farming systems research activity falls outside the scope of the project, a good understanding of the farmers' way to cope with the risks and benefits of the floods is essential for a better understanding of the bottlenecks in their farming system. This applies in particular to flood related problems and to the question how the possibility of better water management might change the farming systems.

In coordination and cooperation with the On-farm Research Unit of the Bangladesh Agricultural Research Institute (BARI), located in Tangail, a study will be formulated into the way farmers are adapting their farming systems and cropping patterns to the existing and improved water management conditions. A possible survey will also include collection of data on crop production costs, and the practise in the Tangail Pilot Project area to transplant deepwater Aman.

This study will be done in such a way that a comparison will be possible between the practises in the project areas and their control areas and between the Tangail and the Sirajganj compartments.

Energy sources

Rural life depends on locally available energy sources, particularly for cooking and processing purposes. Changing cropping patterns may affect the local balance negatively. Mitigation measures might be necessary so as not to worsen the position of the poor and particularly of the women.

Information will be collected on the existing situation and expected developments. Based on a review of the existing literature and (NGO) programmes, possible mitigation measures will be prepared.

Crop demonstration plots

To introduce new varieties and cultural practises adapted to conditions related to new watermanagement situations, it is planned to start crop demonstration plots in farmers fields. This programme should be implemented by DAE. Limited funds to cover expenses for input supply and crop failure are required to support the programme.

5.11.3 Fisheries

Studies of the Irrigation Fisheries Development Project (1978-1982) and FAP 12 have indicated that the evaluation of impact of FCD projects on fisheries is hampered by the fact that baseline data of the pre-project situation is scarce. A special study in the Tangail compartment will start under FAP 20 in May 1992 and will continue for one year. The study will cover:

- **Frame survey**; determination of the number of fishermen, gears and fishing intensity for the different classes and habitats.

- **Catch assessment**; determination of the catch per unit effort and its seasonal variation of the main gears. The samples will be analyzed on weight, main species composition and the length frequency distribution.

- **Reproductive strategies**; reproduction and migration patterns of the main river and beel fish will be followed by sampling the northern water-inlets, three beels and the Lohajang river at regular intervals. The samples will be analyzed on species composition, year classes, length frequency distribution and on the Gonado Somatic Index.

The special fisheries study will be executed in close cooperation with FAP 17 and FAP 16 and, where possible, the different teams will be joined. The methodology is such, that full exchange and use of data is possible. The study should result in figures on the total catch, total consumption (covered by FAP 16), yield/recruit and a better understanding of reproduction and migration.

The results of the household surveys (fisheries component) and this study will be used in the assessment of the impact on fisheries under different water management scenario's and for the formulation and design of mitigation measurements and structures. More detailed information is supplied in the study proposal (annex 9).

5.11.4 Socio-economic and institutional studies

In the CPP, knowledge about the socio-economic situation is of importance for the composition of the different scenarios. Aspects such as people's participation and

mitigation measures for those who are or may become disadvantaged through the present or future water management require more information than is available now. A final decision about what subjects to study in more depth will depend to a large extent on the outcome of the MDSC and the household survey. In the special study plan, the following issues might be included.

Labour market

The landless depend on selling their labour power. During the project life, wage levels will be monitored as that is a relevant and easy indicator to monitor. Possibly the number of days employment for men and women will be monitored as well.

One of the aims of the CPP is to direct as many structural benefits of compartmentalization as possible to the disadvantaged. To do so, the major mechanisms (locality and season related) behind supply and demand for labour will be studied. This will start with a literature study followed by in-depth interviews. If possible, a link will be made to the wage level monitoring so as to correlate and verify the data and information gathered.

People's participation in water management

People's participation is at the centre of the compartmentalization concept. There is however only a limited amount of knowledge on how this can be effectively integrated in a governmental project such as CPP.

A number of innovative experiments have been conducted regarding people's participation in water management projects. As yet the information about these projects, their findings and recommendations is scattered and not easily accessible.

An inventory will be made of the water management projects that have been attempting people's participation. Where possible and relevant, field visits will be made and interviews held.

Local water management committees in the CPP areas

The institutionalization of water management, from the local to the national level, is a task of FAP 26. However, the set-up of the local institutions and the process of decision making can not be separated from the total water management structure. There are existing institutional arrangements at all levels. It is likely that the CPP will advise on setting up of new or renewed institutional arrangements, starting at the local level.

The CPP is not the first water management related project in Tangail or Sirajganj. There are sluicegates, irrigation equipment, etc, that often have management committees of one kind or another. Before venturing into local institutional arrangements (see chapter 7), it is necessary to know more about these committees.

A special study will be made about the existing sluice gates and irrigation committees in the CPP areas. The study will include interviews with those concerned (beneficiaries and those dis-benefitted) as well as in the case of at least one sluice gate, field observations.

Institutional study

It is understood, that the project cannot be effective and successful on its own without any integrated legal support. Before designing an effective legal framework for the project, a detail inventory of existing rules, regulations and laws is needed. To achieve this, an in-depth survey will be conducted.

Following that inventory, a special study will be made to investigate which changes in existing regulations and laws, or new laws, might be needed to support compartmentalization and the related water management. This, or an additional study, will also consider financial and fiscal aspects of water management and the possible role local government and/or compartmental water management boards could play in this context. The experience and lessons from other countries in regard to systems and procedures for integrated area based water management will be collected and summarized in a brief desk study.

5.11.5 Transport and markets

On the base of the findings of the baseline study, a study of the expected future communication, marketing and transport requirements in the compartment may be needed. This will result in a special report on the integration of water management, water transport and road transport, taking into account the social, economic, environmental (pollution) and seasonal aspects of both modes of transport.

5.11.6 The Flood Management Model (FMM)

According to the TOR a simple mathematical model has been developed for the Tangail Compartment. As is described in section 5.4.2 this model is based on the MIKE 11 software and on a upgrading of Kibria's model. The model will be used by the modelling experts of the Consultants and the Project Team as a tool in the planning stage of the project, but is not suitable for the management of the compartment. It is not, and was also not meant to be, a practical instrument for operating the water system of the compartment. Besides this, it is not user friendly for non-specialists.

The development of a full simulation model, which can be used to examine the effects of different operation regimes under different hydrological conditions has not been included in the TOR of FAP 20. However, additional modelling activities and cost estimates could be defined by FAP 20 when the scope of the Flood Management Modelling part of FAP 25 (Flood Modelling and Management) was finalized [TOR, p.11 and 20].

Advised by its Coordination Advisory Team (CAT), FAP 25 has made a proposal and prepared a Terms of Reference for a Flood Management Model. In this TOR the FMM is presented as a hierarchy/system of models on three levels: national, (sub-)regional and local, linked to the flood forecasting model of FAP 10. The output, after two years, will be:

- a coarse FMM on national level;

- a detailed pilot FMM for the North Central Region, and

- a detailed FMM of the Tangail Compartment.

The responsibility for the first two FMM (national and regional) is with FAP 25. The third one, the FMM of the Tangail Compartment, will be developed and tested by FAP 20 in close cooperation with FAP 25 and FAP 19 (GIS). After two years, software, guidelines and manuals will be available, not only for the Tangail compartment but also for application in other compartments. A proposal for the extra activities based on the approved TOR of FAP 25 has been sent to the donor agencies (annex 10).

All the FMM activities, including those of FAP 20, will be coordinated by FAP 25.

The FMM study of FAP 25 is expected to start in June 1992. However, for the development of the Tangail FMM, the presence of the expatriate modelling engineer is already needed during the formulation of the water management alternatives in the period April - June 1992. During that time the problems on water management to be analyzed by the FMM will be formulated.

5.12 Monitoring

The monitoring process is the continuous checking of project performance and serves as a basis for adjustments on structural and non-structural measures if so needed. Annual evaluations, which will form part of the annual reports, will be based on this monitoring process.

The baseline survey and sub-compartmental surveys will verify and indicate the relevance of certain key indicators that need to be monitored on a regular basis throughout the project life. Examples of such key indicators are surface and ground water levels, daily wages and the activities of institutions and groups.

In this section, the key monitoring indicators are tentatively summed up. The indicators as listed don't reflect priority weighting. In the interim reports, the monitoring will be worked out and measurement programmes will be presented.

5.12.1 Hydrology

The monitoring of the hydrological environment as related to compartmentalization will be derived from the baseline survey and the general water balance, indicated in section 5.4.2.

The principal elements to be monitored for each compartment area are:

- Groundwater level
- Rainfall
- Evapotranspiration
- River stages (water level observation programme)

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- Land flooding stages (water level observation programme)
- Changes in water demand and supply and reasons behind (project, non-project)
- Erosion processes and reasons behind
- Sedimentation processes and reasons behind
- State of structural works (embankments, structures).

The erosion and sedimentation processes will be assessed by means of levelling of relevant cross-sections of canals and drains in the dry season.

In addition, FAP 20 proposes that the mathematical models will be updated each year.

5.12.2 Environment

The following factors are relevant key environmental indicators. Indicators will be further defined in cooperation with FAP 16.

- Fish populations in the beels, khals, rivers and floodplains of the compartments
- Water quality (ground and surface water)
- Navigation
- Unused land with agricultural potential (fallow flooded land)
- Fuel use for domestic purposes (changes in kind and quantity)
- Livestock populations
- Soil quality and intensive cultivation (fertility and structure)
- Pests (insects and rats)
- Water related diseases (malaria, diarrhoeal diseases)
- Wildlife
- Wetlands

5.12.3 Socio-economic

The following key socio-economic indicators have been chosen to be monitored during the project life cycle.

- Distribution of temporary income
- Distribution of structural benefits
- Employment opportunities as expressed in the daily wage rate
- Cropping pattern changes
- Yields of crops
- Crop damage
- Cropping intensity
- In- and out-migration.

5.12.4 Institutional

Compartmentalization does involve conflicts of interest. The institutional arrangements will be designed in such a way as to provide an efficient way of settling these conflicts.

The effectiveness of the institutional arrangements will be monitored by checking the following key indicators:

- Functioning of the Local (Advisory) Water Management Board
- Functioning of the sub-compartmental water committees
- Functioning of the BWDB and other GOB/Local Government agencies related to the project
- Conflicts between people living inside and outside the compartments
- Inter sub-compartmental conflicts
- Illegal interventions
- Functioning of Labour Contracting Societies, Earthwork and Structure Maintenance Groups.
- Degree and frequency of interaction and collaboration between government agencies.
- Contributions made by people to local operation and O&M through the sub-compartmental water committees
- relationships between Union Parishads and sub-compartmental water committees
- selection of budgetary priorities at Union Parishad, Upazila Parishad and District level in relation to the sub-compartmental water committees and compartmental water management board.

5.13 Evaluation

Before the end of the project, November 1995, a full scale post-project evaluation of both the CPP areas will be conducted. This multi-criteria assessment will not only evaluate the performance of the two compartments, but will also give input into the guidelines for future compartmentalization. The FPCO "GUIDELINES ON PROJECT ASSESSMENT" (Dhaka, July 1991) will be used to conduct this assessment.

6 DESIGN OF A DEVELOPMENT MODEL

On the basis of the sub-compartmental survey and the expertise in the teams, a number of different scenarios will be developed. One of those scenarios will be recommended for implementation. This chapter describes the process involved. In figure 8 a flow chart is presented, visualising the process of analyzing and decision making.

The basic input for development formulation is the multi-disciplinary sub-compartmental survey. Items covered in this survey comprise the assessment of the rural and the urban people in their present situation: the environment, including agriculture and fisheries, transport, hydrological features, rural industry, and other elements. In this survey, the scope for improvement will be indicated by the people as well.

With this information available (section 5.4.3), and with the knowledge built up in the Project Team and in the Consultants Team through studies and surveys, the present situation will be characterised and the required actions for development will be assessed (related to water management). This assessment will take place on sub-compartmental scale, but also on broader scale: on areas, covering groups of sub-compartments and on the compartment level itself.

The assessment of the present and the future leads to the formulation of targets to be set by the project. Then the question comes, how those targets should be reached. What are the technical possibilities to remove the bottlenecks in water management (waterlogging, flood damage, reduced fish stock, etc.)? This will comprise excavation of khals, strengthening of embankments, construction of structures, and secondary and tertiary watermanagement development. In addition, institutional arrangements will be reviewed, required to support those targets (user groups, management boards, legislation, contribution to construction and O&M). With (preliminary) answers in hand, comprising technical and institutional arrangements, a set of development options will then be formulated.

Options for each (group of) sub-compartments will be combined into a number of development options for the whole compartment. This set of options will be screened by the Project Team/Consultants Team to exclude those options which, very obvious, are non-viable. In this way a set of "Selected Scenarios" will be formulated for further processing; this set is reduced now to a manageable proportion. For the Tangail compartment, the scenarios to be studied will most likely include the following physical options or a combination of those

- the existing situation ("zero option"), to be used as a reference,
- drainage improvement,
- semi-controlled floodwater management (throttled inlets),
- controlled floodwater management (gated inlets),
- sub-compartmentalization (combined with the above).

For each of those scenarios, the hydrological effects of the physical interventions will be analyzed through model runs. With this as base, the effects on agriculture and fisheries will be generated and analysed. Costs and benefits will be quantified for each intervention, and the social, environmental and institutional implications will be valuated as far as possible. This will lead to "Quantified Scenarios".

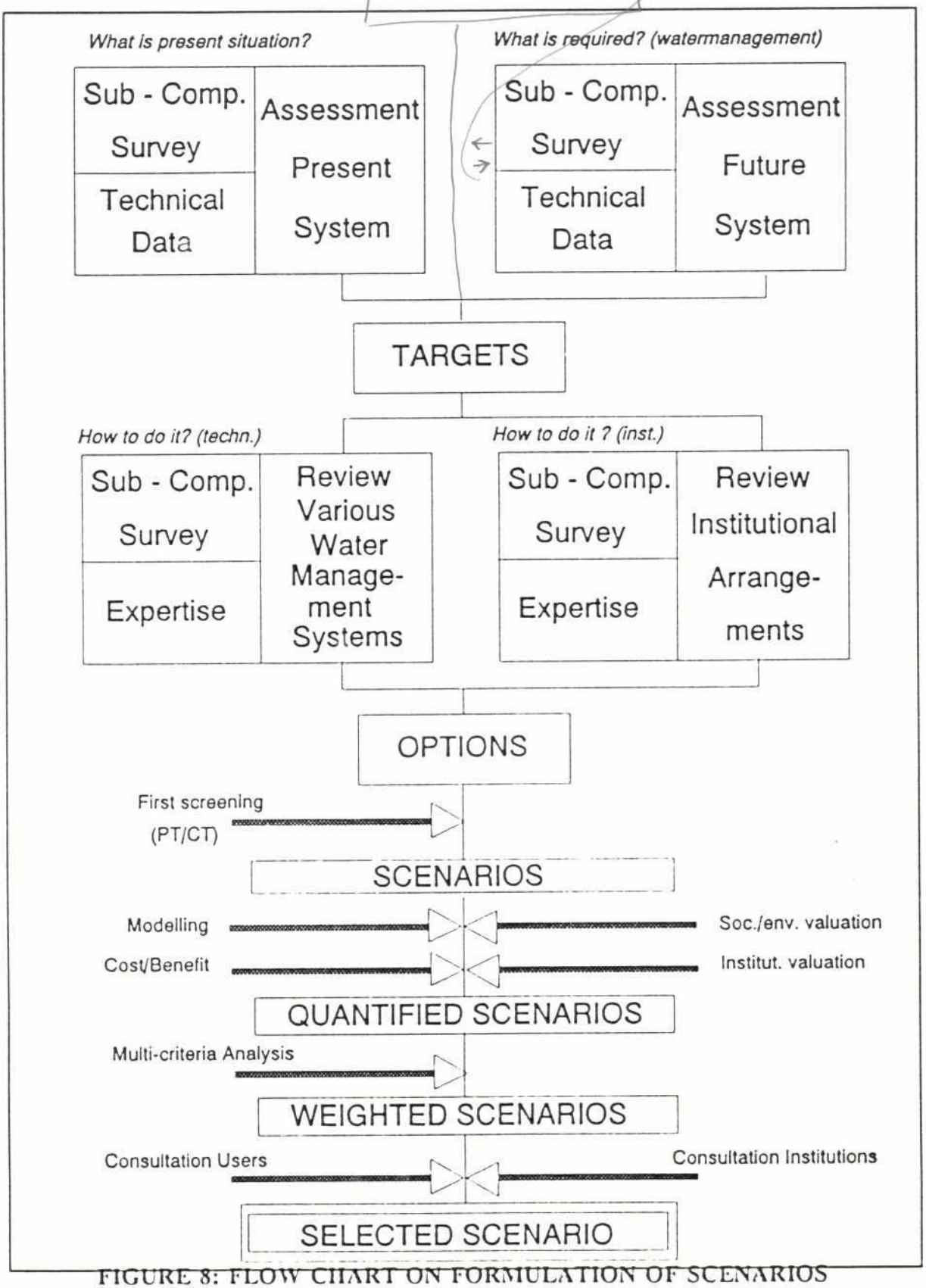


FIGURE 8: FLOW CHART ON FORMULATION OF SCENARIOS AND DECISION MAKING

The "Guidelines On Project Assessment", as produced by the FPCO/POE, formulates the application of the multi-criteria analysis for the FAP. This analysis will be applied to go from "Quantified Scenarios" to "Weighted Scenarios".

Based on the limited set of "Weighted Scenarios", a final decision has to be taken, which one of those scenarios should be selected for implementation.

In a period of about three months, feedback will be sought from the relevant local GOB departments, elected officials and the people about the most attractive two or three scenarios.

Input from the various GOB departments will be sought in various ways:

- through the Project Implementation and Coordination Committee, which by that time will be functioning and which brings together all concerned departments;
- Through specific responses from experts in the various departments who will be requested to provide written responses, and
- through an inter-departmental seminar, scheduled for September, where the various aspects of final options will be reviewed by specialists from within and outside the project.

It is proposed to conduct meetings at sub-compartmental level, or possibly in two or three sub-compartments combined. As far as possible, separate meetings will be arranged for different interest groups i.e., fishermen, farmers, women and landless.

The people living in the compartment and adjacent to it will be consulted in a series of meetings.

Feedback from these consultations will be recorded and systematically analyzed. Development options will then be adjusted in the light of the feedback.

After completing the consultation process, FAP 20 will finally recommend one development option for implementation in the Interim Report.

7. INSTITUTIONAL FRAMEWORK

The project will deal with institutional aspects at four levels:

- the establishment of Sub-Compartmental Water Committees,
- the establishment of a Compartmental Water Management Board, and
- the establishment of an operational mechanism for close coordination and collaboration with the relevant departments.

7.1 Sub-Compartmental Water Committees

The project will approach the establishment of Sub-Compartmental Water Committees as follows:

The composition of these committees will comprise three groups:

- representatives of functional interests (farmers from land at three elevations, fishermen, women, landless and, where appropriate, urban dwellers). These will be elected and will form the largest category in the committee.

- Union Parishad members, selected out of the members of the wards included in the sub-compartment;

- field staff of three government agencies, operating in the area, namely: 2 or 3 block supervisors belonging to the Department of Agricultural Extension, 1 or 2 block inspectors belonging to BRDB and 1 BWDB worker, if possible.

The Committees will be chaired by the Union Parishad Chairmen, who will also act as representatives of the committees towards the higher level: initially the Project Implementation and Coordination Committee and, in due course, the Compartmental Water Management Board.

An outline for the roles of the Sub-Compartmental Water Committees has been drawn up and will be discussed during the envisaged consultation. This consultation will also serve to provide input on the as yet open issue of election of members, definition of functional groups and delineation of sub-groups. After this, consultation procedures for the envisaged committees will be finalized.

The actual establishment of these committees will be guided by the project, but will be executed by selected staff of DAE and BRDB on the one hand and a selected NGO on the other. Both approaches will be tested simultaneously, though at different locations. The field staff of these agencies will be subjected to an intensive training programme, designed and developed by the PT and CT, with the possible involvement of specialized agencies. The input by these various agencies will require funds which will be included in the revised CPP budget as far as government agencies are concerned. It is proposed to channel these funds through CPP after revision of the present PP. The expenses related to the involvement of the NGO will be met directly from NGO funds with either of the two

embassies. If required for the sake of timely execution of these activities, it is proposed that advance payment can be made from TA funds.

Training will not only be given to the field staff who will help to establish and support these Water Committees, but also to the members of the Committees themselves. In fact, this training will become a major effort of the project. A training package on the institutional, technical and operational aspects under the responsibilities of the sub-compartmental water committees will be developed, after a training needs analysis and review of existing training materials and resources.

The training materials development will be done in close collaboration with specialized institutions in Bangladesh and some aspects of the work will be contracted out.

Once committees have been established and trained ongoing attention will be given to the committees, either directly or through the three agencies that will take part in this activity (DAE, BRDB, NGO). This support and the overall functioning of the committees will be monitored closely.

7.2 The Establishment of a Local Board of Water Management

Regarding the establishment of the compartmental Local Boards of Water Management, CPP takes a pragmatic view. Although a concept and general strategy will be presented by the institutional development specialist, CPP cannot establish such a Board in the current situation. This needs decisions and activities at the national level regarding legal and procedural aspects that are beyond CPP's mandate. However, the project needs a mechanism for coordination and increasing involvement of government agencies as well as beneficiaries. It is proposed that the Project Implementation and Coordination Committee will serve as a first step in a process that might, ultimately, lead to the establishment of the Local Board of Water Management. The role, responsibilities and composition of this Committee will change according to this process, but final and detailed regulation can only take place after FAP 26 will have run its course and national decisions have been made. Meanwhile CPP will investigate aspects that might be relevant in this context.

7.3 Coordination with other Agencies: the PICC

It is proposed to establish, as soon as possible, a Project Implementation and Coordination Committee (PICC). This Committee, which has been discussed with relevant departments and authorities, would initially serve to facilitate coordination and collaboration between the project and most concerned departments. These departments are: Department of Agriculture, Fisheries, Forestry, Livestock, BADC (Bangladesh Agricultural Development Corporation), Roads & Highways, the Local Government Engineering Bureau, Bangladesh Rural Development Board and the establishment Division in the positions of Deputy Commissioner (DC) and Upazila Nirbahi Officer. It is proposed to establish a district level committee of which representatives of these various agencies from District and the two most concerned Upazilas (Delduar and Tangail) will be members. The other members will be: the Major or Administrator of Tangail town, representatives of CPP and, as soon as practical, of NGOs. As soon as Sub-

Compartmental Water Committees will be established, these will be represented through their chairmen.

In order to give this PICC sufficient weight and in order to create a situation where both the Project Director and the Deputy Commissioner for Tangail can fully participate, it is proposed to make the State Minister/Member of Parliament for Tangail the Chairman for this Committee. The Project Director and DC will be Vice-Chairmen. The Executive Engineer in the Project Team will be member secretary. It is hoped that support from Dhaka for this approach can be mobilised in order to effectively establish this Committee.

7.4 Practical Collaboration with Government Agencies

Collaboration with the various departments has, so far, not been realized. However, the Government Order about the support to be given by these departments to the project has now been issued and the first discussions have been held with the concerned officers at District and Upazila level. It appears that the formula of part-time deputation to the project needs to be made more practical in two regards. First of all the project needs to present rather specific activities to the respective staff in the departments, in stead of presenting an unspecified request for "collaboration". Such lists will be prepared and discussed. However, this will not remove the second constraint: the material means for the input by staff from other departments. It is felt that the project should have a provision to meet the project related expenses incurred by the other departments, based upon mutual agreement and planning. In the immediate future the general aspects of this issue, in particular the choice of an expedient and acceptable channel for such funding, will be explored. And at the same time detailed discussions will be held with staff in the concerned departments about the nature of their future inputs and the material and immaterial support required for that. The Project Team will, in the present vision, include the staff of the various agencies to the extent they work on project related activities. The Project Director will facilitate and manage their involvement and will endeavour to remove financial or formal obstacles. Some Departments will be directly involved in major CPP initiatives, especially the establishment and training of Sub-Compartmental Water Committees. Close collaboration with the specialists in the various departments will also be sought on the collection, analysis and review of data and for the review of the scenarios developed by them. It is proposed that this involvement will lead to a seminar, jointly organized by CPP and interested officers, on issues related to integrated water management within an area concept.

8 COOPERATION WITH FAP AND OTHER WATER SECTOR PROJECTS

The FAP has 26 component projects. A number of these are evaluations of existing projects, others are supporting studies. Finally there are the regional studies, covering the whole flood plain area of Bangladesh.

FAP 20 has been designed to make full use of the evaluations, supporting and regional studies. In due course, FAP 20 is to provide inputs into the regional and follow-up studies. Some FAP projects (FAP 16, 17, 19 and 25) use the Tangail Compartment for one of their case studies. FAP 20 will provide these FAP projects the data they need, and will give all possible assistance. On the other hand, FAP 20 will benefit of the results of those case studies. Overlap of studies will be limited as much as possible.

In the following sections, the cooperation between FAP 20 and other FAP projects is described.

8.1 FAP 1 - Brahmaputra Right Embankment (BRE)

The success of the FAP 20 activities in the Sirajganj compartment depends to a large extent on the reliability of the BRE. According to the TOR, the responsibility for the BRE is beyond the scope of FAP 20. From the side of the FPCO, FAP 1 and the BWDB are requested to give priority to the (re-)construction of the main embankment between Sirajganj and Kazipur.

With FAP 1, common features will be discussed such as O&M of the main embankment, structures in the embankment, housing and vegetation on the embankment, and resettlement of the people who lost their land and homesteads due to erosion. As both FAP 1 and FAP 20, each from a different point of view, relate to the people outside the BRE, their wellbeing may also be a point for discussion.

8.2 FAP 2 - North West Regional Study (NWRS)

FAP 2 provides the backdrop against which the Serajganj CPP operates. It will give the boundary conditions for the compartment. The development of the compartment has to fit into the plans for the future of the North West region. To a high degree this applies to the mathematical modelling and the development of scenarios. Data and experiences will be exchanged.

8.3 FAP 3 - North Central Regional Study (NCRS)

The relationship of FAP 20 with FAP 3 is similar to that with FAP 2, but then in relation to the Tangail CPP.

A point in question is the realization (as expressed in the FPCO Teamleaders meeting of August 29, 1991) that widespread compartmentalization of the NCRS will depend heavily on solving the drainage problems in the South-East of the region.

FAP 3 has provided information on the selection of a suitable control area for the baseline survey. Also data has been received such as levelling data of the West embankment and agricultural data. Furthermore exchange of modelling data took place.

Of joint interest to FAP 3 and FAP 20 is the Jamuna Bridge project. This applies in particular to one of the options of the Dhaleswari Mitigation Plan. This option includes a closure of the Northern intake of the River Dhaleswari, the main feeder river of the River Lohajang which bisects the Tangail CPP area. Implementation of this option will have a major bearing on the water management in the Tangail Compartment (section 5.4.2.4). FAP 20 advised the FPCO to make objections against this closure.

According to its TOR, FAP 20 has special tasks in the area around Jamalpur where FAP 3.1 investigates the feasibility of a compartment. Due to different planning of both FAP projects, cooperation was not possible up to now. As is explained in section 5.10, FAP 20 will revise its planning.

8.4 FAP 12 - FCD/I Agricultural Study; FAP 13 - O&M

FAP 12 and 13 have provided valuable information on the reasons behind the success and failure of existing FCD/I projects. This has highlighted the relevant issues and areas that need special attention while designing, operating, managing and maintaining the structural and non-structural elements of the compartments.

The input of FAP 12 regarding the methodologies for Rapid Rural Appraisals and household surveys has been most valuable. These methodologies have been followed by FAP 20 and should be a part of all FAP feasibility studies.

8.5 FAP 14 - Flood Response Study

It is expected that FAP 14 will in due course provide insight into the way that people (those living in the areas adjacent to the compartments) respond to flooding. This will facilitate possible mitigating measures.

The information from this study is of importance for FAP 20 because it is likely to indicate in which fields the flood prone people expect most help. It would also indicate which fields need less attention as the people manage to deal with those effectively.

Together with the information collected through the sub-compartment survey, an insight in actual flood response will be formed in both the Tangail and Sirajganj compartments. The findings of FAP 14 will be evaluated in the light of the specific local conditions in both these compartments. This may lead to relevant flood proofing measures.

8.6 FAP 15 - Land acquisition and settlement

Land acquisition and settlement will become relevant for the CPP. Close cooperation with FAP 15 will be sought so as to make this process as positive as possible for the people involved.

A major problem in the Tangail CPP are the silted up khals; parts have been taken over by people living close to them. In Sirajganj, the most obvious concern is the need for early retirement of the BRE. In both projects there will be a need to resettle people (possibly from other areas). This might be done by widening the embankment at certain places. Advice from FAP 15 will be needed in all these fields.

8.7 FAP 16 - Environmental Study

FAP 16 will, among others, conduct a one year in-depth survey of the health related aspects of common resource fisheries in the Tangail compartment. This will broaden the understanding of the relevance of such capture fisheries for the landless in particular. FAP 20 has worked closely together with FAP 16 so as to streamline the data collection process for the FAP 20 baseline survey and the FAP 16 case study to be done in the Tangail CPP area. FAP 16 will use the data collected in the FAP 20 baseline survey for their case study, thus reducing the visit of interviewers in the Tangail compartment.

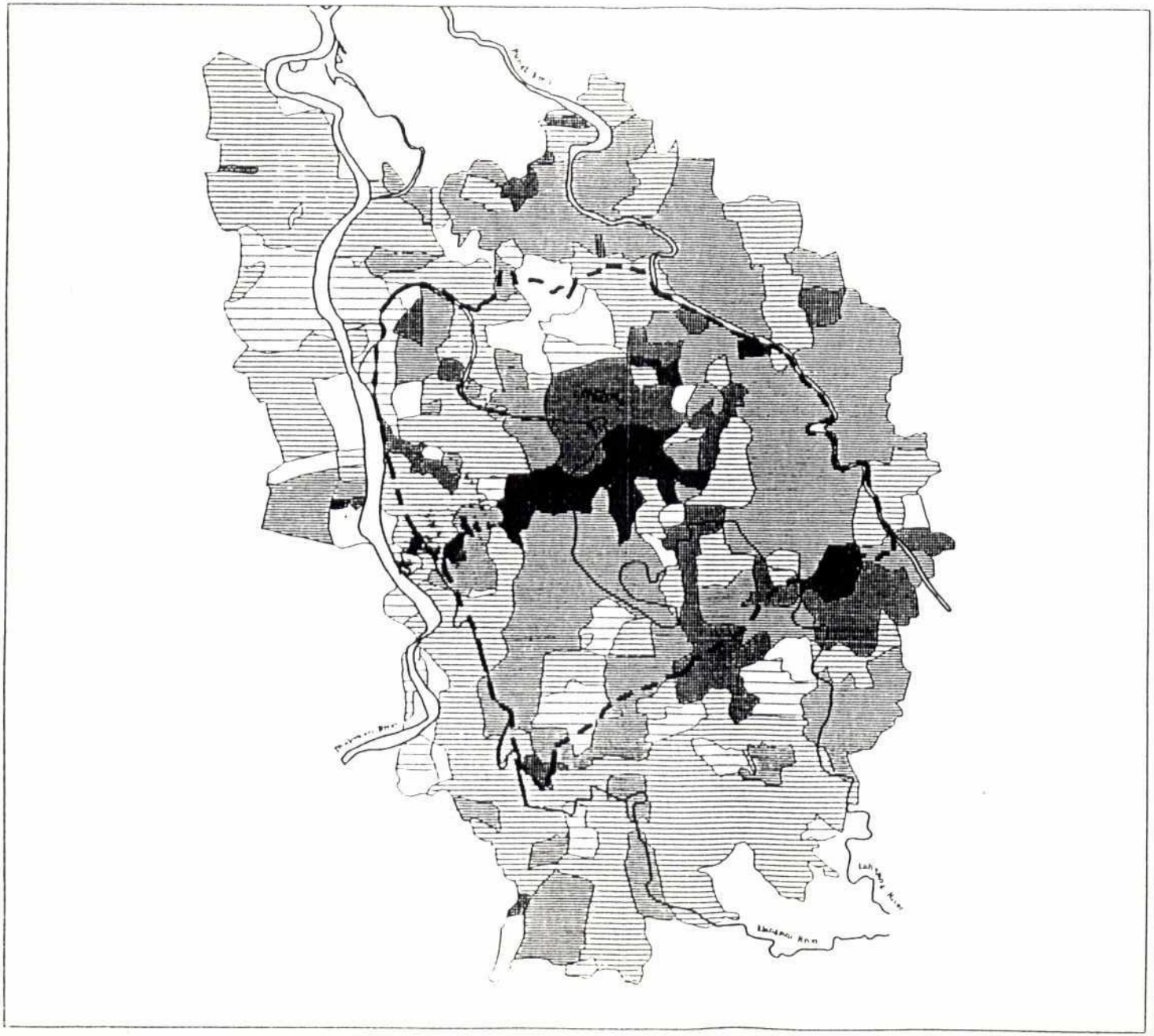
FAP 16 suggested possible key indicators regarding the relevant ecological cycles. These are measured during and after the baseline survey with the purpose to get an indication about the sustainability of compartmentalization. Developments may be changed in a positive direction if needed and possible.

> "The villages were full of healthy inhabitants and the people enjoyed good health and prospered. All this was changed when the Damodar was embanked to stop the inundations." [Willcocks, p.66]

8.8 FAP 17 - Fisheries

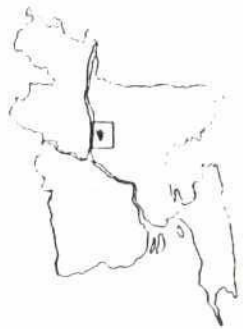
Fisheries and aquaculture are important items for the development of the compartments. Firstly care must be taken that an improvement of the drainage will not lead to a serious decline of the beel fish. Secondly the migration routes may not be hampered by structures, which does not allow the fish to pass.

In both issues FAP 20 will collaborate with FAP 17. This FAP has chosen the Tangail Compartment as one of their case study areas. In this frame work FAP 17 will, together with FAP 16, join FAP 20 in the special study on fisheries (section 5.11.3 and annex 9). Another point of cooperation will be the design and testing of "fish friendly" sluices and regulators.



Tangail Compartmentalization Pilot Project Study Area

Population Density Map



LEGEND

- No data/Error in data
- < 500 per sq km
- 501 - 1000
- 1001 - 1500
- 1501 - 2500
- > 2500
- Compartment Boundary

SOURCE

Small Area Atlas Census 1991
Bangladesh Bureau of Statistics 1997

Flood Action Plan 19 and 20
ISPAN December 1991

Fig. 9

8.9 FAP 19 - Geographical Information System

There is basic agreement on cooperation with FAP 19 in the Tangail CPP area. FAP 19 will use the Tangail Compartment for one of their case studies, utilising data supplied by FAP 20. A result is shown in the figures 6 and 9. The delayed timing of the Tangail baseline survey will allow GIS more time to develop its application as a case study. Its impact on the Tangail planning is therefore expected to increase considerably as compared with FAP 20s earlier planning. Due to FAP 19s limited resources, it will not be able to extend the same level of cooperation to the Sirajganj CPP.

The main value of GIS is its capability to present database type information (e.g. tables on population density, flood depths, cropping patterns etc.) and geographical information in any possible combination. The most detailed level for presenting data is probably the Mauza Map followed by the Union level.

The interrelation of the data indicated will give an in-depth insight in the existing situation. It will permit a ready judgement of most of the alternative solutions used in the decision making process, especially in interaction with the mathematical model. Due to FAP 20s detailed study efforts in the project area, and the computer results, it is believed that the mutual benefit can be considerable.

8.10 FAP 25 - Flood Modelling/management

One of the objectives of FAP 25 is the communication and coordination with other FAP projects about modelling activities so that a unified approach can be developed.

FAP 20 shares its modelling experiences with other FAP projects via FAP 25 in the Flood Management/Modelling Coordination Committee meetings.

Important aspects are the accuracy and reliability of both input and output data. FAP 20 received rainfall and water level data from FAP 25. In respect to the hydrological basis for establishing engineering designs, FAP 20 will follow the approach recommended by FAP 25. It may be mentioned that FAP 20 received the results of the 25 year model run (General Model), which are used in the design of the embankment crest level.

An intensive cooperation between FAP 25 and FAP 20 will soon start with the development of a Flood Management Model (FMM) for the Tangail compartment (section 5.11.6). For this purpose the staff of FAP 20 will be extended. A separate proposal, which is in line with the Terms of Reference for the FMM development of FAP 25, has been presented (Annex 10).

8.11 FAP 26 - Institutional Development

The institutional aspects of Compartmentalization are crucial to its viability. Therefore it is essential that FAP 26 be started as soon as possible. When FAP 26 starts operating, FAP 20 will seek cooperation with FAP 26. In this way the experience on the local level obtained up to then can be brought in.

8.12 Other Water Sector Projects

Systems Rehabilitation Project (SRP)

SRP is introducing a new approach to Operation and Maintenance and Cost Recovery in the BWDB. Maintenance will be clearly divided into preventive, periodic and emergency maintenance; preventive maintenance will be implemented by Earthwork Maintenance Groups, Structure Maintenance Groups and Canal Maintenance Groups and periodic maintenance by contractors and labour groups. Public participation in operation of systems is under formulation. As SRP is developing the strategy for O&M under the BWDB, FAP 20 will follow their strategy in principle.

Jamuna Bridge Project; Dhaleswari Mitigation Plan

FAP 20 will use the relevant reports (EIA) and other data of the Dhaleswari Mitigation Plan study. These data will be used in the computer model for the development of a scenario in which the situation after the construction of the Jamuna Bridge and the closure of the Northern intake of the Dhaleswari will be simulated.

Early Implementation Projects (EIP)

Links exist with other relates non-FAP projects such as EIP; there is an exchange of notes and experiences about procedures on implementation of works, formation of Labour Contracting Societies and on other relevant matters.

9 WORK PLANNING AND STAFFING

9.1 Work programme

In the previous chapters the objectives of the CPP have been defined (chapter 3) and the surveys and studies required to formulate and design specific technical and institutional interventions (chapter 5). Special attention has been given to the process how the development model will be formulated (chapter 6) and which institutional backing is required (chapter 7). This chapter brings all those elements together into an action plan. When assessing this work programme, the details of the four previous chapters must be taken into account.

The work programme deviates from the earlier ones. There are several reasons for that, but the main one is the growing awareness in the Project Team and in the Consultants Team - but also in the whole Flood Action Plan programme - that people's participation is a fundamental pre-condition for the success of any (FAP) project and in particular CPP. People's participation has a main effect on planning and staffing. The decision-making process, described in chapter 6, puts quite a heavy claim in time and manpower on sub-compartmental surveys and on consultations, before the final development scenario for both Tangail and Sirajganj will be selected.

There are other reasons for adjusting the planning as well. The interlinks with other FAP studies (see chapter 8) are more intensive and time-consuming than anticipated. Several FAP studies are concentrating their activities in the Tangail compartment. As FAP 20 is overall responsible for the activities in this compartment, time is required for coordination and guidance. Another reason for change in programme is the delay in the implementation of works under BWDB. Certain river training woks, planned for implementation during FY 1991-92, can not be materialized, as those works are not included in the TAPP. Land acquisition creates delays as well. Last but not least, the Project Team is still far under-staffed, and, as one of the negative consequences, this did increase the workload of the Consultants Team.

In the following three sections, the schedules of activities are presented for the entire project period, and, more into detail, for Tangail and Serajganj during the period mid 1991 - mid 1993. The charts are self explanatory; broad lines are indicated below.

The reconnaissance, preliminary and baseline surveys are the base for planning; these surveys run up to Oct 1992 for Tangail and up to March 1993 for Sirajganj. Exceptions to this are the hydrological surveys. Observations of staff gauges and measuring discharges will continue throughout the project period. Mathematical modelling and the operation of the model will continue for Tangail up to July 1992 full time, and for Sirajganj up to early 1993. From then onwards, the models will be further refined and be updated on a continuous but on a less intensive base.

The formulation of the development options and scenarios and the decision making process on selection is the core of the programme. See again figure 8 for the elements involved. The process takes nine months. A final decision on the scenario to be implemented in Tangail may be expected by early December 1992, and for Sirajganj by August 1993. Implementation of physical works in both the project areas will be initiated during

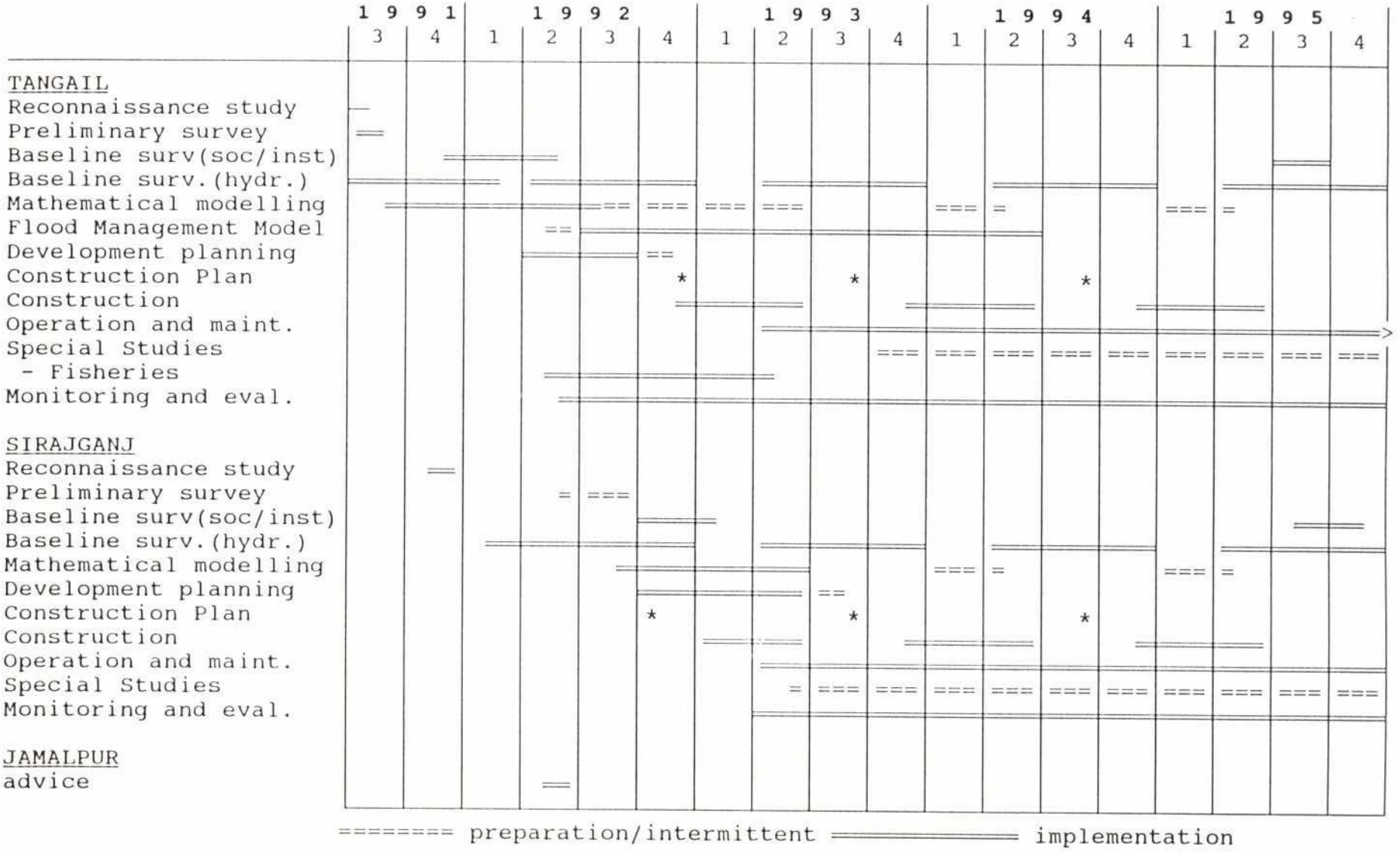
the FY 1992-93 however, though the work volume for Sirajganj will be limited during the first year to come.

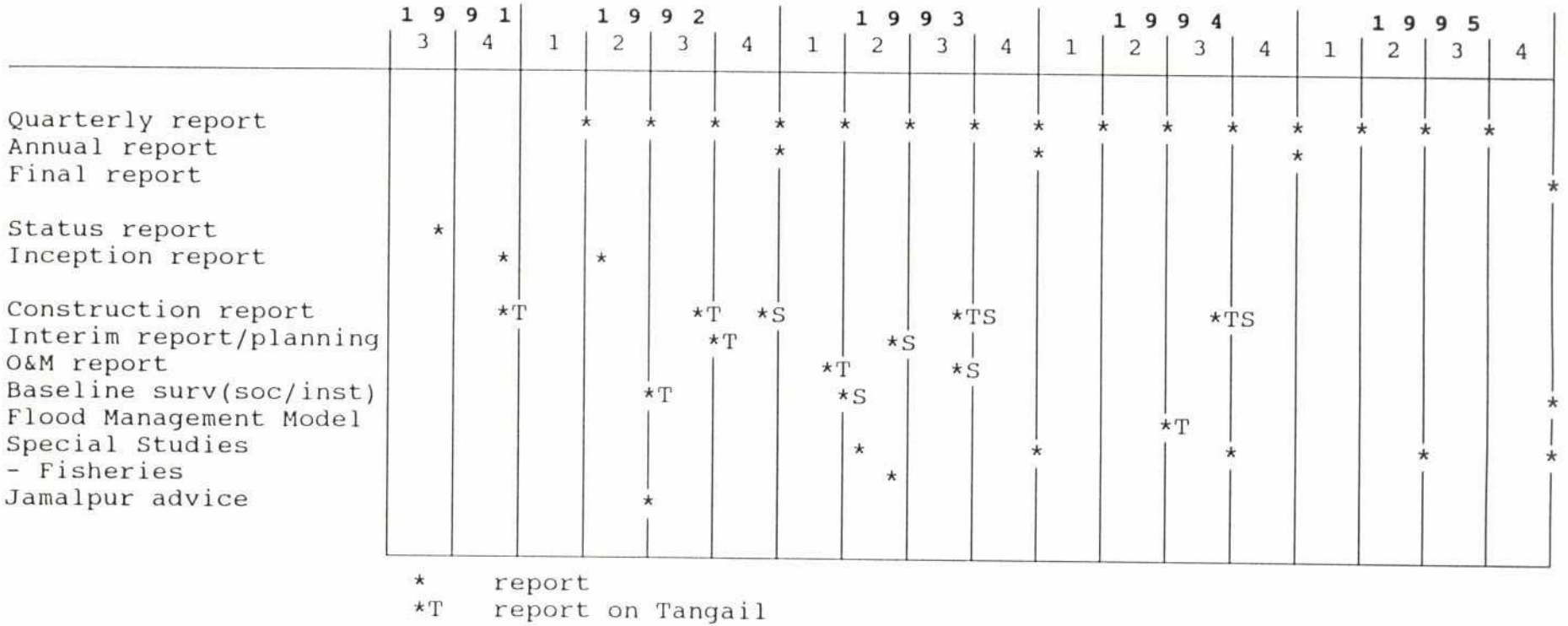
Operation and Maintenance should follow the implementation of works, also if works are partially completed. Guidelines (a draft manual) for Tangail will be ready by early 1993; for Sirajganj, six months later. The manuals will largely be based on those under preparation by SRP.

A number of Special Studies will be presented in the Interim Reports (Oct 1992 for Tangail; June 1993 for Sirajganj). The first study, the one on fisheries (section 5.11.3), has been formulated in close cooperation with FAP 16 and 17, and will run from May 1992 up to May 1993. Monitoring and evaluation, a continuous process, will be further detailed in the Interim Reports as well, and will start from then.

The following three sections present the schedules of activities mentioned. In section 9.1.4, the construction plan for Tangail (1991-92) is presented, as drafted in December 1991. As explained earlier, works could not yet be initiated however.

9.1.1 Schedule of activities for FAP 20; 1991 - 1995

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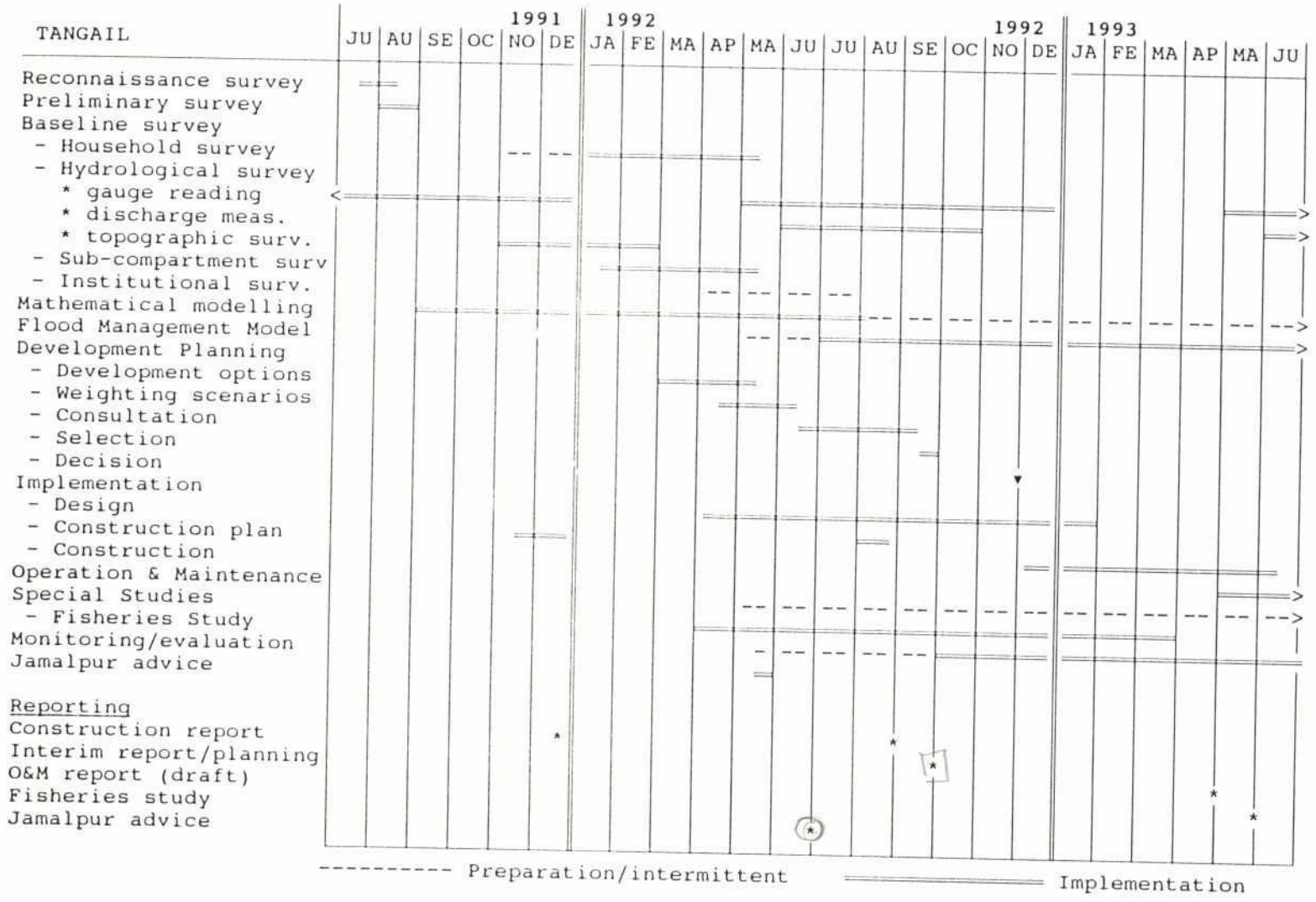
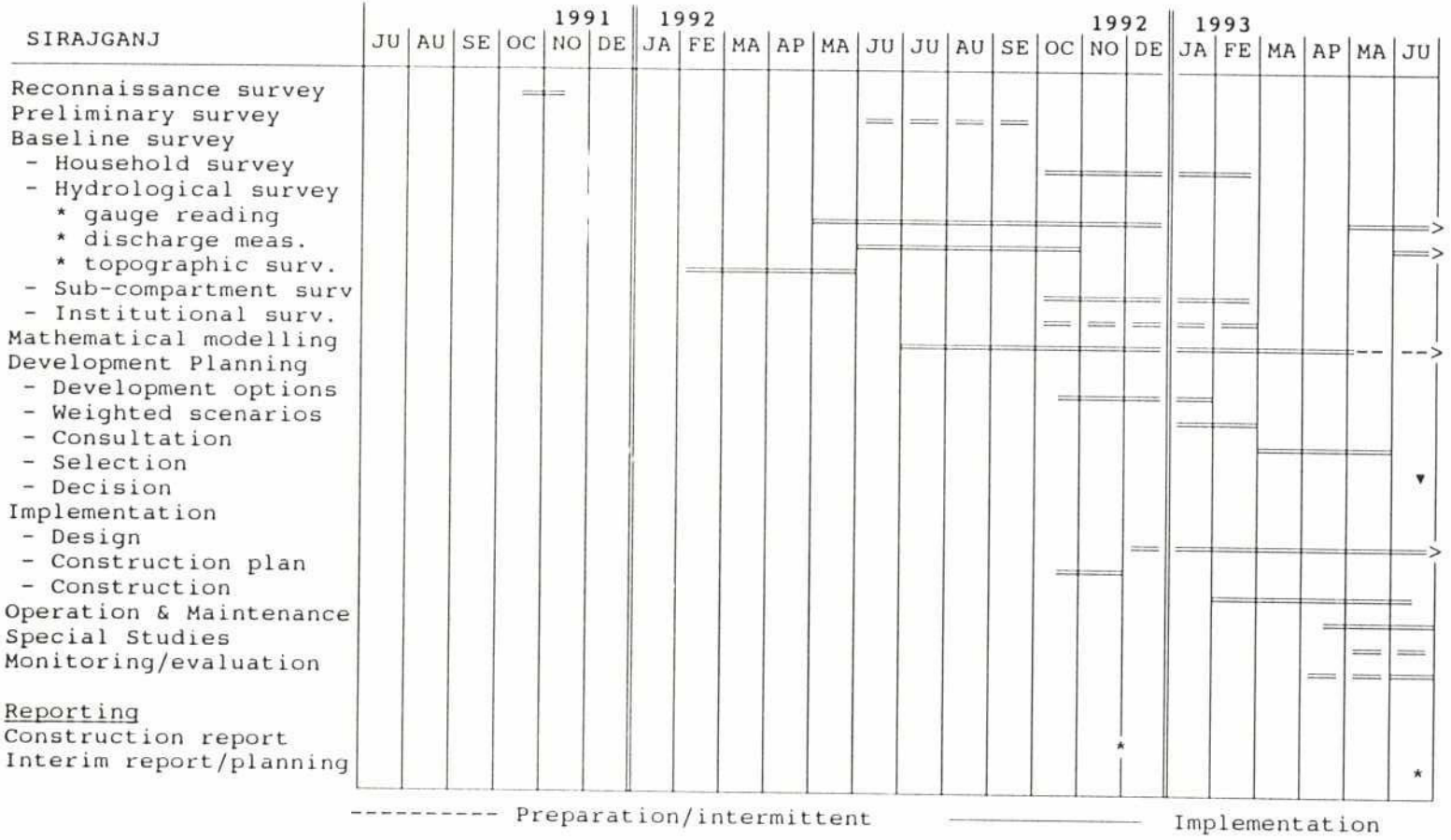
Quarterly report
Annual report
Final report
Status report
Inception report
Construction report
Interim report/planning
O&M report
Baseline surv(soc/inst)
Flood Management Model
Special Studies
- Fisheries
Jamalpur advice
* report
*T report on Tangail

9.1.2 Schedule of activities for Tangail Compartment; 1991 - 1993



9.1.3 Schedule of activities for Sirajganj Compartment; 1991 - 1993



9.1.4 Construction plan Tangail 1991 - 1992

In December 1991, a construction plan has been prepared for the Tangail compartment. This plan comprises a proposal for works to be undertaken in the dry season of the financial year 1991 - 1992:

- resectioning of the embankment along the Dhaleswari and Elanjani rivers;

- erosion protection works along the Pungli and Elanjani rivers (3 sites).

At the end of February 1992, these works have been postponed to the the FY 1992-93. The time available for tendering and resectioning of the embankment was insufficient, due to a change of the design, and land acquisition could not be arranged. Furthermore, the erosion protection works were not included in the TAPP.

At a meeting of FAP 20 with the FPCO/POE in October 1991, the suggestion was put forward to investigate whether it would be possible to make an early start with a test sub-compartment. The major advantage of such an undertaking would have been that FAP 20 would have gained first hand experience of all that is involved in setting up (sub-)compartments. An early success would also have been an advantage because of its demonstrational effect.

FAP 20 conducted a multi-disciplinary survey in Tangail which resulted in the listing of a few potential sub-compartments. It soon became evident, however, that it would be difficult to manage the water in one such unit without the overall compartmental structure in place.

At the time the decision had to be made as to which sub-compartment had to be studied in-depth, it became obvious that FAP 20 would have to bring forward its input in the Jamalpur Priority Pilot Study from December 1991 to March 1992.

Given the workload, it was felt unwise to attempt to cover both the test sub-compartment and the work in Jamalpur. Given the time frame of FAP 3.1, the JPPS had to be given priority.

One element of the test, people's participation in water management, has now been put forward as a special study, in which, together with the people living around the present sluice gates in the western embankment, the existing operation of the sluice gates will be investigated.

9.2 Staffing

9.2.1 Two teams

For the execution of the project, the GOB is responsible to provide a Project Team and the donors to supply a Consultants Team.

- The **Project Team** (PT) is provided by the BWDB. This organisation represents, as far as the daily operations are concerned, the Bangladesh Ministry of Irrigation, Water Development and Flood Control. The PT is responsible for all the aspects of the Pilot Project implementation. These responsibilities include surveys, designs, tendering, supervision of construction, operation and maintenance, special studies, mathematical modelling, monitoring and data collection, planning, programming and reporting, organizational aspects, etc. (TOR, page 14).

- The **Consultants Team** (CT) advises and assists the Project Team in all the Pilot Project related activities. The Team has been selected by the Directorate General for International Cooperation of the Netherlands' Ministry of Foreign Affairs (DGIS). DGIS acts as the Executive Authority at the donor's side.

9.2.2 The Project Team

To perform the responsibilities mentioned under the previous section, the required staffing arrangements for the Project Team, in line with the TOR, are as follows:

- Project Director (Tangail)
- Executive Engineers (1 Tangail, 1 Sirajganj)
- Sub-divisional Engineers (2 Tangail, 2 Sirajganj, 1 Jamalpur)
- Agronomists (1 Tangail, 1 Sirajganj)
- Socio-economists (1 Tangail, 1 Sirajganj)
- Fisheries Specialist
- Livestock Specialist
- Infrastructure Specialist

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The Project Director, the 2 Executive Engineers and the 5 Sub-divisional Engineers have all been posted. They belong to the regular BWDB staff. To support this staff, there is a provision for 57 positions; 40 of these positions are sanctioned and posted.

Considering the Project as a study project, 57 positions, excluding the specialists from the other Ministries and Organisations, were provided in the TAPP. However, according to the TOR the project comprises study, implementation and monitoring. The Project Team is responsible for all these elements; not only study, but also implementation and monitoring. To achieve the required output, more than the normal set-up is required. It is assumed that a minimum staffing of 85 positions will be needed for a smooth implementation of the project.

As the staff of the Project Team has been limited to supporting staff and civil engineers only up to now, the Project Team was not in a position to fulfil its tasks up to expecta-

tions. Ideas and concepts are therefore still too much developed within the Consultants Team, as the Project Team is still not equipped to be effective for an integrated, multi-disciplinary approach.

The posts of agronomists (2) and socio-economists (2) are still vacant. The Project Director was informed in February 1992, that the BWDB was not able to fill these posts. Those posts will shortly be filled now by national consultants; they will be placed in the PT and will work under direct control of the Project Director.

A part of these functions will be fulfilled by former members of the CT. In this way it way the experience of the last year in Tangail can be transferred to the PT. Thus the PT will be able to perform in the Sirajganj Compartment the implementation of the baseline survey and of the other project aspects. Already the supervision on the placing of the gauges and the hydrological survey is done by the PT.

The fisheries specialist, livestock specialist and the infra-structural specialist are expected to be made available from the concerned Ministries on part time basis only (1 week a month each). Government orders has been issued in this respect.

As discussed in section 7 the active involvement of the relevant government departments will be pursued more vigorously and practically. Closer and more regular coordination with these departments (through the PICC as well as directly and informally), mutually elaborated specification of activities for which departmental input is requested and the provision of material means to the extent required for project related activities will increase the involvement of and support by staff room the other agencies. This can take other shapes than the one-week postings envisaged by the Project Documents but might fit better with the requirements of CPP and the constraints of the concerned departments. Beyond the individual involvement of District level and Upazila level staff in specific project activities, it is envisaged that field staff or BRDB and DAE will take up a major role in connection with the establishment and functioning of the envisaged Sub-Compartmental Water Committees.

9.2.3 The Consultants Team

In the original time planning (see annex 11), the major input of the Consultants Team would be finalized before the end of 1992. After that, the Project Team would have been taken over most of the tasks. Partly because of the complicity of the project, partly due to the late start of the Project Team and the fact that this team is still uni-disciplinary, this aim will not be reached. In section 9.1, a number of reasons has been mentioned why the work programme had to be modified.

While discussing the first draft of the Inception Report, the representatives of the donor countries suggested to extend the period of full time consultancy involvement until 1 July 1993. In this way, the development planning process for the Sirajganj compartment could be completed with full support of the Consultants Team. A donor review mission, scheduled for the end of 1992, is now expected by September/October 1992. This mission would review the progress, and form an independent view on the activities to be planned after June 1993, and on the required staffing of the Consultants Team.

Based on these discussions and the work schedule as presented in section 9.1, a revised manning schedule is proposed as presented in section 9.2.4. In this manning schedule, quite some changes are proposed in staffing as compared to the staffing plan, included in the Technical Proposal. For the expatriate consultants, 73.25 mm (calender months in fact) were planned and approved before 1 July 1993 and 32.5 mm thereafter; in total 105.75 mm. Up to 1 July 1993, the number of mm now becomes 102.25, and 38.5 mm for the period thereafter (including 8 mm and 6 mm respectively for the Flood Management Model). For the national consultants, 42 mm were planned before 1 July 1993 and 9 mm thereafter. Numbers are increased to 206 and 17 respectively (including 10 and 14 for FMM). Details are presented on the chart in section 9.2.4.; changes are explained below:

	Extra exp.	Extra nat.
For the preparation of the project the Team Leader stayed already two weeks in April 1991. However, the actual start for the expatriate long termers was delayed by some months.	- 5	
In the manning schedule the working periods of the expatriate Drainage Engineer and Sociologist are extended from 1 December 1992 until 1 July 1993.	+ 14	
Also for the long term members of the CT, the Drainage Engineer, the male and the female Sociologists, the Agronomist, the Fisheries Specialist and the Modelling Specialist, the period has been extended until 1 July 1993.		+ 75
After this date two man months are added for the expatriate Drainage Engineer and two are subtracted for the Team Leader.	--	
The institutional aspects appear to be under estimated. Therefore the period of the expatriate Institutional Specialist has been changed into 2 x 2 weeks in 1992, one month in 1993 and one at the end of the project. For the same reason a national Institutional Specialist has to join the CT until 1 July 1993. Also 3 mm. of a training specialist should be added.	5.25	+ 15
To assist with the EIA in the Sirajganj Compartment, a national Environmentalist will be added to the CT from 1 October 1992 until 1 July 1993.		+ 9
The Fisheries Study (section 5.11.3) requires two junior biologists for one year. Furthermore three extra man months of the expatriate Fisheries Specialist are needed.	+ 3	+ 24
It is expected that other, not yet defined, special studies also will require extra man months.	+ 3	+ 12
For the development of the Flood Management Model is proposed an increase of 12 expatriate man months, two man months extra support for the expatriate long term staff and 24 national man months (section 5.11.6).	+ 14	+ 24

These changes together lead to 35 expatriate and 172 national man months extra. Of course the man months after the first of July (exp.: + 9, nat.: + 17 mm) may differ as a consequence of the Review Mission of September/October.

The job descriptions of the member of the Consultants Team are presented in annex 12.

9.2.4 Revised Manning Schedule Consultants Team, based on fully staffed Project Team

Position	Name	Calendar months Expatriate	Calendar months National	1991 J	A	S	O	N	D	1992 J	F	M	A	M	J	J	A	S	O	N	D	1993-1 J	F	M	A	M	J	93-2	1994	1995
Team Leader	Zijderveld	46-3																										12	4	2.5
Drainage Eng.	Hamel	19+6																										1	1	1
Drainage Eng.	M.Khan		10+14																											
Model spec.	Kibria		4+20																											
Sociologist	Frans	22+6																										1	1	2
Sociologist	Taj Peara Begum		5+15																											
Sociologist	Md. Tauhidun		15+8																											
Environm. spec.	Heringa/...	4																												1
Environm. spec.			9																											
Fisheries spec.	G.J.de Graaf	3																												1
Fisheries spec.	Ahmed/Gazi		6+14																											
Agro-economist	Wiens	5																												2
Agro-economist	Sahadad		5																											1
Agronomist	Butter	3																												1
Agronomist	Khaleque		2+17																											
Legal adviser	Bhuiyan		4																											2
Institutional sp.	M.de Graaf	0.75+2.25																												1
Institutional sp.			15																											
Training spec.		3																												
Project Manager	Jansen	3+0.75																										0.25	0.25	0.5
Special Studies	various spec.	3	12																											
- Fisheries	3 jr.biol.	3	24																											
- FMM mod.eng.		12	24																									4+12	2+2	
- FMM support		2																												
TOTAL CALENDAR MONTHS		105.75+35 (140.75)	51+172 (223)																											

═══ within Technical Proposal (March 1991)

——— additional

51+172 : 51 within techn. prop. before 1 July 1993

172 additional

9.3 Reporting

Revision in the Schedule of Activities (section 9.1.1) implies a revision in the Schedule of Reporting. In the chart, presented in section 9.1.1, a revised schedule of reporting is included. The reports mentioned, correspond to those included in the TOR; timing is different. For further details we refer to the above mentioned chart.

9.4 Cost implications

The FAP 20 expenditures are financed by three sources:

a. Technical Assistance (TA) financing the project expenditures of international and national consultancy, special surveys, investigations, modelling, equipment, instruments, transport, training and fellowships.

b. Financial Assistance (FA) for the financing of the implementation activities under the responsibility of the Bangladesh Executive Party (BWDB) as described in the TOR (page 14); the expenditures made by the BWDB will be reimbursed later;

c. GOB contribution for the remaining project costs which has to be paid by GOB, (e.g. salaries of the employees in service of the government, as well as the requirements for their work, office accommodation, land acquisition, etc.).

The total amounts of the TA (US$ 2.83 million), FA (US$ 6.46 million) and GOB contribution (US$ 2 million) are mentioned in the TOR and in the financial agreements between GOB and the donor countries.

In this Inception Report a number of measures with implications for the TA and the FA budget are mentioned. The financial consequences of those will be reviewed in the following sections.

9.4.1 Technical Assistance

In section 9.5 a number of extra man months for the Consultants Team have been planned in 1992 and the first half of 1993. After that, the occupation of the CT will depend on the advice of the review mission of September/October. This advice will certainly lead to a revision of the TA budget. For the time being the planned changes in the manning schedule will lead to extra costs for 8.75 expatriate and 91.5 national man months in 1991/1992 and respectively 17.25 and 59.5 in the first half of 1993. The following table shows the division over the years.

In the above changes are included a number of special studies of which only the fisheries study and the development of the Flood Management Model (FMM) are defined at this stage. For these studies separate proposals will be submitted.

As will be mentioned in these proposals, the Fisheries study and the FMM will, besides the personal costs, require additional expenditures for equipment, transport, reporting, etc.: respectively 7.5 and 16.2 Lakh Taka. For the fisheries study these costs could be paid from 'unspecified costs'. For the FMM an additional budget will be applied.

EXTRA MAN MONTHS CONSULTANTS TEAM, 1991-1 July 1993
Compared with Technical Proposal, March 1991

	Expatriate Consultants			National Consultants		
	1991	1992	1993*	1991	1992	1993*
Team Leader	-1					
Drainage Engineers			4		8	6
Sociologists			6		11	12
Environment Spec.					3	6
Fisheries Spec.					8	6
Agronomist					11	6
Model Specialist				2	12	6
Institutionalists			1.25		9.5	5.5
Training spec.		3				
Project Manager		0.75				
Special Studies		2	1		6	6
- Fisheries		2	1		18	6
- FMM		3	3		4	6
- FMM support		2				
	-1	12.75	16.25	2	90.5	65.5

* Till 1 July 1993

9.4.2 Financial Assistance

According to the TOR the FA will cover the following project costs:

- civil works;
- operation and maintenance of water control works under the Pilot Project;
- baseline surveys;
- provision, if required, for additional local consultancy.

To this must be added an amount for unforeseen activities. From this amount, the project expenditures made by the other ministries (see chapter 7) could be paid.

9.4.2.1 Construction works

A firm estimate of the construction costs in the Tangail Compartment will be presented in the Interim Report. Of course, this will depend on the scenario which will be chosen.

In the TOR, Appendix 6, a tentative cost estimate is presented, based on one of the possible scenarios. The estimate was Taka 12.4 Crore for construction and Taka 0.8

Crore for maintenance, based on 1989 prices. The 1991 costs would then correspond to approximately 15 and 1 Crore Taka respectively.

In order to provide for an early check on the available funds, two cost scenarios have been worked out tentatively; a high and a low one. The following tables show the results. It appears that the low estimate (Taka 15.5 Crore) stays near the estimated budget for construction in the Tangail Compartment. The high cost estimate (Taka 36 Crore) exceeds this budget considerably.

ALTERNATIVE TENTATIVE ESTIMATE CONSTRUCTION COSTS M I N I M U M.

ITEM	UNIT	NUMBER	PRICE (LAKH '91)	C O S T 91/92 X 1	92/93 X 1.12	93/94 X 1.12^2	94/95 X 1.12^3	TOTAL LAKH TAKA
INLET LOHAJANG								
Regulator 4 vent	PCS	1	85		47.6	53.3		100.9
Closure	PCS	1	10			12.5		12.5
OUTLET LOHAJANG								
Regulator 7 vent	PCS	0	125					
Closure	PCS	0	10					
MEDIUM INLET REGUL.								
Regulator 2 vent	PCS	2	38		42.6	47.7		90.2
Closure	PCS	2	5		5.6	6.3		11.9
EXIST INLET SLUICES								
Sluice	PCS	4	0					
Modification	PCS	2	5		11.2			11.2
MEDIUM OUTLET REGUL.								
Regulator 2 vent	PCS	6	38		127.7	143.0		270.7
Closure	PCS	6	5		16.9	18.8		35.7
MINOR REGULATOR								
Pipe 3 ft.	PCS	25	6		84.0	94.1		178.1
RESEC.MAIN EMBANKMENT (28 TK/M3)								
30 m3/ml	KM	2	8.4		18.8			18.8
20 m3/ml	KM	5	5.6		31.4			31.4
10 m3/ml	KM	15	2.8			52.7		52.7
RESEC.INTERN EMBANKM. (28 TK/M3)								
15 m3/ml	KM	5	4.2		23.5			23.5
10 m3/ml	KM	30	2.8			105.4		105.4
EROSION TANGAIL TOWN								
Groynes	PCS	10	1.5		16.8			16.8
EXCAV CHANNELS (23 TK/M3)								
50 m3/ml	KM	2	12		13.4	15.1		28.5
25 m3/ml	KM	10	6		33.6	37.6		71.2
FISHFARM (18 TK/M3)								
2000 m3/pcs	PCS	10	0.45			5.6		5.6
IMPROVING ACCESS (18 TK/M3)								
15 m3/ml	KM	5	2.5		14.0			14.0
T O T A L				--	487.1	592.1	--	1,079.1
PHYSICAL CONTINGENCIES 25 %				--	121.8	148.0	--	269.8
ENGINEERING COSTS 15 %				--	91.3	111.0	--	202.3
G R A N D T O T A L				--	700.1	851.1	--	1,551.2

At this stage no indication can be given on the construction costs in the Sirajganj compartment and on the operation and maintenance costs in both compartments

ALTERNATIVE TENTATIVE ESTIMATE CONSTRUCTION COSTS M A X I M U M

ITEM	UNIT	NUMBER	PRICE (LAKH '91)	C O S T 91/92 X 1	92/93 X 1.12	93/94 X 1.12^2	94/95 X 1.12^3	TOTAL LAKH TAKA
INLET LOHAJANG								
Regulator 7 vent	PCS	1	125		56.00	62.72	35.12	153.84
Closure	PCS	1	10			6.27	7.02	13.30
OUTLET LOHAJANG								
Regulator 7 vent	PCS	1	125		56.00	62.72	35.12	153.84
Closure	PCS	1	10			6.27	7.02	13.30
MEDIUM INLET REGULATORS								
Regulator 4 vents	PCS	2	60		67.20	75.26		142.46
Closure	PCS	2	5		5.60	6.27		11.87
MEDIUM INLET REGULATORS								
Regulator 3 vents	PCS	3	45		75.60	84.67		160.27
Closure	PCS	3	5		8.40	9.41		17.81
MEDIUM INLET REGULATORS								
Regulator 2 vents	PCS	2	38		42.56	47.67		90.23
Closure	PCS	2	5		5.60	6.27		11.87
MEDIUM INLET REGULATOR								
Regulator 1 vent	PCS	1	30		33.60			33.60
Closure	PCS	1	5		5.60			5.60
EXIST INLET SLUICES								
Sluice	PCS	4	0					
Modification	PCS	4	4		8.96	10.04		19.00
MEDIUM OUTLET REGULATOR								
Regulator 2 vents	PCS	3	38		63.84	71.50		135.34
Closure	PCS	3	5		8.40	9.41		17.81
MINOR REGULATOR								
Pipe 3 ft.	PCS	25	6		84.00	94.08		178.08
SUB-COMP MINOR STR.								
Bridge, culvert,etc.	PCS	20	6		67.20	75.26		142.46
RESEC.MAIN EMBANKMENT (28 TK/M3)								
30 m3/ml	KM	10	8.4		94.08			94.08
20 m3/ml	KM	25	5.6		156.80			156.80
10 m3/ml	KM	20	2.8			70.25		70.25
RESEC.INTERN EMBANKM. (28 TK/M3)								
15 m3/ml	KM	20	4.2		94.08			94.08
10 m3/ml	KM	25	2.8			87.81		87.81
BANK PROTECTION AND RIVER TRAINING	PCS	10	20		112.00	125.44		237.44
EXCAV CHANNELS (23 TK/M3)								
50 m3/ml	KM	10	12		67.20	75.26		142.46
25 m3/ml	KM	25	6		84.00	94.08		178.08
FISHFARM (18 TK/M3)								
2000 m3/pcs	PCS	10	0.45			5.64		5.64
IMPROVING ACCESS (18 TK/M3)								
15 m3/ml	KM	20	2.5		28.00	31.36		59.36
CONSTRUCTION OF BUILDINGS								
Field offices, meeting-places, etc.					100.00			100.00
T O T A L				-	1,224.72	1,117.67	84.30	2,526.69
PHYSICAL CONTINGENCIES 25 %				-	306.18	279.42	21.07	631.67
ENGINEERING COSTS 15 %				-	229.64	209.56	15.81	473.75
G R A N D T O T A L				-	1,760.54	1,606.65	121.18	3,632.11

9.4.2.2 Baseline surveys and Augmentation Project Team

In the Technical Assistance Project Proforma (TAPP), prepared by the Government of Bangladesh, the baseline survey were indicated as to be paid from TA. This was in contradiction with the TOR and the TA budget, which was attached to the agreement with the Consultant. Also the TAPP did not give a provision for an augmentation of the Project Team with consultancy.

To solve these problems a Financial Proposal has been submitted to the donor countries in January 1992. Subsequently the matter has been forwarded to the FPCO via the Project Director. As a result the TAPP would be adjusted in such a way that the baseline survey, the additional consultancy and some required additional equipment and vehicles will be financed from FA. To avoid a delay in the progress of the project activities some of the concerned expenditures will be pre-financed from the TA in the mean time.

A summary of the proposed additional expenditures is given in the following table.

SUMMARY OF EXPENDITURES TO BE FINANCED UNDER FINANCIAL ASSISTANCE

Cost in Lakh Taka

Description	91/92	92/93	93/94	94/95	Dec 95	TOTAL
Baseline Survey	26.06	34.40	27.13	31.21	61.19	179.99
Augmentation Project Team	22.68	34.78	39.99	45.99	26.44	169.88
Additional equipment, etc.	26.38					26.38
	75.12	69.18	67.12	77.20	87.63	376.25
To be pre-financed from the TA budget						
Baseline survey	26.06					
Augmentation PT	22.68					
Add. equipment, etc.	6.95					
	55.69					