ATTACHMENT-3

Agreed Minutes of Meeting of Steering Committee Meetings

AGREED MINUTES OF MEETING
OF
STEERING COMMITTEE
ON
INCEPTION REPORT
OF
FEASIBILITY STUDY FOR IMPROVEMENT OF FLOOD FORECASTING AND WARNING SERVICES
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

Dhaka, November 24, 2002

Mr. Faisal Ahmed Choudhury
Secretary
Ministry of Water Resources
Chairman, Steering Committee

Mr. Hideki Sato
Team Leader
JICA Study Team

Mr. Delwar Hossain
Deputy Secretary
Economic Relations Division,
Ministry of Finance

Mr. A.N.H. Akhtar Hossain
Superintending Engineer / Director
Processing and Flood Forecasting Circle,
Bangladesh Water Development Board

Witnessed by,

Mr. Shigetsugu Yamamoto
Chairman
JICA Advisory Committee

Agreed Minutes of Meeting of Steering Committee on Inception Report

I. Introduction

In line with "The Scope of Work (S/W) for Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh", which was agreed upon between Government of the People's Republic of Bangladesh (GOB) and the Japan International Cooperation Agency (JICA) and duly signed on July 11, 2002, JICA dispatched the Study Team headed by Mr. H. Sato to Bangladesh for conducting the Study.

The Study Team submitted 20 copies of the Inception Report to Bangladesh Water Development Board (BWDB), the Counterpart Agency for the Study, on November 17, 2002. The JICA Study Team had a preliminary discussion on the Inception Report with the Superintending Engineer / Director and Counterpart Staff of Bangladesh Water Development Board (BWDB) on the same day. Subsequently, BWDB delivered copies of the Inception Report to the member agencies of the Steering Committee.

The Steering Committee meeting for the explanation and discussion of the Inception Report was held at the Conference Room of Ministry of Water Resources (MOWR) in Dhaka City on November 23, 2002. Attendants List is attached herewith.

The Meeting discussed in sufficient details on the Inception Report. As a result, the Inception Report was in principle accepted by the Steering Committee in line with the discussion as summarized below.

II. Discussions at the Steering Committee

In the Steering Committee Meeting, the following were discussed and agreed upon by both parties of GOB and JICA for smooth implementation of the Study.

1. Objectives of the Study

   The Bangladesh side observed that there are some differences in objectives of the Study between "Scope of Work" in the agreed minutes dated July 11, 2002 and the Inception Report. They pointed out that instead of "Telemetric System" as written in the Section 1.2 of the Inception Report, the focus to formulate the Improvement Plan should be "Data Communication System". The JICA Study Team agreed to this point in accordance with the Technical Approach explained in the Chapter 2 of the Inception Report.

2. Scope of the Study

   The Bangladesh side pointed out that the scope of the Study as written in Section 1.3 is different from that in S/W signed on July 11, 2002. The JICA Study Team

answered that the contents of the scope of the Study are exactly same as those in S/W as presented in Chapter 3 of the Inception Report in detail. The Steering Committee accepted this.

3. Counterpart Agency

The Steering Committee noted that the counterpart agency of the Study is not the Ministry of Water Resources which is mentioned in the Inception Report but Bangladesh Water Development Board (BWDB). The JICA Study Team recognized that the counterpart agency is BWDB.

4. Local Consultant

The Steering Committee requested JICA to employ associated local consultants for the JICA Study Team by JICA's own cost according to the practice in Bangladesh. JICA answered that JICA cannot employ the local consultant in addition to the current team members. This is the practice in technical cooperation of Japanese Government.

5. Counterpart Personnel

The JICA Study Team asked Bangladesh side to assign counterpart personnel on full-time and one-to-one basis for each Study Team member. Bangladesh side agreed on one-to-one assignment of counterpart personnel but mentioned that it would not be possible for them to assign counterpart personnel on full time basis. However, Bangladesh side agreed to provide counterpart personnel for the entire Study period in part time basis. The JICA Study Team accepted the proposal of Bangladesh side.

6. Cooperation with DANIDA Project

The JICA Study Team emphasized that the mutual cooperation between this Study and ongoing "Consolidation and Strengthening of FFWS" project by Danish International Development Agency (DANIDA) is essential for the success both the Studies. DANIDA Project's Team Leader as well as the steering Committee agreed to provide the JICA Study Team with all of data / information regarding DANIDA Project.

7. Difference between this Study and ongoing DANIDA project

The Bangladesh side asked the JICA Study Team to clarify the difference between this Study and ongoing DANIDA project. The JICA Study Team replied that the objective and output of the JICA Study are not same as those of the on-going DANIDA Project.

8. Taking Abroad of Collected Data/Information

JICA Study Team asked relevant arrangement for taking abroad of necessary data/information for the Study. The BWDB explained the existing rules and

regulation for exporting such data, reports outside the country. However, the BWDB agreed to consider this request, to obtain permission from the competent authority.

9. Steering Committee Member

The JICA Study Team proposed that the representatives of Ministry of Disaster Management and Relief and Joint River Commission are also to be included in the Steering Committee. Representative of BUET also requested that representatives of Roads and Highways, and Bangladesh Inland Water Transport Authority should be included in the Steering Committee. The Steering Committee agreed on these and promised to invite those members in the next steering Committee meeting and thereafter.

Bangladesh side also requested to delete FFWC from Steering Committee as proposed in the Section 2.2.2 of the Inception Report. JICA Study Team agreed with the request.

10. Office Space and Furniture

The JICA Study Team requested BWDB to provide necessary office space and furniture to the JICA Study Team as agreed in the Scope of Work dated July 11, 2002. BWDB replied that they could provide office space and two telephone lines only. They also offered to provide some furniture from their stock. BWDB requested JICA Study Team to arrange other necessary furniture by Japanese side.

11. Identification Card

The JICA Study Team requested BWDB to issue Identification Card for the Study Team members. BWDB agreed to prepare the ID cards of the Study Team members immediately.

12. Responsibility of Steering Committee

The Bangladesh side pointed that among the tasks of the Steering Committee as stated in Section 2.2.2, items 2, 3, and 5 are responsibility of the Counterpart Agency. JICA Study Team acknowledged this.

13. Discrepancy between information in IC/R and actual situation

Bangladesh side mentioned some discrepancy in different articles on the IC/R between the information furnished and the actual situation, particularly items 4 and 5 of the Section 1.4.4. JICA Study Team replied that all these observations would be taken care of on the basis of the actual facts during the course of the Study.

14. Volume of data requested by the Study Team

Bangladesh side claimed that the volume of data requested by the JICA Study Team is too much to provide. JICA Study Team mentioned that this list is to be understood as base line data requirement. However, those information are not always required if those information are summarized or analyzed in some available documents. Bangladesh side agreed to provide all available data which are explicitly required for the Study.

15. Ownership of the documents

Both parties recognized that all documents, tools and information produced during the course of the Study would be jointly owned by JICA and BWDB.

16. Breakdown of Contract amount between JICA and the Study Team and disbursement

Bangladesh side asked to furnish the breakdown of contract amount between JICA and the Study Team and monthly cost disbursement. JICA explained that it is not possible to provide such information.

17. Sample size of the Survey on Evacuation Condition and Awareness of Flood Victims

Bangladesh side pointed that sample size for the survey is insufficient to obtain representative perspective. JICA Study Team proposed that keeping the total sample size of 300, the location will be decided through mutual discussion.

18. Public Exposure of the Study

Both sides confirmed that after the completion of the Study, the Final Report may be publicly exposed.

LIST OF ATTENDEES

1. Bangladesh Side

(Ministry of Water Resources, MOWR)

Mr. Faisal Ahmed Choudhury	Secretary
Mr. Quazi Abdul Ghani	Deputy Secretary
Mr. Abdur Razzak	Joint Chief (in charge)
Mr. Sultan Ahmed	Senior Assistant Secretary

(Bangladesh Water Development Board, BWDB, Ministry of Water Resources)

Mr. Md. Abdul Khaleque	Additional Director General (Planning)
Mr. Abdul Aziz	Additional Chief Engineer (Hydrology)
Mr. A.N.H. Akhtar Hossain	Superintending Engineer / Director, PFFC
Mr. Guna Paudyal	Team Leader, CSFFWSP

(Economic Relations Division, ERD, Ministry of Finance)

Ms. Musrat Meh Jabin	Assistant Chief

(Planning Commission, Ministry of Planning)

Mr. Md. Akhtaruzzaman Khan	Deputy Chief, Irrigation Wing

(Bangladesh Meteorological Department, BMD)

Mr. Md. Akram Hossain	Director

(Space Research and Remote Sensing Organization, SPARRSO)

Mr. Nazmul Hoque	Chief Scientific Officer & Head, Application

(Bangladesh Telegraph and Telephone Board, BTTB)

Mr. A.S.M. Manzurul Quader	Divisional Engineer

(Local Government Engineering Department, LGED)

Mr. Md. Shahidul Haque	Executive Engineer

(Bangladesh University of Engineering and Technology, BUET)

Mr. Jahir Uddin Chowdhury	Professor, IWFM

2. Japanese Side

(Advisory Committee)

Mr. Shigetsugu Yamamoto	Chairman
Mr. Yasunobu Maeda	Member

(JICA Tokyo Head Office)

Mr. Hideaki Matsumoto	Project in-charge

(JICA Bangladesh Office)

Mr. Takuya Otsuka	Deputy Resident Representative

(JICA Study Team)

Mr. Hideki Sato	Team Leader / River and Flood Control Expert
Mr. Masato Okuda	Deputy Team Leader / Telecommunication System Expert
Mr. Gregory Hookey	FFWS Expert
Mr. Kensuke Sakai	Hydrologist
Mr. Nurul Islam	Institutional and Organizational Expert
Mr. Hiroto Nakagawa	Administrative Coordinator

AGREED MINUTES
OF
SECOND STEERING COMMITTEE MEETING
ON
PROGRESS REPORT (1)
OF
THE FEASIBILITY STUDY FOR IMPROVEMENT OF FLOOD FORECASTING AND WARNING SERVICES
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

Dhaka, March 06, 2003

Mr. Sayef Uddin
Secretary
Ministry of Water Resources
Chairman, Steering Committee

Mr. Hideki Sato
Team Leader
JICA Study Team

Mr. Quazi M. Munzur-i-Muqshed
Senior Assistant Secretary
Economic Relations Division,
Ministry of Finance

Mr. A.N.H. Akhtar Hossain
Superintending Engineer / Director
Processing and Flood Forecasting Circle,
Bangladesh Water Development Board

Agreed Minutes of Second Meeting of the Steering Committee on Progress Report (1)

I. Introduction

In line with "The Scope of Work (S/W) for Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh", which was agreed upon between Government of the People's Republic of Bangladesh (GOB) and the Japan International Cooperation Agency (JICA) and duly signed on July 11, 2002, JICA dispatched the Study Team headed by Mr. H. Sato to Bangladesh for conducting the Study.

In line with the Inception Report, which was duly agreed by the both parties on November 24, 2002, the Study Team carried out First Works in Bangladesh and prepared Progress Report (1).

The Study Team submitted 20 copies of the Progress Report (1) to Bangladesh Water Development Board (BWDB), the Counterpart Agency for the Study, on March 05, 2003. The Steering Committee meeting for the explanation and discussion of the Progress Report (1) was held at the Conference Room of Ministry of Water Resources (MOWR) in Dhaka City on March 05, 2003. The Summary of the Progress Report (1) is attached herewith as Attachment – 1. Attendants List is also attached as Attachment – 2.

The Meeting discussed in sufficient details on the Progress Report (1). The Progress Report (1) was in principle accepted by the Steering Committee in line with the discussion as summarized below.

II. Discussions at the Steering Committee

In the Steering Committee Meeting, the following were discussed and agreed upon by both parties of GOB and JICA.

1. Poor Maintenance

The Study Team explained in detail on the present poor maintenance situation of various facilities being used in the flood forecasting services. The Steering Committee expressed its concern and pointed out the need for better maintenance. One member pointed out that the Study should include maintenance plan presenting how to maintain proposed high tech telemetric stations. The Study Team requested BWDB to prepare the maintenance plan for the proposed system so that BWDB would understand well the importance of the maintenance.

2. Difference between this Study and ongoing DANIDA project

One member asked for clarification on difference between this Study and DANIDA project. The Project Director replied that the objective and output of the JICA Study are not same as those of the on-going DANIDA Project but rather supplementary.

3. Centralized vs. Regional System

The Study Team emphasized on the importance of the regional operation system and explained the advantages of regional system in terms of ultimate service delivery, which are warning dissemination and response management. The Steering Committee principally understood the benefits of the regional system but indicated that more realistic way should be considered taking into account the present constraints including financial and manpower limitation.

A number of members mentioned that under present situation prevailing in Bangladesh and BWDB, centralized system with some improvement would be better. However, they mentioned that study should be conducted on regional system before adopting that system. In this regard, the Project Director proposed to consider development of divisional and sub-divisional offices of Hydrology Services with a mandate of data collection, data transmission, warning receiving and warning dissemination.

4. Cost Analysis

A member of the Steering Committee asked about the cost analysis of centralized vs. regional system. The Study Team replied that only conceivable alternatives are presented in the Progress Report (1) and comparative study will be conducted in the next phase and would be included in the Interim Report.

5. Clarification on Some Words

Bangladesh side pointed that the term 'Evacuation system' (page S-1 of summary, Article 2) does not fully express the scope 'Response System' as explained later in the summary paper. The Study Team mentioned that it should be read as 'Response system'.

Bangladesh side also asked if the meaning of 'Priority' in the figure of the proposed telemetric network given in the summary paper is 'Phasing'. The Study Team replied that out of the proposed telemetric stations, priority one is more important stations than priority two; and also explained that phasing is not yet studied.

6. Telemetric Station at Kaptai

A member of the Steering Committee asked why a new telemetric station is not proposed at Kaptai lake. The Project Director replied that already there is one

telemetric station at Kaptai lake installed by Power Development Board and negotiation is going on to receive the data from that station.

7. Alternatives for Hydrological Observation System

Among the three alternatives put forward by the Study Team, the Steering Committee observed that the preferable optimal alternative would be the 'Manual and telemetric combined system'.

8. Satellite based Communication

A member of the Steering Committee mentioned that satellite based communication would be better. The Study Team replied that this option is already considered as one of the options of telecommunication.

9. Problems Faced by the Study Team

The Chairman of the Steering Committee raised the problems faced by the Study Team such as slow data collection, no availability of full time counterparts, non appointment of institutional counterpart and non availability of telephone lines. The Project Director said that necessary action would be taken.

10. Inclusion of other Conceivable Alternatives

The JICA Study Team requested for any other conceivable alternatives in addition to the proposed alternatives explained in the summary report. No other alternative is proposed by the Steering Committee.

11. Automatic Warning Dissemination

The Chairman requested to investigate the possibility of automatic warning dissemination. The Study Team replied that investigation would be carried out in subsequent stage.

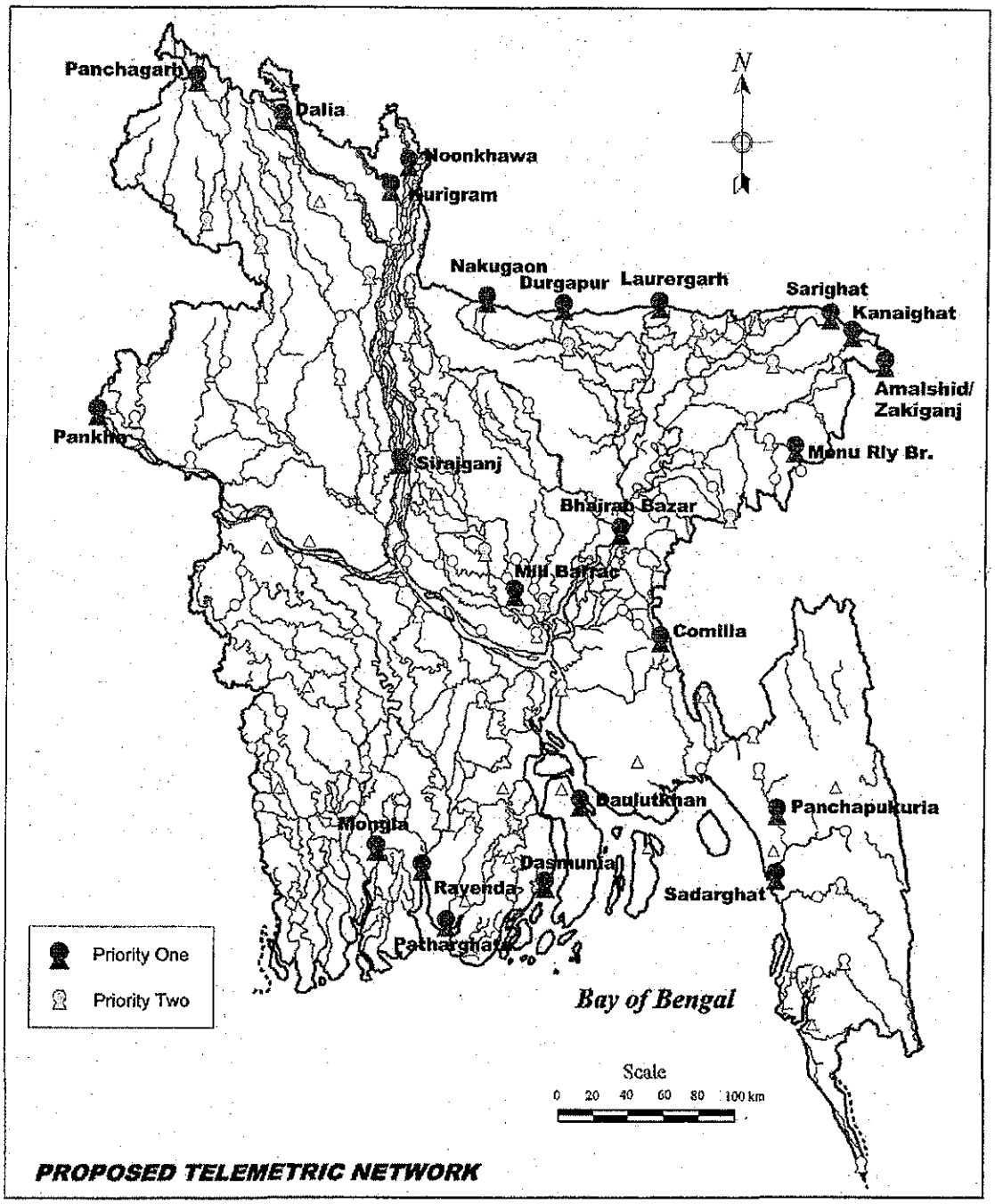
12. Concept of Data Platform

A member of Steering Committee pointed that the concept of data platform that was discussed in the first Steering Committee meeting is not included in the Progress Report (1). The Study Team mentioned that the concept would be considered in the subsequent course of the Study.

Attachment - 1

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

SUMMARY OF PROGRESS REPORT (1)



MARCH 2003

THE STUDY TEAM
OF
JAPAN INTERNATIONAL COOPERATION AGENCY

Feasibility Study
for
Improvement of Flood Forecasting and Warning Services
in
the People's Republic of Bangladesh

PROGRESS REPORT (1)

Summary

1. Background

Based on the mutual agreement between the Government of the People's Republic of Bangladesh (GOB) and the Government of Japan (GOJ), Japan International Cooperation Agency (JICA) organized the Study Team and the Study Team commenced the Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh (the Study) on November 2002. This is the Progress Report (1) which the JICA Study Team prepares and submits in accordance with the Scope of Work which was mutually agreed on the First Steering Committee Meting held on November 2002.

(1) Objective of the Study

1) To formulate the Improvement Plan of Flood Forecasting and Warning System in Bangladesh in order to mitigate flood damage focusing particularly on improvement of telecommunication system
2) To conduct a feasibility study of the selected optimal scheme
3) To perform technology transfer to Bangladesh counterpart personnel in the course of the Study

(2) Scope of the Study

The area for the Study is the entire area of Bangladesh.

Flood Forecasting and Warning System consists of five (5) sub-systems in view of its operational processes as given below.

1) *Observation system*
2) Data transfer system
3) Forecasting system
4) *Warning dissemination system*
5) Evacuation system

To improve existing flood forecasting and warning system. Following works are conducted.

1) Detailed investigation in order to clarify present condition of existing FFWS and problems being encountered therein

2) Formulation of improvement plans of FFWS after detailed study of conceivable alternative plans and selection of an optimal plan among the alternatives

3) Feasibility study on the selected plan

2. Work Progress

(1) Original work schedule

1) Overall schedule of the Study: Commencement in November 2002 and completion in November 2003

2) First Work in Bangladesh during the period from November 15, 2002 to March 15, 2003

(2) Progress of the work

1) Overall work progress:

- Almost on schedule except for data collection on river and flood control

2) Data collection

Almost all the data required in this basic study stage were collected including the following.

- Hydrology & FFWS: Almost all the data available in BWDB/FFWC were collected
- River and flood control: Available data in FFWC were collected, and data on other agencies are still being collected
- Tele communication: Almost all available data were collected
- Socio-economy: Almost all available data were collected
- Institution: Almost all available data were collected

Further data collection will be conducted in the Feasibility Study Stage consisting of the following

- Data of cost estimation
- Topographic map of 1/50,000 or larger on the gauging station sites and repeater station sites
- Flood damage data including socio-economic data to estimate benefit attributable to the project.
- Detailed data required for feasibility study such data as hydrology, river and flood control, telecommunication, socio-economy including flood damage and institution

3) Field reconnaissance and survey

Field reconnaissance were conducted for general inspection of present conditions of rivers, gauging stations, socio-economic conditions, etc. almost on schedule covering the areas of the following Divisions and Districts.

a) Barisal Division: Barisal, Bhola, Patuakhali

b) Chittagong Division: Chittagong, Comilla, Chandpur,

c) Dhaka Division: Dhaka, Faridpur, Munshiganj, Narayanganj

d) Sylhet Division: Maulavi Bazar, Sylhet

e) Khulna Division: Bagerhat, Jessore, Jhenaidah, Kushita, Magura, Khulna

f) Rajshahi Division: Bogra, Kurigram, Nawarganj, Natore, Pabna, Rajshahi, Rangpur, Sirajganj

Inventory survey on existing gauging stations for FFWS was almost completed by sub-contract with the local consultant (BETS) with confirmation made by the Study Team

Interview survey on evacuation was almost completed by sub-contract with the local consultant (BETS) with confirmation made by the Study Team

Workshops were held at 5 places, i.e. Sylhet, Barisal, Rajshahi, Dhaka, and Jessore. The observations in these workshops were in general;

1) FFWS are useful if it is provided properly.
2) More reliable and earlier warning dissemination is needed.
3) Flood warning message should be more easily understandable and more usable for local people.
4) Evacuation system needs more appropriate support, such as food and drink supply, transportation facilities, medical care, etc,

(3) *Problems on conducting the Study Work*

1) Some data collection are behind the schedule
2) No full-time basis counterparts were provided (not effective for transfer of technology)
3) No counterpart for institution is provided yet
4) No exclusive telephone lines were provided (2 lines to be provided)

3. Present Conditions of the current FFWS and Problems involved therein

(1) General consideration of the present FFWS

1) Current FFWS is generally acceptable but considerable effort for improvement is needed.
2) Global approach is necessary to establish more effective FFWS in international rivers, like the Ganges, Brahmaputra, and Meghna by means of organizing an international committee / commission with third party including the subject on low flow as well as flood. Hydrological data in Indian Territory are essential for FFWS in Bangladesh.
3) The main final goal of FFWS is to disseminate proper flood information to the people so that they can take necessary actions to cope with flood. The flood warning message has not always reached to the people
4) Maintenance of observation system is poor in view of no ledger sheet, insufficient maintenance manual, etc. specifically automatic gauges.

(2) Hydrological observation system

1) Hydrological data from India are very limited. This implies that more accurate and long-term forecast may be difficult under present condition

2) Majority of the gauging stations are under manual observation and are provided with simple staff gauges (reading range of 2-3m) which should be shifted according to the water level changes. This implies that there could be involving erroneous reading.

3) Telemeter gauging stations (14 stations only) have never been used for flood forecasting, since there are some damaged by flood, buried or scoured, not available spare parts, inconvenient for computer input, insufficient maintenance, etc.

(3) Data transmission system

1) Data transmission from the gauge sites to FFWC in Dhaka has been made by using wireless telephone with voice communication in case of manual gauging stations. This implies that there are possible errors in reading for sending and rewriting for receiving.

2) Data transmission in telemeter system has been made by multiplex radio links. There have been several cases of disconnection and / or arbitrary change of connection.

(4) Flood forecasting system (Data analysis system)

1) Flood forecasting analysis has been made by a Super model based on MIKE 11. The super model is multiple model and good for flood analysis.

2) The problems are of basic data to be incorporated in the model as being a) inaccurate topographic conditions, b) adjustment for difference between forecasted and observed water levels by means of adding and / or deducting discharge. Another principle problem is that water level / discharge in the boundary station cannot be forecasted.

3) Accuracy of flood forecast in monsoon flood is good for 72hrs, while the accuracy of flood forecast in flash flood is good for 24hrs.

4) Hazard map (inundation map) produced automatically by the computer shows very rough delineations only. This is because of inaccurate topographic map available

(5) Flood warning system (Preparation of flood warning massage)

1) Flood warning message has been prepared based on the forecast and observed data respectively.

2) Warning bulletin shows "observed water level" and "forecast water level", and "how much water level below or above danger level" without notifying possible submergence at practically well known points.

3) People does not understand its meaning

(6) Flood warning dissemination system

1) FFWC has disseminated the flood warning to the related government agencies and media.

2) According to the interview survey and some workshops conducted by the Study Team, flood warning has not been received by inhabitant in many cases formally.

(7) Response system

1) There is no feedback system to confirm if inhabitants received the message or not.

2) Response system is insufficient to take necessary actions upon receiving warning message.

(8) Institution

Current operation of FFWS is under the centralized operation system. This involves the several problems such that;

1) It takes much time for the process from gauge reading to disseminate of flood warning. Flood warning may not be disseminated well in advance of flood occurrence in case of flash flood.

2) Field hydrology office has no power to decide, even appointment of gauge reader when it is vacant, thus gauge reading is discontinued.

3) Field hydrology office could not participate in the disaster prevention activities in the respective areas because they have no authorized power.

4) The central office may not know real situation in the field at the emergency case, since central office staff is not familiar with local condition.

4. Conceivable Solutions

The above problems implies that the basic issues are related to the institutional matter, i.e. organization of hydrology division / sub-division who should have some authority to do in local level knowing local condition well. In view of this, alternative solutions which will be discussed below are conceived on the assumption of localization of FFWC function as one of the alternatives for improvement.

Based on the above present situation of existing FFWS, conceivable solutions by component are enumerated below.

ALTERNATIVES by Component:

(1) Hydrological observation system

1) Three alternatives such as:

a) All manual observation system with some improvement

b) All telemeter system

c) Manual and telemeter combined system

2) Number of Gauging stations

The present system has 91 water level and 67 rainfall gauging stations. Among those gauging stations, number of gauging stations incorporated in the model is counted at 50 water level and 38 rainfall gauging stations as listed below.

Alternative plans are conceived tentatively as 1) all manual gauging stations, 2) all telemeter gauging stations, 3) manual and telemeter combined system as summarized below. In case of alternative 3) minimum number of telemeter gauging stations is conceived such that boundary stations and monitoring stations only are telemeter stations. As summarized below. In the alternatives, 2 additional gauging stations are conceived to be installed in Chittagong area.

	Water level	Rainfall
Present		
Total number of gauging stations (GS)	91	67
GS incorporated in the model	50	38
Proposed alternative1) or 2) (Manual or telemeter)		
Total number of gauging station	52	40
Proposed alternative3) (Combined system)		
Total number of gauging station	52	40
- Manual	29	17
- Telemeter (Model)	21	21
- Outside model	2	2

The major river water level may be predicted by less number of gauging stations according to the correlation analysis. Further study will be conducted to finalize the total number of gauging station required.

(2) Data transmission system

Data transmission system is conceived dividing into two cases, as localized system (Regional office establishment) and centralized system (same as current system: Central Control System referred to hereunder)

1) Regional office
   1) In case of manual observation: Communication from Gauging station to Regional office: by Mobile phone & Digital HF
   2) In case of telemeter system: Communication from Gauging station to Regional office by VHF for telemeter
   3) Combined system: Combination of the above
2) Central Control System
   1) In case of manual observation: communication from Gauging station to Central office: by Mobile phone & Digital HF
   2) In case of Telemeter system: communication from Gauging station to Central office by VHF for telemeter
   3) Combined system: Combination of the above

(3) Flood forecasting system (Data analysis system)

1) Regional office
   - Regional forecasting model will be newly established.
2) Central office
   - Existing super model will be used with some modification

(4) Flood warning system (Preparation of flood warning massage)

1) Improvement of flood warning message
2) Improvement of hazard map

(5) Flood warning dissemination system

1) Media by telephone and facsimile

2) Government agencies by telephone and facsimile

3) Regional office and Central office by telephone and facsimile

(6) Response system

1) Feedback system

2) Response system

- Evacuation
- OM of river structures
- Other socio-economic activities

3) Coordination with Disaster Management System

(7) Institution

1) Centralized control system

2) Regionalized control system

Basic differences between the above two systems are summarized below.

	Regional	Central
Observation system	Easy monitoring	Monitoring difficult
Transmission system	Earlier transmission	Time taking
Forecasting system	Earlier forecast	Time taking
Warning system	Familiar with local condition To met for Short lead time	Less familiar To meet for Longer lead time
Dissemination system	Earlier dissemination	Time taking
Response system	Earlier response	Time taking
Accuracy	More accurate	Less accurate
Equipment	More	Less
Manpower	More	Less
OM cost	More costly	Less cost

Combined Alternatives on the Improvement Plan (Subject to the next stage study)

Based on the result of the alternative studies as above mentioned, the following combined alternatives will be studied in the next stage of the Study

Alternative I: Centralized control system (FFWC central office as same as present organization)

Alternative II: Regionalized control system (Regional office under BWDB or under Hydrology Division of the BWDB)

Each alternative will have sub-alternatives as;

Sub-alternative-1: Manual observation system

Sub alternative-2: Telemeter system

Sub alternative-3: Combined system of manual and telemeter observation system

5. Work Schedule in the Next Stage of the JICA Study

(1) First Work in Japan (May-June 2003)

1) The First Work in Japan will follow the first work in Bangladesh starting from May 2003 and ending by June 2003.
2) Detailed study on the above alternatives in terms of cost and quality will be carried out
3) The optimum scheme will be selected among the above alternatives
4) The Interim Report will be prepared to present the optimum scheme selected above

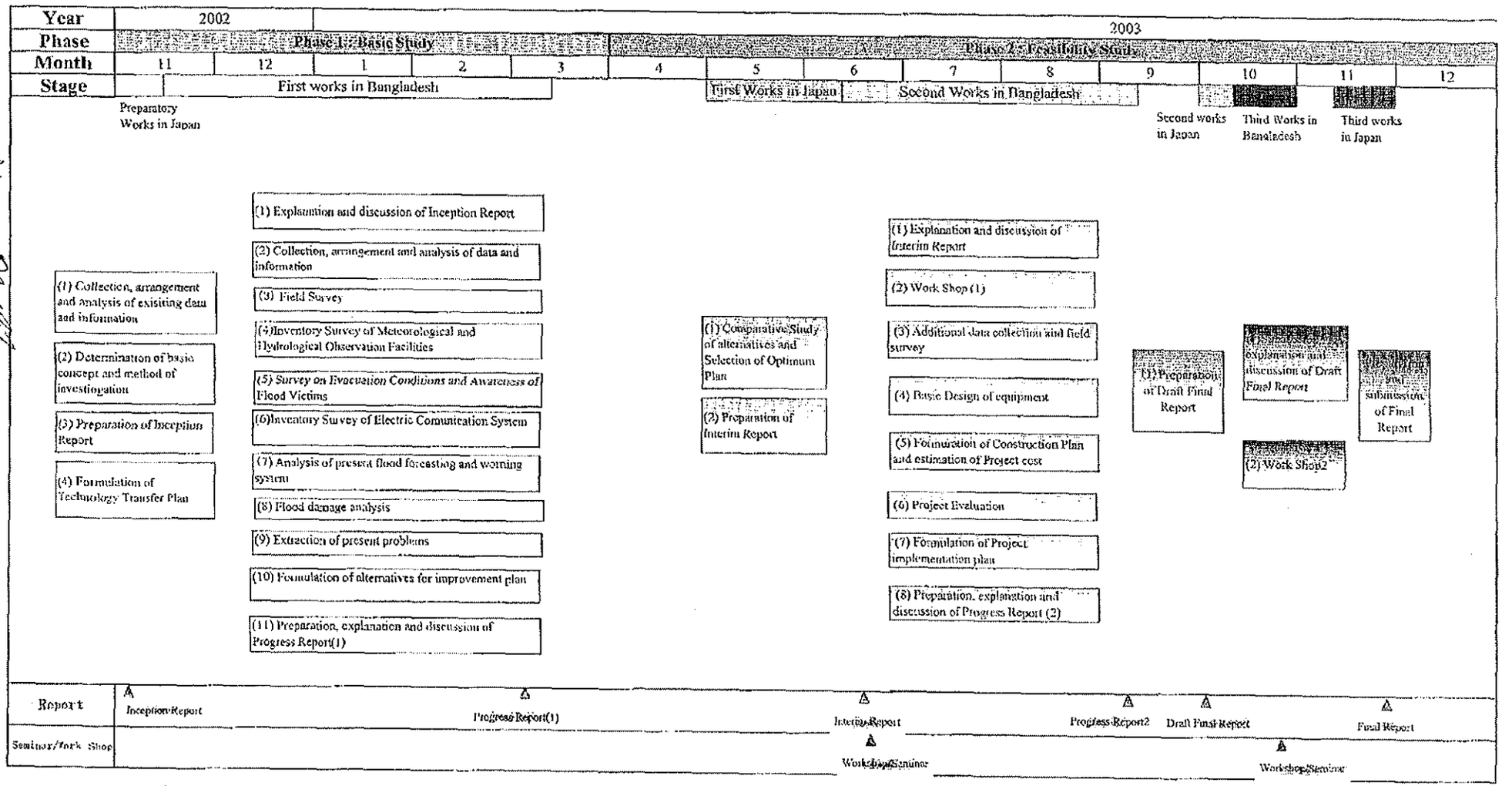
(2) Second Work in Bangladesh (June-September 2003)

1) The Second Work in Bangladesh will be started in July 2003 and finished by the end of September 2003
2) The Second Work in Bangladesh will cover the feasibility Study on the selected Optimum scheme consisting of the following work items which are subject to the approval of JICA.
   - Third Steering Committee Meeting for presentation of Interim Report
   - Additional site investigation including site reconnaissance by helicopter during the rainy season
   - Additional data collection on the hydrology, river / flood, telecommunication system, economic data on benefit to be attributable to FFWS
   - Radio wave propagation test and /or propagation analysis on the desk
   - Project evaluation on technical, socio-economic, and environmental points of view
   - Technology transfer seminar workshop
   - Preparation of Progress Report (2)
   - Forth Steering Committee Meeting for presentation of Progress Report (2)

(3) Work Schedule in subsequent Study

Overall work schedule is the same as those presented in the Inception Report as summarized below.

1) 2nd Works in Japan (September-October 2003)
   The Draft Final Report will be prepared in 2nd Works in Japan
2) Third Works in Bangladesh (October-November 2003)
   - Draft Final Report will be submitted to GOB
   - Fifth Steering Committee Meeting will be held for discussion on the Draft Final report
3) Third Works in Japan (November-December 2003)
   - Final Report will be prepared incorporating the GOB's comment on the Draft Final Report
   - Final Report will be submitted to GOB



Overall Workflow

LIST OF ATTENDEES

1. **Bangladesh Side**

(Ministry of Water Resources, MOWR)

Mr. Sayef Uddin	Secretary
Mr. Ehsam Shamin	Joint Secretary

(Bangladesh Water Development Board, BWDB, Ministry of Water Resources)

Mr. Mukhles Uz Zaman	Director General
Mr. Md. Moinul Hassan	Additional Director General (Planning)
Mr. Md. Aminul Hoque	Additional Chief Engineer (Hydrology)
Mr. A.N.H. Akhtar Hossain	Superintending Engineer / National Project Director
Mr. Md. Salim Bhuiyan	Executive Engineer
Mr. Md. Rashidul Islam	Executive Engineer
Dr. Guna Paudyal	Team Leader, CSFFWSP

(Economic Relations Division, ERD, Ministry of Finance)

Mr. Quazi M. Munzur-i-Muqshed	Senior Assistant Secretary

(Planning Commission, Ministry of Planning)

Mr. Md. Hamidur Rahman	Deputy Chief, Irrigation Wing

(Bangladesh Meteorological Department, BMD)

Mr. Samarendra Karmakar	Deputy Director

(Space Research and Remote Sensing Organization, SPARRSO)

Mr. Md. Anwar Ali	Chairman

(Water Resources Planning Organization, WARPO)

Mr. H.S. Mozaddad Faruque	Director General
Mr. Md. Arzel Hossain Khan	PSO

(Local Government Engineering Department, LGED)

Mr. Bahir Uddin Ahmed	SE & PD/SSWRDSP2

2. **Japanese Side**

(Embassy of Japan, Bangladesh)

Mr. Takaharu Kakinuma	Second Secretary

(JICA Bangladesh Office)

Mr. Zulfiker Ali	Deputy Director

(JICA Study Team)

Mr. Hideki Sato	Team Leader / River and Flood Control Expert
Mr. Masato Okuda	Deputy Team Leader / Telecommunication System Expert
Mr. Gregory Hookey	FFWS Expert
Mr. Kensuke Sakai	Hydrologist
Dr. Nurul Islam	Institutional and Organizational Expert

AGREED MINUTES
OF
THIRD STEERING COMMITTEE MEETING
ON
INTERIM REPORT
OF
THE FEASIBILITY STUDY FOR IMPROVEMENT OF FLOOD FORECASTING AND WARNING SERVICES
IN
THE PEOPLE S REPUBLIC OF BANGLADESH

Dhaka, June 26, 2003

Mr. Sayef Uddin
Secretary
Ministry of Water Resources
Chairman, Steering Committee

Mr. Hideki Sato
Team Leader
JICA Study Team

Economic Relations Division,
Ministry of Finance
MD. TOFAZZAL HOSSAIN
Senior Assistant Secretary
Economic Relations Division
Ministry of Finance
Govt. of the People s Republic
of Bangladesh

Mr. Md. Anwar Hossain
Superintending Engineer
Processing and Flood Forecasting Circle,
Bangladesh Water Development Board
and Project Director, Feasibility Study
for IFFWS in Bangladesh

Witnessed by,

Mr. Akinori Masuda
Chairman
JICA Advisory Committee

Agreed Minutes of Third Meeting of the Steering Committee on Interim Report

I. Introduction

The Study Team submitted 20 copies of the Interim Report to Bangladesh Water Development Board (BWDB), the Counterpart Agency for the Study, on June 21, 2003. The Steering Committee meeting for the explanation and discussion of the Interim Report was held at the Conference Room of Ministry of Water Resources (MOWR) in Dhaka City on June 25, 2003. Attendants List is attached as Attachment.

The Meeting discussed in sufficient details on the Interim Report. The Interim Report was in principle accepted by the Steering Committee in line with the discussion as summarized below.

II. Discussions at the Steering Committee

In the Steering Committee Meeting, the following were discussed and agreed upon by both parties of Government of Bangladesh (GOB) and Japan International Cooperation Agency (JICA).

1. Confirmation of the Minutes of Meeting of the 2nd Steering Committee Meeting

The Steering Committee at first discussed and confirmed the Minutes of Meeting of the 2nd Steering Committee Meeting. The confirmed items are as follows:

a. BWDB will take action to obtain the data of the telemetric station at Kaptai lake installed by Power Development Board (PDB).

b. The Study Team explained that the satellite based communication system is too costly and less reliable. Therefore satellite based communication system is not adopted.

c. Bangladesh side has arranged new counterpart on one-to-one and part-time basis. However, the steering committee promised to arrange two full-time counterparts among the total eight counterparts.

d. On the issue of telephone line, Bangladesh side will provide at least one exclusive telephone line by the end of June, 2003.

e. The Study Team found that the platform is less reliable for application to Flood Forecasting and Warning Services (FFWS), and telecommunication network for FFWS should be for exclusive use of BWDB for better reliability. The Study Team mentioned that they will include its recommendations on inter-agency information system with consideration on platform.

2. Questionnaire on O&M

The Study Team prepared a questionnaire on operation and maintenance (O&M) to investigate current procedure and problems encountered by the field O&M offices. BWDB assured that within 15 days, most of the questionnaires will be collected from the field offices.

3. O&M Plan

The Study Team requested Bangladesh side to prepare the O&M plan for the proposed project. Bangladesh side will prepare the O&M plan for the selected optimal plan.

4. Additional counterpart for International Coordination Expert

The Study Team requested to provide one counterpart for a new position of international coordination expert preferably from Joint River Commission (JRC). Bangladesh side agreed to provide such counterpart.

5. Visit India

The Study Team explained the importance of obtained data from India for the improvement of forecast lead time and expressed their desire to visit India and discuss with Indian JRC. Bangladesh side will settle this matter as soon as possible.

6. Selection of Alternative for Hydrological Observation and Transmission System

Among the three alternatives put forward by the Study Team, the Steering Committee agreed that the preferable optimal alternative is the 'Manual and telemetric combined system' as suggested by the Study Team.

7. Selection of Alternative for Centralized vs Regional System

The Study Team emphasized on the importance of the regional operation system and explained the advantages of regional system in terms of ultimate service delivery, which are warning dissemination and response management. The Steering Committee principally understood the regional system, and agreed that the Study Team will conduct detailed study in the feasibility study stage to clarify in more detail on the benefit and cost of the regional system.

8. Recommendations put forward by the Study Team

The Study Team put forward a number of recommendations in the Interim Report (page S-23). Following discussions were made:

a. O&M Budget: The Study Team recommended allotting necessary O&M budget. The Steering Committee said that they are trying to get more allocation for O&M but the decision depends on Ministry of Finance.

b. Improvement of Organization: The Study Team recommended strengthening good relation among different divisions of BWDB. The Director General (DG) of BWDB said that he will look into the matter.

c. Water and / or River Code: The Study Team recommended promulgating these codes as soon as possible. Bangladesh side said that both are in preparation stage.

d. Regional Disaster Management: The Study Team recommended that GOB will make an effort to setup a regional disaster management program. Bangladesh side fully supported the issue.

e. O&M Record: The Study Team recommended that ledger sheet for O&M should be maintained. BWDB agreed and mentioned that steps will be taken in this regard.

f. Flood Damage Survey: The Study Team recommended that flood damage survey is to be conducted containing monetary values of flood damages. Bangladesh side understood the importance and agreed to consider.

Attachment

LIST OF ATTENDEES

1. Bangladesh Side

(Ministry of Water Resources, MOWR)

Mr. Sayef Uddin	Secretary
Mr. Ehsan Shamin	Joint Secretary
Mr. Golam Moula Bhuiyan	Deputy Secretary

(Bangladesh Water Development Board, BWDB, Ministry of Water Resources)

Mr. Mukhles Uz Zaman	Director General
Mr. Md. Momul Hassan	Additional Director General (Planning)
Mr. Md. Aminul Hoque	Chief Engineer (Hydrology)
Mr. Md. Anwar Hossain	Superintending Engineer / National Project Director
Mr. Md. Salim Bhuiyan	Executive Engineer
Mr. Md. Rashidul Islam	Executive Engineer

(Bangladesh Meteorological Department, BMD)

Mr. Akram Hossain	Director

(Space Research and Remote Sensing Organization, SPARRSO)

Mr. Md. Abul Kalam

(Water Resources Planning Organization, WARPO)

Mr. H.S. Mozaddad Faruque	Director General

2. Japanese Side

(Advisory Committee)

Mr. Akinori Masuda	Chairman
Mr. Yasunobu Maeda	Member

(JICA Tokyo Head Office)

Mr. Hideaki Matsumoto	Official Project Coordinator

(JICA Study Team)

Mr. Hideki Sato	Team Leader / River and Flood Control Expert
Mr. Masato Okuda	Deputy Team Leader / Telecommunication System Expert
Mr. Masahiro Sakagami	Radio Transmission Expert
Mr. Kensuke Sakai	Hydrologist
Dr. Nurul Islam	Institutional and Organizational Expert

AGREED MINUTES
OF
FOURTH STEERING COMMITTEE MEETING
ON
PROGRESS REPORT (2)
OF
THE FEASIBILITY STUDY FOR IMPROVEMENT OF FLOOD FORECASTING AND WARNING SERVICES
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

Dhaka, September 15, 2003

15/09/03

Mr. Md. Sayef Uddin
Secretary
Ministry of Water Resources
Chairman, Steering Committee

Mr. Hideki Sato
Team Leader
JICA Study Team

15/9/03

Economic Relations Division,
Ministry of Finance

IQBAL MAHMOOD
Deputy Secretary
Economic Relations Division
Ministry of Finance
Govt. of the People's Republic
of Bangladesh

15/9/03

Mr. Md. Anwar Hossain
Superintending Engineer / Director
Processing and Flood Forecasting Circle,
Bangladesh Water Development Board

Agreed Minutes Of Fourth Meeting Of The Steering Committee On Progress Report (2) Of The Feasibility Study For Improvement Of Flood Forecasting And Warning Services In The People's Republic Of Bangladesh

I. Introduction

The Study Team submitted 20 copies of the Progress Report (2) to Bangladesh Water Development Board (BWDB), the Counterpart Agency for the Study, on September 9, 2003. The Steering Committee meeting for the explanation and discussion of the Progress Report (2) was held at the Conference Room of Ministry of Water Resources (MOWR) in Dhaka City on September 14, 2003. Attendants List is attached as Attachment – 1.

II. Discussions at the Steering Committee

In the meeting the study team presented the Progress report-2. Then it was discussed among the participants. During the discussion it was found that there were some differences of opinion between the BWDB and the Study Team on some issues. So the Steering Committee felt that there should be more detail discussions between BWDB and the study team to resolve those issues. But as the study team will leave Bangladesh on 16th September 2003 there is little scope for detail discussion. It was therefore, decided that Bangladesh side would send all the comments they have to the Study Team by three weeks, which in turn to be addressed by the Study Team and reflected in the Draft Final Report. The Draft Final Report will be presented in the 5th meeting of The Steering Committee in October 2003.

III. The meeting then ended with vote of thanks by the Chair.

LIST OF ATTENDEES

Attachment

1. **Bangladesh side**

Ministry of water Resources (MoWR)

Mr. Md. Sayef Uddin	: Secretary
Mr. Ehsan Shamim	: Additional Secretary
Mr. Md. Habibullah Muzumder	: Joint Secretary
Mr. A.B.M. Golam Maula Bhuiyan	: Deputy Secretary
Mr. Ahmed S. Salehin	: Sr. Asstt. Secretary

Bangladesh Water Development Board (BWDB), Ministry of Water Resources.

Mr. Mokhles-Uz-Zaman	: Director General
Mr. Moinul Husain	: Additional Director General (Planning)
Mr. Aminul Haque	: Chief Engineer (Hydrology)
Mr. Md. Anwar Hossain	: Superintending Engineer/National Project Director
Mr. Md. salim Bhuiyan	: Executive Engineer, FFWC
Mr. Md, Rashidul Islam	: Executive Engineer, C&I Division

Bangladesh Meteorological Department (BMD)

Mr. Md. Akram Hossain	: Director

Space Research & Remote Sensing Organization (SPARRSO)

Mr. Md. Abul Kalam	:

Water Resource Planning Organization (WARPO)

Mr. H.S.M. Faruque	: Director General

Bangladesh Telegraph & Telephone Board (BTTB)

Mr. S.K. Abdul Latif	: Divisional Engineer

Economic Relations Division (ERD)

Mr. Iqbal Mahmood	: Deputy Secretary

2. **Royal Danish Embassay**

Mr. Abdul Motaleb	:

3. **Japanese Side**

Embassy of Japan

Mr. Takaiane Kakinuma

JICA Bangladesh Office

Mr. Sayedul Arefin

JICA Study Team

Mr. Hideki Sato	: Team Leader/River & Flood Control Expert.
Mr. Masato Okuda	: Deputy Team Leader/ Telecommunication Expert.
Mr. Kensuke Sakai	: Hydrologist.
Mr. Nurul Islam	: Organization Analyst.
Mr. Kiminari Tachiyama	: Economist Financial Analyst.
Mr. Gregory R. Hookey	: Flood Forecasting & Waning System Expert.
Mr. Naoko Anzai	:
Mr. Tadohiro Fakuda	:

AGREED MINUTES
OF
FIFTH STEERING COMMITTEE MEETING
ON
DRAFT FINAL REPORT
OF
THE FEASIBILITY STUDY FOR IMPROVEMENT OF FLOOD FORECASTING AND WARNING SERVICES
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

Dhaka, October 29, 2003

Mr. Md. Sayef Uddin
Secretary
Ministry of Water Resources
Chairman, Steering Committee

Mr. Hideki Sato
Team Leader
JICA Study Team

Economic Relations Division,
Ministry of Finance
IQBAL MAHMOOD
Deputy Secretary
Economic Relations Division
Ministry of Finance
Govt. of the People's Republic
of Bangladesh

Mr. Md. Anwar Hossain
Superintending Engineer / Director
Processing and Flood Forecasting Circle,
Bangladesh Water Development Board

Witnessed by,

Mr. Akinori Masuda
Chairman
JICA Advisory Committee

Agreed Minutes of Fifth Meeting of the Steering Committee on Draft Final Report

I. Introduction

The Study Team submitted 20 copies of the Draft Final Report to Bangladesh Water Development Board (BWDB), the Counterpart Agency for the Study, on October 21, 2003. The Steering Committee meeting for the explanation and discussion of the Draft Final Report was held at the Conference Room of Ministry of Water Resources (MOWR) in Dhaka City on October 26, 2003. Attendants List is attached as Attachment.

The Meeting discussed in sufficient details on the Draft Final Report. The Draft Final Report was in principle accepted by the Steering Committee after the discussion as summarized below.

II. Discussions at the Steering Committee

In the Steering Committee Meeting, the following were discussed and agreed upon by both parties of GOB and JICA.

1. Basic Framework

   The Steering Committee principally agreed with the regional control system together with combined manual and telemetric observation system.

2. O&M Plan by BWDB

   The Study Team requested BWDB to submit a draft O&M plan for the proposed project by November 7, 2003. The Study Team will make comments on that by November 16, 2003. Based on the comments, BWDB will submit final O&M plan by December 15, 2003 through MOWR.

3. Comments on DFR

   The Study Team received a written comment from Chief Engineer, Hydrology, BWDB, who is a member of Steering Committee. The Study Team mentioned that they will review the comments and would incorporate accordingly, as required.

4. Integrated Comments on DFR

   The Study Team requested Bangladesh side to submit written and compiled comments on DFR by November 16, 2003. If the comments do not reach the Study Team on time, Study Team recognizes no comments from Bangladesh side.

5. Study on Central System

   Though accepted the regional control system, Bangladesh side requested the Study Team to present the details on central control system for better understanding and comparison. The Study Team replied that the details would be included in the Final Report.

LIST OF ATTENDEES

1. Bangladesh Side

(Ministry of Water Resources, MOWR)

Mr. Ehsan Shamim	Additional Secretary
Mr. Md. Habibullah Majumder	Joint Secretary
Mr. Golam Moula Bhuiyan	Deputy Secretary

(Bangladesh Water Development Board, BWDB, Ministry of Water Resources)

Mr. Md. Moinul Hassan	Additional Director General (Planning)
Mr. Md. Aminul Hoque	Additional Chief Engineer (Hydrology)
Mr. Md. Anwar Hossain	Superintending Engineer / National Project Director
Mr. Md. Salim Bhuiyan	Executive Engineer, FFWC
Mr. Md. Rashidul Islam	Executive Engineer, C&I

(Water Resources Planning Organization, WARPO)

Mr. Md. Arzel Hossain Khan	Principal Scientific Officer

(Bangladesh Telephone and Telegraph Board, BTTB)

Mr. Ashraful Islam

(Economic Relations Division, ERD)

Mr. Md. Tofazzal Hossain	Senior Assistant Secretary

(Planning Commision)

Mr. Md. Rezaul Karim	Senior Assistant Secretary

(Royal Danish Embassy)

Mr. Abdul Motaleb	Program Officer, Water and Sanitation Sector

2. Japanese Side

(Advisory Committee)

Mr. Akinori Masuda	Chairman

(JICA Tokyo Head Office)

Mr. Hideaki Matsumoto	Official Project Coordinator

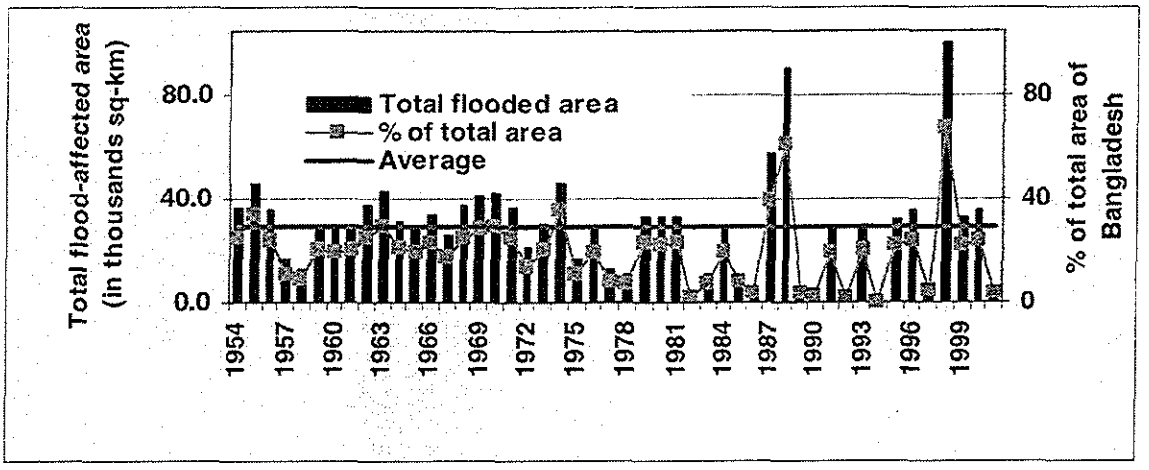
(JICA Study Team)

Mr. Hideki Sato	Team Leader / River and Flood Control Expert
Mr. Masato Okuda	Deputy Team Leader / Telecommunication System Expert
Mr. Kensuke Sakai	Hydrologist
Mr. Greg Hookey	FFWS Expert
Mr. Nurul Islam	Institutional and Organizational Expert
Mr. Tadahiro Fukuda	Administrator

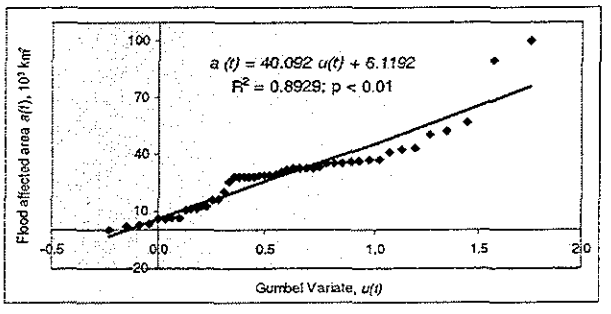
ATTACHMENT-4

Operation and Maintenance Plan of Proposed Project Prepared by the GOB

MINISTRY OF WATER RESOURCES
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH



Operation & Maintenance (O&M) Plan
For
Regionalized Control System of Improved Flood Forecasting and Warning Services (FFWS) with Combined Manual and Telemeter Observation System



December 2003

Bangladesh Water Development Board

I. Background

Bangladesh is a natural disaster prone country. Flood is the most common natural disaster. Understanding the human sufferings and impact on the National Economy due to flood disaster, FFWC was established in 1972 under Bangladesh Water Development Board (BWDB) as a non - structural measure of flood management. With the time and need continuous improvement / development has been made in the field of "Flood Forecasting and Warning Services" in Bangladesh. The chronological developments are:

- **1972** : FFWC established

  ▶Forecasting based on simple gauge-to-gauge correlation method (Muskinghum-Cunje flood routing model)

  ▶Only at 10 stations along main rivers

- **1989-1994** : UNDP assistance, FAP10 project

  ▶MIKE11 based FF by DHI established

  ▶Forecast at 16 stations

- **1995-1999** : Danida assistance; Extension of FAP10 project

  ▶Expansion of FFWS (MIKE11 with GIS)

  ▶Forecast at 30 stations

  ▶Flood inundation map

- **2000-2004** : Danida assistance Consolidation and Strengthening of Flood Forecasting & Warning Services

  ▶Full flood prone area under the model

  ▶Forecast at 72 forecast points

A pilot telemeter system was installed in 1985 and 1996 through Japan's debt relief fund. But the benefit of the telemeter system could not be effectively utilized in the forecasting system because of the fewness of the number and inadequate alignment of the telemetric observatories and non-interlinking of the system with the model. Limitations in the existing system are: i) Manual Observation resulting human error in Gauge reading, ii) Data Transmission by Wireless/ Mobile cropping error in voice communication, iii) Upstream Boundary Stations within Bangladesh, iv) Real-time data from Up-stream Station in India are not always available, v) Up-to date DEM not available, vi) Quantitative Precipitation Forecast not available, vii) Forecasting w.r.t Danger Level in Major Rivers only, viii) Dissemination up-to village level very weak, ix) No flood damage assessment, x)Manually Input of Data into Flood Models etc.

Recognizing the importance of the improvement and expansion of the existing telemeter net work for the prompt and accurate forecast analysis Government of Bangladesh (GOB) made a request to the Government of Japan (GOJ) in 2001 for a Technical Assistance to conduct " The Feasibility Study for up-gradation and expansion of Data Communication / Transmission Network for Flood Forecasting and Warning Services". In response to the request of the GOB the GOJ decided to conduct the study rather in a broader way covering the data communication network along with dissemination system , the most essential component of the FFWS.

The objectives and scope of work (S/W) on the technical cooperation for the Study was discussed and finalized among Ministry of Water Resources (MOWR), Ministry of Finance (MOF), Bangladesh Water Development Board (BWDB) and Japan International Cooperation Agency (JICA) on July 11, 2002 in Dhaka. In the meeting the name of the study was modified to as "Feasibility Study for Improvement of Flood Forecasting and Warning Services"

The Study Team / Consultants organized by JICA in close cooperation with GOB Counterpart Officials conducted the study. An Advisory Committee formed by staff of the Ministry of Land, Infrastructure and Transport (MLIT), Japan and Ministry of Foreign Affairs, Japan guided the Study Team and reviewed the findings thereby. A Steering Committee chaired by the Secretary of the MOWR with members from various relevant agencies also guided and supported the Study Team.

The study has been conducted in two stages, i.e. 1) Basic Study and 2) Feasibility Study. The study commenced in November 2002 and the field investigations, study on conceivable alternative plans, selection of optimum improvement plan were completed and framework plan of FFWS was proposed in the Basic Study stage. The proposed framework plan studied in detailed in the Feasibility Stage has been presented in the Draft Final Report before the Steering Committee on 26 October, 2003. ***"The Regionalized Control System with combination of manual observation and telemeter system" proposed by the Study Team has been accepted in the Steering Committee meeting. As such, BWDB has been assigned to provide an O&M plan for "Regionalized Control System of Improved Flood Forecasting And Warning Services With Combined Manual And Telemeter Observation System". Accordingly this Operation and Maintenance (O & M) plan has been prepare to be sent to Japan through MOWR for incorporation in the Final Report.***

II. Proposed Project

A. Control System

i. Central Control System (Control Station: Dhaka)
Flood Hydrology Circle (FHC), Headed by Superintending Engineer.

ii. Five Regional Control System
Regional Flood Hydrology Division (RFHD), Headed by Executive Engineer.

a. NERFHD (Control Station: Sylhet)
b. NWRFHD (Control Station: Rangpur)
c. SERFHD (Control Station: Cittagong)
d. SWRFHD (Control Station: Barisal)
e. NCRFHD (Control Station: Dhaka)

Districts under RFHD

Region	District
NERFHD	Brahmanbaria (part), Habiganj, Kishorganj (part), Moulvibazar, Mymenshing (part), Netrocona, Sherpur, Sunamganj and Sylhet.
NWRFHD	Bogra, Chapai Nawabganj, Dinajpur, Gaibanda, Joypurhat, Kurigram, Lalmonirhat, Naogaon, Nator, Nilphamari & Pabna.
SERFHD	Bandarban, Bhola, Chittagong, Cox's Bazar, Khagrachari, Noakhali & Ramgati.
SWRFHD	Bagherhat, Barisal, Bhola, Borguna, Chuadanga, Faridpur, Gopalganj, Jessore, Jhalkathi, Jhenaidha, Khulna, Kushtia and Madaripur.
NCRFHD	Brahmanbaria (part), Chandpur, Comilla, Dhaka, Feni, Gazipur, Jamalour, Kishoreganj (part), Laksipur, Manikganj, Munshiganj, Mymenshing (part), Narayanganj, and Narshingdi.

B. Observation System

Manual-Telemeter Combined

1. Water Level Gauging Stations:

a. Manual : 69 (NE: 11, NW: 17, SE: 10, SW: 12, NC: 19).
b. Telemeter : 23 (NE: 7, NW: 5, SE: 2, SW: 5, NC: 4).

2. Rainfall Gauging Stations:

a. Manual : 46 (NE: 9, NW: 11, SE: 10, SW: 9, NC: 7).
b. Telemeter : 23 (NE: 7, NW: 5, SE: 2, SW: 5, NC: 4).

C. Project Features

1. Observation System

a. Manual : Existing system.

b. Telemeter : i. Water level: Sonar type sensor/ Sensing pole type sensor.
ii. Rainfall : Tipping bucket.

2. Data Transmission System

a. **Manual** : i. Digital transmission - **Mobile or HF.**
ii. Automatic recording in computers at all control stations.

b. **Telemeter** : i. From Gauging station to regional station
- BWDB VHF Link.
ii. From Regional station to Central control station
-BWDB HF Link.

3. **Analysis System**
All data from manual and telemeter observatory will be used.

a. **Regional control system:** i. Forecasting with Regional model
ii. Monitoring with Telemeter observed data

b. **Central control system:** i. Forecasting with Nationwide Supermodel and also Regional model.

4. **Warning Dissemination System**

a. **Forecast and Warning Message Dissemination**
i. From Regional control station to BWDB O&M Offices, DC & Upazilla Offices
-E-mail, Fax, Telephone
ii. From Central control station to PM, President, Ministries, Secretariats, Head of different organizations, TV, Radio, News media and International agencies
- **Web, E-mail, Fax, Telephone, Messenger.**

b. **Point to Point Direct Data Dissemination (Telemeter only)**
i. From telemeter gauging station to BWDB O&M Offices, Upazilla Offices
– **VHF Link**

c. **Warning Dissemination in Local Level**

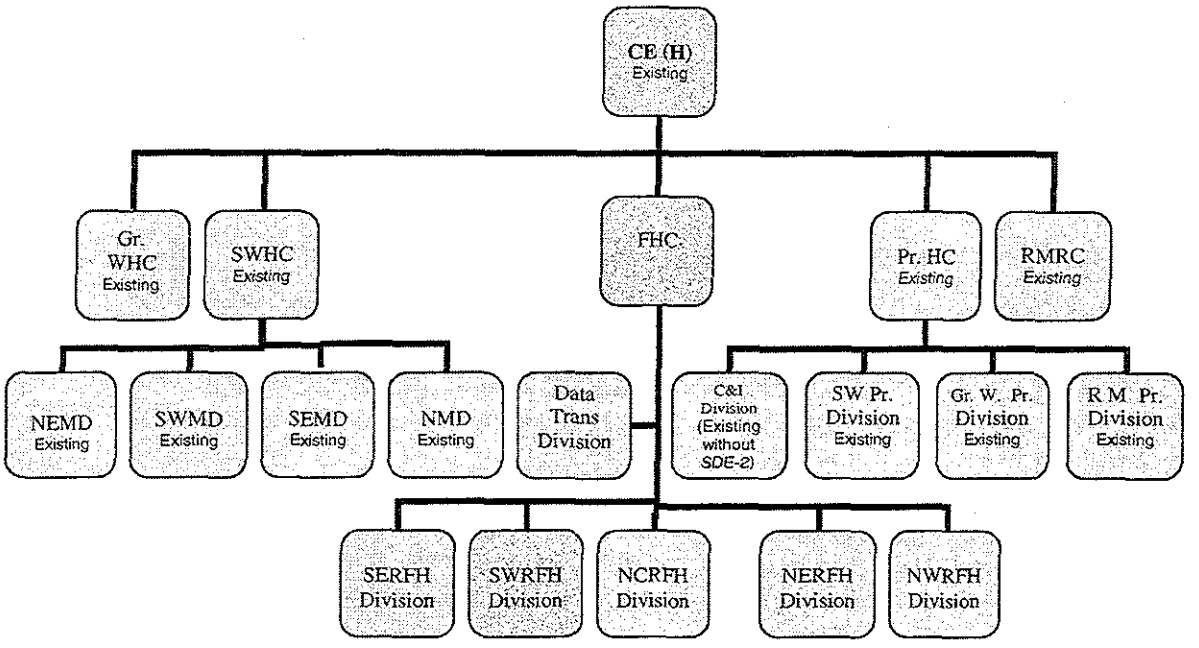
i. From Upazilla to Union Level local people / shelter
– Fax, Telephone, Drum beating, Bike, Speaker & visit

Note: a. & b. will be the responsibility of FHS, BWDB and c. will be the responsibility of Upazilla administration.

D. Main Components

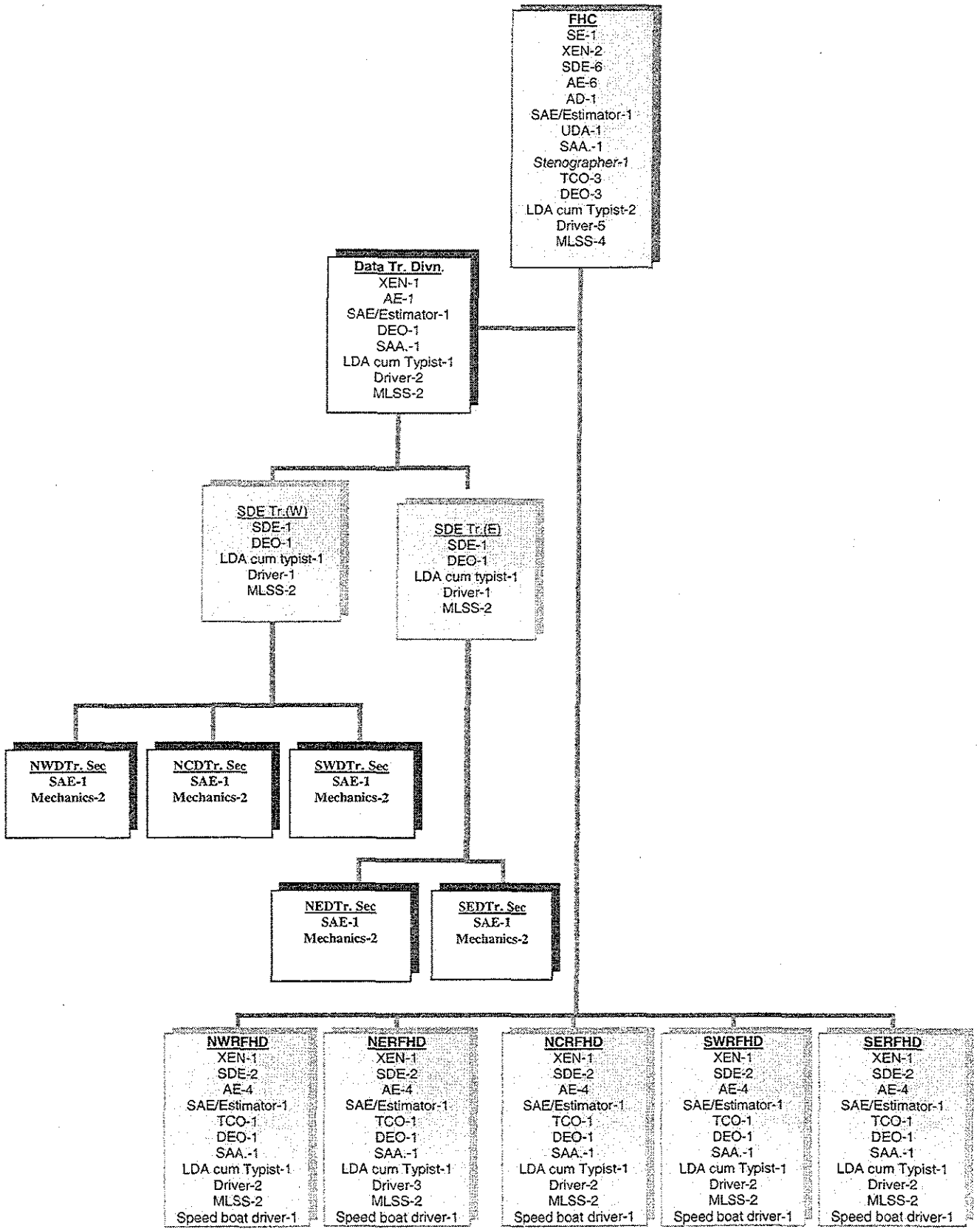
Place	Main Item	Item	Number
Central Office (Dhaka) including Data Tr. Division.	Equipment	Database Server (central) Super Model Analysis System Database Server (regional) Regional Analysis System Monitor Computer	1 1 5 5 14
	Office	FHC NCRFHD Data Tr. Division	1 1 1
	Others	Vehicle Speed Boat	6 0
Regional Office	Equipment	Database Server (regional) Regional Analysis System Monitor Computer	5 5 16
	Office	New Office	4
	Others	Vehicle Speed Boat	14 5
Repeater Station (O&M Office)	Equipment	Repeater Equipment	21
		Monitoring equipment	9
	Space	(Existing O&M office)	
Repeater Station (not O&M Office)	Equipment	Repeater Equipment	6
	Space	New House	6
Telemeter gauging station	Equipment	Telemeter equipment i) Sonar type sensor ii) Sensing pole type sensor	23 7 16
	Space	New House	23
Manual gauging Station	Equipment	Mobile Phone	42
		Digital HF System	43
	Space	(Existing Wireless station)	
Point to Point Direct Dissemination	Equipment	Monitoring equipment	32
	Space	(Existing Upazilla office	

E. Organogram of Hydrology Services (Up to Division Level)



CHIEF ENGINEER, HYDROLOGY	
Flood Hydrology Services	**Hydrology Services**
FHC :Flood Hydrology Circle	RMRC : River Morphology Research Circle
Data Transmission Division	SWHC : Surface Water Hydrology Circle
NWRFH Division :N-W Regional Flood Hydrology Division	Gr. WHC : Ground Water Hydrology Circle
NEWRFH Division :N-E Regional Flood Hydrology Division	Pr. HC : Processing Hydrology Circle
NCRFH Division :North Central Regional Flood Hydrology Division	NEMD : North East measurement division
SWRFH Division :South West Regional Flood Hydrology Division	NMD : Northern Measurement division
SERFH Division :South East Regional Flood Hydrology Division	SEMD : South East measurement division
	SWMD : South West measurement division
	C&I Division : Construction & Instrumentation Division
	SW Pr. Division : Surface Water Processing division
	Gr. W Pr. Division : Ground Water processing division
	RM Pr. Division : River Morphology Processing Division

F. FLOOD HYDROLOGY CIRCLE



Staff Strength Proposed Project										
OFFICE	**Unit**	**SE**	**XEN**	**SDE**	**AE**	**SAE**	**Tech staff**	**Support Staff**	**Gauge Reader**	**TOTAL**
Regional FHD	**RFHD**		5			5	0	36		**46**
	Data Management	-		5	10		5		W.L.GR=69 RF GR= 46	**135**
	Model & Forecasting			5	10		5			**20**
	Data Tr. Sub-divisions & Sections			2		5	12	8		**27**
	TOTAL	**0**	**5**	**12**	**20**	**10**	**22**	**44**	**115**	**228**
Central FHC	**FHC**	1	0	0	0	1	6	15	0	**23**
	Data Management		1	1	1	0				**3**
	Model & Forecasting		1	5	5	0				**11**
	Data Transmission Division	0	1	0	1	1	1	6		**10**
	TOTAL	**1**	**3**	**6**	**7**	**2**	**7**	**21**	**0**	**47**
	Grand Total	**1**	**8**	**18**	**27**	**12**	**29**	**65**	**115**	**275**

G. O&M For Proposed Project

Quantities of Main Components

1) Facility

Number of main component	NEFHD	NWFHD	SEFHD	SWFHD	NCFHD	D.Tr.Divn	FHC	Total
A1 Central Office (Dhaka)	0	0	0	0	0	1	1	**2**
- Regional (Dhaka)	0	0	0	0	1	1	0	**2**
A2 Regional Office	1	1	1	1	0	0	0	**4**
A3 Repeater Station (O&M Office)	4	9	0	5	3	0	0	**21**
A4 Repeater Office (not O&M office)	4	0	1	0	1	0	0	**6**
A5 Telemeter gauging Station	7	5	2	5	4	0	0	**23**
A6 Manual gauging Station	11	19	12	19	24	0	0	**85**
(HF)	5	10	6	10	12	0	0	**43**
(Mobile)	6	9	6	9	12	0	0	**42**
A7 Point to Point Direct Dissemination	16	10	6	0	0	0	0	**32**

Number of transportation equipment	NEFHD	NWFHD	SEFHD	SWFHD	NCFHD	D.Tr. Divn	FHC	Total
Vehicle	3	2	2	2	2	4	5	**20**
Speed Boat	1	1	1	1	1	0	0	**5**

Number of office equipment	NEFHD	NWFHD	SEFHD	SWFHD	NCFHD	D.Tr. Divn	FHC	Total
Computer	5	5	5	5	6	9	17	**52**
Printer	3	3	3	3	4	9	6	**31**
Fax	2	2	2	2	2	1	2	**13**
Tel & Internet	3	2	2	2	3	3	3	**18**
Desk	16	16	16	16	16	6	24	**110**
Air conditioner	4	4	4	4	6	3	7	**32**

2) Staff

Number of staff	NEFHD	NWFHD	SEFHD	SWFHD	NCFHD	D.Tr.Divn	FHC	Total
SE	0	0	0	0	0	0	1	**1**
XEN	1	1	1	1	1	1	2	**8**
SDE	2	2	2	2	2	2	6	**18**
AE	4	4	4	4	4	1	6	**27**
Technical Staff	3	3	3	3	3	19	7	**41**
Support Staff	8	7	7	7	7	14	15	**65**
Gauge Reader	20	28	20	21	26	0	0	**115**
Total	**38**	**45**	**37**	**38**	**43**	**37**	**37**	**275**

Cost Estimate for Computer Systems of Proposed Project

SL. NO.	NAME OF ITEM	NUMBER	RATE (In Million TK)	AMOUNT (In Million Tk)	REMARKS
1	Data Base Server				
	a) Hard	11	2.5	27.50	Rate as per Study Team
	b) Soft	11	5	55.00	-do-
2	Super Model Analysis System				
	a) Hard	1	1.5	1.50	-do-
	b) Soft	1	2.5	2.50	-do-
3	Regional Model Analysis System				
	a) Hard	10	1.5	15.00	-do-
	b) Soft	10	7.5	75.00	-do-
			Sub-Tota (A)	**176.50**	
4	Monitor Computer	30	0.1	3.00	Market Rate in Bangladesh
5	Printer	31	0.03	0.93	-do-
6	Fax	13	0.05	0.65	-do-
7	Telephone	18	0.02	0.36	-do-
8	Air Condition	32	0.08	2.56	-do-
			Sub-Tota (B)	**7.50**	
			Total(A+B)	**184.00**	

Repair and Maintenance Cost Estimate (In million Tk.)

a) For Computer System: 10% of 184.00	18.40
b) For Telemeter System (Assessed by Study Team)	1.30
c) For Civil Works (Assessed by Study Team)	5.10
Total	**24.80**

Staff Salary

SL. No	Position	Number of office staff	Salary in Tk/Month	Salary in Tk/Year	Remarks
1	SE	1	20000	290000	
2	XEN	8	17000	1972000	
3	SDE	18	15000	3915000	
4	AE	27	10000	3915000	14.5 mm/y has been considered to cover the festival bonous and other allowances
5	Technical staff	41	6500	3864250	
6	Support Staff	65	6000	5655000	
7	W L G.R	69	3500	3501750	
8	R F G.R	46	1500	1000500	
	Total(a)	275		24113500	
	Total(a) in Million Tk.			24.11	

Annual O & M Cost(In million Tk.)				
ITEM	Foreign	Local	Total	Remarks
1. Transportation Cost		2.00	2.00	
2. Communication Cost		4.00	4.00	
3. Vehicle Operation Cost		3.20	3.20	
4. Boat Operation Cost		0.50	0.50	
5. Repair & Maintenance Cost		24.80	24.80	
6. O&M cost for the manual gaugegs		0.29	0.29	
7. Light, fuel, water cost		1.00	1.00	
8. Consumables		0.50	0.50	
9. Advertisement		0.30	0.30	
10. Social expenses		0.30	0.30	
11. Social Welfare		0.20	0.20	
12. House & land rental		0.30	0.30	
13. Training cost		0.80	0.80	
14. Insurance		0.40	0.40	
15. Sundry		2.00	2.00	
Total (b)		40.59	40.59	
Total (a+b)		64.70	64.70	

Depreciation	Total (c)	135.50	135.50	Assessed by Study Team
Grand Total(a+b+c)		200.20	200.20	

The O&M expenditure as proposed in this O&M Plan will be arranged from the GOB's Annual Revenue Budget after the full implementation of the Project. During the project implementation period all additional O&M expenditure including additional staff salary and installation of all component of the project will be borne by the Project.

Signature

Project Director, FSIFFWS

H. Rules & Regulation On Flood Hydrology And O&M (Tasks And Duties: Mandate)

Flood control is the mandate of BWDB. There are already guide lines for the flood control activities. But these are in the scattered form. A specific set rules and regulations will be framed out to be followed as a guide lines by all O& M and Flood Hydrology units of BWDB. Three stage actions are there for three situations: i) preparatory and preventive measures at pre-event phase, ii) emergency and safety measures at event phase and iii) rescue and rehabilitation measures at post event phase. During flood season in addition to the normal routine activities BWDB O&M and Flood Hydrology units shall have to response specially to the forecast and warning messages issued from the Central FHC and Regional FHD proposed to be placed near to the BWDB O&M CE/SE's office at five different locations (Dhaka, Rangpur, Barisal, Sylhet and Chittagong) for the emergency and safety measures of hydraulic /river infrastructures at event phase.

BWDB O&M units and RFHD shall have to interact with the local bodies like District and Upzilla administration, local disaster management unit, elected public representatives and NGO's for coordinated & integrated flood management to save lives and properties.

BWDB O&M units and RFHD shall also inform other relevant organizations like LGED, R&H etc. to response to the flood forecast & warning messages for safety measures of their infrastructures.

All BWDB O&M units and RFHD shall have their jurisdiction map showing all infrastructures and activities under that unit. All units shall have to maintain background history of any structure or project under their respective jurisdiction with objectives & requirements of the same. All O&M activities shall have to record in the ledger sheet in a formatted way for all structures.

A response management guide line should be prepared for all concerned agencies including BWDB.

GOB will be accountable for the safety & security of lives and properties against the flood disaster by its action plan through BWDB's activity both as structural as well as non-structural measures.

Regional Flood Hydrology Division (RFHD) under Flood Hydrology Circle (FHC) is a regional level FHS's unit of Chief Engineer, Hydrology (CEH), BWDB. These units will be under the administrative and financial control of CEH. For better service and coordination nearest CE/SE, O&M, BWDB will also monitor and supervise their activities.

I. Co-Operation With Other Agencies

Valuable climatic data inside the country and out side in India are made available through BMD. Satellite images are made available through SPARRSO and CEGIS. National Water Resources database are maintained by WARPO. As such, coordination & co-operation among these agencies shall have to be strengthened further more for necessary data exchange & technology transfer.

Institution for Water Modeling (IWM) has successfully developed in a great extant in the field of modeling activities. For technical backup support & technology transfer FHS & IWM will act in much more coordinated way.

To combat flood disaster FHS & DMB shall act in integrated way for better management and dissemination to the grassroots level with co-operation of the District and Upzilla level administration and elected local level public representatives.

Firm inter-agency network connecting among disaster relate agencies such as BWDB, BMD, DMD, IWM SPARRSO, CPP, CEGIS etc. to be developed.

J. Routine Inspection Schedule of Proposed Telemetry and Wireless Stations

Sl. No.	Inspection by	Telemetry Regional Control /Master Stations	Repeater Stations	Telemetry Gauging equipment	Telemetry Telecom equipment	Civil structures (Hard point, shed etc.)	Wireless Stations	Remarks
1.	E. E	Twice a year	Once a year	Once a year	Once a year	Once a year	Once a year	Over all inspection
2.	SDE	Routine checking - once a week Detail checking -fortnightly	Routine checking - once a week Detail checking -fortnightly	Routine checking - once a month Detail checking -alternate month	Routine checking - once a week Detail checking -fortnightly	Routine checking - once a month Detail checking -alternate month	Routine checking - once a month Detail checking -alternate month	
3.	SAE	Routine checking - twice a week Detail checking -weekly	Routine checking - twice a week Detail checking -weekly	Routine checking - fortnightly Detail checking - once a month	Routine checking - twice a week Detail checking -weekly	Routine checking - fortnightly Detail checking - once a month	Routine checking - fortnightly Detail checking - once a month	

Notes:
Routine Inspection

Telemetry Master/ Regional Control Station: i) Checking Status of all concerned gauging stations, ii) Checking Status of all concerned VHF Repeater stations, iii) Checking all HF, Internet & others linkages (may be BTTB Digital) between Regional controls to Master control station, .iv) Data receiving status both in data-servers, printer's conditions and control panel monitor, v) Checking temperature & humidity at Control stations and take measures to maintain the desired operation condition, vi) Inspecting the full functions of data storage units/servers & other electrical- electronics – equipments etc.

Gauging Stations: i) Visual inspection and cleaning of Telemetry equipment shade, Antenna., Cables, Water level (WL) Sensors, Solar cells, Solar power distribution unit, Rain fall gauges, Floats etc and gauge housings. ii) Checking of electrolyte- level of storage batteries. iii) Visual inspections of civil structures. iv) Checking wired/wireless transmission system between WL gauges and data transmission equipments at the shade. v) Checking physical condition (verticality etc) of WL & RF gauge structures along with their fitting-fixing arrangements with the anchorage. vi) Checking temp, humidity & dusty condition at the equipment shade.vii) checking strange noise and smell at equipment shades. viii) Collecting WL data from the manual gauges, checking those with the data, measured by gauging equipments and making adjustment if necessary.

Repeater Stations: i) Visual inspection of repeater telecommunication equipments ii) Checking VHF linkage (voice & data) between gauging to repeater or repeater to repeater stations. iii) Checking temp, humidity & dusty condition at the equipment shade. iv) Checking strange noises and smells at

equipment shades. v) Checking of Solar cells, Solar power distribution unit, electrolyte- level of storage batteries vi) Inspection of equipment shades, Antenna and antenna mast /towers etc. vii) Checking condition of lightening-arrester arrangement viii) Checking the data displayed on equipment etc.

Detailed Inspection

Telemetry Master/ Regional Control Station: I) Telecommunication networking testing between Master / Regional Control Stations to repeater or gauging stations. ii) Detailed functional testing of all existing equipments (Data-servers, computer networking, printer's, control panel monitor etc) iii) Checking functional testing of antenna & lightening-arrester arrangements. v) Testing functions of software if any.

Gauging Stations: i) Telecommunication networking testing ii) Inspection of anchorage system/foundation of gauge, shade & antenna structures. iii) Detailed functional testing. iv) Checking operating conditions of all equipments & cables (such as Current, Voltage, connectivity etc) v) others if any.

Repeater Stations: i) Telecommunication networking testing between gauging to repeater & repeater to repeater stations. ii) Inspection of equipment shade & antenna structures. iii) Detailed functional testing of all equipment. iv) Checking functional testing of lightening-arrester arrangement. v) Others if any.

II. Pilot Project

A. Control System

i) **Central Control System (Control Station: Dhaka).**
Existing FFWC, Headed by Executive Engineer

ii. **Regional Control System**
Regional Flood Hydrology Division, Headed by Executive Engineer

a) NERFHD), Control Station: Sylhet

Districts under NERFHD:
Brahmanbaria (part), Habiganj, Kishorganj (part), Moulvibazar, Mymenshing (part), Netrocona, Sherpur, Sunamganj and Sylhet.

Districts under Central Existing FFWC: All districts including those under **NERFHD**.

B. Observation System

Manual-Telemeter Combined

1) **Water Level Gauging Stations**

a) **Manual** : 69 (NE: 11, Others: 58)
b) **Telemeter** : 23 (NE: 7, Others: 16)

2) **Rainfall Gauging Stations**

a. **Manual** : 46 (NE: 9, Others: 37)
b. **Telemeter** : 23 (NE: 7, Others: 16)

C. Project Features

1) **Observation System**

a) Manual : Existing system
b) Telemeter : i) Water level: Sonar type sensor/ Sensing pole type sensor
ii) Rainfall : Tipping bucket

2) **Data Transmission System**

a) Manual : i) Digital transmission- **Mobile or HF.**
ii) Automatic recording in computer in control station
b) Telemeter : i) From Gauging station to regional station - **BWDB VHF Link.**
ii) From Regional station to Central control station- **BWDB HF Link.**

3) **Analysis System**

All data from manual and telemeter observatory will be used.

a) **Regional control system:** i) Forecasting with Regional model

ii) Monitoring with Telemeter observed data

b) **Central control system:** i) Forecasting with Nationwide Supermodel and also Regional model.

4) **Warning Dissemination System**

a) Forecast and Warning Message Dissemination

i. From Regional control station to BWDB O&M Offices, DC & Upazilla Offices
- E-mail, Fax, Telephone

ii. From Central control station to:

a) PM, President, Ministries, Secretariats, Head of different organizations,
TV, Radio, News media and International agencies
– Web, E-mail, Fax, Telephone, Messenger.

b) BWDB O&M Offices, DC & Upazilla Offices
– E-mail, Fax, Telephone

b) Point to Point Direct Data Dissemination (Telemeter only)

i) From telemeter gauging station to BWDB O&M Offices, Upazilla Offices
– VHF Link

c) Warning Dissemination in Local Level

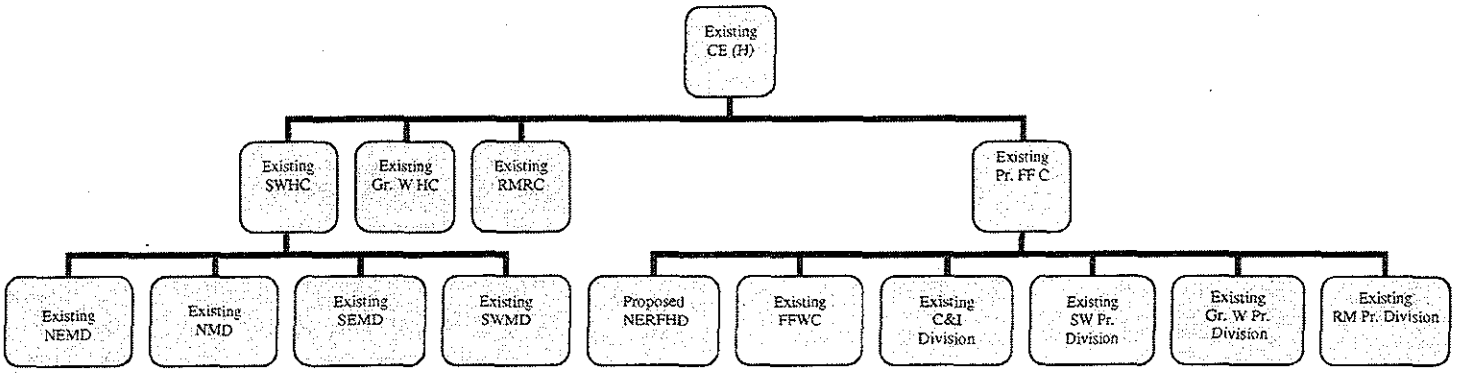
i) From Upazilla to Union Level local people / shelter
–Fax, Telephone, Drum beating, Bike, Speaker & visit

Note: a. & b. will be the responsibility of FHS, BWDB and c. will be the responsibility of Upazilla administration.

D. Main Components

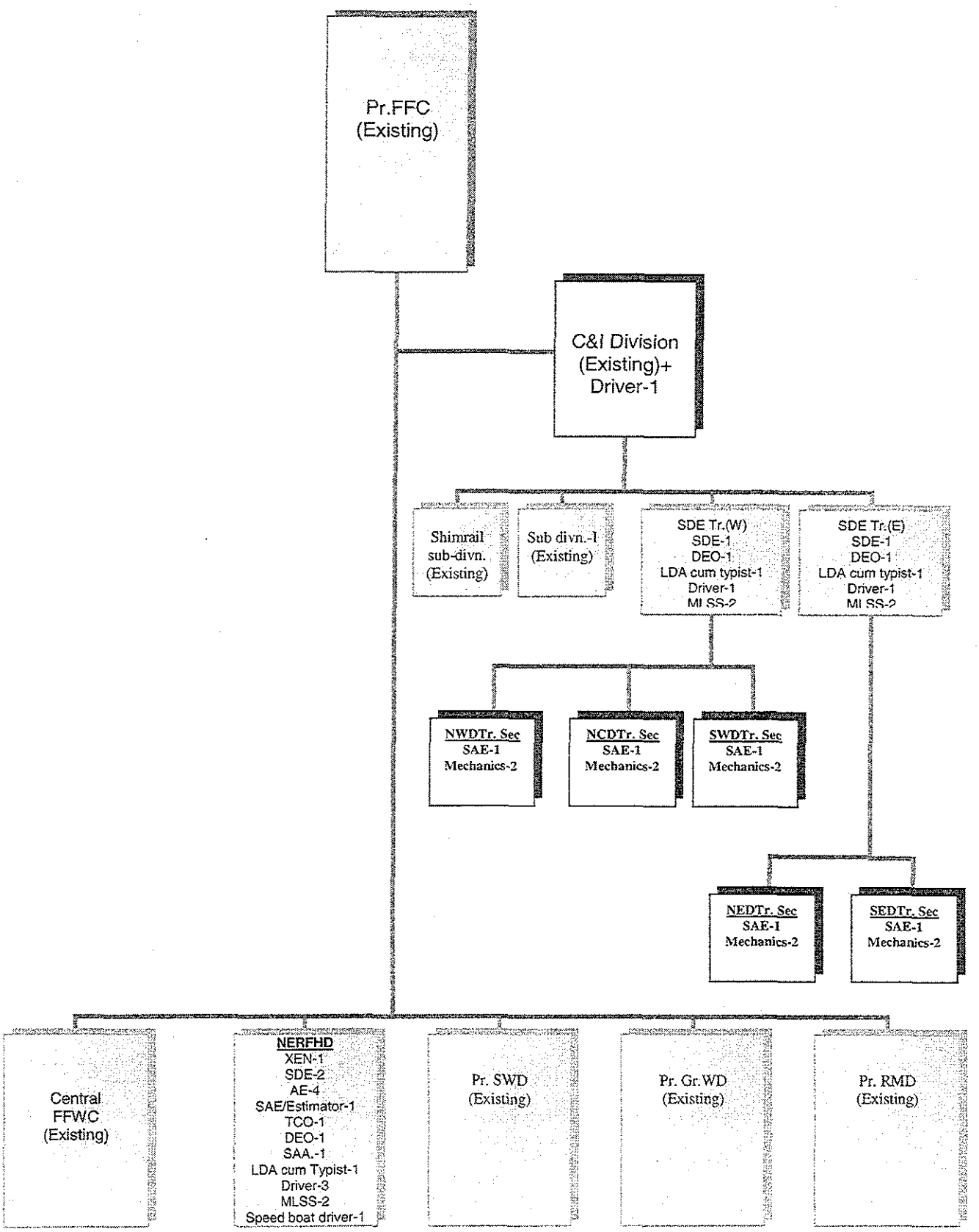
Place	Main Item	Item	Number
Central Office (Dhaka) including Data Tr. Division.	Equipment	Database Server (central) Super Model Analysis System Database Server (regional) Regional Analysis System Monitor Computer	1 1 5 1 8
	Office	Pr. FFC(Existing) FFWC9Existing) C&I ivn.(Existing)	0 0 0
	Others	Vehicle Speed Boat	4 1
Regional Office	Equipment	Database Server (regional) Regional Analysis System Monitor Computer	1 1 3
	Office	New Office	1
	Others	Vehicle Speed Boat	7 2
Repeater Station (O&M Office)	Equipment	Repeater Equipment	21
		Monitoring equipment	9
	Space	(Existing O&M office)	
Repeater Station (not O&M Office)	Equipment	Repeater Equipment	6
	Space	New House	6
Telemeter gauging station	Equipment	Telemeter equipment i) Sonar type sensor ii) Sensing pole type sensor	23 7 16
	Space	New House	23
Manual gauging Station	Equipment	Mobile Phone	42
		Digital HF System	43
	Space	(Existing Wireless station)	
Point to Point Direct Dissemination	Equipment	Monitoring equipment	32
	Space	(Existing Upazilla office	

E. Organogram of Hydrology (Showing position of Proposed Project at pilot stage)



CHIEF ENGINEER, HYDROLOGY			
Pr. HC	: *Processing Hydrology Circle*	RMRC	: River Morphology Research Circle
FFWC	: Flood Forecasting Warning Centre	SWHC	: Surface Water Hydrology Circle
NEWRFH Divn	: N-E Regional Flood Hydrology Division	Gr. WHC	: Ground Water Hydrology Circle
C&I Division	: Construction & Instrumentation Division	NEMD	: North East measurement division
SW Pr. Division	: Surface Water Processing Division	NMD	: Northern Measurement division
Gr. W Pr. Divn.	: *Ground Water processing Division*	SEMD	: South East measurement division
RM Pr. Division	: River Morphology Processing Division	SWMD	: South West measurement division

F. PROCESSING & FLOOD FORECASTING CIRCLE at Pilot stage



Additional Staff Strength In the Proposed Project At Pilot Stage

OFFICE	Unit	SE	XEN	SDE	AE	SAE	Tech staff	Support Staff	Gauge Reader	TOTAL
Regional FHD	RFHD		1			1	0	8	W.L.GR=11 RF GR= 9 (Existing)	**10**
	Data Management	-		1	2		1			**4**
	Model & *Forecasting*			1	2		1			**4**
	SDE Tr.(W) *Existing*	0	0	0	0	1	6	2	0	**9**
	SDE Tr.(E)	0	0	1	0	2	5	4	0	**12**
TOTAL		**0**	**1**	**3**	**4**	**4**	**13**	**14**	**20 Existing**	**39**
Central Pr. FFC FFWC C&I Divn.	Pr. FFC	0	0	0	0	0	0	0	0	**0**
	FFWC	0	0	0	0	0	0	0	0	**0**
	C&I Division	0	0	0	0	0	0	1	0	**1**
TOTAL		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**
Grand Total		**0**	**1**	**3**	**4**	**4**	**13**	**15**	**20 Existing**	**40**

G. Additional O&M For Proposed Pilot Project

Quantities of Main Components

1) Facility

Number of main component	NEFHD	NWFHD	SEFHD	SWFHD	FFWC	C&I Divn.	Pr.FFC	Total
A1 Central Office (Dhaka)	0	0	0	0	0	0	0	**0**
- Regional (Dhaka)	0	0	0	0	0	0	0	**0**
A2 Regional Office	1	0	0	0	0	0	0	**1**
A3 Repeater Station (O&M Office)	4	9	0	5	3	0	0	**21**
A4 Repeater Office (not O&M office)	4	0	1	0	1	0	0	**6**
A5 Telemeter gauging Station	7	5	2	5	4	0	0	**23**
A6 Manual gauging Station	11	19	12	19	24	0	0	**85**
(HF)	5	10	6	10	12	0	0	**43**
(Mobile)	6	9	6	9	12	0	0	**42**
A7 Point to Point Direct Dissemination	16	10	6	0	0	0	0	**32**

Number of transportation equipment	NEFHD	NWFHD	SEFHD	SWFHD	FFWC	C&I Divn.	Pr.FFC	Total
Vehicle	3	0	0	0	0	1	0	**4**
Speed Boat	1	0	0	0	1	0	0	**2**

Number of office equipment	NEFHD	NWFHD	SEFHD	SWFHD	FFWC	C&I Divn.	Pr.FFC	Total
Computer	5	0	0	0	5	2	2	**14**
Printer	3	0	0	0	2	2	1	**8**
Fax	2	0	0	0	1	1	1	**5**
Tel & Internet	3	0	0	0	0	2	0	**5**
Desk	16	0	0	0	0	2	0	**18**
Air conditioner	4	0	0	0	0	2	0	**6**

2) Staff

Number of staff	NEFHD	NWFHD	SEFHD	SWFHD	FFWC	C&I Divn.	Pr.FFC	Total
SE	0	0	0	0	0	0	0	**0**
XEN	1	0	0	0	0	0	0	**1**
SDE	2	0	0	0	0	1	0	**3**
AE	4	0	0	0	0	0	0	**4**
Technical Staff	3	0	0	0	0	14	0	**17**
Support Staff	8	0	0	0	0	7	0	**15**
Gauge Reader	20-Existing	0	0	0	0	0	0	20-Existing
Total	**18**	**0**	**0**	**0**	**0**	**22**	**0**	**40**

Additional Staff Salary for Pilot Project					
SL. No	Position	Number of office staff	Salary in Tk/Month	Salary in Tk/Year	Remarks
1	SE	0	20000	0	14.5 mm/y has been considered to cover the festival bonous and other allowances
2	XEN	1	17000	246500	
3	SDE	3	15000	652500	
4	AE	4	10000	580000	
5	Technical staff	17	6500	1602250	
6	Support Staff	15	6000	1305000	
7	W L G.R	11-Existing	4000	0	
8	R F G.R	9-Existing	1500	0	
	Total(a)	**40**		***4386250***	
			Total(a) in Million Tk.	**4.39**	

Note: During the implementation of the project all additional O&M cost including additional staff salary will be borne by the Project.

Remarks:

1. At present NERFHD(Sylhet) only will be activated and all other area will be addressed from the present Central Flood Forecasting Warning Centre at Dhaka

2. Success and performance of the proposed pilot NERFHD at Sylhet will be evaluated. As per findings and experience of the Pilot project fine adjustments will be made in the Central and Regional Flood Hydrology Services to activate the system as a whole.

Signature

Project Director, FSIFFWS

FUNCTIONS OF DIFFERENT UNITS OF PROPOSED Improved FFWS

Sl. No	Unit	Headed by/ Officer in charge	Function
A. Flood Hydrology Circle (FHC)			
1	**FHC**	**Superintending Engineer**	(1) *To supervise the following task in connection with flood hydrology services:* *a) Overall Monitoring real time data collection related to the flood forecast & warning system, data transmission, all O&M activities related to the data collection & transmission system and timely dissemination of flood forecast & warning message to different Ministries/Organizations/News media and NGO's at national & international level through bulletin, b) Maintaining liaison with MOWR, Cabinet Division, MOD&R and the office of the PM for briefing them on flood situation in the country, c) Publishing the monthly Flood Report during the monsoon, monthly low flow monitoring report and an annual report.* (2) *To supervise the quality of model output, forecast and warning message* (3) *To supervise maintenance of equipment, telemeter and wireless system, and installation.* (4) *To coordinate with BWDB and other related agencies on flood, drought and erosion studies, research, data management and other related business.* (5) Co-ordinate implementation of relevant project activities and is responsible for project Administration & Control of finance. (6) Co-ordinate in preparing operation action plans & projects Report. (7) Other administrative and financial business and to undertake any other issues that may be assigned.
2	**Data Management**	**Executive Engineer**	1. *Data acquisition, quality checking, & Archive all Hydrological data from 5(five) Regional Offices, data processing and Database management* 2. *Overall responsibility for data processing and Database management.* *To undertake any other issues that may be assigned.*
3	**Model & Forecasting**	**Executive Engineer**	(1) *Set the boundary condition, Run Super Model, To prepare country bulletin and flood inundation map integrating GIS and real time data, dissemination of all the daily central output including updating of the Website.* (2) *Send daily flood bulletin to the offices of President, Prime Minister, relevant Ministers, Govt. Offices, Radio, Television, Press media, NGO's etc.* (3) *Acquisition of NOAA/GMS Satellite and radar data on real time basis and process, interpret and prepare necessary graphics* (4) *System & software management, Updating & Validation of the model, modification of Hazard maps* (5) *Prepare and circulate the following flood related documents:* *a) Daily monsoon flood bulletin* *b) Monthly Flood Report* *c) Annual Flood Report* *d) Weekly dry season bulletin* (6) *Archiving model result (Forecast & estimate) and warning messages and other output of all the 5 Regional Flood Hydrology Divisions and compare those output running all the regional model centrally*

			and verify the Bulletins etc. (7) **To undertake any other issues that may be assigned.**
B.	**Data Transmission Division (D Tr. Divn.)**		
1	**D tr. Divn.**	**Executive Engineer**	1. ***Over all management of the Data transmission systems, construction and operation, repair & maintenance of wireless station, wireless receivers, telemeter system, Automatic gauges, HF Transceiver, mobile and other related equipment through out the country.*** 2. Other administrative and financial business and to undertake any other issues that may be assigned. 3. To take necessary steps for implementation and monitoring of projects including in ADP. 4. **To prepare survey report of unserviceable condemned equipments and take necessary steps for their disposal**
2	**Data Tr. Subdivision.**	**SDE**	1. ***Construction and operation, repair & maintenance of wireless station, wireless receivers, telemeter system, Automatic gauges, HF Transceiver, mobile and other related equipment within his jurisdiction through his section officers placed in each RFHD.*** 2. ***Transmission of real time data from the gauge station to the the central and regional control offices.*** 3. Other administrative and financial business and to undertake any other issues that may be assigned. 4. To take necessary steps for implementation and monitoring of projects including in ADP. 5. ***Prepare survey report of unserviceable condemned equipments and take necessary steps for their disposal***
C.	**Regional Flood Hydrology Divisions (RFHD) 5 in no (NW RFHD, NE RFHD, NC RFHD, SW RFHD, SE RFHD)**		
1	**RFHD**	**Executive Engineer**	1. ***Installation and restoration of manual water level and rain gauges, measurement of water level and rainfall information required for Flood Forecasting And Warning purposes under his region.*** 2. ***To collect real time hydrometric and telemeter data for flood forecasting and inundation model.*** 3. ***Prepare warning bulletin on the basis of the model output and flood inundation map integrating GIS and real time data.*** 4. ***Liaison With Local administration, other offices NGO, LDMC, BWDB O&M etc. for disaster management.*** 5. ***Warring Message Dissemination (Forecasted) form Regional Control Station to BWDB O&M Offices, DC Office, Upazilla office etc.*** 6. ***Receive & Preserve all Hydrological data within the Region & quality check of all the data, data processing & Database management.*** 7. ***Prepare and circulate the following flood related documents for the concerned region:*** *e) Daily monsoon flood bulletin* *f) Monthly Flood Report* *g) Annual Flood Report* *h) Weekly dry season bulletin* 8. **To maintain different equipment used in flood forecasting.** 9. **To take necessary steps for implementation and monitoring of projects including in ADP** 10. **Other administrative and financial business and to undertake any other issues that may be assigned.**

D. Surface Water Hydrology Circle (SWHC)			
1	SWHC (Existing)	Superintending Engineer	Existing
2	Measurement Divisions	Executive Engineer	Existing
E. Ground Water Hydrology Circle (Gr.WHC)			
1	Gr.WHC (Existing)	Director	Existing
F. River Morphology And Research Circle (RMRC)			
1	RMRC (Existing)	Superintending Engineer	Existing
G. Pr. Hydrology Circle (Pr. HC)			
1	Pr. HC (modified existing Pr.FFC)	Superintending Engineer	All existing activities except the flood forecasting related activities including the data transmission activities.

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পানি সম্পদ মন্ত্রণালয়
শাখা-উঃ ৩

নং-পাসম-উঃ৩/জাপান-৩/৯৯(অংশ-১)/৪০১ তারিখ ঃ ১৫/১২/২০০৩ খ্রিঃ।

প্রেরকঃ মোসাম্মৎ নাসিমা বেগম
সিনিয়র সহাকারী সচিব।

প্রাপকঃ মহাপরিচালক
বাংলাদেশ পানি উন্নয়ন বোর্ড
ওয়াপদা ভবন, মতিঝিল
ঢাকা।

বিষয় ঃ- **Feasibility Study for Improvement of Flood Forecasting & Warning Services in the People's Republic of Bangladesh** শীর্ষক প্রকল্পের চূড়ান্ত **O&M Plan** পানি সম্পদ মন্ত্রণালয়ের মাধ্যমে **JICA Study Team** এর নিকট প্রেরণ প্রসংগে।

সূত্র ঃ- বাপাউবো'র স্মারক নং-২২৫-পাউবো(সচি)পরি-১/বিবিধ-২/৯৮, তারিখ-১১/১২/২০০৩ খ্রিঃ।

মহোদয়,

উপর্যুক্ত বিষয় ও সূত্রস্থ স্মারকের বরাতে বাংলাদেশ পানি উন্নয়ন বোর্ড হতে প্রাপ্ত O&M Plan পরবর্তী প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য নির্দেশক্রমে এতদসংগে প্রেরণ করা হলো।

Nasima
১৫-১২-০৩
(মোসাম্মৎ নাসিমা বেগম)
সিনিয়র সহাকারী সচিব।
ফোন ঃ ৭১৬৯৬২৯

সংযোজন ঃ বর্ণনা মতে।

অনুলিপি জ্ঞাতার্থে ও কার্যার্থে ঃ

তত্ত্বাবধায়ক প্রকৌশলী, প্রসেসিং এন্ড ফ্লাড ফোরকাষ্টিং সার্কেল, বাংলাদেশ পানি উন্নয়ন বোর্ড, ঢাকা।

1.	**Name of Project**	: **Regionalized Control System of Improved Flood Forecasting and Warning Services (FFWS) with Combined Manual and Telemeter Observation System**
2.	**Name of Ministry**	: **Ministry of Water Resources**
3.	**Executing Agency**	: **Bangladesh Water Development Board**
4.	**Name of Probable Donor**	: **GOJ**
5.	**Implementation Period**	: **January 2004 to December 2008**
6.	**Project Area**	: **Whole Bangladesh**
7.	**Annual O & M Cost**	:

A) With Depreciation cost: Taka 200.20 million.
B) Without Depreciation cost: Taka 64.70 million.

SIGNATURE OF THE HEAD OF THE DEPARTMENT/ ORGANIZATION

11.12.03

DIRECTOR GENERAL
BANGLADESH WATER DEVELOPMENT BOARD

SIGNATURE OF THE HEAD OF THE RECOMMENDING AUTHORITY

13.12.2003

SECRETARY
MINISTRY OF WATER RESOURCES

Staff Salary

SL. No	Position	Number of office staff	Salary in Tk/Month	Salary in Tk/Year	Remarks
1	SE	1	20000	290000	14.5 mm/y has been considered to cover the festival bonous and other allowances
2	XEN	8	17000	1972000	
3	SDE	18	15000	3915000	
4	AE	27	10000	3915000	
5	Technical staff	41	6500	3864250	
6	Support Staff	65	6000	5655000	
7	WL G.R	69	3500	3501750	
8	R F G.R	46	1500	1000500	
	Total(a)	275		24113500	
			Total(a) in Million Tk.	24.11	

Annual O & M Cost(In million Tk.)				
ITEM	Foreign	Local	Total	Remarks
1. Transportation Cost		2.00	2.00	
2. Communication Cost		4.00	4.00	
3. Vehicle Operation Cost		3.20	3.20	
4. Boat Operation Cost		0.50	0.50	
5. Repair & Maintenance Cost		24.80	24.80	
6. O&M cost for the manual gaugegs		0.29	0.29	
7. Light, fuel, water cost		1.00	1.00	
8. Consumables		0.50	0.50	
9. Advertisement		0.30	0.30	
10. Social expenses		0.30	0.30	
11. Social Welfare		0.20	0.20	
12. House & land rental		0.30	0.30	
13. Training cost		0.80	0.80	
14. Insurance		0.40	0.40	
15. Sundry		2.00	2.00	
Total (b)		40.59	40.59	
Total (a+b)		64.70	64.70	
Depreciation	Total (c)	135.50	135.50	Assessed by Study Team
Grand Total(a+b+c)		200.20	200.20	

The O&M expenditure as proposed in this O&M Plan will be arranged from the GOB's Annual Revenue Budget after the full implementation of the Project. During the project implementa period all additional O&M expenditure including additional staff salary and installation of all component of the project will be borne by the Project.

Signature

9/11/07

Project Director, FSIFFWS

Additional Staff Salary for Pilot Project					
SL. No	Position	Number of office staff	Salary in Tk/Month	Salary in Tk/Year	Remarks
1	SE	0	20000	0	14.5 mm/y has been considered to cover the festival bonous and other allowances
2	XEN	1	17000	246500	
3	SDE	3	15000	652500	
4	AE	4	10000	580000	
5	Technical staff	17	6500	1602250	
6	Support Staff	15	6000	1305000	
7	W L G.R	11-Existing	4000	0	
8	R F G.R	9-Existing	1500	0	
	Total(a)	40		4386250	
			Total(a) in Million Tk.	4.39	

Note: During the implementation of the project all additional O&M cost including additional staff salary will be borne by the Project.

Remarks:

1. At present NERFHD(Sylhet) only will be activated and all other area will be addressed from the present Central Flood Forecasting Warning Centre at Dhaka

2. Success and performance of the proposed pilot NERFHD at Sylhet will be evaluated. As per findings and experience of the Pilot project fine adjustments will be made in the Central and Regional Flood Hydrology Services to activate the system as a whole.

Signature

Project Director, FSIFFWS

ATTACHMENT-5

Comments of the JICA Study Team on the O&M Plan of the Project Submitted by the GOB

Comments on "Final O&M Plan of Proposed FFWS" Prepared by the GOB

The JICA Study Team received the "Final O&M Plan of Proposed FFWS" from GOB on December 15, 2003 through E-mail (see **Attachment-4**). Given hereunder are the comments/observations of the JICA Study Team thereto.

GOB/BWDB is requested to make necessary corrections on the Plan toward the effective implementation of the Project.

1. General

(1) The GOB/BWDB is highly appreciated on that it submitted the O&M plan on December 15, 2003 just on schedule agreed between both sides. The Study Team also realized the willingness to the implementation and the necessity of the Project from your prompt and sincere actions.

(2) Japanese side has comprehended that the existing telemeter system, which was installed in 1985 and 1996 through Japan's debt relief fund, has not been fully utilized because of insufficient funding and staffing for its operation and maintenance. Japanese side has been worried that if Bangladesh can utilize the Project sustainable and also has enough capabilities of utilizing it. Such circumstances lead Japanese side to have significant attention on this O&M Plan, and it will be a basis for evaluating the applicability of the Project.

(3) The Study Team has recognized that this O&M Plan has been worked out with full understanding on the Project. However, this still needs some correction / modification, and the Team believes that the Plan can still be brushed up even after the approval of MOWR. The most important issue is to declare its strong willingness to implement the Project with sufficient funding and manpower supports ensuring its sustainable operation so as not to repeat such improper situation as seen in the existing telemeter system. Unless otherwise BWDB presents its willingness on the O&M Plan to eliminate the worries of the Japanese Government, it may be difficult for the Japanese side to take up the implementation of the Project.

(4) The important issues are "Existing Telemeter System", "Regional Operation System", and "Cooperation with O&M Division and Other Agencies", which need some modifications and additions to this O&M Plan.

(5) The O&M Plan should be prepared with special attentions on, as a whole, 1) consistency through all statements, 2) presentation / explanation on what is the improvement from the present O&M, 3) what are the difference / modifications deviated from the O&M Plan proposed by the Study Team, and 4) regionalization is the "Must" to ensure effective operation of FFWS.

(6) Again, it should be fully understood that there are still some gaps between the ideas of the Study Team (Japanese side) and the Bangladesh side. When the GOB submits the official request on the financial and technical assistance for the implementation of the Project to the GOJ, the GOJ makes strict inspections on the O&M Plan.

2. Existing Telemeter System

As the causes of the ineffectiveness of the existing telemeter system for the flood forecasting operation, the GOB listed up three main items, namely, 1) fewness of the number, 2) inadequate alignment of observatories and 3) non-interlinking with the model.

The Study Team thinks that they are right. However, the Study Team could not find any sign of the GOB's self-searching although the planning, design and construction of the existing

system was made under the responsibility of the GOB. In other word, the responsibility seems to be not on the GOB but on some other parties in accordance with the description made in the Plan. The GOB should clarify what are the causes of above three points by the GOB itself in order to avoid the recurrence of such unexpected situations. Please mention the GOB's thought on this more in depth in the O&M Plan.

As for the conditions and/or problems of the existing telemeter system and the countermeasures, please make explanations on each of the following. Some comments on each item are given below by the Study Team for your reference.

(1) Present Conditions:

- Only 5 or 6 observatories are under operation.

(2) Causes:

- Floods or changes in river courses damaged observation instruments and it costs so much to repair them.
- The liability of the BTTB Communication Line connecting a central hub and relay stations is low.
- Equipment are old and spare parts are hard to find and costly, so that limited maintenance only can be provided.

(3) Countermeasures:

- Since the equipment are old and there are restrictions on performing maintenance, the operating observatories should be limited.
- BWDB is considering the effective use of existing system as far as possible.
- Those limited telemeter observatories should be utilized for evaluating the reliability / accuracy of manually observed data.

(4) Utilization of the Existing System in Collaboration with the Proposed One

- Existing system is less reliable. For securing the reliability of proposed system, existing system should not be integrated in the proposed system.

3. Regional Operation System

(1) The proposed system may not work effectively without enhancing the Regional Operation System. The Steering Committee also agreed the Regional Operation System, and the effectiveness of the installation of Regional Office, which includes both Hydrology and O&M divisions, was recognized in the meeting with the Secretary of the Ministry of Water Resources held on October 25, 2003. BWDB has started to take an action toward the implementation of the Regional Operation System. BWDB should consider this fact and progress sincerely and propose an excellent flood forecast and warning system for BWDB and the nation.

(2) The basic objective of our proposing Regional Operation System is to invigorate regional disaster prevention activities. In view of that, FFWS should be targeted to realize disaster management but not only for flood forecasting through hydrological analysis. A base for such activities needs some driving force to put regional sections together with them and lead them.

(3) BWDB's activities in terms of hydrology that have been separately conducted for such as River Morphology (RM), Surface Water Hydrology (SW) and Ground Water Hydrology (GW) should also be provided by the same base integrally from the viewpoint of effective services for regions. Therefore, **the Regional Office has at least to work as the Office of Hydrology** and should be an organization having the

function / ability to conduct extensive and comprehensive activities and lead them.

(4) The presented organization chart, which is at the stage of the completion of full scale project, does not show the regionalization of Hydrology but shows the regionalization of Flood Hydrology Circle (Flood Forecasting Sector) only. Furthermore, one division called "NERFHD" is just added under existing PFFC in the Pilot Project Stage. Considering that the Pilot project will be implemented on condition that the full scale project will follow, the organization in the Pilot project stage should also have high quality form to some degree. Based on the performance of the Pilot project, fine adjustment of the regionalization plan of remaining 4 regions will be undertaken.

4. Cooperation with O&M Division and Other Agencies

Since newly established Flood Hydrology Circle (FHC) seems like only the separation of flood forecasting function from existing PFFC, it is very much doubtful whether the FHC can have smooth and firm communication with O&M of BWDB and with other outside agencies or not. To erase such doubt, the GOB should mention how the FHC secure effective cooperation with O&M division and other agencies such as DMB, BMD, LGED etc. more concretely in its O&M Plan.

5. Measures for the Implementation of the Project

The JICA Study Team cordially appreciates the efforts made by the GOB for the execution of the O&M planning within the limited time available. However, the consideration of the GOB on the organization for the effective FFWS does not satisfy the Study Team. It means that the most serious bottleneck may not be solved if the Project proceeds forward without making any revision of this O&M Plan prepared by the GOB.

The Team fully understands that it is difficult for BWDB to make detached decision regarding the organizational aspects because BWDB is the one which is subject to be changed.

To make these efforts fruitful, an institutional study should be undertaken before or in conjunction with the implementation of the Project. The Draft Terms of Reference (TOR) of this institutional study prepared by the Study Team is given as **Attachment-1** of this volume. This kind of study has already been done by the Study Team, but is mainly focused on the effective operation of flood forecasting services due to the limitation of the Study period. The proposals issued both by the GOB and the Study Team can be examined in detail and adjusted through this institutional study from much wider viewpoint. Although the Water Management Improvement Plan (WMIP) Project funded by the World Bank (WB) is undergoing, the study on the organizational reform of BWDB is not within the scope of this WMIP according to the interview with the WB staff in charge.

The GOB may be highly appreciated if it thinks about this recommendation positively and makes official request to the WB or other foreign assistance agencies.