

Government of the People's Republic of Bangladesh
Bangladesh Water Development Board

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River Training Studies of the Brahmaputra River

Master Plan Report

FAR 1

Response to Comments

February 1994

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Sir William Halcrow & Partners Ltd.
in association with

Danish Hydraulic Institute
Engineering & Planning Consultants Ltd.
Design Innovations Group

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Government of the People's Republic of Bangladesh
Bangladesh Water Development Board

**River Training Studies of the
Brahmaputra River**



Master Plan Report

FAP-1

Response to Comments

February 1994

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Sir William Halcrow & Partners Ltd.
in association with

Danish Hydraulic Institute
Engineering & Planning Consultants Ltd.
Design Innovations Group



Mr Liaquat Hossain
Chief Engineer, Planning
Bangladesh Water Development Board
WAPDA Building
Motijheel C/A
Dhaka

07 March 1994

Our ref: API/BRT/622

Your ref

Dear Mr Hossain

RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER Master Plan Report - Response to Comments

I am pleased to enclose 5 copies of our response to the various comments received from BWDB, FPCO and WARPO on the BRTS Master Plan Report.

The attached document is a compilation of the responses to all the comments.

Yours sincerely

V R Baghirathan
Regional Director

cc: Mr M H Siddiqi, Chief Engineer, FPCO
Md Shahidullah Miah, Director, Planning (General), BWDB, Dhaka
Mr S A Rana, Head of Agriculture, World Bank RMB, Dhaka

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**GOVERNMENT OF PEOPLE'S REPUBLIC OF BANGLADESH
BANGLADESH WATER DEVELOPMENT BOARD**

**RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER
MASTER PLAN REPORT: RESPONSE TO COMMENTS**

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**RESPONSES TO FPCO'S COMMENTS OF 27 JULY 1993
ON THE MAIN REPORT**

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**Brahmaputra River Training Studies
Master Plan Report - Main Report**

Responses to FPCO's Comments of 27 July 1993

1. Page 5-7, Table 5.2

Comment

Are the average daily flow and the annual maximum daily flow mean of several years? Clarification would be useful.

Response

The average daily flow is the mean of daily flows over a period of years at the gauging stations. The annual maximum daily flow is the historic maximum daily flow at the gauging stations. The maxima recorded in Table 5.2 occurred as follows:

Teesta at Dalia:	1968
Dudhkumar at Pateswari:	1987
Dharla at Taluksimulabari:	1987

2. Page 5-10, Table 5.4

Comment

There are significant differences in 100 year flood levels estimated by FAP-1 and FAP-25, for example, more than 1 m at Noonkhawa and more than 0.5 m Kamarjani and Porabari. What is the reason? There should be consistency among FAP studies.

Response

The differences between the 100 year return period peak flood levels determined by FAP-1 and FAP-25 are due in part to the different periods of observations used, and may also be due in part to different approaches in data screening and distribution fitting. FAP-25's analysis was based on data for the period 1965-1989, whereas BRTS used data for the number of sample years shown in Table 5.4, in some case going back to the early 1960s. Full details are given in Appendix C to the BRTS Inception Report, May 1990.

The table shows that the FAP-25 preliminary estimate of the 100 year return period flood level in the Brahmaputra is not consistent with the 1988 peak flood levels, eg. the 100 year estimated flood level at Noonkhawa is 1.1 m higher than the 1988 peak water level observed at the gauging site, whereas at Porabari the estimated 100 year flood level is lower than the 1988 peak water level observed there.

3. Page 5-10, Table 5.4, Foot note 3.

Comment

The Flood Hydrology Study of FAP-25 was completed long time ago. How the estimate of 100 year water level made by FAP-25 can be preliminary?

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Response

Frequency analyses of flood levels were done by FAP-25 for all the stations shown in Table 5.4 at an early stage of the Flood Hydrology Study. However, in the final report of the Flood Hydrology Study, frequency analyses of only five Brahmaputra gauging sites (Chilmari, Bahadurabad, Kazipur, Sirajganj and Porabari) are presented.

4. Page 5-15, Line 7

Comment

What is the uncertainty in the flow duration curve? This can be assessed by specifying upper and lower confidence curves in Figure 5.17. This would also help in assessing the uncertainty in the estimate of dominant discharge in terms of confidence intervals.

Response

The uncertainty in the flow duration curve is directly related to the uncertainty involved in the estimation of Brahmaputra flow. Dominant discharge is a function of water and sediment flow in a river, and is more sensitive to water data than it is to sediment. In this case less reliance can be placed on the sediment data than on the water data, but the effect of sediment data quality is less significant. Three equations for sediment transport were used, giving the same result in each case (38,000 m³/s) as shown in Figure 5.16.

5. Page 5-15, Para 3

Comment

Are the bar topping discharges consistent with the analysis in the Flood Hydrology Study (Annex-2) of FAP-25? A discussion can be included.

Response

FAP-25 did not analyse bar topping discharges as part of the Flood Hydrology Study (see Annex 2 of the Flood Hydrology Study, February 1993)

6. Page 5-34, Table 5.7

Comment

The upper half of the table is for 4.0 m depth and the lower half is for 7.0 m depth. Is it not? The table should indicate this.

Response

The upper half of the table shows the 2D/BENDFLOW comparison for 4.0 m depth, and the lower half of the table shows it for 7.0 m depth. The table has been modified to show this more clearly and is presented below; d is the water depth in metres.

Table 5.7 Comparison between the 2-D model and the BENDFLOW model

Model	d	h_{min}	h_{max}	h_{max}/h_{mean}	v_{mean}	v_{max}	v_{max}/v_{mean}
2-D	4.0	1.46	8.09	2.02	1.53	1.94	1.26
BENDFLOW	4.0	1.79	7.15	1.79	1.51	2.01	1.33
2-D	7.0	1.47	15.07	2.17	2.03	2.53	1.25
BENDFLOW	7.0	3.12	12.51	1.79	2.00	2.61	1.31

7. Page 5-40, Para 3 Conclusion 3

Comment

What is the approximate time difference between immediate increase in water level due to the constriction and the reduced water due to the adjusted river bed in the long term? This is important for maintenance aspect.

Response

The severe constriction referred to here is the very hypothetical case of the width of the Jamuna being constricted to 5 km all the way from the Teesta outfall to Aricha. In this case the full development of the degraded bed profile will take a long time (in excess of 25 years) to reach Aricha. The full effect of the degraded bed profile on peak flood levels will thus not be felt at Aricha for a long time. However, the effect will be felt much earlier at the upstream end of the constriction. A systematic quantification of how this effect propagates downstream would require several model simulations depicting the arrival of the 1988 flood at various intervals after the construction of such a hypothetical scheme.

The smaller benefit which would accrue due to the scouring of the bed at the Jamuna Bridge constriction would be felt substantially after two normal flood years.

8. Page 7-2, Section 7.3

Comment

Inclusion of an example of the step by step procedure in the local bank erosion prediction would be helpful.

Response

Please refer to the example in Appendix B of the Main Report.

Step 1 The reach is Reach 3 and the upper table on page 7-8 applies.

The mean erosion rates are given in Table 5.1: see northings 765000-755000 and 755000 to 745000

Step 2 Examination of Plates 3, 4 and 5

Step 3 Refer to Figures B2, B3 and B4. Note the rapid increase in erosion from 1990 shown in Figure B4. At its most severe this equates to 600 m/year. Note the duration of extremely rapid erosion in Figure 7.3 for different probabilities. Similarly the likely duration of erosion rates shown on Figures B2 and B3 can be determined.

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Step 4 Consideration of the morphological features and their influence on the likely future behaviour of the reach in question is given in Section 3 of Appendix B, and discussion of possible outcomes is given in Section 4. These possible scenarios are illustrated in Figure B5.

9. Page 9-3, Line 8

Comment

It has been stated that the stabilisation of the main river bank alone will have no effect on the dominant discharge. The statement is to be supported by argument and analysis.

Response

The stabilisation of the main river banks (in their present positions) will change neither the water conveyance capacity nor the sediment transport capacity of the river as a whole. Thus there should not be any change in the hydraulic regime of the river. Consequently the dominant discharge and the frequency of inundation of the chars will not be affected.

Stabilisation of the banks would however reduce bank erosion and thereby influence planform changes and the shifting of thalwegs.

10. Page 14-5, Article 14-3.2, 2nd para, 3rd to 5th lines

Comment

"by their nature theyto an equal extent". This will not necessarily take place in case of very wide river specially if braided.

Response

Please see the next response below.

11. Page 14-6, 2nd para, 1st four lines

Comment

"It has been noted other bank to an equal extent:" It is happening in braided river?

Response

In any river channel, construction of groyne on one bank will normally result in erosion of the opposite bank to an extent equal to the stabilisation/accretion at the site of the groyne, unless a complementary set of groyne is provided across the channel. In a single channel river, this erosion will occur on the opposite bank; in a braided river, it will occur on the opposite side of the anabranch, i.e., in the Brahmaputra, the chars would begin to erode.

12. Page 14-8, Article 14.4.4, middle part, 6th to 8th lines

Comment

"The 2-D modelling has been usedof flow around chars" How reliable the result of such 2-D model? What about morphological aspects?

Response

The 2-D mathematical model has been developed to simulate the complex interchange between hydrodynamic (HD) flow conditions and sediment transport (ST) and derived morphological changes. The overall objectives are described in the detail in Chapter 4 of the "Working Paper on 2-D Modelling" (BRTS, December 1990). The model has been set up, calibrated, and verified against field data from two test areas before simulating selected key phenomena of importance for the BRTS Study. The calibration is described in Chapter 4 of Annex 3 Part 2 the First Interim Report (BRTS, April 1991). The verification phase is summarised in Part 9 of the BRTS Report on Model Studies (March 1993) which includes assessments of reliability in the different aspects of analysis in which the 2-D model was used.

13. Section 14.4.6, 2nd Para, last 3 lines

Comment

"In fact it is found that to the length of the window" Length of window should depend on velocity.

Response

Yes. The point is that the average velocity for a 200 day window (0.7 m/s for a 50% probability) is not very different to that for a 150 day window -0.6 m/s for a 50% probability -see Figure No. 14.1.

14. Page 14-11, Art. 14.5.2, Table 14.1

Comment

Design velocities (probability for exceedance of 100 year design event is 1% in project life time (30 years). How you use 1% not clear.

Response

Please refer to Appendix F of Annex 4 of the Master Plan Report.

15. Page 14-13, 3rd Para, 4th to 6th lines

Comment

It is necessary to have at least three layers of armour material instead of two layers as mentioned.

Response

Please refer to Section 8 of Appendix D of Annex 4. This explains that the layer thickness on the scoured slope need not exceed that on the slope above the setting level. In fact model testing has shown that a single layer of blocks after launching will prevent further scour. The thickness employed in the designs is equivalent to 2.3 layers.

16. Page 14-15, Art 14.6.2, 2nd Para, last sentence

Comment

"The quantity of armour materialwith a thickness of armoring in excess of two layers".

Better to mention at least 3 layers.

Response

All that is required to protect the geotextile is a single layer of appropriately sized blocks. As blocks below water will be dumped rather than placed, it is not possible to guarantee complete coverage using only a single layer. Allowing for a porosity of 40%, and bearing in mind the controls on distribution written into the specification, two layers are sufficient.

17. Page 15-1, Art. 15.1, 2nd Para, 3rd & 4th lines

Comment

"Thus a set back distance of 5 kmnot receive protection".

It is not justified & socially acceptable to have a 5 km set bank distance. Set back distance should be considered also along with bank protection as proposed by hard points in future.

Response

This is the point which is made. 20 percent of the benefit area would receive no protection were such a set-back distance to be adopted. Please see Chapter 7 of Annex 2 of the Master Plan Report for detailed discussion of optimal set-back distance.

18. Page 15-1, Para 3

Comment

What is the justification for a freeboard of 1.5 m? The selection of freeboard should be based upon uncertainties, safety factors and risk factors.

Response

A detailed analysis of windspeed data was taken in order to determine the significant wave height for armour sizing (see Annex 4, Appendix H). The maximum fetch normal to the bank (and hence to the BRE) is 3.35 miles, or, allowing for an angle of incidence of 45°, 5 miles.

The USBR "Design of Small Dams" gives the minimum freeboard (for dams) for a 5 mile fetch as 6 feet with rip-rap armouring, or 9 feet for a smooth upstream pavement. The surface of an embankment such as the BRE will be between the two, say 7.5 feet or 2.3m.

However, this is excessive for an embankment which seldom needs to be more than 5m high, and it may be reduced on account of the following:

- (i) The highest winds are predominantly from the north and west, i.e. normal to or opposing the maximum fetch.

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- (ii) The highest winds occur most frequently during the pre-monsoon season, i.e. before the river reaches its highest water level.
- (iii) Wave attenuation will occur over the shallow water distance by which the BRE is set back from the river bank.
- (iv) Any vegetation on the flood plain or embankment slope will further reduce wave action (see also Section 15.3.3, third paragraph).

For these reasons, the freeboard is reduced by one third, i.e. to 1.5m. This compares with the minimum freeboard permissible, which is 3 feet (0.91m).

19. Page 15-2, Top Para, 2nd to 4th lines

Comment

"The embankmentlack of clod breaking".

The embankment should be properly compacted and there should be proper clod breaking.

Response

Agreed. The paragraph in question indicates the type of poor workmanship which must be allowed for in the design. It does not commend that standard of workmanship.

20. Page 15-3, 1st Para

Comment

It is not necessary to go for geotextile filter layer for cross bar or any other embankment. Use of geotextile for river bank protection will be necessary in many cases specially below low water level.

Response

This sentence is to be read in conjunction with the preceding three paragraphs. Embankments designed to come into contact with wave action (as opposed to the shallow water waves referred to in the previous paragraph) must have a properly designed filter layer, and geotextiles are most suitable for this purpose. The primary cause of failure of most existing cross-bars is the migration under wave action of fine material from behind the brick mattressing.

21. Page 15-5, Art 15.8

Comment

Set back distance should be considered from future hard points along the river.

Response

The set-back distance is a measure of retirement, i.e. from the present (threatened) location of the BRE to its new (retired) location.

**RESPONSES TO WARPO'S COMMENTS OF
7 AUGUST 1993**

**Brahmaputra River Training Studies
Master Plan Report - Main Report**

Responses to WARPO's Comments of 7 August 1993

The above mentioned report is found to have been a very good one. Time given is too short to make any comments on this sort of voluminous report. However, here are few comments on the said report as mentioned below:

1. Article 12, Page 12-1 to 12-12

Comment

This chapter does not include the environmental impact on the left bank of the Brahmaputra for the river training works on the right bank. This requires to be studies because thousand of people on the opposite bank are involved in it.

Response

The emphasis of the Terms of Reference for BRTS is upon the long term strategy for the protection of the BRE, and the earliest measures proposed under the Master Plan are directed towards that end. The impact of the right bank works will inevitably be greater on the right bank than it will on the left, where the impact of the first few hard points will be minimal. However, the Initial Environmental Evaluation - Annex 4 of the Report - considers the wider picture, including the left bank (see especially Chapter 4). The important point is that a detailed Environmental Impact Assessment must be carried out at each stage in the implementation programme.

2. Article 13.8, Page 13-11, Recommendations, SI.3

Comment

Works as recommended here may be done by River Monitoring and Planning Unit to be established within the BWDB. Existing survey divisions of BWDB can assist.

Response

It is understood that this comment applies to item 2 in Section (Article) 13.8.

3. Article 14.2.2, Page 14-3, Design Life

Comment

Design life of the work has been set at 30 years and excess life has been put to the probability. Question is if the cost involved in the project and its design life would justify taking over of the project?

Response

The design life of 30 years corresponds to a 1 per cent risk level associated with the occurrence of a 100 year return period flood. As described in Appendix C of the Main Report, Table 1 gives the maximum velocities for a given exceedance probability for a 100 year return period event. For a project life of 30 years there is a probability of 26 per cent of the occurrence of a 100 year hydrological event. Thus for a risk of 1 per cent over the

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project life, the velocities in Table 1 for 8 per cent exceedance probability should be used (ie $0.08 \times 0.5 \times 0.26 = 1$ per cent). The factor of 0.5 is applied because the maximum velocity can occur only near one or other bank (or island).

As noted, proper maintenance should extend the useful life of the structures well beyond 30 years.

4. Article 14.3.1, Page 14-4, Active Channel Training

Comment

"The excavation of pilot cuts and the construction of temporary submerged sills to encourage a river to follow a particular course" is correctly stated to have little merit for the river like Brahmaputra. For this purpose a model could have been developed using the existing char land for economic solution of the problem.

Response

The second and third paragraphs of this section (article) describe the modelling of flow around a char. Further details are given in Part 13 of the BRTS Report on Model Studies.

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**RESPONSES TO COMMENTS BY THE SUPERINTENDING
ENGINEER, DESIGN CIRCLE, BWDB, DHAKA**

**Brahmaputra River Training Studies
Master Plan Report - Main Report**

**Responses to Comments by the Superintending Engineer, Design Circle, Northern Zone,
BWDB, Dhaka, forwarded on 1 September 1993**

1. Comment

The Master Plan is required to address possible alternative measures to river training works viz, embankment retirement or control of erosion or combination of both types of works for ensuring the BRE's satisfactory performance. The selection of the recommend alternatives are to be based on technical and economic analysis and social and environmental considerations.

Response

No response required.

2. Comment

The report is presented in a very comprehensive and orderly manner. It includes all necessary and improved techniques and methods in order to ensure the project stability the light of present hydrological and morphological conditions of the river.

Response

The comment is appreciated.

3. Comment

However, there would have been some provisions and suggestions in the reports regarding arrangement of funding to meet the tremendous recurring O&M cost of the project throughout the whole project life. Otherwise, it may be difficult for the Govt. of Bangladesh to meet up the O&M cost of the project. A total of 35 stations were selected for determining water level characteristics. Why all the level stations around the area installed by WDB were not considered? (page 5-7)

Response

- (a) The question of funding the O&M costs is a very important one. Some suggestions as to how this might be achieved are put forward in Chapter 11 of Annex 2 of this report.
- (b) The water level stations with long periods of continuous (or near-continuous) records were selected. The total of 35 stations whose data were used was considered to give adequate coverage without the necessity of introducing short term or discontinuous records and thereby possible inconsistency of approach.

4. Comment

As mentioned in the report, the validity of the equations given by JMBA has been checked against the data from the surveyed cross sections and found to be consistent. But no details of the process of checking have been furnished.... (page 5-32).

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Response

The JMBA equations are plotted against the observed data in Figures Nos. 5.35 and 5.36, and good correlation (despite the scatter) is obtained.

5. Comment

It will be more justified to minimise the loss arising from bank erosion and a study on the ways and means to minimise the loss could have been conducted and presented besides study on controlling of the river. (page 8-1). Or in other words, there should be some clear cut indications in the study report so as to educate the people for living with the possible hazards of bank erosion, floods etc. by keeping the loss at a level as minimum as possible.

Response

It is not clear what means of minimising the loss arising from bank erosion are envisaged in this comment. Issues of public awareness and involvement are addressed in Chapter 13 of the Main Report, and the wider implications of social issues are discussed in Annex 4 to this report, Sociological Considerations.

6. Comment

It has been rightly mentioned in the report that there prevails considerable vocal opposition among the elements of the professional community in Dhaka to the very concept of 'training' the Brahmaputra River.

The Report says that there has been a dearth of constructive proposals for alternative actions. As advocated in the Report that there can certainly be no questions of living with bank erosion. But it is opined that rather [than] jumping into such a gigantic investment, it is rather advisable to live with bank erosion and in order to give relief to the people losing their lands, the Government may rehabilitate them socio-economically in the accredited chars. (p-13-2).

Response

The problem is one of continuing net loss of land, as illustrated by the increasing water area 1973-92 in Figure No. 5.38. The prospects for reoccupation of char land are discussed in Chapter 3 of Annex 1 of this Report.

As is stated in the report, implementation of the river training works will be phased over a period of many years - 30 or more for the right bank works alone, commencing only with the most urgent (Sariakandi/ Mathurapara and Sirajganj). There is no question of "jumping into a gigantic investment". Further phases of the work will be implemented only slowly, and the consequences of erosion will be felt for many years yet in the remaining areas. In the meantime it is agreed that Government should take all possible measures to minimise the hardship experienced by those affected.

7. Comment

It is proposed in the Report (13-11) to appoint supporting Expatriate Consultants for a period of 2 years to develop the River Monitoring and Planning Units of BWDB. In this connection it is opined that against the cost involved in appointing Expatriate consultants, many professionals also working in BWDB can be trained in foreign countries to learn new

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techniques and develop ability to do the job by themselves. So appointment of foreign consultants may be avoided.

Response

Whilst training of BWDB staff in foreign countries is to be encouraged, it is not a substitute for "hands-on" experience gained on the actual works under the guidance of the designers and those closely involved in the construction, using the equipment purchased specifically for the purpose. A large part of the practical training will be in monitoring the river, and for this experience on the Brahmaputra is irreplaceable. The reader is referred to Annex 5 for further details.

8. Comment

Design life as proposed in the Report (page 14-3) has been fixed at 30 years which is too short. Considering huge expenditures, it is advisable to select as design life at 100 years.

Response

Please refer to the response to WARPO Comment 3.

9. Comment

Use of local resources has not been desirably emphasised in the Report (page 14-3)

Response

The requirements of the Terms of Reference in this respect have been reflected in the design. Beyond meeting these requirements, resourcing of the work, in accordance with the procedures for International Competitive Bidding, is the responsibility of the Contractor.

10. Comment

Doubt has been expressed about the availability of armouring materials from local resources/quarries. Extraction of hard rocks from Madhapara Hard Rock Quarry should have been emphasised in the Report before undertaking execution of the Project.

Response

Discussions concerning the supply of armour materials were held with suppliers. None expressed confidence that the required programme for supply of rock could be met from within Bangladesh. It is understood that production from Madhapara Rock Quarry will increase as time progresses, and it may become a suitable source in the future.

11. Comment

Local Labour forces may be economically employed for the execution of the Projects. But the Report did not mention how effectively those enormous forces can be utilised in the Projects.

Response

As noted above, the responsibility for provision of labour rests with the Contractor. The issue is discussed further in Annex 1 Chapter 9 and Annex 2 Chapter 10.

12. Comment

Dimensions of concrete Blocks are presented in the Report but no specifications were given in case of other armouring materials. (page 14-15)

Response

Please refer to Annex 4 Appendix G for sizing of the rock armour. A comparison of the dimensions of the three types of armour is given below.

Location	Armour Type & Size (mm)		
	c.c. block: brick agg.	c.c. block: stone agg.	rock (D50)
Linear revetments and downstream terminations	550	450	320
Upstream terminations	720	550	450
Noses of groynes	850	650	530

13. Comment

In the report it is mentioned that there is scope to establish the principles of O&M cost recovery from urban centres. It does not seem realistic to impose any taxes on the urban people who are mostly poor for the maintenance of the bank protection works. Even if some funds are realised, this amount will constitute a very negligible part of the O&M cost of the works. So, it is opined that foreign donors should be available to bear the recurring annual O&M costs. (p-22-1)

Response

The comment is an important one and it is noted. See also Response 3 (a) above.

14. Comment

Until financial commitments for execution of all works for all phases (Phase 1A, 1B, 1C works) are ensured beforehand by the willing foreign donor, Agencies, no single phase should go into implementation.

Contrary to the above suggestions, if works of any single phase need to be taken up, it should be clearly mentioned in the report so as to ascertain that there would be no adverse effect resulting from non-execution of the works of the remaining phases.

Response

- (a) This is not a practicable suggestion. There are certain works which are urgently required, namely the Phase 1A Works at Sariakandi/ Mathurapara and Sirajganj. If these were to be delayed until finance for all of Phase 1 were assured, the Brahmaputra would almost certainly break through into the Bangali with extremely serious consequences for the country, and a substantial part of the town of Sirajganj could well be lost.

- (b) The impact of Phase 1A was carefully considered before the decision to proceed was made, and a fundamental conclusion of the Initial Environmental Evaluation (Annex 3) is that the impact must be properly assessed before each new stage is commenced.

**RESPONSES TO FPCO'S COMMENTS OF 4 SEPTEMBER 1993
ON THE TECHNICAL ANNEXES**

**Brahmaputra River Training Studies
Master Plan Report**

**Responses to FPCO's Comments of 4 September 1993
Technical Annexes**

**Annex 1
Sociological Considerations**

General Comments

- A comprehensive and a well conceived document
- The Chapter under "Existing Situation" need include a section on operations of fishery department, Comparatives and Local Government institutions.

General Comment

P5-3, Section 5.6 para 1 and 2

This again proves that BWDB local level committee system is dysfunctional

Category - B:

1. P2-5, Section 2.4.5, para 2

Comment

Has the local drainage system is affected by BRE? If so, to what extent?

Response

Yes. This is discussed in Section 15.9 of the Main Report.

2. P5-2, Section 5.4, para 1

Comment

This contributes to the inflated land price.

Response

Noted.

Category - C:

3. P2-3, Section 2.2 para 5, last sentence

Comment

This observation is well taken. The communities in question if not integrated into the main stream of the permanent resident population one should not be surprised to see serious conflict arising between the two communities.

Response

Agreed.

4. P2-4, section 2.4.2

Comment

A short observation is needed on the effect of BRE on open water fisheries so as to make the discussion meaningful.

Response

Please refer to Section 3.7 of Annex 3.

5. P2-5, Section 2.4.5, para 1

Comment

What about the formation of Local Labour Association?

Response

There would be prospects for setting up groups such as for FCDI projects: Earthwork Maintenance Groups, for landless women heads of households, through NGOs or the BRDB, Landless Contracting Societies, through the BRDB, and Canal Maintenance Groups.

6. P3-1, Section 3.2

Comment

This section may also include the farming of wheat and maize.

Response

Wheat and maize crops are less popular now than they were in the 1970s after the introduction of HYV seeds; since the 1980s the area given over to wheat has decreased because farmers prefer HYV boró, which yields greater profits. Wheat accounts for about 8% of the total cultivated area on the char land, which is a rather lower proportion than on adjacent attached and set-back areas (13%).

7. P4-3, Section 4.4

Comment

A paragraph on health services, particularly the EPI, other preventive health care programmes and the family planning should help.

Response

Noted, although the intention of this chapter is to review the positive and negative impacts of the BRE, rather than the wider issues.

8. P B-7, Section 3.1.1

Comment

Is it possible to estimate socio-economic cost-effectiveness of BRE in statistical terms.

Response

This would be a major exercise beyond the scope of these studies, which take as their starting point the measures to protect the BRE.

9. Comment

In sum, having thoroughly read this report I strongly recommend that at least a half-day seminar be organised to deliberate the findings of this study and to which the BWDB, the Ministry, relevant FAP consultants and local MPs with some UP Chairmen are invited.

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Comments on FAP-1: Brahmaputra Right Embankment
Strengthening : River Training Studies of the
Brahmaputra River Master Plan Report
May, 1993

Quazi Shahabuddin (POE)
August 05, 1993.

The comments are confined to Technical Annex-2 on Economic Assessment of the Report. These are noted below:

- a) My main comment relates to the set of conversion factors used in economic analysis. These conversion factors were estimated by Planning Commission in the mid-1980's. In 1992, a special study was commissioned by FPCO to update these factors, which has subsequently been incorporated in the GPA(1992) for use in all FAP studies. It is surprising how this escaped the attention of the consultants conducting their study in 1993 while all other FAP studies have been using these updated set of factors for more than one year. The consultants should re-estimate the economic costs and benefits and economic rate of return of different project options using the updated set of conversion factors as incorporated in Annex-6 (Prices for Economic Analysis) of the GPA (1992). This is necessary to ensure consistency and comparability with other FAP studies.
- b) The sensitivity analyses carried out for priority locations (Table 6.1) remain incomplete as this is confined to increase and decrease of incremental benefits (20% and 40%) and project costs (10% and 20%) only. Other candidates that should qualify for sensitivity analysis, as mentioned in the GPA (1992), such as delays in achieving project benefits, delays in project implementation etc. has not been incorporated in the Report. Also, the consultants should attempt to

distinguish the impact of changes in capital costs from those costs need to be incurred for project operation and maintenance. This is true for different components of benefits as well.

- c) The Report suggests, while evaluating indirect economic benefits, that a factor of the order of 1.25 to 1.30 could be applied to the direct benefits of Serajgonj Town Protection works to reflect (these) indirect economic losses. While it is recognized that the indirect benefits could make an important contribution to economic development of the BRE project area, the basis of derivation of the factor (1.25 to 1.30) is not clear. If this factor is based on French macroeconomic study, then one should appreciate that this is based on preliminary analysis and more work is needed before one can take it seriously.
- d) Multi-criteria analysis, much in line with what is suggested in the GPA, incorporating all benefits and disbenefits (valued, quantified and qualitatively described) of proposed project intervention should be incorporated in the Report.

a:qsahab-2/wm/7.8.93

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**Responses to FPCO's Comments of 4 September 1993
Technical Annexes**

**Annex 2
Economic Assessment**

Paras (a) and (b)

The economic analysis of the BRTS priority locations was undertaken between October and December 1991, with some revisions being made in February/March 1992 in order to meet the IDA Pre-Appraisal Mission's timetable for selecting the sites for priority implementation under the River Bank Protection Project. This was, of course, prior to the completion of new FPCO Project guidelines (GPA, 1992). The analysis was submitted in the BRTS Second Interim Report in early 1992. The only further work performed on the priority locations subsequent to that (the selection of sites for priority implementation having been made in April 1992) was to update the revetment costs in accordance with the Engineer's Estimate of October 1992.

When considered in relation to the other variables in long term projections for river bank protection - changes in river morphology necessitating changes in design and location of structures, for instance - the relatively small differences between the two sets of economic conversion factors are not significant.

The effect of the revised conversion factors is to increase the economic cost of works at a particular location by less than 1 percent when expressed as a fraction of the financial cost. The works at Sirajganj will remain justifiable by a considerable margin in conventional economic terms, and the works at Sariakandi and Mathurapara are as much justified by the threat of a breakthrough by the Brahmaputra into the Bangali River as by the BRE breach scenarios presented in the Second Interim/ Master Plan Report analysis. The other priority locations will fail to satisfy conventional economic criteria by slightly greater margins.

Para (c)

In the estimation of the indirect benefits to the Sirajganj Town protection works, it was assumed that a factor of 1.25 to 1.3 could be applied to the direct benefits. This was based on the "French" macroeconomic study, and it is appreciated that this was only a preliminary analysis to provide an indication of the order of magnitude of indirect benefits.

Para (c)

The various components of multi-criteria analysis, eg. economic, sociological and environmental, were undertaken as part of BRTS. However, these components were not brought together in the multicriteria analysis format as outlined in the GPA, 1992. It is stated in the introduction to the GPA that the guidelines are for the assessment of flood control, drainage and, where appropriate, irrigation projects, and are directed towards the Regional Water Resources Planning Studies. The format is not necessarily appropriate for a river training works master plan on a major river, covering a timespan of 30 years or more, which may or may not be implemented more than in part. The time for analysis of the type suggested will be when individual components within the Master Plan come up for consideration. It should also be noted that the Master Plan works as a whole fail to satisfy conventional economic criteria by a substantial margin (see Section 8.6 of Annex 2) although the application of high thresholds (eg 12% EIRR) is not wholly appropriate for such a large public infrastructure programme, with considerable benefits not only for the

present inhabitants of the right bank of the Brahmaputra, but for future generations. Any decision on whether or not to proceed with implementation of the Plan beyond the first phase will depend upon other competing national priorities, rather than upon analysis of the Plan in isolation.

Kamal/28.7.93/Dhaka

River Training studies of the Brahmaputra River
Master Plan Report, May 1993
Technical Annex 3
Initial Environmental Evaluation

The report had the potential of being a good document, had it been a little more coherent and consistent.

Introduction, Project Description and the Master Plan Strategies could have chronologically followed before The Environment, Initial Environmental Evaluation and Monitoring and Action Plan. Brief History of the Brahmaputra river (3.3.1) could be a part of project description.

Rational for the project is very good in contents and presentation. Environmental Assessment methodology used has been referred to the EIA guideline of May 1992. I am not sure if October 1992 version were available with the consultants. 1.4.1 last two lines (P 1-15) that the IEE has been carried with modification in line with the EIA on the priority works. Unfortunately the EIA of the priority work was not a well carried out work and was accordingly intimated.

Clear delineation of the Master plan and priority sites identified and priority works under taken should have been clearly described under project location. No indication of time scale of implementation of the Master Plan could be visualized (mentioned indecades). Time is an essential element in this work.

It is heartening to note the sophisticated numerical modelling techniques have been used in support of satellite image interpretation and physical modelling to evaluating the effectiveness. Most of the works about the river characteristics

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are centred around morphological aspect and FAP 21/22 also contributed towards enhancing knowledge in this respect. Considering the long term objective being the stabilization of the full length of the right bank of the river, the very important and pressing Geotechnical investigation appears lacking (P 2-7) and is a matter of concern to representative evaluation report.

For the benefit of the consultant the following information, reports may be taken with serious attention:

1. "Seismic Zoning map of Bangladesh and outline of a code of Earthquake Resistant Design of Structure 1979". Contain data on earthquake occurrence in Bangladesh and neighbourhood from 1833-1971.
2. The catalogue of Indian society of Earthquake Technology - 1983 contain data from historical period upto 1979, 1979-1990 data can be obtained from yearly bulletin of Indian Society of Earthquake Technology.
3. "Probabilities Earthquake Expectancy in the North-East Indian Region" has identified 6 tectonic blocks in the area". Goswami & Sarmah (1982).
4. "Siesmicity and Seismic Intensity for the Region North of the confluence of Jamuna and Ganges River, Bangladesh (1985)" Bolt, B.A.
5. "Site specific study of Seismic Intensity and ground motion parameter for proposed Jamuna river Bridge, Bangladesh (1987) has identified (No 4&5) 4 zones each capable of producing damaging earthquakes of which one located inside Bangladesh. Bolt has identified a Bogra fault.

02

6. Hossain, A.M. and Chowdhury J.R. (1992) have critically reviewed the papers of Goswami and Bolt in "Tectonics and earthquake occurrences in Bangladesh".

7. "Ground motion and soil liquefaction during Earthquake" - H. B. Seed and I.M. Idriss (1982).

8. "Seismic Risk Maps in the World" - S.Hattori (1979).

Earthquake data in modelling the seismic behavior of a region, information of geology, tectonics, fault parameters etc are important and essential. These elements enable a seismologist to identify main structure and tectonic block of a region and determining expectancy of earthquake occurrence using recurrence rates determined from Gumbel's theory of extreme events.

These are now expressed in two ways.

i) earthquake magnitude (Richter Scale) = M

ii) Body wave magnitude scale = M_b .

From the Epicentres Seismic Map of Bangladesh and Neighbourhood one of the 4 epicentres is very near the stretch under study which ranges from $7.0 < Mag \leq 7.4$ to $5.5 < Mag \leq 5.9$ based on 200, 100 and 50 years return period.

Ground Surface Acceleration contour (in $10^{-3}g$) in 50 years return period passes very near parallel to Jamuna and Jamuna-Ganges flow upto Meghna confluence.

100 year R.I. pass parallel to upper half of Jamuna and cut across mid point of the river. 200 years R.I. cross the river at the upper and lower limit of the project boundary.

Actual case history:

Great Assam Earthquake 12/6/1897 (Oldham Intensity Scale) 1st Isoseit cut across the river lower mid ways and epicentre about 50 KM north of Mymensingh Border. (Ref: Geological Survey of India Memoirs, Vol No. XXIX, Map 1 Bihar - Nepal Earthquake 15/1/1924 (Mag 8.3).

Mercelli intensity scale VI Isoseismal passes very near parallel to upper half of Jamuna. (ref: Geological Survey of India Memoirs, Vol No.73 P 1 No 2

Srimangal Earthquake (8/7/1918)

(Mag 7.6)

Oldham Intensity scale

(Ref: Geological survey of India Memoirs, Vol No XLVI-PL No 11)

The above informations if already consultantated may be disregarded but I have not got any impression to that effect.

P 3.4 (4th para, last 3 lines) "The fact that the river passed through the meandering stage and entered the braiding mode, where it has remained since is a strong indication, though not conclusive, that it is now in its preferred state".

P 4.1 (sec 4.2 - 1st para last 3 lines) "There is strong circumstantial and deterministic evidence that this progression is not yet complete and that in the absence of intervention the degree of braiding is likely to become more intense, particularly south of Sirajganj".

Do these lines contradict each other?

Environmental Evaluation: Evaluation and Assessment Method under Annex A has been a good tretise. Grouping and sub-grouping

could be a useful tool. But the matrix Evaluation for the present situation compared to the original flood plain (table 5.1) (P 5-4 2nd para) was not clear to me. What it really wanted to portray ? Table A.1 what the conversion values mean in relation to this report and understanding of the Table 5.1 (P 5-1 1st few paras).

At IEE level qualitative assessment, if carried out professionally and honestly should be good enough. Aa has rightly been pointed out that details could be worked out at each project level initiatives (EIA) P 6.6 section 6.7 but certainly the works should not be as scanty as was the case in the priority level work EIA, already commented upon.

P 5-7 Section 5.4.3 - 4th para and the following paras. The statements are rather loose. Most likely the works will be carried out during dry months and Hydraulic fill work will have considerable effect on fisheries (whatever is the present status)

P 5-8 Sec 5.4.5 Resettlement issue needs much more attention even at IEE level. Some suggestions could be tabled even in absence of political policy. P 5-10 Sec 5.4.8 - "Present fishery is probably only in existence through recruitment within the left bank flood plain" is an extremely serious situation, but may not necessarily be a true picture. The breeches and retirement of the right embankment over the years must have contributed to the total stock and the provisions of fish entry to and from river and flood plain in the new initiatives under FAP shall compensate to a great extent.

P. 5-10 Section 5.5 last para - not "some" but "huge" impact on the environment.

a:kamal-4/wm/7.8.93

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**Responses to FPCO's Comments of 4 September 1993
Technical Annexes**

**Annex 3
Initial Environmental Evaluation**

Comments Reference

1. Page 1, para 3

The modification to the Priority Works Environmental Impact Assessment (EIA) in respect of multi-criteria analysis is explained in Section 1.4.1 of the IEE. The comment concerning the EIA is not accepted.

2. Page 1, para 4

This technical annex appears to have been read in isolation from the rest of the report. For the purposes of economic assessment, a programme of 30 years duration was assumed for stabilization of the right bank; please see the Main Report, Chapter 21, and Annex 2, Chapter 8. Exact time limits cannot be placed upon the subsequent stages of development listed in Section 4.5 of the annex under review.

3. Page 1, para 5

Again, this annex appears to have been read in isolation. Geotechnical considerations are presented in Section 14.4.2 of the Main Report, Chapter 3 of Annex 4, and, in greater detail, in the BRTS Draft Final Report of January 1993.

4. Page 2, para 2 et seq.

The earthquake data given in the comments are appreciated. Earthquake studies and analyses have, however, been undertaken as part of the River Training Studies, and the conclusions are set out in Annex 4, Chapter 3 and Appendices B and I. The design earthquake is magnitude 7.

5. Page 4 (references to Annex 3 pp 3.4 and 4.1)

There is no contradiction between these two references. The indications are that the river is now in its preferred state, i.e. the braiding mode; the change from meandering to braiding does lend weight to this concept. Within that mode, however, there is strong evidence that the degree of braiding is likely to become more intense. It is also possible that the upstream supply of sediment will influence the braiding character of the river, and as the only change likely is increase in sediment supply, this would lead to a further increase in braiding rather than the reverse.

6. Page 4, last para

In Table 5.1 to 5.3, the Group (A) and Group (B) criteria, as defined in Appendix A, are used as tools to compare the existing situation - the "no change" strategy, Option 1 in Section 4.4 - with the pre-BRE situation, in Table 5.1, with the planned retirement/ no hard-point strategy, Option 2, in Table 5.2 and the hard-point/ stabilization strategies, Options 3 and 4, in Table 5.3. Option 2 (as reported in Section 5.8) shows a largely neutral strategy with some benefits; Options 3 and 4 show improved benefits on Option 2, through with some negative construction impacts which can largely be mitigated by careful planning and enforcement of contractual requirements.

7. Page 5 (reference to Section 5.4.3)

The comment about dry season dredging is reflected in the first paragraph of Section 5.4.3.

8. Page 5 (reference to Section 5.4.5)

It is agreed that resettlement is a major issue, which affects not only those displaced by construction, but those who will lose their land as a result of future erosion, and those already squatting (illegally) on the BRE. Security of tenure and gainful employment are two of the most of the most frequently expressed wishes of displaced persons.

The provision of a berm on the BRE, where those who have lost their land would be allowed to resettle and grow certain specified crops in exchange for undertaking maintenance has been suggested, although the proposed pilot project for this has not met with government approval. This possibility is, however, discussed further in Chapter 6 of Annex 1 of the Master Plan Report.

8. Page 5, last para

Quantification of the longer term impacts can only be subjective at this point in time, hence the need for a detailed EIA at every stage.

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**Responses to FPCO's Comments of 4 September 1993
Technical Annexes**

**Annex 4
Design and Construction**

A: General: There are no major adverse comments

B: Detail Comments

1. Page 3.4 para 2

Comment

There is a possibility of quarried rock from Ranipukur in Bangladesh

This may be mentioned in this para

Response

Please see the response to Comment No. 10 by the Superintending Engineer, Design Circle, Northern Zone, BWDB, Dhaka.

2. Page 3-22, last para

Comment

It is proposed to (randomly?) dump blocks (armouring) below LWL + 2m to form the equivalent of two layers.

Question is whether this is adequate. The blocks being large in size there may be voids. How these will protect the proposed geotextiles underneath. Even there is a possibility of being punctured while dumping. The consultant should explain this properly.

Response

Inevitably there will be voids in a dumped armouring system of concrete cubes. In the design, a porosity of 40% has been assumed, thus the two layer thickness will provide a coverage equivalent to 1.2D compared to 1.0D above Low Water Level +2m. Provided that the blocks are sized adequately and placed in accordance with the specification, the geotextile will be adequately protected against the design condition.

The geotextile itself is covered with a protective broken brick layer prior to sinking as a fascine mattress.

3. Page 5-5, para 3

Comment

It is proposed to complete the Sirajganj protective works in two seasons.

Works completed partly in one year is likely to be damaged during the following monsoon. Therefore, it has to be decided carefully whether the works should be completed in one year or in two years.

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Response

The scale of the works is such that construction in a single dry season would pose formidable difficulties in the mobilization of equipment and working on land, with consequent increases in cost. Provision for protection of the Works at the end of the first dry season is made in the Tender Documents.

4. Page 5-6, last but one para

Comment

It is said that jute does not have filter properties.

This may not be correct. Main problem of jute is its short longevity.

Response

Jute does not have the requisite filter properties for this situation, nor does it have the longevity.

5. Page 7-3, para 4

Comment

It is state that there is a provision in the contract for liquidated damages.

The said clause of the contract documents has to be examined properly.

Response

The relevant clause in Clause 47 in the General Conditions of Contract for Works of Civil Engineering Construction, Fourth Edition, published by the Federation Internationale des Ingenieurs-Conseils, and included in the World Bank's Sample Bidding Documents for the Procurement of Works by International Competitive Bidding.

6. Page 7-3, last two paras

Comment

It is to be clearly stated that the contractor should be fully responsible for all the works until the work completely finished even if it is carried over to two or more working seasons with gaps between those.

This should be also be incorporated in the contract documents.

Response

It is. Clause 20, Sub-Clause 20.1 (FIDIC 4) makes the Contractor fully responsible for the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the Whole of the Works.

7. Page 7-5, para 1

Comment

It is stated that the statutory standards of navigation should be made available by the BWDB to the contractor. Whether BWDB can take this delicate responsibility?

Otherwise, the clause has to be modified, so that the contractor may take this responsibility.

Response

Although the contractual responsibility lies with BWDB as a party to the Contract, the work of maintaining the channels to the published Least Available Depth is undertaken by BWTA.

8. Page 7-5, para 2

Comment

BWDB should review carefully about the responsibility of resettlement and the squatters problems.

Response

As recorded elsewhere, resettlement of squatters is an important issue. The resettlement of those affected by the Priority Works construction (i.e. Sariakandi, Mathurapara and Sirajganj) is addressed in the Draft Resettlement Plans issued in December 1992 (revised June 1993). These were reviewed at an Inter-Ministerial Meeting at MIWDFC on 26 May 1993, attended by BWDB. Decisions necessary to the furtherance of the Plans were taken, and a matrix of categories and entitlements of Project Affected Persons was drawn up.

