VOLUME : 15

6.482 Category 1 : Comments

The elaboration on "the Navigation" has been made and at page N6-2, Table 6.2 a cost comparison given. The comparison shows that the local cost transport Tk/Maund/Km by boat is lower.

But to take up specific improvement programme the study may include the detail economic and financial analysis not a separate comparison like transportation cost.

The study may include the cost effect of Bank Protection, River Training and Dredging to improve the Navigability and establishment of Transit port.

Noted.

APPENDIX 1

General Note on the Green River Proposal

The Green River concept continues to have its limitations, which must be resolved before it can be considered a practical proposition. The Consultants do not appear to have taken full account of the reservations raised earlier. In the meantime other questions have arisen. Figure 10.2, Volume 9 shows that the proposed interventions have practically no effect over the lowest 80km of the Atrai. This is not surprising since (high) water levels are determined by outfall levels in the Jamuna. The proposed measures are effective mainly between Jotebazar and Singra. Therefore only over this reach would interventions be really effective, apart from any retention in the upstream parts of the catchment. Clearly the reason to intervene, is that the existing system is not effective because of natural or manmade breaches. One solution would be to strengthen the embankments and provide adequate structures. However this option has not been examined seriously either from a technical viewpoint or by systematic public consultation. Clearly further work is necessary.

The Green River proposal raises problems with planning and management of flood plain utilization. Although the roughness coefficient has been taken appreciably higher than that of the river channel, in reality the main function of the off river channel part of the section will probably be to store part of the flood wave. The attenuating effect will only be small. Another alternative that the study should consider is to retire the embankment over sufficient distance to lower the peak of the flood, as desired. This would leave part of the presently protected area unprotected, which could well meet with opposition. But the width of the unprotected strip may be much narrower than that for the Green River. It may be possible to build lower, submersible embankments closer to the river, but there should not be any impediment to the flow across the un- or lightly protected part of the flood plain.

An in-depth examination and evaluation should be made of the above alternatives and possibly others in the light of further hydrological and modelling studies, and systematic public consultations.

The Green River concept will not dramatically effect peak water levels along the Atrai, particularly in the lower reaches of the Atrai where the levels are dominated by backwater effects from the Jamuna. The benefits of the Green River concept come from partial protection of land between the river and the CFD embankments, which are set some 5-10 kilometres away from the river. The partial protection is designed to ensure that the pre- and early-monsoon crops can be harvested without damage, except for the exceptionally high flood events. Following this period, the partial protection is designed to be over-topped thereby allowing flood storage and flow over a large area which has sufficient conveyance capacity to mitigate the adverse effects of confinement of the river course which would result from full CFD embankments adjacent to the river.

The comments in paragraph 2 appear to conflict with those in the first paragraph. It has already been noted that peak water levels in the lower 80km reach of the Atrai cannot be reduced due to the dominant backwater effects from the Jamuna. Further retirement of the CFD embankments would therefore not influence these levels (as suggested). There also appears to be some confusion about the 'green river' concept. The FAP 2 concept is to include partial protection close to the river course, setback 100-200m, whereas the CFD embankments (designed only to overtop for severe floods (1 in 20 year) define the limit of the 'green river' with setbacks in the order of 5-10km.

The alignment of the CFD embankments in the Green River concept were selected based on the present infrastructure such as existing embankments and minor roads and highways. Construction costs are therefore kept to a minimum to give a cost effective solution to the problem. Alternative alignments should be addressed during the next phase of the study, FAP 2.2.

The MIKE11 model used for the hydraulic studies is a dynamic model which takes account of storage and attenuation of flood peaks. The roughness coefficients for the active floodplains was taken as 20 times that of the river courses to reflect the relative conveyance capacities between the river and the floodplains. Further restrictions to the floodplain flow, using restricted opening structures perpendicular to the main flow paths, were also included to represent obstacles such as roads and embankments.

The suggestion that full CFD in the Lower Atrai has not been examined seriously is strongly disputed as this was covered extensively during the Interim Planning phase and is reported in the Interim Report. Full CFD in the Lower Atrai has been shown to fail time after time due to public cuts, poor construction and social inequality. Three locations in particular show clearly the type of problems which are encountered throughout the Lower Atrai , the west embankment of Polder D, the Khorshuti regulator on the River Nagor, and the west embankment of SIRDP. It is inconceivable that, for the time being, any solution can be found for these locations which involves "strengthening the embankments and providing adequate structures" since (as stated by the Chalan Beel study and agreed by us) the problems are not engineering, but social. Presumably no-one would recommend a solution which would require permanent guarding of the embankment.There are numerous other locations where cuts occur: the Chalan Beel study itemised over 100 in the Chalan Beel polders. On this basis we rejected the concept of full protection in the Lower Atrai. Raising river levels by 2-3 metres (as is the case for full confinement) is not a realistic proposition.

The major drains were also investigated at the time of the Interim Report. These were found to be expensive, to have benefits not commensurate with the costs,and to have uncertain environmental and institutional impacts. It was therefore recommended that they should not be studied further: this recommendation is a sound one, and is widely supported.

If full FCD and FCD with the major drains is not feasible, then a solution along the lines of the Green River is inevitable. The consultants acknowledge the difficulty of the concept and the need to look at options. That is why a sub-regional study has been recommended. However the consultants strongly reject the implication that they were inadequate in their approach to analysis (either in relation to modelling or to drainage analysis). In regard to investigation of options, the FAP2 team investigated as many as they could. If a "thorough investigation of an option" involves a 25-yr model run (the consultants agree that it does), it should be noted that it takes in the order of three weeks for each investigation with currently available 486 technology (about a week each for set-up, model run, and analysis). In the time since the Interim Report, only a limited number of investigations have therefore been possible, since the sub-regional model had first to be constructed and calibrated.

It is probably generally agreed that there should be a sub-regional study of the Lower Atrai. The consultants made this recommendation and support it. However they would also strongly recommend that the scope of the study is based on the Green River concept, so that time and money is not wasted on infeasible options of full protection or the major drains. They also support the idea of systematic consultation (though they would reject any accompanying implication that no consultation was carried out during the FAP2 study). Experience from this and other FAP studies would suggest that considerable resources will also need to be allocated to this.

APPENDIX 2

Estimation of Agricultural Benefits

1. Flood Tolerance Criteria

The comment is made (6.328) that the consultants did not discuss their approach to flood tolerance criteria. This is not true. The attached correspondence shows that discussion did take place: the correspondence shows that there was, at the very least, knowledge and some degree of acquiescence by the Panel of Experts in the approach that the consultants were at that time developing.

2. Approach Actually Followed.

Notwithstanding this, the consultants were themselves concerned about the appropriateness of an approach which relied very heavily on the hydrodynamic model and very precise flood-tolerance criteria. Internal discussions continued within the consultants' team throughout the middle part of 1992. Finally, there was a further meeting with the two agriculturalists from the Panel of Experts on September 23, 1992, five weeks before the draft final report was submitted. Although no notes were taken at this meeting, it became clear that the whole approach to assessing agricultural benefits needed rethinking. This was accordingly done, at considerable effort, in time for the Draft Final Report, and the approach finally used was the modified MPO approach, which is discussed at several points in the Draft Final Report (Volume 5, Gaibandha Main Report, Volume 12, Agriculture and Volume 13, Economics).

It is regretted that time did not permit the complete re-writing of the reports to make it clearer which approach was actually being followed. Nevertheless the cropping patterns derived from the MPO approach were quoted in the Gaibandha Main Report (Appendix B), and the analysis was actually based on them. The Final Report uses these alone, and the results of the analysis are the same.

We are confident that the approach finally used by us makes the best possible use of the MPO approach and additional data coming available from modelling. We hold our analysis to be correct within the normal levels of accuracy which one would expect from this type of planning (pre-feasibility level for the regional plan, feasibility level for Gaibandha).

We also believe that efforts should continue to develop approaches which combine hydrodynamic modelling results with cropping patterns based on flood tolerance criteria.

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70137/2/L

5 March 1992

Mr. M. H.Siddiqui
Chief Engineer,
Flood Plan Co-ordination Organisation,
7, Green Road,
Dhaka 1215

Dear Mr. Siddiqui

North West Regional Study (FAP2)
Classification for Water Levels for Planning

You may recall that comments were made at the time of the Interim Report concerning the classification of water levels for planning purposes (p19 of the document "Interim Report - Comments and Responses").

In this regard, members of our team have made further study and had discussions on the matter with various people. I attach notes on a meeting with Mr. Brammer of the Panel of Experts. From this you will see that it appears to us to be sensible to retain the classification we used for the interim regional planning (with minor modifications). We suggest that it should be referred to as WL in order to distinguish clearly from the F classification used by MPO and other existing organisations.

I hope this meets with your approval. If you wish to discuss it further, please contact me.

Yours sincerely,

T.R.Franks
Team Leader

North West Regional Study (FAP2)
Classification for Water Levels for Planning

A meeting was held on the 3rd February with Mr Hugh Brammer. The meeting was attended from FAP2 by Messrs Chisholm, Haider and Seager. Minutes of the meeting, and conclusions, are recorded below.

1. The discussion started with a consideration of the rationale, and origin, of the water levels ("F" values as they have been called until now) that are used. It was noted that slightly different figures have been used by different organisations, for varying purposes. Mr Brammer explained the origin of the "F" numbers: they were devised to indicate conditions obtaining for most of the year on any given part of the landscape; not just in one season. For devising cropping patterns water levels at different, closely defined times of the year, i.e. the life of the particular crop, are needed. The water levels used by FAP2 have been devised with this principle in view. Mr Brammer has found them acceptable. He also agreed that another class be added, to help identify land where sugarcane is now grown on soils is deemed too light by the farmers for economic irrigation of boro rice, because of the high field losses. The classes to be used in analysing 10-day water depth data will therefore be: 0-30cm; 30-70cm; 70-100cm; 100-150cm; 150-300cm; and over 300cm. We were cautioned that to avoid confusion, we should not designate these levels with the letter "F". We therefore suggest to rename them WL, for water levels. Thus henceforth the nomenclature for flood depth classes suitable for various kinds of rice and sugarcane at the growth stages specified in paragraphs 2-4 below will be:

WL0: 0- 30 cm	WL1: 30- 70 cm
WL2: 70-100 cm	WL3: 100-150 cm
WL4: 150-300 cm	WL5: >300cm

2. The FAP2 staff explained the rationale of these numbers as follows:

(i) WL1 is the highest water level that HYV rice can tolerate without significant loss of yield but only when fully grown.

(ii) WL2 is the same for local fixed-height varieties of rice.

(iii) WL4 is the maximum depth where deep-water rice, broadcast or transplanted (para 4) is likely to be an economically attractive crop.

(iv) The rationale for WL3 is the level that sugarcane can tolerate after June/2. However, it must be made clear that the yield is unlikely to exceed more than about 25t/ha and that the farmer grows it because he cannot think of anything better.

3. Transplanted floating rice (tr fl r) will henceforth be called transplanted deep-water aman or TDW aman. B aman will remain to denote broadcast deep-water rice.

4. TDW aman can be grown on land that is WL0 till the end of July/2 and no more than WL4 at any time [para 2 (iii)].

5. Planning criteria for future-with-project cropping patterns were discussed. While it appeared that, on the whole, farmers plant an area that is likely to give its full yield four years out of five, some have to be satisfied with two years out of three or even less. It was therefore decided that the work we plan to do, and is described fully in other documents, will be pursued. We are in the process of calculating cropping patterns for as many years for which we can get data. It will be assumed that

the farmer knew at the beginning of the season what the flood levels will be and planted accordingly, assuming present conditions and incentives. The percentage of each crop will be separately plotted over the last 25 years (or the number of years for which water level data can be made available). The percentage of the area planted to that crop, as derived from our survey results, will be drawn across the curve as a straight line. We will note the number of years the farmer could have grown more, or less, than he did. This historic decision will be considered when determining the area of the crop under consideration in the cropping patterns designed for project conditions.

6. The groundwater development situation, and prospects for its eventual extent, were discussed. The fact that the rate of development will eventually flatten was recognised as inevitable, but it appears from our surveys that in our project areas this is not yet the case. It was agreed that for planning purposes it can be accepted that the ultimate irrigation development will be about 80% of the area where the soils are suitable, i.e. where field losses do not make irrigation unacceptably expensive. For such areas of highly permeable soils, should they prove extensive, irrigating crops other than boro rice, most probably HYV wheat, should be considered as a planning criterion.

7. Mr Brammer informed us that non-irrigated transplanted aus, local or HYV, may well be a significant portion of the aus area on currently non-irrigated land in some places in the region. He does not expect the crop to be grown as an alternative to boro, i.e. if irrigation is deemed feasible because of soil conditions, and becomes available. It was decided that this issue will be further investigated.

(1) 1 → 70137/2/L

1 → Master In FPCO

26February1992

Mr T.R. Franks,
Team Leader,
FAP2

Dear Tom ,

Re. your letter 70137/2L of 11 February on water levels, I have one major and one minor amendment to suggest to Andrew Seager's discussion note.

In his para. 1, it needs to be clarified that the WL classes relate to specific crops at specific growth stages, as detailed in his paras 2-4. The WL classes are used in analysing 10-day water-depth data to identify cut-off limits for growing individual crops. Paragraph 1 could be modified as follows:-

a) Omit 4th sentence 'Therefore ... patterns'. (The F classes are, in fact, used for determining cropping patterns).

b) In the 9th sentence ('The classes ... 300cm'), after 'to be used' add 'in analysing 10-day water-depth data'.

c) In the last sentence ('Thus ... will be'), after 'nomenclature' add 'for flood-depth classes suitable for various kinds of rice and sugarcane at the growth stages specified in paragraphs 2-4 below'.

d) On the last line, change 'WL5:300cm<' to 'WL5:>300cm'.

Also, in para. 4, line 2, change 'para 2(c)' to 'para 2(iii)'.

Yours sincerely,

Hugh

H. Brammer

APPENDIX 3

Upper Karatoya/Bangali Basin

1. Introduction

For preparation of Northwest Regional Plan for flood control and drainage, the region has been divided into fifteen sub-regions in consideration of the hydrological and hydraulic characteristics and they are called planning units from the planning standpoint. Locations of the planning units are shown in Figure 1.

Among those planning units, planning unit 6/Upper Karatoya, planning unit 7/Gaibanda Area, planning unit 8/Middle Bangali, planning unit 14/Lower Bangali are closely related.

The Karatoya river, the main river in the planning unit 6/Upper Karatoya basin, flows down from the north-west to the south-east and flows into the planning unit 8/Middle Bangali basin as the Kathakali river. The Ghagot river, the main river in the planning unit 7/Gaibandha flews down from the north-west to the south-east and diverges to the Ghagot floodway and the Alai river in the Middle Bangali basin. The Alai river flows down from the north-est to the south-west and soon joins the Kathakali river and the river becomes the Bangali river. The Bangali river flows down from the north to the south in the Middle Bangali basin and flows into the planning unit 14/Lower Bangali basin. The Bangali river flows down from the north to the south and finally joins the Hurasagar river.

Development options and scenarios have been discussed and proposed for each planning unit in the Final Report. This paper has been prepared to briefly discuss development scenarios of the Middle Bangali basin in consideration of inter-relationship of flood control and drainage of these planning units related to the Karatoya-Bangali river system.

2. Present Situation

Planning Unit 6, Upper Karatoya

Planning unit 6, Upper Karatoya basin is bounded by the railway on the west, the Ghagot river on the east and north. The major rivers in the Upper Karatoya basin are the Karatoya, Jamuneswari and Chikli. The Jamuneswari and Chikli are tributaries of the Karatoya. The flooding and drainage problems in the basin are spillage of flood water from the Karatoya.

Hydrological analysis based on NAM model results and a review of available cropping statistics indicates that the lower reaches of the Upper Karatoya are the most seriously affected by flooding of all the internal rivers in the upper reaches of the region. This analysis is discussed in detail in Regional Plan Engineering, Volume 3 of the Draft Final Report. Flooding in this location is a regular occurrence:it was again serious in 1991 when a cut was made at the offtake of the old Karatoya, which flows past Bogra, in order to relieve flooding on the left bank of the Upper Karatoya.

Planning Unit 7, Gaibandha Area

Planning unit 7, Gaibandha area is bounded by the Teesta on the north, the Brahmaputra on the east, and the Ghagot on the west. Major problems of flooding and drainage of the area are: 1) spills from the Teesta and the Brahmaputra due to breaches of flood embankments being caused by severe erosion of river bank along those rivers, 2) spills from the Ghagot, 3) drainage congestion due to insufficient capacity of regulators and closure of drainage routes by rural road system especially in sub-drainage system flowing into the major drainage canal.

Planning Unit 8, Middle Bangali basin

As a downstream basin of the Upper Karatoya basin there exists the basin of the Middle Bangali basin. The basin of the Middle Bangali is bounded by the Katakhali - Alai on the north, on the west by the Rangpur Bogra -Nagarbari highway including the catchment area of the old Karatoya river basin. This area is bounded by the BRE on the east from Gaibandha to Serajganj, and by the road from Serajganj to Bogra Nagarbari highway on the south, including Ichamati river basin. The topography is shown in Figure 2.

Karatoya - Bangali River is the principal river in the Middle Bangali basin. It has two old river channels which are called the Old Karatoya and Old Bangali river respectively. Formerly the Karatoya river flowed down to the south near Gobindagonj and passed through Bogra town. But to avoid the flooding in Bogra town a new channel was excavated from Gobingagonj to the east and connected to the Alai river near Mahimaganj. This is now called the Katakhali river. From Mahimagonj, the river is known as the Bangali river which extends up to Chaksodhi. The original Karatoya (old) flows from Gobindagonj that passes near the Bogra Town and finally joins the Bangali river at Chaksodhi. The old Bangali river, at present the Ichamati river starts from downstream of Sariakandi and finally outfalls into the Bangali river near Nalkasengati. The Alai river diverting from the Ghagot river near Gaibandha town flows to the south and joins the Katakhali.

The problems of flooding and drainage in this Middle Bangali basin are as follows:

In the northern part of the basin, there are basically two problems in the northern part of the basin. One of these is an external problem. Controlling flood water coming into the area via the Alai and the Karatoya should be achieved. This planning is influenced by the development of GIP and the Upper Karatoya basin. The other problem in the basin is the drainage constraints.

The major problem of flooding and drainage in the southern part of the basin is caused by the breach of BRE. One breach at Mathurapara in 1991 was four miles long, bringing large discharges into the basin. This also brought large deposits of silt and sediment.

Planning Unit 14, Lower Bangali basin

Lower Bangali basin is the downstream basin of the Middle Bangali basin. The area is bounded by the Bhadai river on the west, the Brahmaputra river on the east, the Atrai and the Hurasagar rivers on the south. The area includes the Serajganj Rural Development Project (SIRDP) and Hurasagar Project areas. The area is mainly subject to prolonged inundation due to back water effect of the Brahmaputra and also suffers flooding due to breaches of BRE. SIRDP area is also suffering flooding due to breaches of its western mbankment of the Lower Atrai.

3. Development Scenarios

Planning Unit 6

Proposals under consideration for the Upper Karatoya are to incorporate further embanking on both banks of the Karatoya, with drainage provision particularly on the left bank where the land slopes are towards the river. In consideration of increased discharge of the Karatoya, Kathakali and Bangali, as a result of development of the Upper Karatoya mentioned above, provision of shortened interceptor from the Bangali near Shimulbari to the Brahmaputra is proposed. This is called Bangali Floodway. Such interceptor will require a backwater levee, together with the necessary control structures. The purpose of the Bangali Floodway is to discharge river flows from the Bangali-Karatoya system direct to the Brahmaputra, rather than allowing these discharges to add to flooding in the Lower Bangali basin. Construction of the Bangali floodway would enable development of the Upper Karatoya to take place, without increasing flooding problems downstream.

The Bangali Floodway is designed to carry flow in excess of a predefined magnitude directly to the Brahmaputra with some residual flow to the Middle Bangali basin. This floodway would reduce the flooding risk in the Middle Bangali system. But this may cause morphological change in the Middle Bangali basin. Based in a consideration of morphology and flooding risk in the Middle Bangali basin a residual flow of 500 m^3/s is selected. It is planned that all flow in excess of this passes along the Bangali Floodway directly to the Brahmaputra.

Initially two routes for the Bangali Floodway were considered (Volume 3, Regional Plan Engineering) Based on cost of construction Route 2, the one with its outfall further upstream on the Brahmaputra, is adopted as a proposal.

Two cross-section shapes were considered:

- trapezoidal which is the most hydraulically efficient shape; this involves excavation and re-sectioning along approximately 100 km of channel,
- a two stage channel. This involved no change to the natural low flow channel of the Upper Karatoya river.

Both cross-section shapes also involve the construction of flood embankments.

Interception of Karatoya/Bangali flood flows and their passage to the Brahmaputra via the Bangali floodway would form a part of the strategy of passing flows to the Brahmaputra as far upstream in the region as possible.

Planning Unit 7

To improve flooding problems of the Gaibandha area, the major following measures are proposed: 1)strengthening of Teesta Right Embankment, 2) strengthening of Ghagot flood embankment, 3) improvement of Ghagot floodway to discharge the flood water of the Ghagot to the Brahmaputra, and 4) compartmentalisation.

Spillage from the Alai is being considered under potential EIP projects. In the Gaibandha Improvement Project, the Alai river which is now diverted from the Ghagot is proposed to be closed

with a regulator. Design discharge of the Alai is nil but during dry season maintenance flow is to be passed through the regulator from the Ghagot. The general layout of the GIP is shown in Figure 3.

Planning Unit 8

Provision of better drainage in the northern part of the Middle Bangali basin is another requirement. Desilting of the old Karatoya and the Bangali and also the re-excavation of the drainage system between them would improve the present drainage problem in the area and reduce over-spillage onto the surrounding land. This is being considered as a feasibility study by SRP, which is also looking at dry season supplies through regulator at the Karatoya at upstream of Katakhali bridge over the trunk road from Bogra to Rangpur.

In the southern part of the Middle Bangali basin, the most important measure to improve flooding conditions is the sealing of the BRE.

Rehabilitation and strengthening of the BRE is being studied under FAP1. Regional planning for FAP-2 assumes that the BRE will be effectively sealed.

According to the hydraulic model result, flooding situation in the basin will be greatly improved on the condition of sealing of BRE even though the upstream conditions are the present. Besides the Bangali floodway is to reduce the flood water coming from the Upper Karatoya and the Alai.

Establishing and maintaining the integrity of the BRE is a major element of FAP and of flood policy in Bangladesh.It is therefore not possible to justify major flood protection projects in the area behind the BRE: such justification would depend on achieving long-term benefits from the measures which would also theoretically accure to work on the BRE itself. This approach is supported by rapid rural appraisals carried out in the area (volume 11 of the Draft Final Report): local people maintained that all their flooding problems came direct from the Brahmaputra.

The major problem with a strategy of limited intervention in the middle Bangali basin lies in uncertainty relating to the BRE work, both regards timing and effectiveness. The main solution to this problem lies in flood proofing of the area affected by breaches. Flood proofing works in the area would comprise both structural and non-structural component. The structural measures would include the provision of flood shelters and the improvement and raising of 100 km of rural roads; the estimated cost of implementing these measures would be approximately Tk.40 million.

In addition, consideration was given to a "second line of defence" against breaches. Possibilities include the Nagarbari-Bogra road, the right bank of the Ichamati (Bangali) river or compartmentalisation to the east of the Ichamati. Use of the road as a flood defence is not a practical option. In the event of very severe floods, maintenance of vital road links has the highest priority. This requires that the road be designed to pass flod flows with minimum constraint, rather than being used as a flood barrier. Indeed, since 1988 the number of bridges along the road has been increased with this in mind.

The second alternative comprises three compartments along BRE from Sariakandi to Kazipur. The compartment embankment are along the left bank of the Ichamati, mostly following the existing road. In case of a breach, only a single compartment will be damaged rather than the whole area. Since the normal drainage is along the Ichamati, during breaches in the BRE there would be possibility of opening the drainage regualtors or making a cut in the west embankment of the compartment to get flood relief.

The third alternative is to consturct an embankment on the right bank of the Ichamati from Lakshmipur to Nalkasengati. The purpose of the embankment would be to protect the area situated

Planning Unit 14

Proposals for the planning unit 14 include improvement of Hurasagar Project and alteration of SIRDP project. To eliminate the backwater effect the flood embankment along the Lower Bangali river is proposed to be extended from Baghabari to Nalkasengati. SIRDP area is proposed to divided into two portions, the upstream portion and downstream portion. The upstream portion is proposed to be CFD area and the downstream portion is proposed to be a flow area of Green River.

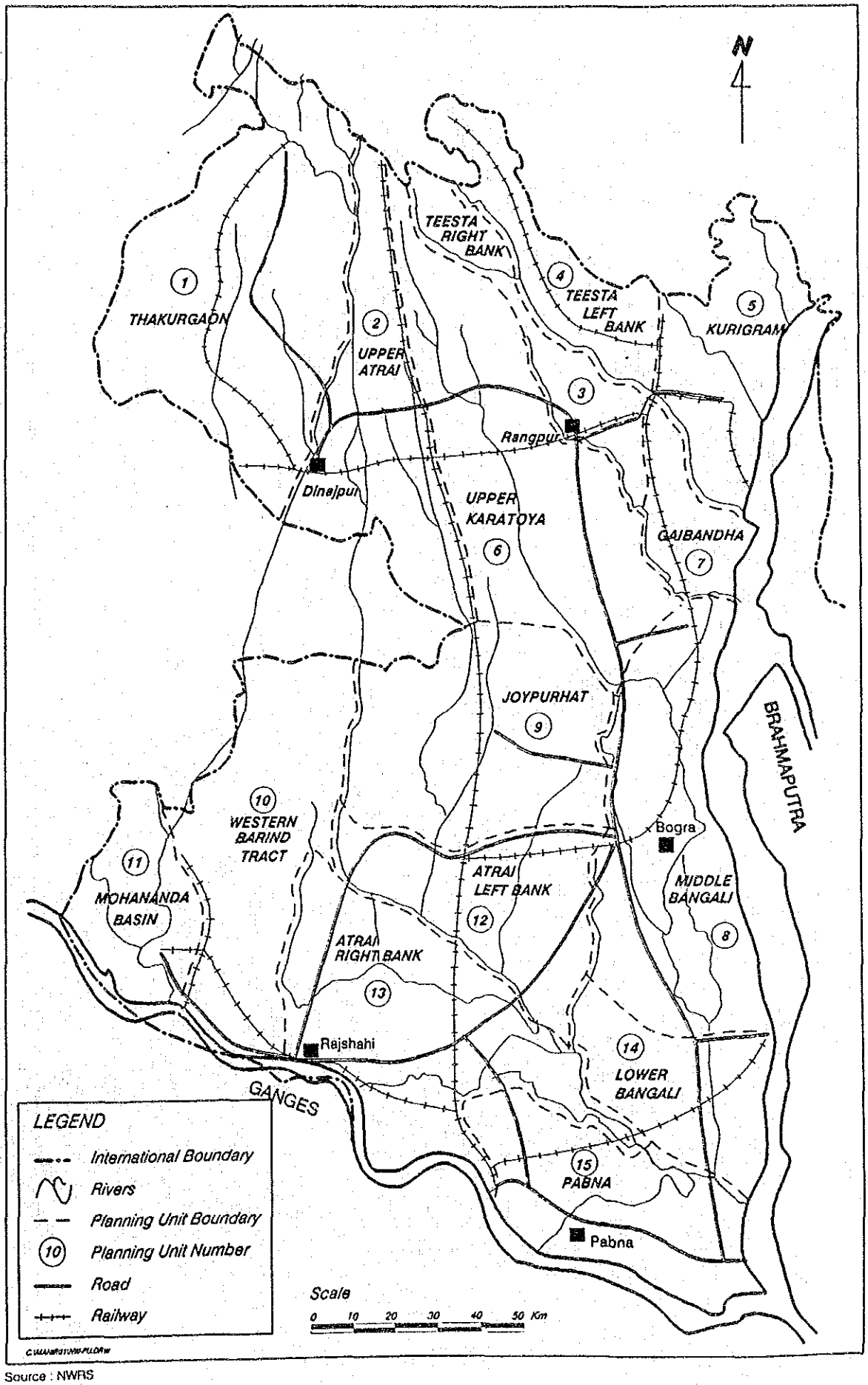
4. Conclusion

The Figure 4 shows the longitudinal profile of the Bangali river from its outfall to Mohimganj. The Figure shows that the design high water level of the Bangali river in its downstream reaches is higher than the right bank elevation in the reach from the outfall to near Khanpur and higher than the left bank in the reach from the outfall to near Nalkasengati. In consideration of this, flood embankments were considered in these reaches on the respective sides as shown in Figure 2. These plans are presented in the development scenario of the Planning Unit No.14, since these reaches are mainly included in the basin of Lower Bangali Basin. Economic analysis carried out for the regional plan showed that embankments on the left of the Karatoya (which would form part of the Hurasagar North project) are not viable, and these have not been carried further. In the reaches upstream of the Bangali river, high water levels are somewhat higher than the bank elevations but these reaches are included in the reaches of the proposed Bangali Floodway.

Therefore proposals on flood control and drainage of the basin in the Middle Bangali basin for regional plan is the sealing of the BRE, the Gaibandha Improvement Project, drainage improvement by SRP and possible development of the Upper Karatoya in conjunction with the Bangali floodway.

Figure 1

NWRS PLANNING UNITS



Source : NWRS

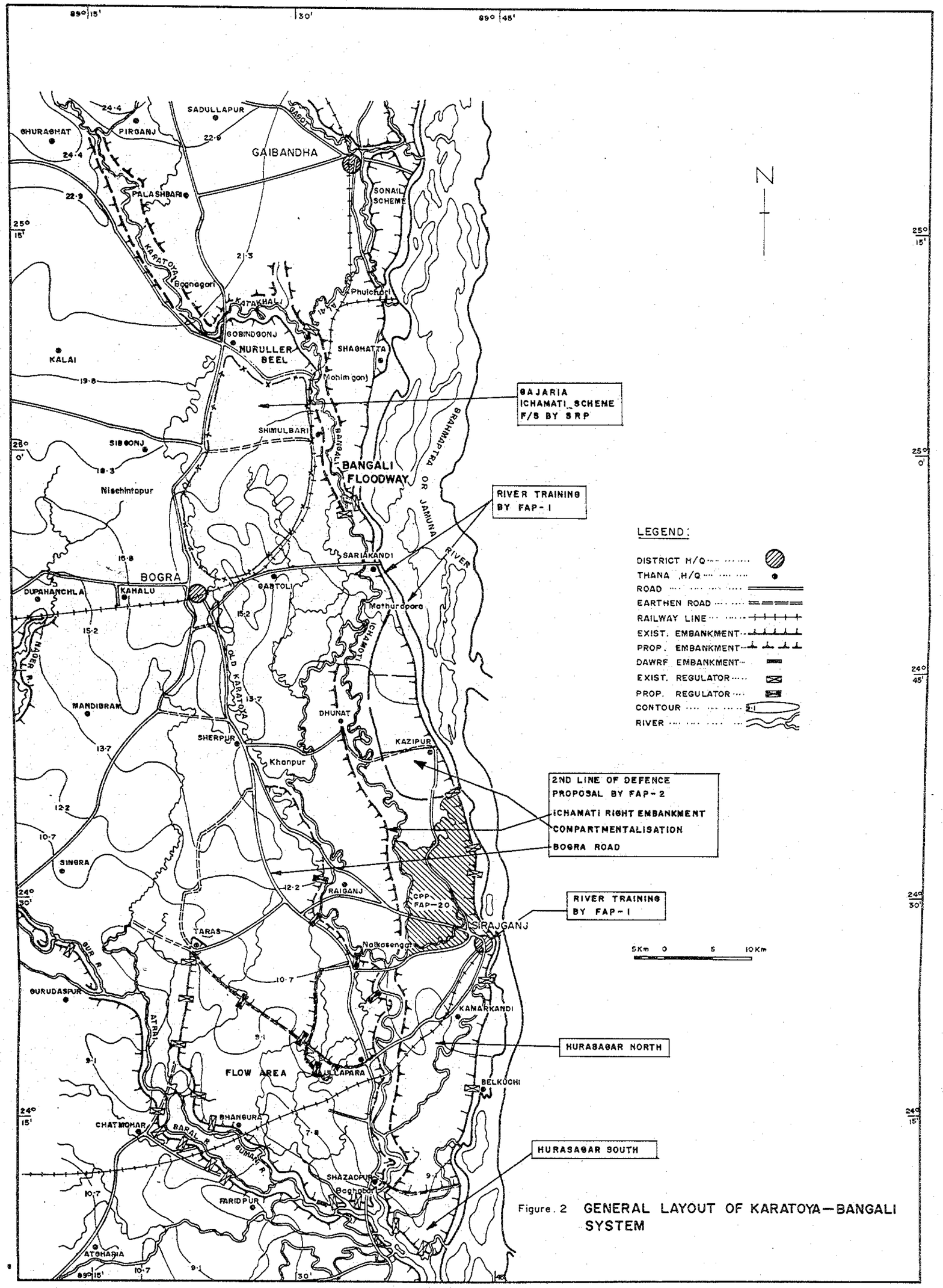


Figure. 2 GENERAL LAYOUT OF KARATOYA—BANGALI SYSTEM

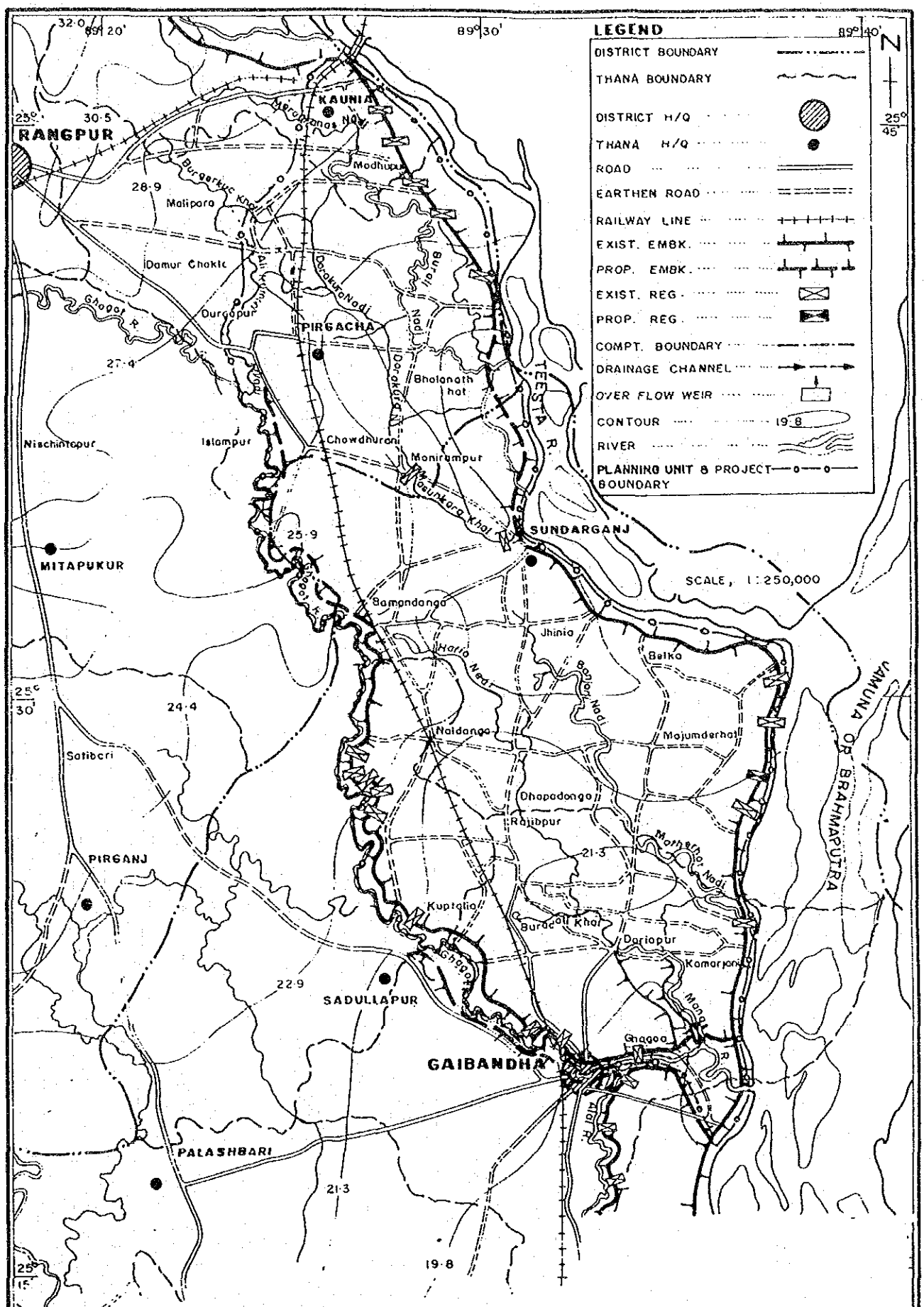


Figure 3 GENERAL LAYOUT OF GAIBANDHA (PLANNING UNIT NO.7)

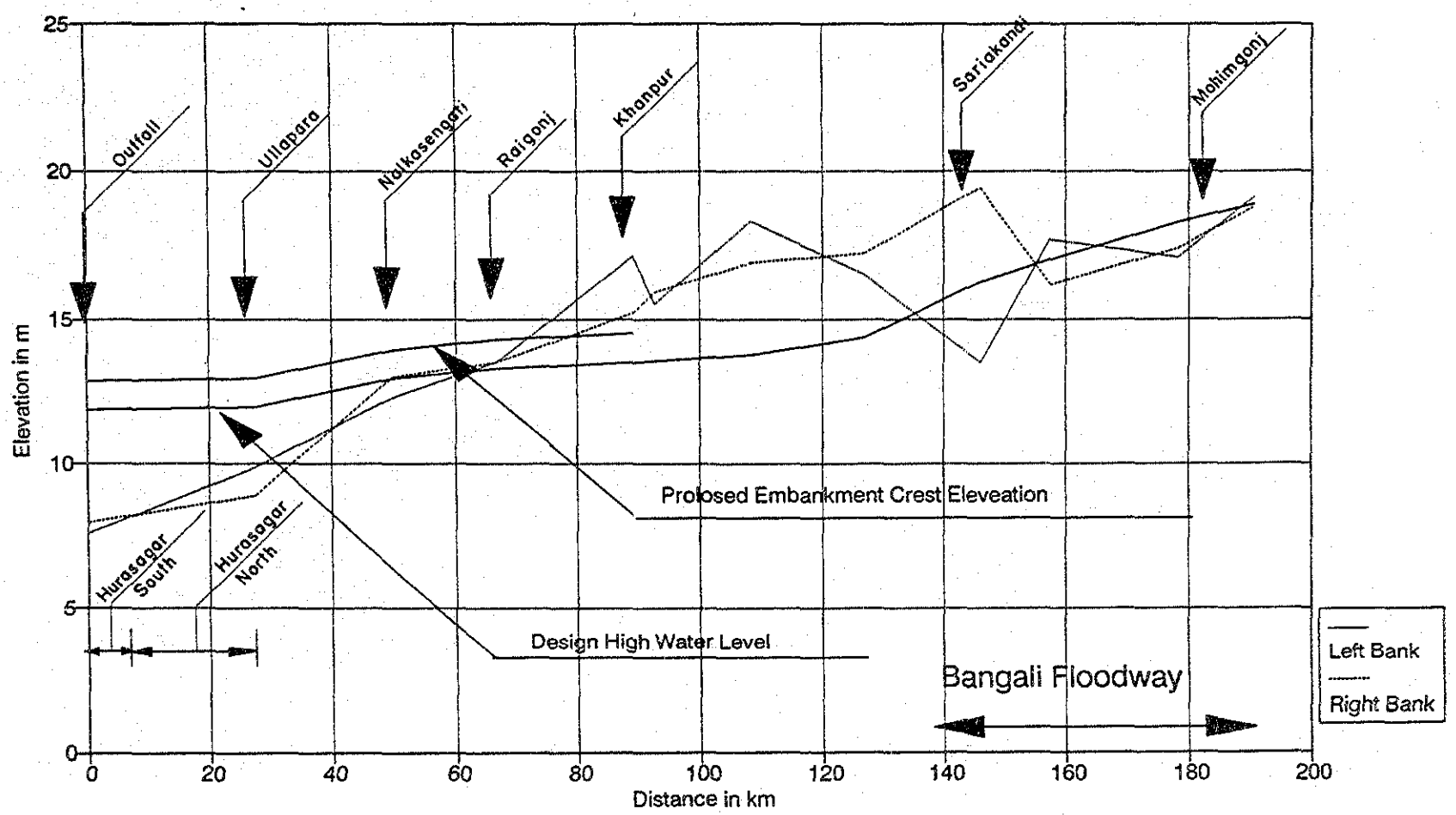


Figure 4 LONGITUDINAL PROFILE OF BANGALI RIVER

ANNEX 2

Resume of the seminar held at Rajshahi, on 19th December, 1992 on North West Regional Study.

A seminar was held on 19th December, 1992 in the Postal Academy, Rajshahi to appraise the honourable members of the Parliament of the Draft final report of North west Regional Study.

The following Members of the Parliament was present in the seminar.

1. Mr. Akhter Hamid Siddiqui
2. Prof. Abdul Hafiz
3. Mr. Shamsuddin Ahmed
4. Mr. Mizanur Rahman
5. Mr. Md. Nasiruddin
6. Mr. Md. Mukhlesur Rahman
7. Mr. Abu Bakar
8. Mrs. Lutfunnesa Hossain
9. Mr. Azizur Rahman Chowdhury
10. Prof. Abdul Quddus
11. Mr. Shahiduzzaman
12. Mr. Azizur Rahman
13. Mr. Hafizur Rahman Pramanik
14. Mr. Abdur Rauf
15. Mr. Mirza Muraduzzaman

The Chief Engineer, Northern Zone, BWDB, Mr. Mazharul Islam, welcomed the honourable members of the Parliament and other guests at the seminar. He gave a brief outline of the works done and are being done by the Board. He expected that FAP-2, North West Regional Study Team will be able to give guideline to the development of the region which has a complex hydrological system. The responses and the suggestions of the MPs would help in the preparation of the final report and chalking out a suitable development plan.

The Chief Engineer, FPCO, Mr. M.H. Siddiqui, Bir Uttam, stated the background of FAP studies which was initiated and supported by world bodies and advanced world countries in consequence of the severe 1988 flood. He outlined the implications of flooding on life of the people. The damage by flood is caused to structural and nonstructural components. While immense loss to crops and infrastructures are caused by flood but there are various uncountable losses also. In order to find out a comprehensive solution to floods that occur throughout the country different (26) studies were taken up. The regional studies are expected to extend over a period of five years. While the studies continue projects would by identified and formulated so that the mitigation measures may simultaneously by continued.

The Team Leader, NWRS, (FAP-2) Mr. T.R. Franks dealt on the issues and approaches on the plan.

The study takes into account the prevailing flood situation in the region, the development activities that have so far taken place, achievement and impact of such activities and aims at drawing out a regional development plan and prepare a feasibility level study for a priority project.

One project named Gaibandha Improvement Project has been prepared to solve the problems being faced by the area.

The approach in the study was as follows:

a) Hydraulic model would help understanding hydraulic regime.

b) Improvement in one area should not affect the other areas.

c) Integrate existing development in the regional plan.

d) Preference to small scale schemes was given.

e) Partial protection be provided in deeply flooded area.

f) Interdisciplinary approach was taken with specific stress on environment, fisheries.

g) Social factor was given importance and peoples opinion was consulted at all stages.

The Chief Engineer, Teesta Project, BWDB, Mr. Meser Ali gave an outline of Teesta Project activities and its utility and effectiveness in the development of the project area. He expected to bring 15000 ha under irrigation as a demonstration of impact of the project.

The Hydrologist ,NWRS, (FAP-2) S.N.Anwar dealt on flooding ,river configuration and water resources.

While elaborating on river system he showed that rivers like Dudhkumar, Dharla and Mahananda flow almost independently without having much effect on adjacent catchments. Teesta river though having a well defined catchment often overspills and flows in Gangachara and Gaibandha area. River Karatoya like the above rivers rises in India and enters Bangladesh in Panchagarh district. This river acts as a collector drain and all other regional rivers fall into it on its way to the Brahmaputra through Hurasagar river.

The flooding in the area may be divided in three main categories:

Flooding due to breaches in the embankments along the main river: The breaches in Teesta river mainly occur from the outfall of Buri Teesta to Haragacha in the upstream of Kaunia and near Belka and Sundarganj in the downstream.

The breaches in the BRE are mainly at Fulchari, Sariakandi, Mathurapara, Serajganj and Kazipur.The breach at Mathurapara is very long and it has very serious implication both in the up and down stream. The flooding through these breaches cause flood in Bangali basin .A part of the flood water enters SIRDP area from where it goes into Atrai river.

Flooding due to outfall constraint: Outfall condition of Hurasagar which drains almost three fourth of the region is constrained by the Level of the Brahmaputra which remain very high during the monsoon. Water cannot flow out until water level inside Chalan beel builds up to a level capable of forcing out through Hurasagar. A large area (40%) in the south east of the region remain deeply flooded for prolonged period.

Flooding due to intensive rainfall: Upper area of the region is steeper than elsewhere and is susceptible to flash flooding. In most cases the floods last for few days and do not cause a great deal of damage to crops though they can do to infrastructure.
But at times widespread intense rainfall as it occurred in 1987, 1988 causes widespread flood. Even in 1991 there was a severe flood in Thakurgaon and Upper Atrai basin. But the flood of 1991 attenuated quite quickly and in Dinajpur it was less severe than 1987 flood though it was severest in Thakurgaon. A very localised flood occurred in Teesta basin in 1989.

River configuration:

Detailed morphological study was carried out inrespect of the rivers in the region. It was found that rivers in the region are mostly in a balanced state for a average flow condition. The development activities like embanking may increase the meandering tendency .

Water Resources:

Though there is huge water in the region in the monsoon, the dry season flow is available only in four main rivers namely Teesta, Dharla, Dudhkumar and Mahananda.

Mr.Shahidul Alam, River Engineer, NWRS (FAP-2) dealt on the planning of the study.

He stated that serious flooding occurs along the BRE in the Bangali basin due to breaches in the BRE. Most of the problems may be eliminated by effective sealing of the BRE which FAP-1 is actively working on. A consideration of second line of defence was given in case of failure of BRE. However, keeping BRE in operation rather than second line of defence is more desirable. Flood proofing may be done in BRE breach susceptible area as an associated development.

Breaches in Teesta cause flood in Rangpur and Gaibandha districts. TRE breach sealing in the upstream of Kaunia along with Gaibandha Improvement Project which proposed Ghagot Floodway will take care of the problem.

Development in the upper Karatoya is likely to increase flood flow in the down stream. The excess flow is planned to be drained out through the Bangali floodway.

A limited number of proposals were investigated in other areas including Little Jamuna and Mahananda basins. Consideration was given to the existing and the ongoing Projects in the area.

In order to mitigate flood in the lower Atrai the study of diverting flow through interceptor and diversion drain was found technically feasible but economically unviable. The full protection in lower Atrai is likely to cause a increase of water level by about 3m. So, to make a viable preposition a new concept, "the green river" was developed. This allows flows through the different polder areas after 20th of July. Development under these options were analysed and preliminary indications show that economically viable projects are worth investigating in the lower Atrai.

Mr. M.A. Aziz, Consultant NWRS (FAP-2) spoke on agricultural and economic aspect of the study.

He stated that cropping pattern depends on the flood phase and drainage system in any area. The present cropping pattern is derived from the upazila crop statistics of BSS which with minimal editing fitted well with the cropping expected from the phase data of MPO. Future without project condition cropping data is derived from the assumed change in the area under irrigation with irrigation development.

Irrigation development has been assumed to have developed in the area starting from F3 land and then moved to the higher flood phases. Future with project condition is expected to change the flood phase only. Therefore, cropping pattern will change on the basis of flood phase and irrigation. The project benefit is expected to come from increased HYV Aman production and preventing crop and non-crop damage. Rice price has been adopted as the average of export substituting and espect oriented strategies in case of rice. Export oriented price will be much lower than the import substitution price.

The Fisheries Consultant, NWRS (FAP-2) Mr. Shahadat Ali spoke on the fisheries condition. He depicted that the open water fish resources have declined significantly though culture fisheries has increased slightly. But culture fishery accounts for a very small fraction of the total catch.

He suggested some measures to increase fisheries and some of them are:

1) Enforcement of fisheries rule
2) Development of borrow pits for fisheries
3) Preservation and improvement of khas water bodies
4) Improved fisheries extension
5) Modification of structure for allow fish passage
6) External enhancement of fish resources.

After the brief deliberation by the Team Leader and other participating consultants the MPs responded individually as given below:

1. Mr. Akhtar Hamid Siddiqui, MP Naogaon-3

a) Flood in 1991 severely affected 6 out of 10 unions of Mahadevpur and 5 out of 10 Unions Badalghahi UZ.

b) Flood not only causes damage to crops and infrastructure but also immeasurable sufferings to people. So, flood must be controlled.

c) Steps taken to ensure peoples participation is praiseworthy though the step has been taken very late.

ii) Embanking rivers is not a solution to flood problem.

iii) Dredging is the real solution to flooding

iv) So, all endeavours should be made to make the activities fruitful so that failures do not occur after execution of projects.

v) Expenditure in water sector is significantly higher than other sectors but outcome is not encouraging.

vi) Flood should be forecast at least 90 days ahead so that farmers may plan the agriculture accordingly.

vii) The planning should be regional as well as areal.

2. **Prof. Abdul Hafiz, MP Nilphamari-4**

a) Areas which were never been flooded before is suffering from flood now a days due to unplanned infrastructural development. Short duration flood areas have also turned into long duration flood areas.

b) Crops diversification is necessary.

c) Borrow pits are not filled up which lead to wastage of scarce land.

d) Siltation of rivers is a serious cause of flooding. This is also referred to in the district gazetteers of British period. So, dredging is essential for flood conveyance and human power may be utilized for this purpose.

e) Not only flood is a problem but drought is also a serious problem. So, a complete flood and drought management is needed.

f) In the opinion of World Bank Teesta Barrage is fruitless work and Tk.525 cr. may be a mere waste. But it is not so, rather the project is essential and beneficial for the area.

g) So many studies have, so far, been conducted but fruitful works have not been done.

h) Our Engineers must be allowed to work and their capabilities are to be utilized to solve our problems.

i) Wastage and corruption must be stopped to make proper use of available resources.

j) Co-ordination between bureaucracy and politics is essential for successful implementation of development works.

k) Small scale projects should be taken up as they are easily manageable.

l) Due to encroachment and otherwise rivers and canals have become narrower. So, these are to be brought back to shape.

m) Rivers are to be made navigable. So these may be used for fisheries also.

Mr. Shamsuddin Ahmed, MP Naogaon-5.

1. Our Engineers and consultants are aware of our problems they are to be involved in the work.

2. Flood problem is exacerbated by embankment A small breach may cause a havoc questioning the very utility of such a structure.

3. Dredging is the solution to the problem. WFP wheat may be utilized for this work.

4. Naogaon Polder-1 could not be closed in the town area. People will not accept any work that will exclude vital part of the town from flood protection. The confinement effect of 10ft as is said by someone will nullify the project.

5. Palashbari khal is required to be re-excavated. This canal on re-excavation may help irrigation of a vast area.

6. Drinking water becomes scarce in few months of dry season and hand tube-wells run dry.

7. Though self sufficiency in rice is expected this year but the cost of rice being very low may discourage farmers from increasing output. Incentives might be given so that the endeavour continues.

8. Fisheries rules must be enforced and "current" net must not be allowed for fish survival.

Mizanur Rahman Manu, MP Dinajpur-4

1. We are to depend on our resources and manpower for our development projects.

2. The study will continue upto 1995 but what would happen during the period.

3. The people of Dinajpur suffered from flood in 1991 from August-December but such flooding was not prevalent in earlier days.

4. The flood of 1969 has not been taken into account.

5. The infrastructure and housing in this area suffers much. The houses are mud build. These housed collapse as soon as water comes in contact with the base of the walls.

6. Protective works are being done in Panchagarh, Dinajpur etc. town where most of Govt. Officers and well to do people live. Nothing is being done for the million who live in the villages. Programme for these should be taken to improve the lot of the common people.

7. There are a large number of small rivers which have not been taken into consideration. Re-excavation of rivers are necessary for redressing flooding problem.

8. In the study a prescription has been given: a solution to the problem has not been sought.

9. Development is a continuous process. So there should be close co-ordination between Fisheries, Agriculture, LGEB and BWDB.

10. Small scale schemes on areal basis should be taken as a part of total planning which is required.

11. Atrai is eroding near Khansama which is likely to be devoured in a short time, The river is also eroding near Alorjhari area. An embankment to protect the area is needed.

12. Inappropriate application of insecticides are affecting fisheries resources. Nothing has been said about alternate pest management.

Mr. Md. Nasiruddin, MP-Naogaon-4

1. Dredging of rivers are necessary to retain water in river channel.

2. Water table at Naogaon falls so low in summer that hand tube-wells go dry.

3. Withdrawal of Ganges water has significant contribution to the decline of ground water table in the Gangetic belt.

4. Water control structure may be incorporated in projects to reserve water for use in dry season.

5. Co-operation of India and Nepal may be sought for this purpose.

6. Height of embankments of some projects are too low. These are to be increased in height.

7. Embankment of polder D on the western side ie the left bank of Sib river is cut out of malice causing immense loss to polder D area.

8. Fakirni river has become silted and needs resuscitation.

Mr. Md. Mokhlesur Rahman, MP Thakurgaon-3

1. Rural based programmes should be taken instead of town based programme.

2. Small scale projects should be taken-up.

3. Some measures should be taken to deal with flash flood of 1988 type.

4. Canal digging should be done only when these are worth giving benefits. The rivers are to be dredged to mitigate flood.

5. Embankment and dredging should be taken up simultaneously.

6. Bends and loops of Tangon are to be cut and embankment provided.

7. Structures should be constructed on Kulik, Dhepa etc. rivers.

Mr. Abu Bakar, MP Natore-3

1. Dredging is needed to mitigate flooding. The feeling of general mass is also the same.

2. Land is an acute problem in this land hungry country. So, borrow materials should be taken from the river bed.

3. No benefits has occurred from the polderisation.

4. Nagor valley project embankments are to be redesigned to save people of chalan beel and Bogra polder-4 area.

5. There should a cross bandh on Gur river at Singra and a bridge should be constructed.

6. Mini Nagor project needs execution.

7. Sluice gates are to be constructed to facilitate drainage.

Mrs. Lutfunnesa Hossain, MP (W) Nawabgonj

1. The area Nawabgonj is suffering from the impact of Farakka Barrage and no endeavour is being made to mitigate flood of the area.

2. Drought is causing immense damage to the area and there is scarcity of drinking water.

3. Environment is being affected by Farakka Barrage .

4. Steps for water retention is Mahananda river system is to be taken up.

5. The khas ponds of the Barind should be excavated to retain water and may be brought under pisciculture.

Mr. Md. Azizur Rahman Choudhury, MP Dinajpur - 6

1. The Karatoya right embankment was damaged by flood. As a result a large area is flooded. So,the embankment should be reconstructed.

2. The regulator at Gulglipara damaged in 1988 flood requires reconstruction.

3. Little Jamuna river has become silted and should be dredged and right bank embankment repaired.

4. Tulsiganga river should be re-excavated and water retention structure constructed for irrigation.

5. Ashuria beels ponds & tanks like Alta-dighi should be re-excavated and brought under piscicultrure.

Prof. Abdul Quddus, MP Natore-4

1. The plan should aim at preventing flood during rainy season and providing water during dry season.

2. Many works have been done in the name of Chalan beel but nothing has been done in real Chalan Beel.

3. The regulator on Baral at Charghat is causing moisture deficiency in Baral basin. The area is turning into barren areas. No mitigation measures have so far been taken.

4. Bhashani and Gumani rivers needs re-excavation.

5. Chalan beel is a one crop area and needs development.

6. Embankments in Taras and along Nimaichara are unwanted . These are cut to allow flow of water that cause flood in Chalan beel area.

Mr. Md. Shahiduzzaman, MP Noagaon-2

1. Flooding in the area is caused by water brought in by the rivers as well as small channels from upstream Indian territory. So, decisions in respect of re-excavation of these channels are to be taken and realistic steps for flood control are to be taken.

2. Appropriate technology, mechanical or manual may be adopted for dredging which may help in controlling flood.

3. Dredging and Embanking should go side by side.

4. There are rivers which may remain effective for long period after dredging. These may be considered if technically feasible after all other aspects are taken into consideration.

5. Total planning should be aimed at solving the problems relatively high land which suffer from drought.

6. Regulators in Noagaon Project area is very essential.

7. The embankments of Patnitala and Chilimpur should be constructed according to the standard of Noagaon polder-I as failure here would cause flood in Naogaon area.

8. The embankment of Badalgachi ends abruptly without considering the flooding problem that may be created by water entering through the upstream area.

9. Realistic step is to be taken to prevent erosion of Atrai at chak Hariharpur.

Mr. Azizur Rahman, Raj.-5

1. The Ganges is eroding at Yusufpur. Nearly 1/2 mile wide strips have already been devoured causing untold miseries to the people.

2. Plans are to be produced to mitigate the erosion of the area.

3. Baral river needs dredging. alternate plan to mitigate water deficiency in Baral basin must be taken up.

Mr. Hafizur Rahman Pramanik, MP Gaibandha-1

1. The area adjacent to Manas regulator is threatened by erosion. Similar areas around Kamarjani, Belka etc. are also in danger of erosion. So, protective embankments are necessary at these places.

2. Gaibandha Improvement Project should immediately be undertake to mitigate the problems of one of the poorest area of the country.

3. Sonail project should be re-designed to shift the drainage requirement of the area.

Mr. Abdur Rauf, MP Nilphamari-1

1. What works have so far been taken up and completed.

2. Most of money spent in the study projects are taken away by the expatriate consultants. The works can be accomplished by local Engineers. So, local Engineers should be entrusted with such works.

3. World Bank feels that money spent for Teesta Project is a mere waste. But in fact it is essential and vital for the area. So the project must be executed.

4. We must become self dependent.

5. The people participation meeting should have been held much more earlier.

Mr. Shafiuddin Ahmed, Superintending Engineer, Rajshahi Circle, BWDB, offered the vote of thanks. He expressed his gratitudes to the organisers and personnel who worked to make the seminar successful. He thanked the members of the Parliament, the consultants from NWRS and others present for participating in the seminar. He expected that the responses of the honourable Members of Parliament will help in the finalisation of the report. Thus he called the seminar to its end.

ANNEX 3
FAP2 WORKING PAPERS

The following working papers were produced during the course of the study

Nr.	Title	Date
Unnumbered	Modelling Rivers in the NW Region	Feb 1991
1	The Major Drains	Jun 1991
2	Options for Development	Jun 1991
3	Planning and Design Criteria	Jun 1991
4	Socio-Economic Framework	Jun 1991
5	Assessment of the Calibration of the MIKE11 Flood Model	Sep 1991
6	Quality Control and Infilling of Rainfall Data	Feb 1992
7	Gaibandha Improvement Project	Apr 1992
8	Regional Planning	Jul 1992
9	Implementation Planning	Jul 1992