CHAPTER 3 CONSTRAINTS AND PROBLEMS

3.1 General

Sample Surveys were carried out in 256 Mouzas under 40 Upazilas of 8 districts to assess the existing flood related constraints and the response from the affected people. Besides, the Study Team held several reconnaissance surveys and discussions with the stakeholders during their field visits. The reconnaissance surveys and the Sample Surveys were also intended to know the people's ideas about the mitigation measures that they thought were urgently needed. Sample surveys were carried out through questionnaires.

3.2 Flood related surveys

All the Mouzas selected for Sample Survey were in some way or other affected by floods. During the questionnaire survey, in some cases, the public proposed demands for unfeasible measures of mitigation. In some other cases, legitimate mitigation measures were not proposed. These omissions and commissions were considered in the analysis while sorting out the most intriguing problem due to floods and their effective and feasible mitigation. The following two Tables show the result of the Sample Survey showing people's idea about the problems and possible measures of their mitigation.

In the char area, many dwellers demanded protection of river erosion in the char land by hard materials which was obviously an unfeasible proposition. In the Haor areas, the necessity of the plantation of Hijal/Koroch trees for sustainability of resistance to wave action was not opined for.

The following Table 3.1 and Table 3.2 indicate constraints under two different flood environments in areas under the Study. Inundation of homesteads and lack of shelter for people and livestock appear to be the main issues in the Char area. While in Haor area, wave erosion of village mounds is the prime constraint, with lack of shelter, inundation of the households etc in the next order. The item 'other' in the columns of constraints includes 'absence of roads', 'absence of submersible embankments' etc.

The tables indicate % of people who think a particular constraint is the prime impediment to the rural development at the moment that requires immediate attention.

Table 3.1 Constraints on Floods and Their Suggested Measures Claimed by Char Dwellers

Constraints	Suggested Measures	Gaibandha (%)	Jamalpur (%)	Kurigram (%)	Sirajganj (%)
1) Homestead inundation	1) Raising of homesteads by earthwork	18	24	36	46
2) Erosion of the Char	2) Protection of the Char against erosion desired	6	8	21	4
3) Absence of shelter for people and cattle	3) Construction of shelter for people and livestock	65	59	35	40
4) Lack of flood warning and preparedness	4) Installation workable flood warning and dissemination	3	3	6	7
5) Others	5) Construction of roads and embankment	8	6	2	3

Source: JICA Study Team based on the Flood Related Facilities Survey, 2001 (number of sample Mouzas=99)

Table 3.2 Constraints on Floods and Their Suggested Measures Claimed by Haor Dwellers

Constraints	Suggested Measures	Habiganj (%)	Kishoreganj (%)	Netrokona (%)	Sunamganj (%)
1) Homestead inundation	1) Raising of homesteads by earthwork	14	12	18	18
2) Wave erosion of the Village Mound and diminishing of homestead	2) Mound Protection & extension by constructing masonry wall	41	47	41	46
3) Absence of shelter for people and cattle	3) Construction of shelter for people and livestock	19	34	26	27
4) Lack of flood warning and preparedness	4) Installation workable flood warning and dissemination	14	2	9	6
5) Lack of transport in dry season and boats during monsoon, sub-embankment etc.	5) Construction of road, sub-embankment, availability of boat	12	5	6	3

Source: JICA Study Team based on the Flood Related Facilities Survey, 2001 (number of sample Mouzas =157)

3.3 Flood environment

3.3.1 Flood environment in char area

The flood environments of the char areas are mainly influenced by their location in the active river flood plain. On the basis of their situation they are termed as (a) Island char area (b) Attached char area (c) Setback land and (d) unprotected mainland adjacent to active floodplain.

3.3.2 Flood environment in haor area

The haor areas have two major environments which are: (a) deep haor areas below 4m contour line of GL and (b) shallow haor areas (between 6 to 4 m contours). The deep haor areas fall under the F_4 type of agricultural land classification where the flood depth is more than 3m and are more susceptible to wave action than the shallow haor. The Shallow haor areas belong to the F_1, F_2, F_3 type of land which have the flood depth up to 0.90m, 1.80m and 3.00m respectively.

The effectiveness of all mitigation measures lie in their application with respect to the situation in particular environment. The characteristic of flood events in a flood protected area by a full height or a submersible embankment will be different from that of a totally unprotected area.

3.4 Result and response

3.4.1 Common demands

In the Char area, people generally desired raising of homesteads, shelter for themselves and their cattleheads and better communication with the mainland etc. In the haor areas, the respondents commonly desired protection of the village mounds which are subjected to wave erosion during the monsoon. They also desired protection of Boro crop from early flood, just prior to harvesting in April-May. Opinions were, however, divided on the issue of full FC or part protection by submersible embankment. To have roads above the monsoon flood level in the hoar and char areas were also a common desire of the people.

3.4.2 Flood warning

Present radio/TV announcements regarding the flood warnings relate to the Major river which has little relevance to the smaller river areas. The smaller rivers have influence of floods arising from the local rainfall. Improved localized warnings are also needed. The smaller rivers, especially those coming from across the international borders, bring the flash floods which are unpredictable, quick in action and more destructive.

As has been explained later under Section 4.11, when this flow reaches the wider river in the haor areas, it looses the flashy character, but fills the haor areas with rapid rise in water level with retarded drainage. The haor area under the present Study does not have the havoc of flash flood in a true sense. When the flash flood water reaches the haor area in April-May, it becomes an early flood, which submerges the standing Boro crop, in case there is no protection by submersible embankment. The areas that are directly hit by the flash flood are situated within 20 km from the international borderline of Netrokuna, Sunamganj and Habiganj districts. Improved flood warnings have been sought in both haor and char areas. At present the flood warnings can only reach to some people through radio, TV and new papers. In some cases, information of a probable danger is disseminated through public conversations but that is not a sure way to warn the rural mass that need to be warned in a more definite way.

Survey of the Sample Mouzas indicates that the flood warning system in the Char and Haor areas are rather unintelligible to the people of the flood prone localities. The warnings are given only for particular points (stations where the WL gauge is situated) whereas the people desire warnings for probability of depth and area inundation.

3.4.3 Vulnerability of chars

In the char areas, both inundation of the households and the erosion of the char itself make the dwellers more vulnerable to floods which often result in the shifting of the house-holds. They may move to a nearby flood free place temporarily till the flood recedes. In case of erosion of their home, they may settle in a nearby location waiting indefinitely for the eroded char to re-emerge.

The houses are built in the char by such materials as can be moved easily in time of need. Having a boat for transportation is not always possible. The char dwellers' needs are many: ranging from the flood warning to assistance during evacuation, provision of shelters, and other support services.

3.4.3.1 Problems facing the chars

Sample Surveys were conducted in 99 Mouzas. None of the Mouzas is protected from flooding of any degree nor are from river erosion of the char itself. Households are vegetated in many cases which provide though in a very extent limited extent, protection against rapid decaying of homesteads under thrust of monsoon flows. Source of flooding is the main river. The flood inundation of the chars is shorter than that in the haors. River erosion in chars is as prime a hazard as flood inundation.

The following Table 2.3 gives an account of the depth and duration of flooding in Char area during 1998, 1999 and 2000.

Table 2.3: Depth and Duration of Flooding in the Last Three Years in 1998, 1999 and 2000

Years	Char									
	No. of sample villages with depth of flooding (m)					No. of sample villages with duration of flooding (month)				
	Depth range	<1.5	1.5 –3.0	3.01-4.50	4.5>	Duration range	<2	2-3	4-5	5>
1998	No. of villages	15	96	4	0	No. of villages	1	107	7	0
1999		93	22	0	0		40	74	1	0
2000		100	15	0	0		47	66	1	1

Source: JICA Study team based on Rural Living Condition Survey 2001

3.4.3.2 Vulnerability of the Haor area

Sample surveys were carried out in 157 Mouzas in the Haor area. The Haor areas are deeply flooded during the monsoon months (June-September) with varying depths from three to seven meters. Raised platforms of 3 to 6 meters in height are constructed on higher lands with homes clustered on them.

Table 2.4 below gives an account of the depth and duration of flooding in Haor area during 1998, 1999 and 2000.

Table 2.4: Depth and Duration of Flooding in the Last Three Years in 1998,1999 and 2000

Years	Haor									
	No. of sample villages with depth of flooding (m)					No. of sample villages with duration of flooding (month)				
	Depth range	<1.5	1.5 -3.0	3.01 -4.50	4.5>	Duration range	<2	2-3	4-5	5>
1998	No. of villages	9	26	63	43	No. of Villages	33	63	41	4
1999		45	43	48	5		69	49	23	0
2000		35	59	40	7		68	45	22	6

Source: JICA Study team based on Rural Living Condition Survey 2001

In earlier days, people had the resources (access to labor time away from paid or other directly productive employment) to undertake the annual earthwork maintenance of their homesteads. Homesteads were on average larger and located on higher land than today. The area had significant coverage of swamp forest which served to lessen the effect of wave action.

Now the swamp forest has disappeared due to people's fell action on the trees. The villages have come to be composed of small, low homesteads, exposed to wave action. The people occupying these homesteads are unable to carry out maintenance earthwork due to increasing economic hardship. Without this maintenance, they find themselves in a way to continuous poverty. A particularly bad year arising from wave erosion can reduce the homestead by 15 to 20%. At present many villages have lost their homestead area by 25% which they had some years before.

In the haor areas indigenous protection of mounds, raising floor of homestead, strengthening house structure and storing foods are the major actions taken by the villagers before the occurrences of floods. During the flood season, they have to concentrate only on fighting wave erosion to protect their homesteads.

3.4.3.3 Inundation experience

Under FAP 14 an analysis of the frequency of flooding in houses by flood environment shows that on average 2.7 no. of times the house floors of char areas and 1.7 no. of times the house floors of haor areas were inundated during the previous 10 years.

The deeply flooded haor area is characterized by monsoon flooding which typically begins in late May and persist for five to six months each year. In some years the flood level is below the homestead level. But during other years, water may rise above plinth level. Once this happens, high water level tends to persist for several weeks.

A 3-4m high homestead subsides about 15 cm due to rainfall erosion and gradual slumping of the platform during monsoon in a year without inundation of the platform. Each time the platform is

inundated for a few days, homestead platform will subside by an additional 5 cm, mainly due to aggravated erosion by any flow velocity, wave action, and movement of human and animals.

In the haor areas, erosion in village mounds from wave action during monsoon is acute. Only a few rich people could construct the protective masonry walls by their own finance. In some cases, CARE or other NGO-funded protective walls or slope protections have been constructed, but most of the houses belonging to the poor remain unprotected.

People in general prefer the masonry wall to brick block/ cc block revetment on slope because the masonry wall is more effective and dependable. The present practice of the vegetative protection by 'chailla grass' that works to a very limited degree is also becoming scarce. Lands where the grass is cultivated are being increasingly occupied by cereal cultivation.

Lack of space in the village mounds to accommodate increasing population is another problem. The cattleheads are the worst affected during floods. Raised ground for the cattle is another vital necessity.

During flood, in most cases, boats are the only mode of transport. However, lack of roads in the haor areas makes transportation more difficult in the dry season than during wet season.

Crop damage in the pre-monsoon is another major problem in the haor areas. In most of the haor areas, monsoon crop is not possible. During the rabi season, in most cases, the only crop (Boro) is grown. But that is also vulnerable to damage due to early flash flood in April-May just before the harvesting time. The chance of harvest is often fifty-fifty, especially where there is no protection by BWDB's submersible embankment. Even where a BWDB submersible embankment exists, its yearly maintenance to make it operational before May becomes an intriguing issue. Lack of timely sanctioning of BWDB fund may cause complete or partial Buro crop damage any year (example FY 2000).

CHAPTER 4 DEVELOPMENT STRATEGIES

4.1 National Water Policy: Provision of Flood Proofing

The National Water Policy (NWPo) approved by the government in January 1999 includes the following in relation to the planning and management of the water resources in flood risk zone.

"The Government will further.....

Designate flood risk zones and take appropriate measures to provide desired levels of protection for life, property, vital infrastructure, agriculture and wetlands. In this regard the following principles will guide future action:

i. *Regions of economic importance such as metropolitan areas, sea and airports, and export processing zones will be fully protected against floods as a matter of first priority. Other critical areas such as district and upazila towns, important commercial centers, and places of historical importance will be gradually provided reasonable degree of protection against flood. In the remaining rural areas, with the exception of those already covered by existing flood control infrastructure, the people will be motivated to develop different Flood Proofing measures such as raising of platform for homesteads, market places, educational institutions, community centers, etc., and adjusting the cropping pattern to suit the flood regime.*

ii. In future all national and regional highways, railway tracks, and public buildings and facilities will be constructed above the highest ever-recorded level of flood in the country. This principle will also apply in cases of reconstruction of existing structures of this nature.

iii. All plans for roads and railways embankment will adequately provide for unimpeded drainage.

The requirement of the National Water Policy regarding the future infrastructure and public buildings are to be constructed or re-constructed above maximum flood level should be considered a positive step towards flood proofing. The present Study for Rural Development focusing on Flood Proofing has to ensure that the National Water Policy of the GoB has been complied with.

4.2 Strategy of the Master Plan formulation: UZ-wise formulation

The Study area extends over parts of 8 administrative districts - 4 districts have the riverine Chars and 4 districts contain the Haors. The 8 districts have 73 no. of UZs, out of which 48 UZs have either the haors or the chars (19 UZs have the chars and 29 UZs have the haors). This means the remaining 25 UZs under the 8 districts have neither char nor haor areas as defined under the scope of the Study. For the purpose of Sample Survey, 40 UZs were selected; 16 UZs in the char area and 24 UZs in the haor area. The UZs comprising the char areas have, in each instance, some mainland part also. Many UZs of the haor area, on the other hand, are comprised of all-haor territory, while some UZs have haor areas in their parts only.

From the reconnaissance and the questionnaire field surveys, it came out that the characteristics of floods and flood-related problems and their responses in different haors or chars of the respective UZs are remarkably similar. With this strategy in view, the Master Plan has been formulated UZ-wise.

4.3 Planning Period for implementation; and basic UZ information

The Master Plan of flood proofing program has been prepared for the period 2002-2026. The basic data for Char and Haor, population, no. of household/village mounds have been projected are furnished in **Table 4.1 and Table 4.2.**

4.4 Recognizing Flood Environments

Flood Proofing requirements will depend on the flood environment at a particular location. The flood environment is a function of the characteristics of the floods that occur. The Characteristics of floods vary throughout Bangladesh depending on inter alia the source of floodwater, positions of water bodies, the rate of rise and fall of floodwater, the duration of floods, local topography and impediment to drainage.

4.5 Objective of Flood Proofing

The objectives of the Flood Proofing are to avoid loss of life, reduce adverse effects on health and nutrition, and sustain and improve normal family and community activities during and after severe floods, protecting the environmental and social values. The requirement is to plan and implement development so that people including the officials can continue their activities during floods without interruptions and setbacks.

Flood Proofing activities are focused on finding ways for people to live and improve their lives and reduce their suffering in an environment that frequently floods. The Flood Proofing measures can be grouped on measures that focus on:

- protecting the homesteads / village mounds from inundation and erosion caused by the wave action
- Ensuring a flood free housing
- sheltering the flood affected population
- Flood Forecasting and Warning with establishing a workable system of timely dissemination
- Carrying out the O&M of Flood Proofing infrastructure

Table: 4.1 Char area population-household, present and projected

Distruct	UZ	Char area (%) of total	Area of char (ha)	Population of char area 2001	No. of homestead in char area	Present Growth rate %	Population of char area 2005	No. of homestead 2005	Population of char area 2010	No. of homestead 2010	Population of char area 2025	No. of homestead 2025
	Char Area											
Gaibandha	Fulchari	87	26,631	91,547	15,128	1.04	96,407	15,931	101,526	16,777	118,571	19,594
	Gaibandha Sadar	21	6,675	24,029	4,412	2.26	26,870	4,934	30,046	5,517	42,013	7,714
	Shaghata	38	8,557	61,133	12,324	3.19	71,526	14,419	83,686	16,870	134,034	27,020
	Sundarganj	20	8,533	24,321	1,821	1.52	26,226	1,964	28,281	2,118	35,463	2,655
Jamalpur	Dewanganj	78	20,888	148,392	28,998	1.82	162,396	31,735	177,722	34,730	232,937	45,519
	Islampur	34	11,611	66,132	12,924	1.96	72,872	14,241	80,299	15,693	107,438	20,996
	Madarganj	45	10,097	74,161	15,053	1.99	81,840	16,612	90,313	18,332	121,371	24,636
	Sharishabari	39	10,164	88,442	10,682	2.29	99,043	11,962	110,915	13,396	155,772	18,814
Kurigram	Char Rajibpur	87	9,694	47,550	9,110	0.7	49,238	9,433	50,985	9,768	56,609	10,846
	Chilmari	83	18,607	51,029	10,275	1.21	54,192	10,912	57,551	11,588	68,929	13,879
	Kurigram Sadar	28	7,650	20,806	3,663	2.13	23,118	4,070	25,688	4,522	35,239	6,204
	Nageshwari	51	21,060	109,223	19,745	1.74	119,062	21,524	129,787	23,463	168,115	30,391
	Raumari	39	7,702	45,109	4,974	1.81	49,342	5,441	53,972	5,951	70,636	7,789
	Ulipur	41	20,769	61,573	5,685	2.41	69,359	6,404	78,129	7,214	111,673	10,311
Sirajganj	Belkuchi	51	8,315	96,576	17,275	2.72	110,445	19,756	126,305	22,593	188,905	33,790
	Chauhali	100	24,367	116,642	21,400	0.73	120,962	22,193	125,442	23,015	139,903	25,668
	Kazipur	70	25,836	129,180	24,723	0.94	135,367	25,907	141,850	27,148	163,222	31,238
	Shahjadpur	21	6,942	63,750	7,573	2.09	70,696	8,398	78,399	9,313	106,920	12,701
	Siragnj Sadar	38	12,542	79,561	12,735	1.36	85,120	13,625	91,068	14,577	111,523	17,851

Pop-area/XLs CHAR Population 2001-2025

Table: 4.2 Haor area population-household, present and projected

Distruct	UZ	Haor area (%) of total UZ	Area of Haor (ha)	Population of Haor area 2001	No. of household in Haor area 2001	No. of village mounds 2001	Total area of mounds (ha)	Average area of a village mound (ha)	Presend Growth rate %	Population of Haor area 2005	No. of village mounds 2005	Population of Haor area 2010	No. of village mounds 2010	Population of Haor area 2025	No. of village mounds 2025
	Haor Area														
Habiganj	Ajmiriganj	100	22,399	101,744	17,244	410	397.00	0.97	1.60	110,148	18,668	119,247	20,210	151,304	25,644
	Bahubal	24	5,915	4,621	866	19.11	19.51	1.02	1.65	5,015	940	5,443	1,020	6,957	1,304
	Baniachang	83	39,866	194,732	34,122	1,150	1243.00	1.08	1.46	209,369	36,687	225,105	39,444	279,775	49,024
	Habiganj Sadar	54	13,586	90,750	15,175	375.37	383.20	1.02	2.35	101,926	17,044	114,479	19,143	162,197	27,122
	Lakhai	100	19,655	134,742	24,019	245	246.00	1.00	2.02	148,912	26,545	164,572	29,336	222,145	39,599
	Madhabpur	37	10,861	101,234	14,874	418.74	427.47	1.02	2.53	114,705	16,853	129,968	19,096	189,060	27,778
	Nabiganj	45	19,669	90,259	19,055	352	316.00	0.90	1.32	96,375	20,346	102,906	21,725	125,277	26,448
Kishoreganj	Ashtogram	100	35,555	167,704	26,589	90	753.00	8.37	2.40	188,818	29,937	212,590	33,706	303,419	48,106
	Bajitpur	75	14,463	153,786	27,311	2	2.00	1.00	2.44	173,486	30,810	195,710	34,756	280,967	49,897
	Itna	100	40,195	154,901	27,897	270	324.00	1.20	1.54	167,201	30,112	180,479	32,503	226,978	40,878
	Karimganj	100	20,051	281,529	51,574	50	94.00	1.88	1.73	306,739	56,192	334,205	61,224	432,264	79,188
	Kishoreganj Sa.	38	7,361	142,554	23,001	207.35	208.35	1.00	2.25	159,329	25,708	178,079	28,733	248,635	40,117
	Mithamain	100	22,292	141,788	22,516	80	142.00	1.78	2.74	162,307	25,774	185,795	29,504	278,695	44,257
	Nikli	99	21,168	124,100	21,112	128	202.00	1.58	1.54	133,955	22,788	144,592	24,598	181,845	30,936
	Tarail	59	8,291	88,585	14,579	129.47	129.47	1.00	2.30	99,252	16,335	111,203	18,301	156,405	25,741
Netrokuna	Khaliajuri	100	29,764	83,649	14,239	181	405.00	2.24	0.99	87,872	14,958	92,309	15,713	107,009	18,215
	Kalmakanda	34	12,870	63,992	11,749	164	265.00	1.62	2.04	70,791	12,997	78,312	14,378	106,020	19,465
	Madan	58	13,131	61,208	11,234	53	86.00	1.62	1.25	65,130	11,954	69,304	12,720	83,500	15,325
	Mohanganj	59	14,357	62,714	11,196	125	126.00	1.01	1.83	68,666	12,259	75,183	13,422	98,687	17,618
Sunamganj	Bishwambarpu	57	11,057	56,936	10,121	43.49	54.01	1.24	1.95	62,708	11,147	69,065	12,277	92,272	16,402
	Derai	100	42,094	207,114	33,580	76	81.00	1.07	1.12	218,975	35,503	231,515	37,536	273,613	44,362
	Dhamapasha	95	47,342	158,774	27,431	115	135.00	1.17	1.08	167,535	28,945	176,779	30,542	207,687	35,882
	Jagannathpur	52	18,992	76,507	11,974	58.44	72.58	1.24	1.42	82,095	12,849	88,092	13,787	108,841	17,035
	Jamalganj	100	33,876	123,115	20,699	158	274.00	1.73	1.34	131,588	22,124	140,644	23,646	171,725	28,872
	Sulla	100	26,073	113,680	13,881	187	201.00	1.07	2.37	127,805	15,606	143,685	17,545	204,175	24,931
	Sunamganj Sa.	66	36,992	193,646	35,047	88	102.00	1.16	1.78	211,505	38,279	231,011	41,810	301,002	54,477
	Tahirpur	76	23,982	96,548	15,320	58	54.00	0.93	1.98	106,492	16,898	117,461	18,638	157,623	25,011
	Chatak	52	22,663	128,939	22,663	98.49	122.31	1.24	2.13	143,269	25,182	159,191	27,980	218,382	38,384
	Dowarabazar	18	5,076	28,568	4,501	21.82	27.10	1.24	1.39	30,609	4,823	32,797	5,167	40,342	6,356

Pop-area/XLs Haor Population 2001-2025

4.6 Strategy of Flood Proofing in char and haor areas

The Flood Proofing measures related to each of the groupings are discussed below:

4.6.1 Protection of the homestead from river erosion in the char area; and village mounds from wave erosion in the Haor area

The char area in the active Jamuna floodplain has a dynamic environment due to river erosion and sedimentation. It has a low population density and low land productivity. Structural measures such as embankment, regulators etc are not appropriate for protection against flood in the char area. However, Flood Proofing measures such as the provision of flood shelter with adequate tools for evacuation, raising the homestead level, protecting the household from river flow and wave by vegetation have the possibility to lessen the impacts of floods on households and communities to a great extent.

Char area: Much of the Jamuna char land lacks tree cover, although the more stable island chars have some homestead vegetation. Under the FAP 3.1, it has been suggested that there is considerable scope for afforestation program, although care must be exerted in selecting appropriate species in term of their flood tolerance as well as for human utilization for shade, fuel, timber and fruit. Protection of the char villages against river erosion of the Jamuna will not be feasible beyond the indigenous and traditional vegetative methods (and in extreme situation in house shifting).

Haor area: The village mounds in the haor area has a scope for protection against the wave erosion which is most staggering problem facing the haor population. Villagers have a constant battle throughout the monsoon to save their homesteads from this kind of erosion. Occasionally floodwaters overtop the village mounds, as it did in 1988 and also to a considerable extent in 1993 and 1998, but this does not tend to happen every year. On the other hand, the erosion due to the wave is a regular phenomenon in each monsoon for 5-6 months in all the haor areas particularly in the deep haor regions. From everywhere in the haors, vegetative cover has long been absent due to people's suicidal action against the environment. The Hijal *(Barrington Recemosa)* and the 'Koroch' *(Pongamia Pinnata)* trees that once thrived in the haor waters and gave vegetative protection against the wave thrust, have yielded their place to agricultural expansion during the last 50 years or more. Now time has come to remind the haor people about the outcome of their fell action against the naturally grown trees, which they can observe for themselves possibly better than others.

Present response to the erosion of the homestead is done by a yearly rehabilitation of the lost earth during the dry period. The 'Chailla' grass, which does not rot quickly rot under water, is placed on the earthen slope of the mound doweling with bamboo stakes in order to reduce the thrust of the monsoon waves. 'Chailla' is also becoming scarce as lands that once grew the grass are being used for agricultural purposes these days. In some cases, a few rich people got their homesteads protected by brick masonry wall with their own finance. Some mound protection by hard materials

have been provided by NGOs, but most of the mounds of the poor mass are protected by ‘Chailla' only and practically remain unprotected.

Villagers task of protecting their mounds is, however, difficult as the soil is predominantly easily eroded type. Protection of homesteads dominates all their activities in monsoon and drain most their resources leaving very little for any productive works during the period. Rural development in the haor areas, therefore, can not be achieved without the protection of the homestead mounds from wave action. With this background in view, the Study envisages the protection of the village mounds.

The protection against the wave erosion may be provided one or more of the following:

(a) By earthwork to replenish the eroded earth every year in the immediate next dry season

This is the most widely mode of village mound protection. The earth-only approach has the disadvantage that it is not durable. The soil is mostly non-clayey in nature. Every year the lost earth has to be replenished. However, in the absence of vegetative mode of protection becoming effective during the first 10 years, this method has to be widely adopted in a bid to save the village mounds from total extinction.

(b) By vegetative protection of Hijal/Koroch

This can help make the whole process of protection of the village mounds sustainable in the long run which should be the main tool for flood proofing the haor area settlements. The water resistant Hijal/Koroch trees will require 10-15 years to grow to a mature state and become fully effective. Therefore, the immediate action that should be done is to start the afforestation program Hijal/Koroch . Once the plantation is established it will go on multiplying naturally. The villagers needs be trained to preserve the plantation. Normally there is chance of pilferage of the semi-grown or grown trees for fuel use.

(c) By brick-block revetment

The revetment work will give dependable protection for 20-25 years provided well designed and properly constructed and regularly maintained. This is a costly item and so will be provided for a very limited no. of mounds (5% of the total) which need the protection urgently in deep and shallow haor during the first two phases. It is expected that the plantation will grow to a mature state and will start functioning in resisting the wave erosion towards the beginning of Phase-III and the hard material type of protection will seldom be used thereafter.

(d) By RCC or masonry wall

This is the costliest of all protective measures, although fully effective in protection. It needs minor maintenance and hence O&M cost is the minimum provided well designed and properly

constructed. This will be used only in the deep haor area where wave height is very high (more than 2 meters) and the mounds that needs urgent attention due to threat of extinction. A total of 3% mounds will be protected by this mode.

4.7 Towards a flood free housing : raising the homestead

Floods can extract a toll on human life and can cause disruptions to social and economic activities both in terms of people being drowned and people not being able to sustain normal life during and after a flood. Inundation, damage or loss of homes and shortage of necessities can lead to deterioration of health and physical condition of those affected; which will impair their ability to earn even when employment becomes available again.

Loss of people's private property and capital assets also causes considerable suffering during and after floods. Private property includes house, homesteads, and commercial and industrial premises. Capital assets include personal possessions, household furniture, utensils, tools, commercials and industrial equipment, livestock and fodder, agricultural supplies, food and other consumable items.

Flood proofing programs should include measures to protect homesteads from inundation of flood. Traditionally, individuals and families have depended on their own Flood Proofing initiatives to protect their properties and possessions from flood damage. Under the present Study, therefore, raising of the homestead level above a design flood level (in this case that of 1998) to ensure flood free habitation throughout a flood has been planned. Raising of homesteads above flood level is of particular importance to women as their daily activities are centered mostly on homesteads.

Homesteads loose earth from the top surface and the side slopes due to rainfall and by the occasional inundation. Also the earth mounds settle over time. Generally the mounds loose 150 mm/year due to rainfall and when overtopped it looses a further 50 mm yearly (Source FAP 6 report). When inundated, the house plinth and the related structure start to disintegrate. Houses start to sink into the platform, walls fall apart and the walling materials and bamboo supports start to rot.

Therefore, it is necessary to recoup the lost earth caused by rainfall and flooding every year for a sustainable flood free housing. Instead of raising the room(s) only, the present Study favors raising the homestead with courtyard so that flood stricken people can at least do some household works without getting confined in rooms for months together during flood.

Measures to protect houses from damage due to inundation could be adopted and structural stability may be increased. The community may be motivated to build with timber at least one two-storied room with sufficient structural stability in every house so that in time of need at least 2-3 inmates could live in their own house during the flood.

The flood-affected people of char and haor areas are generally poor. During flood they are fully occupied with the task of protecting their homesteads from manifold hydro-meteorological onslaughts, and drain their resources leaving very little for other productive activities like selling labor. Helping them raise their homestead above flood level with sustainability will make them free from the constant flood time agony; and will allow them to get engaged in other economic pursuits. This will help prevent pauperization in a disadvantaged society like theirs.

The char and the haor areas experience inundation of households, with varying depths and duration, all through monsoon. The maximum depth of inundation varies with the severity of the flood level. For the purpose of deciding an average height (or a number of average heights) in a wider area by which the homesteads/ village mounds / plinths have to be raised, a specified frequency flood is to be chosen as a reference for the preparation of the Master Plan.

While formulating the Master Plan for flood proofing, the 1998 flood level has been considered as the reference elevation for the flood proofing works relating to raising of homesteads.. The flood of 1998 has been considered a 20-year frequency flood for both Haor and Char areas.

As per the FAP guideline for flood proofing (FAP 14/FAP 23), the Free Board for the raising of homesteads for areas subject to erosion could be 0.30 m above the design flood level while the Free Board for the same purpose could be 0.50m for areas not subject to erosion. Therefore, for homestead raising, Free Board may considered 0.30m for char area and 0.50m for haor area.

Stability of the char should receive special attention before undertaking works of homestead raising and shelter construction. As a principle, the Study does not consider the mentioned works for the chars that have in existence for less than 7 years and /or has a visible sign of approaching erosion.

4.8 Multi-purpose Shelters with raised earthen platforms for cattle

4.8.1 Flood sheltering /FC Embankment as shelter

In a situation, where there are no adequate numbers of flood shelters in a flood prone area, people take shelter on full height FC embankments, high roads or elevated grounds where available. People residing in the setback land (or the chars where an FC embankment exists nearby) often take refuge on the FC embankments and are often 'tolerated' by the concerned authority during floods.

As it is not possible to bring immediately each homestead level above the design flood level, it will be imperative to build Flood Shelters in strategic points of the char and haor areas. Since there is chance of flood of a severe nature every 5-6 years, it will be essential to construct flood shelters above the severe flood level for saving human life. The shelters should have two parts: one will be the building part and other will be open air part. The sick and invalid among the evacuees should get preference in the building. For the sociological reasons, separate provision for men and women is needed. The shelter building, therefore, should be twin in nature. The shelter building will be used as a school (or UP office, community storage or for other community purposes) in normal time. The extended raised platform will accommodate the livestock and in extreme situation will accommodate the additional evacuees under the open air. During such circumstances, the relief distributing agencies can install tents for the evacuees in the open-air part of the platform.

As per the FAP 14/FAP 23 recommendations, Free Board of shelters, should be minimum 1 m above the highest flood level, in the present case level of 1988.

The existing flood shelters are all male-dominated. There is full of hazard that lark for the women and children. Parents hesitate to take their adolescent girls to the shelter even in time of extreme needs. This is evident from the reconnaissance as well from the flood related surveys undertaken during the studies. So in the Master Plan, twin shelter building has been proposed, one part will be used by the females exclusively.

As per the infra-structural survey under the present Study, there are 232 flood shelters in the char area for a total population of 1,399,156, and 168 flood shelters are in the Haor area for a population of 3,428,419. This is definitely scanty.

Flood shelter must not be very far from the evacuee's house – it should not be more than 3 km, It is to be ensured that the evacuee can visit his abandoned submerged house to look after his home belongings at least once a day. There are advantages in constructing shelters close to the communities. Less time will be required to reach the shelters and people will remain reasonably near to their homes. So, in the Master Plan more number of comparatively smaller shelter-cum-refuges for people and cattle has been proposed rather than less number of large capacity shelters long distance apart.

4.9 O&M and the sustainability of the flood proofing measures

In order to have a sustainable solution to the flood proofing, O&M of the flood proofing works need adequate attention. In the Master Plan O&M of the earthworks in raising the homesteads and the 'earthwork only' type of protection from wave erosion has been proposed for. The vegetative growth of the Hijal/Koroch trees will be effective when matured in a 10-12 years time from the time of plantation. Thereafter, the trees will provide resistance to wave action and will make the process of flood proofing sustainable. Maintenance of the Flood Shelters will be needed after each monsoon.

4.10 Interest of the disadvantaged groups

During Master Planning, the interest of the disadvantaged groups including the women and the rural poor has been given special consideration. The opinion of the people regarding the existing problems and their probable solutions, including their ideas about the feasibility and the implication of the mitigation have been taken in to account.

The planning process confirmed whether the measures identified are:

- compatible to people's needs and wishes
- practicable administratively and institutionally
- capable of being implemented without creating major social disruption to any social group

The individuals, communities, government or non-government institutions using private or public funds may apply the principles of Flood Proofing in a number of pilot areas that may be adopted and implemented.

The cattleheads are the worst affected during floods. Raised ground for the cattle is another vital necessity. The multi-purpose shelters have been proposed with refuge platform for the livestock.

During flood, in most cases, boats are the only mode of transport. Lack of roads in the haor areas makes transportation more difficult in the dry seas on than during wet season.

4.11 Flood warning system

BWDB's Flood Forecasting and Warning Centre has an objective to cover the whole flood prone areas of the country and to disseminate information and warnings to the people of the probable affected areas in a more straightforward and meaningful way through its on-going DANIDA -aided project. The Centre does not have any tools to forecast flash floods which require a direct access to the real-time rainfall data in Indian territory.

FAP 6 had a Study to provide timely and readily understood warnings to villagers in Flash Flood prone areas of Northeast Region. Storm over the Indian states of Meghalaya and Tripura can occur both in pre-monsoon or monsoon. The flash floods travel down these rivers 20 to 30 km, wrecking havoc in the riverside villages before their energy is dissipated by merging of their flows with those in larger rivers in Haor area. Such flash floods endanger riverside villagers' lives and properties. Details of the technology required to generate these warning signals, and of the actions villagers should take have been worked out to establish the technical requirements of the system. It was recommended that a full directorate name "Flash Flood Warning Agency" be established within the BWDB to establish operate and maintain the proposed system. However, the post-Study implementation has not been materialized. The Study identified 9 flash flood affected areas, 4 of which are in the present Study area of Flood Proofing.

The flash floods are characterized by the rapidity with which the river water rises to a peak level exceeding the riverbank usually less than a day, sometime less than an hour. The rapid rise in water level not only inundates the riverside villages but also flows very fast resulting in loss of life, collapsing of houses, loss of livestock and properties. Flow velocities may vary from 3 to 6 m/sec. Such havoc appear to occur once in 5 years on average. However, when these flow reaches the bigger river in the haor areas, they loose the flashy character, only fill the haor areas in rapid rise in water level with retarded drainage.

The present forecasting system on point inundation (where BWDB gauge is situated) is to be improved for forecasting area inundation probability so the target people understand it better. Further, the warning dissemination system is to be improved and extended to other flood prone areas after successful testing in the DANIDA-assisted 3 pilot UZs.

4.12 Flood preparedness

Flood preparedness is the provision of short term measures for individuals, families, communities, and institutions to reduce the disruption and damage by an ensuing floods. Flood preparedness is primarily the development of service delivery systems for people or institutions to use before, during, or after a flood. Flood preparedness measures are designed to ensure the readiness and ability of a society to forecast floods, take precautionary measures in advance of a flood, and respond to and deliver effective rescue, relief, and other post-disaster assistance.

4.13 Erosion Forecasting and Warning System as viewed by NWMP

As reported in the NWMP DDS Report August 2000, the technology of erosion forecasting is only just beginning to emerge as a potential tool for disaster management, but the likelihood is that over the next decade it will become a feasible technology which could be used to improve planning. It has been developed in Bangladesh mostly in connection with the planning and design of major civil engineering works at Bangabandhu Bridge, the three recently constructed hardpoints on the Brahmaputra River Training Works, and at the proposed Pakshi Bridge/Gorai River mouth complex.

Monitoring by radar imagery can show the development of bends and echo-soundings can measure the depth of flow. Combination of these should permit the general area of probable erosion over the next few months to be predicted. People living in the area can be warned of the impending danger, so they can make contingency plans. Depending on the GoB's level of commitment towards assisting people displaced by erosion, evacuation and resettlement plans can also be prepared in advance.