CHAPTER 8 FEASIBILITY STUDY FOR THE MODEL AREA IN HAOR

8.1 The Study Area

8.1.1 Location and History

Gurai gram is located in the western edge of Haor area. It belongs administratively to Gurai Union, south-western part of Nikli Upazila, Kishoreganj District. It is bounded by Nikli Union to the north, Chhatir Char gram to the east, Daulatpur gram to the south, and Chhetra gram to the west. It is about 5 km south of Nikli Upazila headquarters and 30 km away from the Kishoreganj District headquarters.

Gurai gram has a long history (Table 8.1). It was founded some 800 years ago by a Sultan. Muslim rulers invaded this village in the medieval age and their army built temporary camps at Gurai. A mosque named "Shahi Masjid", which still exists, was built by those soldiers. Afterwards people started to live first at the present Majsid para.

Some villagers believe that "Gurai" was named after the river "Ghora Utra" which flows in the east side of the gram, while others think the name of Gurai came from the name of a Muslim ruler Mohammad Ghuri.

Table 8.1 Chronological Table of Gurai Gram

Year	Incident
800 years ago	The first settlement was started at Gurai
1917	First land survey by the British Colonial Ruler
1940	Second land survey, which was very important for the villagers
1944	Flood eroded most of the part of the village
1954	Due to flood and wave erosion, people from Biatir Char migrated and first inhabited in this village and rebuilding a new Para named Naogaon Hati. At that time at least 14 Hindu families left the village for Mymensingh and other districts.
1960-70	3 Hindu families left the village and migrated to India permanently
1971	Liberation Movement. At least 40 people died. Beside, Pakistani army destroyed many valuable assets, livestock and poultry by setting fire.
1974	10 people have died due to flood. Immediately after flood at least 29 families left the village for Chittagong & Dhaka in search of work.
1975	Diarrhea claimed at least 50 lives.
1980	3 Hindu families migrated to India and 7 Hindu families went to Mymensingh for business purpose.
1988	Flood caused serious damage to the village. After this worst flood about 50 families left Gurai to other districts in search of work.
1998	Enormous damage by flood. Boro crop failed that year. A great damage on roads, houses and livestock. 80 families left the village immediately after flood for Chittagong and Dhaka due to severe poverty.
2000	About 30 families left the village in search of work for Chittagong and Dhaka.

Source: JICA Study Team based on PRA by DICS, 2002

GURAI GRAM, GURAI UNION
NIKLI UZ, KISHOREGANJ DISTRICT

Scale.1:20,000

0 500 1,000 m

TO NIKLI

SAJANPUR

CHHOTA DIGHIR PAR

CHHATARA

ATHARABARIA

Homestead Area of Gurai Gram

GURAI

CHHATIR CHAR

BIATIR CHAR

SAHAPUR

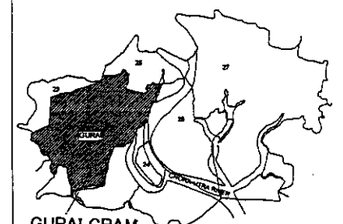
PARA BAJIPUR

DAULATPUR

GHORA UTRA RIVER

GURAI UNION

Para Baikpur	22
Gurai	23
Biatir Char	24
Chhota Dighir char	25
Chhatir Char	26
Char Dighirpar	27



LEGEND

- STUDY AREA FOR GURAI
- PARA BOUNDARY
- EMBANKMENT ROAD
- FOOT PATH
- VILLAGE MOUND
- WATER POND
- RIVER BANK
- STEEP AREA
- CONTOUR FOR EACH METERS
- CONTOUR FOR EACH 50 CENTIMETERS

LOCATION MAP OF OF GURAI GRAM

8.1.2 Area and Population

Gurai gram has an area of 569 ha, of which 7.9% or 45 ha are homestead area including the bazaar area, 89.2% or 507 ha are agricultural area, and 3.9% or 17 ha are water body including ponds.

The population of the whole gram totals 12,132 consisting of 6,656 male and 5,476 female. As shown in the map of Gurai, the gram is divided into 17 paras or neighbourhoods, each consisting of a group of homesteads. They are: Chila para, Bania para, Atka para, Uttar para, Fakir para, Jal para, Kuna para, Masjid para, Namsud para, Dakhin para, Purba para, Ghosh para, Pashchim para, Shibir para, Pal para, Naogaon para and Moddon para. These paras are clearly divided by canals and roads.

Para-wise population by sex and households are shown in Table 8.2.

Table 8.2 Para-wise Population by Sex, Average Family Size and Population Density

No.	Name of Para	Population			HH*	Family size	Homestead area (ha)	Density** (people/km^2)
		Male	Female	Total				
1.	Chila para	81	67	148	21	7.0	0.5	29,600
2.	Bania para	226	189	415	58	7.2	0.8	51,875
3.	Atka para	410	345	755	109	6.9	1.8	41,944
4.	Uttar para	235	203	438	62	7.1	1.7	25,765
5.	Fakir para	56	47	103	15	6.9	1.2	8,583
6.	Jal para	324	273	597	85	7.0	3.8	15,711
7.	Kuna para	175	97	272	39	7.0	1.4	19,429
8.	Masjid para	1,001	836	1,837	248	7.4	7.8	23,551
9.	Namasud para	84	72	156	22	7.1	0.6	26,000
10.	Dakhin para	350	293	643	85	7.6	1.2	53,140
11.	Purba para	1,010	823	1,833	256	7.2	3.6	50,917
12.	Ghosh para	302	253	555	81	6.9	3.0	18,500
13.	Pashchim para	444	371	815	116	7.0	1.5	54,333
14.	Shibir para	411	338	749	107	7.0	3.0	24,967
15.	Pal para	469	372	841	121	7.0	3.8	22,132
16.	Naogaon para	745	601	1,346	205	6.6	4.8	28,042
17.	Moddon para	333	296	629	90	7.0	2.7	23,296
Total (average)		**6,656**	**5,476**	**12,132**	**1,720**	**7.1**	**43.2**	**27,135**

Remarks: *:Number of household; **:Population density based on the homestead area

Source: JICA Study Team based on the PRA by DICS, 2002

The total population of Gurai gram is 12,132 with 1,720 households. Male population surpasses female population by some 20%, for which the reason is unknown. Average family size is 7.1 ranging from 6.6 to 7.4. Homestead area is confined to the higher land with 43.2 ha. Population density is very high with more than 27,000 on average, ranging from 8,583 in Fakir para to 54,333 in Pashchim para. This high population density is due to decreased homestead area by mound erosion by wave actions in the rainy season. At the events of large flood, edges of the mound are eroded and lost with houses. Those who lost houses move to inner part of the gram if not move out of the gram.

Naogaon para located in the south-western part was established some 50 years ago by in-migrants from Biatir Char, which was totally eroded by a large flood. Flood refugees have been settled this para since then.

The gram is Muslim dominant. Some 92% of the population is Muslim. Namasud para is an almost pure Hindu community with the population of 156. Other Hindus mainly live in paras in the western part such as Pal para, Ghosh para and Atka para. As Muslim and Hindus have lived for long time, no religion based conflict between them has been reported. Even there is no political disputes as the two political leaders of Awami League union and BNP union closely cooperate each other.

The eastern part of the gram, facing to Haor area, are vulnerable to erosion caused by wave action in the rainy season. Edges of the mounds where people live have been eroded year by year. The vulnerable paras include Chila para, Bania para, Uttar para, Fakir para, Jal para, Kuna para, Dakhin para and Purba para.

8.1.3 Natural Conditions

(1) General description

Gurai falls under physiographic unit 9, i.e. Agro-Ecological Zone of old Bramaputra Flood Plain, Surma-Kushiyara Flood Plain and old Meghna Estuarine Flood Plain. More specifically, Nikli Upazila covers old Meghna Esturiane Flood Plain (120.79 km^2) and Sylhet Basin (72.62 km^2).

Seasonal flooding is by accumulated rainwater, which is unable to drain off the land when water level is high in the adjoining Sylhet basin and old Bramaputra, Jamuna and Meghna rivers. During the rainy season, low land is flooded generally with considerable depth.

The soil is clay and clay loam. It is low in nitrogen and phosphorus and high in calcium, copper, iron and manganese. The Ritchi and Austogram soil groups prevail in the Study Area. It is subjected to rapid rise in flood level. The soil type of Nikli Upazila covers Acid Basin Clay (193.48km^2) and Non Calcareous Dark Grey Flood Plain (0.98km^2) only.

(2) Surface water quality

The JICA Study Team collected the three water samples for surface water quality analysis. The sampling was done on random basis within the Study Area. Data in Table 8.3 indicate that pH varies from 6.72 to 7.06, electrical conductivity, EC between 248 to 302 μS/cm and total dissolved solids, TDS between 109 to 142 mg/l. The surface water quality is within Bangladesh and WHO guideline values and suitable for irrigation.

Table 8.3 Surface Water Quality in Gurai Gram

Water Quality Parameters	Unit	Bangladesh Standard	WHO Standard	Gurai		
				Location -1	Location -2	Location -3
				Open pond Md. Ali Akbar Gurai	Roar Beel Gurai	Open pond Mr. Haradhan Pal Gurai
PH		6.5-8.5		7.06	6.72	7.05
EC	µ S/cm			302	302	248
TDS	mg/l	1000	1000	140	142	109
Chloride (Cl^-)	mg/l	600	250	19.0	20.0	9.0
Nitrate (NO_3^-)	mg/l	10	50	0.0	0.0	0.9

Source: JICA Study Team

(3) Ground water

The sampling was done on random basis consisting of three samples from hand tube wells with depth varying between 50 m to105 m within the Study Area. Data in Table 8.4 indicates that pH varies between 7.42 to 7.52, EC between 474 to 518 µS/cm, arsenic contents 0.055 mg/l in one sample, iron contents between 0.25 to 0.52 mg/l, and phosphate contents between 0.5 to 3.5 mg/l. The data indicate that except the arsenic content in one tube well, the groundwater quality is within Bangladesh and WHO guideline values and suitable for both drinking and irrigation purposes.

Table 8.4 Groundwater Quality in Gurai Gram

Water quality parameters	Unit	Bangladesh standard for drinking water	WHO standard for drinking water	Gurai		
				Gurai, Depth: 105 m, Hand Tubewell	Golam Rahman Golap, Depth: 75 m, Hand Tubewell	Dr. Mihir Ranjan Pal, Depth: 53 Hand Tubewell
PH		6.5-8.5		7.42	7.35	7.52
EC	µ S/cm			518	474	478
Iron (Fe)	mg/l	0.3-1.0	0.3	0.52	0.49	0.25
Arsenic (As)	mg/l	0.05	0.01	0	0.055	0
Chloride (Cl)	mg/l	600	250	2.5	4.0	3.0
Manganese (Mn)	mg/l	0.1	0.1	0.0	0.0	0.0
Sulphate (SO_4)	mg/l	400	250	0.0	0.0	0.0
Phosphate (PO_4)	mg/l	6		0.5	3.5	1.0
Nitrate (NO_3)	mg/l	10	50	8.9	0.9	0.0

Source: JICA Study Team

(4) Ecological resources

Wetland fora

The wetland flora of the Study Area is rich in bio-diversity. The dominant plants in the Haor basin are Hijal (Barringtonia acutangula), Koroch (Pongamia pinnata), Barun (Crataeva nurvala), Bon Golap (Rosa involucrata) etc. These plants (except Barun) are now depleted at an alarming rate because of loss of habitats e.g., conversion of land for agricultural purposes, human settlement

and cutting of wood for domestic purposes. Wetland floral diversity is highest from June to December of the year or when land is submerged in the Study Area. The Barun (Crataeva nurvala) is the dominant tree species in the Haor basin. Most of the 25-30 families of the plant diversity existing in Bangladesh are present in the Study Area e.g., Cyperaceae, Gramineae, Amaranthaceae, Malvaceae, Nymphaceae, Polygonaceae, Scrophulariaceae, Rubiaceae, Araceae, Boraginaceae, Compositae, etc.

Terrestrial flora

Most of the 20-25 principal families of the plants existing in Bangladesh are found in the present Study Area e.g., Gramineae, Leguminosae, Anacardiaceae, Moraceae, Myrtaceae, Cyperaceae, Euphorbiaceae, Annonaceae, Rutaceae, Cucurbitaceae, Ebenaceae, Solanaceae, Lythraceae, Labiatae, Lauraceae, Rubiaceae, Malvaceae, Apocynaceae, Compositae, Combretaceae, etc.

Wetland fauna

The Study Area supports a variety of wildlife and fish population. Different types of native fish are still present in a moderate number. This Haor area supports two types of seasonal wildlife population and their habitats in a year because the area inundate for six months and the rest of the months it is dry-up. Some endangered wildlife and fish species are identified.

Terrestrial fauna

Different types of wildlife species are the core component of the terrestrial fauna in the Study Area. Wildlife fauna in the Haor areas is abundant during the rainy season. In the dry season, Haor areas act as a nesting ground for the terrestrial wildlife especially for birds. Both in the dry and the rainy seasons, the Haor areas naturally produce plenty of food for the terrestrial and wetland wildlife. As a result, different types of migratory birds also visit these areas for some months for taking food, shelter, nesting etc. Some endangered wildlife species have been identified.

8.1.4 Socio-economic Conditions

(1) Land use

Land use of Gurai gram is determined largely by elevation of land: high land, medium land and low land. In higher land including artificially raised land, people enjoy ordinary life. Homesteads with useful trees and garden, road, school, hat/bazaar, etc. are seen on highland. Medium land around the mounds is utilized for crop fields for potatoes, groundnuts, tomatoes, chilli, onion, garlic, coriander, etc. Lower land, extends over the Haor area, is mainly for paddy cultivation in the dry season by using groundwater as irrigation source. Fish ponds have been established within the mounds and commonly used for fish farming. By villagers' perception, the whole gram is divided into three broad categories of land: (i) Ati or homestead land; (ii) Bandh or agricultural field; and (iii) Pagar or fish pond.

Major crops grown are rice, groundnut, chilli, potatoes, garlic, onion, coriander, snake gourd, etc. Fruit trees grown include: mangoes, black berry, jackfruit, coconut, banana, betel nut, papaya, etc. Trees grown on the homesteads include: mahogany, Dalbergia sisso, eucalyptus, rain tree, etc.

(2) Land ownership and land tenure system

Land holding size

Situation of land ownership by holding size and occupation by land size category are shown in Table 8.5.

Table 8.5 Households by Land Holding Size Category

Land size (in acre)	Category	Nos. of male headed HH	Nos. of female headed HH	Total HH	Occupation
0	Absolute landless	178	106	284 (17%)	Daily labor, rickshaw puller.
0-0.04	Functional landless	151	16	167 (10%)	Daily labor, fishermen
0.05-0.49	Landless	345	25	370 (21%)	Daily labor, fishermen
0.50-0.99	Marginal Farmer	109	28	137 (8%)	Daily labor, share cropper
1.00-2.49	Small Farmer	319	31	350 (20%)	Daily labor, share cropper, business
2.5-7.49	Medium Farmer	363	0	363 (21%)	Farmer, business
7.5 & above	Larger farmer	49	0	49 (3%)	Farmer, business
Total		**1,514**	**206**	**1,720** (100%)	-

Source: PRA by DICS, 2002.

The absolute landless share 284 households or 16.5% of the total households. The broad category of landless, combining absolute landless, functional landless and landless accounts for 821 households or 48% of the total. Lager farmers with 7.5 acre or larger land total 49, or 2.8% of the total households. More than 70% of female headed households fall in the broad category of landless.

Not only landless and marginal farmers, but also small farmers work as daily laborers, as demand for labor by medium and large farmers is high, especially in transplanting and harvesting seasons. Functional landless and landless go fishing for livelihood while marginal and small farmers cultivate others land by sharecropping; medium and large farmers do business.

Land tenure

Land tenure systems prevailing in the gram include: landownership, share cropping, land lease, land mortgage, and Shanpatan.

Land ownership by inheritance for Muslim people is the same as that in Algar Char as described in Section 7.1.4 (2). In the Hindu society, women cannot inherit any land property. Boys inherit all the land property of their father. If there is no son in the family, the grandson will inherit the land. If there is no grandson, then the property will go to the uncle of the daughter; i.e. brother of the landowner.

Shanpatan is one-year base land lease contract. Lease amount is Tk.5,000 per acre.

(3) Social structure

Social norms and customs

Social customs and events in the gram are much related to the religion. Various ceremonies such as Khatna (circumcision), Milad (a socio-religious ceremony), Chehlum (special pray for departed soul of dead body), Eid-ul-Fitr (celebration after one month fasting), Eid-ul-Azha (sacrificing ceremony), Oaz (Preaching for Islamic life style), etc., are Muslim based events.

For Hindus, Puja, a series of religious worship, represents important communal activities. On an occasion of Puja, they prepare emblems of goddesses in three Hindu temples after worshiping. They also prepare sweets and hotchpotch and distribute them to the community people.

Every year the villagers organize a village fair with their collective efforts. In the fair spiritual Fakirs appear and sing spiritual songs including Baul songs, Dehotori and Bhatiali. During the fair, furniture, toys, food items and other materials are bought and sold. Jatra also is staged in the fair. A committee is formed for the fair. Important people of 15-20 constitute the committee. The committee selects a chairman. The overall supervision is made by the Chairman of Gurai Union Parishad.

In case of any disputes and conflicts, the Chairman of the Union Parishad, members, medical practitioners, businessmen and the members of political parties participate in the mediation and settlement of the problems through salish (village mediator).

Power structure

In the local society, a leader, referred to as a matabbar, has a power in terms of economy, politics, and judiciary. Matabbars exist in every para. They are generally rich landowners, school teachers, village doctors, ex. UP members, etc., and very influential in decision making, judicial matters, etc. Basically their power lies with their wealth. Usually villagers obey and follow the advice and instruction of the matabbars with respect.

At the gram level, the Chairman of Union Parishad, who lives in Gurai gram takes the leadership and make decisions. At the ward level, members of Union Parishad (UP), elected representatives of the ward, are considered as the leaders of a ward. Exercise of power by UP members are undoubtedly confined in a ward. Some para matabbars are so influential and powerful that UP

members do not confront with them. Generally female UP members cannot play any significant role in the ward.

At the Union level, the Union Parishad Chairman is the chief executive of the lowest level governmental body. The UP Chairman, usually rich businessman or large agricultural producer, is the most influential person in the union. Being local government representatives, they have tie with the political parties.

At the Upazila level, the Upazila Nirbahi Officer (UNO) appointed by the Government has the power to hold and chair the meetings of Upazila Parishad. In addition, all related Upazila level officers such as LGED engineers, education officers, bank officers, land ministry officers, police officers in charge, etc., hold the power to influence the villagers before serving them any assistance.

General power structure by level of society is summarized in Table 8.6.

Table 8.6 Power Structure by Level of Society

Level	Exerciser of power	Their role
Para level (Informal sub-division of a village, but very important for every day course in village)	Matabbar In every para of the village, there are a few or more Matabbars. They are informal village leaders (village big landlord, teacher, village doctor, Ex. UP member & Chairman, etc.) The Matabbors come for wards to help solve the problems of the village people and play an important role. The general people obey and pay respect to them.	• The Matabbar cooperates with the people in different issues and assists in getting help from outside. • The Matabbars also come forward to settle any dispute in the village area.
Village level		• If any offence takes place the Matabbars try to settle the matters through salish (village mediator). In case of failure, the UP chairman settles. If the UP chairman is unable to settle the issue the matter is referred to the Upazila. Then the UP chairman along with the village people coordinate with the Upazila administration and settle the matter upon discussion with the complainant and the plaintiff. If it is not resolved in Upazila, then the matter goes to the Sadar Court of Kishoreganj. It is worth mentioning that about 90% of the issues are settled in the village salish. Both the parties agree and obey the verdict.
Ward level	Union Parishad member Elected member of UP. There are 9 ward in one UP and 9 male member is elected from 9 ward of a Union Parishad and 3 female members (one represents 3 ward)	
Union level	Union Parishad Chairman Elected chairperson of a UP	
Upazila	Upazila level officers, Upazila administration	
District level	District Administration	
National	Member of Parliament (MP)	• Law maker in the parliament

Source: PRA by DICS, 2002

(4) Gender Balance

Women and girl children suffer discrimination due to socio-cultural norms. Islamic and Hindu inheritance laws distribute the land unevenly to sons, daughters and wives in favor of sons. The practice of dowry from the bride's family to the groom and early marriage of young girls still

prevails. Women and girl children have limited access to resources such as education, health and finance throughout their life cycle.

However, female play a very important role in the family life. They perform almost all domestic activities including washing utensils and clothes, cleaning up rooms and yards, taking care of children, poultry and livestock, maintaining foodstuffs, preparing fuels, cooking meals, etc. They also participate in the economic activities in the field as daily labor or agricultural laborers, to augment their livelihood, but in a limited extent due to overwhelming domestic works.

Male are the main players outside houses. They are mainly engaged in economic activities and marketing. Their houses are the places for them to relax, taking rest, taking food, and sleeping.

Although male and female sometimes do same works such as agricultural labor, there exists a big difference in wage, as shown in the previous chapter (Table 7.7).

(5) Occupation

Table 8.7 provides the type of occupation and the number of people in each occupation by sex.

Table 8.7 Working Population by Sex by Occupation

Occupation	Male	Female	Total
Farming in own field	200	0	200
Share cropper	800	0	800
Daily labor/agricultural labor	1,500	100	1,600
Tailoring	1	0	1
NGO activities	3	6	9
Garments	5	40	45
Trading	92	2	94
Rickshaw/van puller	25	0	25
Duck farming	2	0	2
Village doctor	6	0	6
Fishing	125	0	125
Public service	11	0	11
Banking	2	0	2
Barber	4	0	0
Family planning worker	3	3	6
Teacher	25	17	42
Maid servant	0	40	40
Helper in the shops	10	1	11
Total	**2,814**	**209**	**3,023**

Source: PRA by DICS, 2002

The total working population is 3,023. Agriculture related activities such as agricultural labor, share cropping, and self-employed farming are by far dominant occupation in Gurai. Other occupation includes fishing, trading, rickshaw/van puller, teacher etc. for men, while garments, maid servant, etc., for women.

As the agricultural work is the main profession in the dry season, many people become jobless in the wet season, due to submergence of agricultural fields by floods. Economic activities are very limited only to fishing, boat transport, etc.

(6) Cottage industry

There are several cottage type industries: (i) fishnet making; and (ii) sewing and stitching Katha (traditional embroidery). All the raw materials for both industries are available in the local market. In fishnet making, five people are employed with nominal wage while only family members are employed in Katha making. They acquire those skills from their ancestors, or elder people of the family. Fishnet making has steady market within the village all the year round.

(7) Income and expenditure

Annual average income and expenditure by occupation are presented in Table 8.8.

Table 8.8 Annual Average Income and Expenditure Profile by Occupation

Unit: Taka

	Occupation								
	Large Farmer	**Small Farmer**	**Daily Labor**	**Poultry Rear**	**Fishing**	**Bank clerk**	**FP***	**Teacher***	**Shop keeper**
Income	108,000	28,800	19,800/10,800	19,800	18,000	60,000	60,000	54,000	28,800
Expenditure	96,000	36,800	25,800/24,000	27,000	24,000	72,000	72,000	64,000	36,000
Difference	12,000	-8,000	-6,000/-13,200	-7,200	-6,000	-12,000	-12,000	-10,000	-7,200

Note: Two different figures for daily labors is for male and female respectively.
Remarks: *: Both male and female's occupations
Source: Verbal communication with villagers through Focus Group Discussion under PRA by DICS, 2002

In most cases, the expenditure surpasses the income. The deficit is filled by credit obtained from different sources, according to the interview to the villagers. Expenditure by item and by occupation is shown in Table 8.9.

Table 8.9 Distribution of Expenditure by Item by Occupation

Unit: %

Sl.	**Expenditure items**	**Large farmer**	**Small farmer**	**Daily Labor**		**Poultry rearing**	**Fishing**	**Bank clerk**	**Teacher***	**Shop keeper**
				male	**female**					
1	Food	52.1	76.1	79.5	83.3	75.9	83.3	38.9	37.5	80.6
2	Housing	9.4	3.8	3.9	3.3	3.7	0.8	8.8	8.6	3.3
3	Education	5.4	3.0	3.1	1.3	3.7	1.7	16.0	7.0	1.9
4	Clothes	7.3	2.7	1.9	2.1	4.8	2.9	8.3	12.5	3.6
5	Health care and medicine	7.3	2.7	3.1	2.5	3.7	3.8	11.1	17.3	3.3
6	Cooking energy	2.9	2.7	2.7	2.5	3.0	2.9	4.2	4.2	3.1
7	Transportation	9.4	3.0	2.3	2.1	2.2	2.9	7.9	8.6	2.1
8	Flood/wave protection	6.3	6.0	3.5	2.9	3.0	1.7	4.9	4.2	2.1
Total Expenditure		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: JICA Study Team based on PRA by DICS, 2002

Food expenditure is generally much larger than other expenditures. It ranges from 39% for Bank clerks to 83% for female daily laborers and fishermen. It is observed from the above two tables, that food expenditure is larger when total expenditure is lower. Other important expenditures vary by occupation.

The expenditure pattern does not change much by season although most expenditures increases in the rainy season by 20 to 30 percent as compared with the dry season. It is noteworthy that irrespective of occupation, people spend 1.7% to 6.3% of total expenditure for flood/wave protection in the rainy season.

(8) Education

Literacy rate in Gurai is 70% for male and 63% for female. Higher literacy rates for both male and female may be due to the Total Literacy Movement (TLM).

There are 1,950 school-aged children in the gram, of which 73% or 1,500 are enrolled. There are four primary schools (one government and three registered private), two NGO schools, and two Madrasha. In the four primary schools, children – teacher ratio is 43:1 on average ranging from 38:1 to 49:1. Schools do not have enough capacity to accommodate all school-aged children due to lack of facilities as well as insufficient number of teachers. Drop-out rate as of 2001 was 35%. The reasons for drop-out include: (i) poverty of family; (ii) early marriage; (iii) lack of communication; (iv) lack of awareness of the parents, and (v) school closing in flood season.

The NGO schools have 330 pupils in total, of which 160 are boy, with 11 teachers. The Madrasha has 500 students of which 362 are boy, with 15 teachers.

(9) Health, nutrition and sanitation

Food intake

Most villagers take rice and ruti (bread) as staple food. Ruti is usually taken at breakfast. Side dishes include pulses, potatoes, and some vegetables.

Due to mal-distribution of nutrients, nutritional disorders like anemia, night blindness, angular stomatitis, etc. are observed. Malnutrition are observed more in female, as food intake is generally less because of discrimination due to socio-cultural background.

Diseases and health services

Major diseases reported in Gurai include fever, flu, dysentery, diarrhea, peptic ulcer, small pox, etc. Cases of fever, flu increase in the winter season, while dysentery and diarrhea are observed more in the rainy season and summer time. Health services utilized by the villagers are shown in Table 8.10.

Table 8.10 Health Services and Their Utilization

% population		Name of Health Service	Distance from the village	Name of the service	Remarks
Male	Female				
62	58	Village Quack	Within village	• Treatment • Prescription • Common medicines	Available all the time; Free treatment for the poor
3	17	Union Health and Family Welfare Center	Center of the village	• Free treatment • Prescription • ANC/PNC	100% service for pregnant women
10	6	Bagalpur Medical College	10 km	• All kinds of treatment with surgery	Service available but expensive
7	5	Homeopathy	Center of the village	• Treatment • Medicine	-
5	5	Nikli Upazila Health Complex	7 km	• Treatment • Prescription, • Common medicine	To be registered and emergency patients take admission
6	3	Hiluchia Union Health Complex	1.5 km	• Primary treatment • Prescription • Common medicine	-
4	4	Kabiraj	Center of the village	• Treatment • Medicine	Treatment by creepers, leaves, hides of trees, etc.
3	2	Kishoreganj, Mymensingh, Dhaka	22 km 92 km 135 km	• All kinds of scientific and modern treatment	Solvent people go to those places

Source: PRA by DICS, 2002

More than 80% of patients in the gram receive health services within the gram or nearby gram. Village doctors are the most accessible health services for the majority of villagers. Many female go to Family Welfare Center in the gram. Only limited number of people who are generally rich have access to modern treatment outside the village.

Sanitation conditions

People in Gurai generally have good access to hand tubewells, but they are not accustomed to wash hand after defecation. Villagers wash their hands before and after meals only with water. The sanitary latrine is yet to be introduced. Sanitary conditions are summarized in Table 8.11.

Table 8.11 Sanitation Conditions

Practices		Share	Remarks
Type of latrine used	Hanging	90%	• 90% people use hanging latrine. • There are 20 sanitary latrine in the gram. • Villagers who defecate using the hanging latrine in the dry season suffer in the wet season when many hanging latrine goes under water. They use boats for defecation in the wet season • The poorest of the poor have to defecate in open field.
	Sanitary	2%	
	Open field	8%	
Drinking Water		Tubewell (nos. some 220)	• People are aware of pure drinking water • Per 6 family 1 tube well is accessible on average
Hand washing before taking food			Awareness level is high.

Source: JICA Study Team based on PRA by DICS, 2002

(10) Energy

Cooking energy sources used in Gurai include: cow dung, rice straw, jute stick, Dhaincha (Sesbania spp.), rice husk, and leaves of trees grown in the gram. They collect energy sources within their locality in principle. The main source of cooking energy is Dhaincha. When the materials are short, villagers go to Hiluchia bazaar to buy jute stick. They store fuel in the dry season for use in the wet season.

Almost all part of the gram is electrified. For lighting 90% of the households use electric lamps. Only those who live in remote areas and poor households cannot afford the rural electricity and use kerosene.

(11) Credit

Various credit facilities are available in the gram. There are one national agricultural bank, two national NGOs, one BRDB, one Social Welfare Department, and many local money lenders, which extend loans to villagers.

Objectives of applying for credit vary from the sources. The Agricultural Bank limits its utilization on agricultural production like purchase of inputs, breeding animals, installation of pumps, etc. NGOs extend loans for various purposes such as agricultural production, business, housing, etc. Local money lenders do not limit utilization purpose. Annual interest rates of loan varies from 8% by BRDB to 120% by local money lenders. The number of borrowers in the gram totals more than 3,000. Credit schemes available in Gurai is shown in Table 8.12.

Table 8.12 Credit Facilities Available in Gurai

Sources of Credit		Share of borrower	Nos. of borrowers		Rate of interest	Utilization of Credit
			Women	Men		
Bank	Agricultural Bank	13%	5	385	14%	Purchase of seed, manure, breeding of livestock, tractors, to install tube-well, shallow machine and to lease land.
Registered NGOs	Proshika	30%	510	410	17%	Breeding of cows, buffaloes and goat, grocery shop, housing, house preparing after flood, installation of tube-well, livestock, luck farming, kitchen-gardening.
	BRAC (Hiluchia)	10%	311	-	15%	
	BRAC (Nikli)	7%	200	-	15%	
B R D B	Bittohin Somittees	9%	168	112	8%	Breeding of poultry, small business, purchase of seeds and manure etc.
Social welfare	Samajkalyan Samobay Somittees	17%	309	205	10%	Purchase of cows, buffalos and goats, small business, purchase of sewing machine etc.
Money lender	Village money lender	14%	42	376	120%	For going out side of village, Dowry, Duck farming, Emergency treatment and any other purpose.

Source: JICA Study Team based on PRA by DICS, 2002

More men utilize loans of the Agricultural Bank and money lenders, while women have rather easy access to NGOs and the Social Welfare Department.

Villagers prefer credits of BRDB, NGOs and the Social Welfare Department, due to high security, relatively low interest rates, availability, relatively easy repayment, etc. The Agricultural Bank is preferred for its lower interest rates and high security, but complicated paper work for application prevents villagers from applying for loans. Local money lenders are most accessible for the villagers. They are available all the time, and do not limit uses. However, very high interest rates and low security make applying for loans risky.

8.1.5 Agriculture and Marketing

(1) Agricultural land use

Agricultural land use in Gurai gram is presented in Table 8.13, based on the sample survey.

The share of agricultural land in the total area is some 89.2% with cropping intensity of 1.02. The farm land is divided into the paddy field with 482.6 ha or 95.1% and the upland field with 24.7 ha or 4.9%.

Table 8.13 Land Use of Gurai Gram by Para (1/3)

Para :	1. Chila	2. Bania	3. Atka	4. Uttar	5. Fakir	6. Jala	7. Kona	SUBTOTAL
Gross Area : (ha)	8.60	11.10	26.40	138.80	6.00	28.10	17.20	236.20
Farm Land : (ha)	8.10	10.10	24.30	136.90	4.50	23.10	15.00	222.00
Paddy : (ha)	8.10	10.10	24.30	124.70	4.50	22.70	14.20	208.60
Up-land : (ha)	-	-	-	12.20	-	0.40	0.80	13.40
Crops and Area (ha)								0.00
Aus (LV)								0.00
Aus (HYV)								0.00
Aman (LV)								0.00
Aman (HYV)								0.00
Boro (LV)					0.23			0.23
Boro (HYV)	6.09	8.05	20.15	120.26	2.20	21.67	10.17	188.59
Wheat								0.00
Jute						0.40		0.40
Pulses		0.31		12.15	1.28	0.30		14.04
Potato				1.21	0.50		0.61	2.32
Sweet Potato	0.40			1.21			0.16	1.77
Vegetable					0.17	0.10	0.65	0.92
Suger Cane				0.40				0.40
Spices	0.60	0.69	2.05		0.02		0.39	3.75
G.Nut							0.65	0.65
Water Melon								0.00
Oil Seed	1.00	1.07	2.10	12.15		0.60	2.35	19.27
China								0.00
Otbhers				1.62	0.10			1.72
Total Area	8.09	10.12	24.30	149.00	4.50	23.07	14.98	234.06
Cropping Intensity	1.00	1.00	1.00	1.09	1.00	1.00	1.00	1.00
Home Stead	0.50	0.80	1.80	1.70	1.20	3.80	1.40	11.20
Ponds or River Bed	-	0.20	0.30	0.20	0.30	1.20	0.80	3.00

Source: JICA Study Team

Table 8.13 Land Use of Gurai Gram by Para (2/3)

Para :	8. Mosjid	9. Nomosudra	10. Dakshin	11. Purba	12. Ghosh	13. Pashim	14. Shibir	SUBTOTAL
Gross Area : (ha)	76.30	4.00	18.60	95.10	20.20	40.80	37.20	292.20
Farm Land : (ha)	67.00	3.00	16.20	89.00	16.60	37.20	32.40	261.40
Paddy : (ha)	60.70	2.80	16.20	87.00	16.20	36.40	32.40	251.70
Up-land : (ha)	6.30	0.20	-	2.00	0.40	0.80	-	9.70
Crops and Area (ha)								0.00
Aus (LV)								0.00
Aus (HYV)								0.00
Aman (LV)								0.00
Aman (HYV)								0.00
Boro (LV)								0.00
Boro (HYV)	56.69	2.83	12.09	80.04	14.23	36.44	29.80	232.12
Wheat								0.00
Jute					0.60			0.60
Pulses	2.02					0.16	1.40	3.58
Potato	1.14	0.05		2.50		0.20		3.89
Sweet Potato								0.00
Vegetable	0.50	0.05		2.02	0.40	0.15		3.12
Suger Cane								0.00
Spices	4.62		3.00	1.00		0.30		8.92
G.Nut				1.00				1.00
Water Melon								0.00
Oil Seed	2.02		1.10	2.50	1.36		1.20	8.18
China								0.00
Otbhers		0.10						0.10
Total Area	66.99	3.03	16.19	89.06	16.59	37.25	32.40	261.51
Cropping Intensity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Home Stead	7.80	0.60	1.20	3.60	3.00	1.50	3.00	20.70
Ponds or River Bed	1.50	0.40	1.20	2.50	0.60	2.00	1.80	10.00

Source: JICA Study Team

Table 8.13 Land Use of Gurai Gram by Para (3/3)

Para :	15. Pal	16. Noagaon	17. Maddha				SUBTOTAL	TOTAL
Gross Area : (ha)	11.80	19.40	7.20				38.40	569.00
Farm Land : (ha)	6.50	13.00	4.50				24.00	507.30
Paddy : (ha)	6.10	12.20	4.10				22.40	482.60
Up-land : (ha)	0.40	0.80	0.40				1.60	24.70
Crops and Area (ha)							0.00	0.00
Aus (LV)							0.00	0.00
Aus (HYV)							0.00	0.00
Aman (LV)							0.00	0.00
Aman (HYV)							0.00	0.00
Boro (LV)							0.00	0.23
Boro (HYV)	5.86	12.15	4.05				22.06	442.77
Wheat							0.00	0.00
Jute							0.00	1.00
Pulses							0.00	17.62
Potato		0.19					0.19	6.40
Sweet Potato							0.00	1.77
Vegetable	0.20	0.15					0.35	4.39
Suger Cane							0.00	0.40
Spices	0.41	0.17	0.20				0.78	13.45
G.Nut							0.00	1.65
Water Melon							0.00	0.00
Oil Seed		0.30					0.30	27.75
China							0.00	0.00
Otbhers			0.20				0.20	2.02
Total Area	6.47	12.96	4.45				23.88	519.45
Cropping Intensity	1.00	1.00	1.00				1.00	1.02
Home Stead	3.80	4.80	2.70				11.30	43.20
Ponds or River Bed	1.50	1.60	-				3.10	16.10

Source: JICA Study Team

The average crops yield is estimated at 5.93 ton/ha of Boro (HYV).

(2) Cropping calendar

The cropping calendar of Kuna para was selected for typical cropping calendar in Gurai gram, and is shown in Figure 8.1.

In Gurai gram, Kharif season cropping is impossible due to submergence of the whole agricultural area during the wet season while Rabi season crop is almost all paddy because of high water contents in soil and heavy soil textures.

Name of Crops	(ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aus (LV)													
Aus (HYV)													
Aman (LV)													
Aman (HYV)													
Boro (LV)													
Boro (HYV)	10.17	●	―	―	―	●							●
Wheat													
Jute													
Pulses (Lentils)													
Potato	0.61	●	―	●									●
Sweet Potato	0.16	●	―	●									●
Vegetables	0.65	●	―	●									●
Sugar Cane													
Spices	0.39	●	―	―	●								●
G. Nut	0.65	●	―	―	●								
Water Melon													
Oil seed	2.35	●	―	●									●
Others													

Source: JICA Study Team

Figure 8.1 Cropping Calendar of Kuna Para

(3) Agricultural input

Use of agricultural input is summarized in Table 8.14.

Table 8.14 Use of Agricultural Input

Unit: kg/ha

Input \ Crop	HYV (Boro)	Chilli	Oil Seed	Jute	Remarks
(1) Seed	11 (30)	8 (8)	2 (10)	8.1 (30)	
(2) Fertilizers					
Urea	33 (37)	55 (81)	40 (41)	148 (100)	
TSP	29 (36)	100 (89)	49 (49)	- (0)	
MP	11 (15)	29 (32)	16 (16)	- (0)	

Source: JICA Study Team
( ) by DAE

(4) Irrigation

For farming in the Haor area, the irrigation facilities are required in the dry season. In the area, the pumping facilities are provided for the irrigation, covering the paddy field. Table 8.15 shows the sample feasibilities of the irrigation pumps.

Table 8.15 Irrigation Facilities

Para \ Items	Paddy (ha)	Irrigated Area (ha)	Irrigated System	Pump Facilities				
				Q (I/S)	φ (mm)	Head (m)	HP	Unit
1. Moddha	(BOR;HY) 0.526	0.526	Pump	N.A	N.A	N.A	N.A	N.A
2 Dakshin	(BOR;HYV) 0.708	0.708	Pump	.....	.....	-ditto-	.....	.....
3 Ghosh	(BOR;HYV) 0.688	0.688	Pump	.....	.....	-ditto-	.....	.....
4 Purba	(BOR;HYV) 0.567	0.567	Pump	.....	.....	-ditto-	.....	.....
5 Paschim	(BOR;HYV) 0.405	0.405	Pump	.....	.....	-ditto-	.....	.....
6 Uttar	(BOR;HYV) 4.14	4.14	Pump	-	100	27	4	-
7 Gurai	(BOR;HYV) 1.357	1.357	Pump	3.5	100	31.5	4	2

Source: JICA Study Team

(5) Extension works

Extension activities are mainly organized through regular visits by the Block Supervisors to the village. Block Supervisors are responsible for distribution and adoption of modern technologies by farmers. Block Supervisors services, however, are insufficient in the project area because of limited staff.

(6) Fishery

Fishery is considered the most important source of cash-income. Table 8.16 summarizes the production in natural fishing and the fish culture respectively.

Table 8.16 Fish Production in Natural and Cultural Conditions

Area & Para / Items	HAOR Uttar (4)							
Natural Fishing	Selling Amount (Kg/Year)		Selling Price (Tk/Year)		Unit Price	Others		
(1) Lui (L)						1. Place of Fishary:		Haor
(2) Lui (S)						1) Dry Season		-
(3) Milka						2) Wet Season		-do-
(4) Katura						3) All the Year		-
(5) Irisi						2. Fishing License:		-
(6) Putty Carp	300 kg/y		6,000 Tk/y		20 Tk/kg	3. Type of Caught:		Net
(7) Shrimp	80 kg/y		14,400 Tk/y		180 Tk/kg	4. Marketing:		Hiluchia
(8) Club								L=1.5 km
(8) Baila	200 kg/y		12,000 Tk/y		60 Tk/kg			
(9) Balm	180 kg/y		9,000 Tk/y		50 Tk/kg			
Fish Culture	1. No. of Pond 1.0		2. Area (ha) 0.21		3. Water Depth (m) 2.13	4. Owner: Private		
5.Name of Fish	Amount of Finger lings	Price of (F)	Feed Sources	Amount of Feed	Price of Feed	Production	Selling Price	Harvest C
(1) Lui (L)	3.0 kg/ha	600 Tk/kg	Oil Cake Pabby Husk	180 kg/y	(8 Tk/kg) 1,440 Tk/y	95 kg/y	5,700 Tk/y	6.0 month
(2) Lui (S)	-	400 Tk/kg	-	-	-	-	-	-
(3) Milka	2.0 kg/ha	500 Tk/kg	Oil Cake Pabby Husk	180 kg/y	1,440 Tk/y	74 kg/y	3,700 Tk/y	6.0 month
(4) Katura	2.0 kg/ha	400 Tk/kg	-ditto-	180 kg/y	1,440 Tk/y	95 kg/y	5,225 Tk/y	6.0 month
(5) Irisi	-	-	-	-	-	-	-	-
(6) Putty Carp	3.0 kg/ha	400 Tk/kg	-ditto-	180 kg/y	1,440 Tk/y	74 kg/y	2,960 Tk/y	6.0 month
(7) Shrimp	-	-	-	-	-	-	-	-
(8) Club	-	-	-	-	-	-	-	-
(9) Silver Cup	3.0 kg/ha	400 Tk/kg	-ditto-	180 kg/y	1,440 Tk/y	84 kg/y	3,360 Tk/y	6.0 month
Note	(F); Fingerlings		Survival Rate: 70~79%					C; Cycle

In Gurai gram, the flooding and inundation area are important fishing grounds. On the other hand, fish ponds are contracted with private owners with the net-income of Tk.4,000 for a typical pond of 0.21 ha surface area.

(7) Livestock and Poultry

According to the questionnaire survey at each para in the Gurai gram, they keep cattle, buffalo, goat, chicken, pigeon, and duck. Number of cattle and goat are 970 and 270, respectively.

(8) Marketing

There is only one bazaar in Gurai Union, and is not opened officially at the time of field survey, conducted on March 2002. The bazaar committee, composed of 270 members, owns the new Gurai Noya bazaar, and the union chairman heads the committee. Every Friday is the hat day and there are some shop owners already started their business in advance of official opening.

Before the Gurai Noya bazaar was established, villagers had to go to neighboring markets such as Hiluchia (1.5 km away from Gurai) and Bajitpur (12km) to sell their agricultural products, in many case through middlemen, and to buy daily necessities, farming implements, livestock, etc. Now, middlemen so called "Paikari", and a small number of shopkeepers started to transport such commodities as food and other daily necessities to the Gurai Noya bazaar. They bring them from

neighboring markets, such as Hiluchia, Nikli, Katiadi, and Bajitpur. It is expected that about 150 shops will newly open in the Gurai Noya bazaar, and it may generate new employment opportunities for villagers.

Table 8.17 shows the market profile in Gurai Union.

Table 8.17 Market Profile in the Gurai Union

Name	Gurai Noya Bazaar
Place	Gurai
Distance (km) from UP	0.1km
Area (m^2)	18,000m^2
Owner	Bazaar Committee
Frequency (times/week)	Once per week
Number of user	4,500
Number of tenant	N.A
Tenant Fee	N.A
Taxation system	N.A

Source: Gurai Union, collected by Nikli Upazila Office.

Main products in the Study Area are rice, wheat, chilly, tomato, garlic, onion, potato, pumpkin, beans, cucumber and ground nuts for agricultural products, and cattle, goat, chicken, duck, chicken egg, duck egg and milk for products of livestock, and Rui, Baila, Puty Carp, Katula, Silver Carp, Milka, Pangash, Balm, Boul, shrimp and crab (Tangra) for fishery products. Most of the products are shipped to local bazaars, such as Gurai Noya bazaar, Hiluchia bazaar (1.5km), and markets in Bajitpur (12km) and Kishoreganji (35km), through middlemen, or sold directory by farmers.

Most of agricultural input materials, such as seed, fertilizer, manure and insecticide, are available in the Gurai Noya bazaar and Hiluchia bazaar, and farmers living in the Study Area purchase them from the local markets directly. The Bangladesh Agricultural Development Corporation (BADC) also supplies HYV Boro's seed to villagers, at prices of Tk.12 to Tk.15 per kg, little higher than the retail prices at local bazaars (Tk.10 to Tk.12 per kg). As for fishery production, fingerlings of such species as Lui, Milka, Katra, Putty carp, Silver carp, Baila, Boul, shrimp and crab (Tangra) are available in the Kishoreganj (35 km away from study area) or Bhairab bazaar (26 km). Oil cake, paddy husk and urea are used as feed source, and farmers buy them from villagers and/ or local bazaars/ markets in Hiluchia, Bajitpur and Sararchar (7 km).

Most rice produced in the Study Area is marketed. Farmers sell their paddy products such as HYV Boro, at Tk.6 per kg to their landowner or middleman. Weight of paddy is reduced to about 68% after milling, and thus price of paddy at farm gate is equivalent to Tk.9 per kg of rice. On the other hand, retail price of Boro rice at local bazaars is around Tk.15 per kg. Shipping cost, including cost for parboiling, drying, milling and transportation, is estimated at Tk.6 per kg, and retail price of Boro rice is around 1.7 times of farm gate price in the Study Area. According to key informant survey, conducted by the JICA Study Team on March 2002, average cost of parboiling is Tk.0.12 per kg, and average drying and milling cost are Tk.0.25 per kg and Tk.0.2 per kg respectively. The balance of Tk.5.13 per kg, 36 % of retail price of Boro rice, is considered to be profits,

including transportation cost, of parboiling facility's owner and/or local traders.

8.1.6 Rural Infrastructure

(1) NGO's activities for rural infrastructure development

Submersible road from Nikli, where Upazila Parishad office is located, to Gurai gram with a total length of 5.7 km is under construction. Out of 5.7 km, CARE Bangladesh is undertaking 1.4 km length during FY 2001/2002, and 0.5 km length will be implemented in FY 2002/2003. Remaining 3.8 km length is under construction by LGED now.

Market facilities in the gram have been constructed by CARE's support. CARE' interventions include 1) raising plinth level by earth work, 2) RCC retaining wall with 265 m length, 3) two fish and vegetable sheds, 4) community latrine/ urinal, 5) women's corner, and 6) drains.

(2) Rural communication

(a) Village roads

One main village trunk road categorized as R2 is running from north to south within homestead area of Gurai gram. At the north side, this road connects to submersible road under construction, which goes to the NIkli Upazila parishad office, and to the south, connect to Hiluchia town with elevated road by crossing river.

Kacha (without pavement) roads with length of 6.35 km exist while there is no pucca (with pavement) within homestead area of the gram as shown in Table 8.18. Out of 6.35 km, 3.45 km length is elevated road, which is not submerged during 1998 flood. Remaining 2.9 km length of the road is submerged during the normal flood.

Even though the Union Parishad office have engaged 10 women selected from poor families as road maintenance labor within Gurai Union with a remuneration of Tk.1,200 /month with four years contract, many sections of roads within homestead area are narrow with 1.5 m~2 m width due to erosion by enlarging fish ponds.

Table 8.18 Length of Village Road in Gurai Gram

No	Name of Para	Population	Homestead	Length of Village Road within homestead area (m)		Density	
		(no.)	Area (ha)	Total	(Elevated)	(m/no.)	(m/ha)
1.	Chila	148	0.5	190	(0)	1.3	380
2.	Bania	415	1.8	120	(0)	0.3	150
3.	Atka	755	1.7	230	(230)	0.3	128
4.	Uttar	438	1.2	310	(200)	0.7	182
5.	Fakir	103	3.8	290	(0)	2.8	242
6.	Jal	597	1.4	370	(90)	0.6	97
7.	Kuna	272	7.8	430	(110)	1.6	307
8.	Masjid	1,837	0.6	800	(710)	0.4	103
9.	Namasud	156	1.2	120	(120)	0.8	200
10.	Dakhin	643	3.6	210	(0)	0.3	174
11.	Purba	1,833	3.0	570	(0)	0.3	158
12.	Ghosh	555	1.5	900	(390)	1.6	300
13.	Pashchim	815	3.0	120	(120)	0.1	80
14.	Shibir	749	3.8	320	(320)	0.4	107
15.	Pal	841	4.8	400	(190)	0.5	105
16.	Naogaon	1,346	2.7	660	(660)	0.5	138
17.	Moddon	629	1.5	310	(310)	0.5	115
Total (Average)		**12,132**	**44.7**	**6,350**	**3,450**	**(0.5)**	**(142)**
	Other roads:	Paved submersible road: 1,500 m, Un-elevated farm road: 750 m					

Source: Questionnaire survey by the JICA Study Team

(b) Water transport

Table 8.19 shows numbers of boat users a day for going to Hiluchia bazar during the rainy season.

Table 8.19 Numbers of Boat Users in Gurai Gram

No	Name of Para	Population (no.)	Boat landing place	No. of boat users for Hiluchia during flood season (no.)
1.	Chila	148		15
2.	Bania	415		10
3.	Atka	755	○	110
4.	Uttar	438		n.a.
5.	Fakir	103		n.a.
6.	Jal	597		n.a.
7.	Kuna	272	○	40
8.	Masjid	1,837	○	30
9.	Namasud	156	○	250
10.	Dakhin	643	○	40
11.	Purba	1,833		60
12.	Ghosh	555		15
13.	Pashchim	815	○	28
14.	Shibir	749	○	15
15.	Pal	841	○	12
16.	Naogaon	1,346	○	10
17.	Moddon	629	○	30
	Total	**12,132**	**10 places**	**665**

Source: Questionnaire survey by the JICA Study Team

There are several boat landing places that villagers use for going to either Hilucha, Bajitpur or Nikli during the rainy season. During rainy season, water transport is the only way to go to Nikli town which is their administrative upazila. Although a road is connected to go to bazaars located at Hiluchai and Bajitpur, they use boats as water transport is easier than using road.

(c) Telecommunications

Telecommunication facility is not available in Gurai gram. For emergency, villagers go to Hiluchiai 2 km away on foot during the dry season and by boat during the rainy season. Generally they communicate with outside by post mail.

(3) Marketing facilities

One local market, namely the Gurai Noya bazaar under construction supported by CARE is available in the gram. The market has about 9,000 m^2 with one hand tubewell and two community latrines. Villagers usually go to this market, or occasionally to Bajitpur bazaar 8 km away, once a week by rickshaw and on foot taking more than 1 hour during the dry season and by boat during the rainy season.

(4) Rural water supply by hand tubewell

Present status of tubewells are summarized by para in Table 8.20.

Table 8.20 Existing Numbers of Hand Tubewell in Gurai Gram

No	Name of Para	Population (no.)	Numbers of tubewell (no.)			Coverage by the flood condition (popul./well.)
			Total nos.of tubewell	Nos. of inundated in 1998 flood	Nos.of tubewell available during flood season	
1.	Chila	148	1	0	1	148
2.	Bania	415	2	2	0	-
3.	Atka	755	1	1	0	-
4.	Uttar	438	34	0	34	13
5.	Fakir	103	2	1	1	103
6.	Jal	597	4	0	4	149
7.	Kuna	272	10	10	0	-
8.	Masjid	1,837	26	0	26	71
9.	Namasud	156	1	0	1	156
10.	Dakhin	643	6	6	0	-
11.	Purba	1,833	18	8	10	183
12.	Ghosh	555	8	0	8	69
13.	Pashchim	815	12	1	11	74
14.	Shibir	749	6	2	4	187
15.	Pal	841	15	0	15	56
16.	Naogaon	1,346	11	7	4	337
17.	Moddon	629	30	6	24	26
Total (Average)		**12,132**	**187**	**44**	**143**	**85**

Source: Questionnaire survey by JICA Study team

The tubewell density in Atka Para (No.3) is remarkably insufficient, while Moddon Para (No.17) is

better off as compared with other paras, where the average is 77 population/tubewell. There are 187 tubewells, both government and private, in Gurai gram, of which 44 were inundated in the 1998 flood. In particular, in the four paras of Bania, Atka, Kuna and Dakhin, no tubewells were available for safe water during the flood.

DPHE is supporting villagers to have safe water. If they prepare the amount of Tk.1,200 for one tubewell, DPHE subsidizes remaining construction cost including materials for the total cost of Tk.5,200 on average. Then, all tubewells existing in the gram are maintained by benefited villagers. Average depth of existing tubewells in the gram is 80 m, and iron and arsenic are detected from some of these tubewells.

(5) Sanitary latrine

Table 8.21 shows number of sanitary latrines and household coverage. A total of 40 sanitary latrines exist with coverage of 2.3% in Gurai gram. All sanitary latrines available in Gurai gram were constructed through projects by DPHE, NGOs, etc. While construction cost including material is about Tk.10,000 per unit, beneficiary villagers contribute labor works.

Table 8.21 Sanitary Latrines in Gurai Gram

No	Name of Para	Household (no.)	Nos. of Sanitary latrine (no.)	Coverage (no./HH)
1.	Chila	21	0	-
2.	Bania	58	1	1.7%
3.	Atka	109	2	1.8%
4.	Uttar	62	8	12.9%
5.	Fakir	15	1	6.7%
6.	Jal	85	3	3.5%
7.	Kuna	39	0	-
8.	Masjid	248	3	1.2%
9.	Namasud	22	5	22.7%
10.	Dakhin	85	2	2.4%
11.	Purba	256	2	0.8%
12.	Ghosh	81	3	3.7%
13.	Pashchim	116	4	3.4%
14.	Shibir	107	1	0.9%
15.	Pal	121	1	0.8%
16.	Naogaon	205	1	0.5%
17.	Moddon	90	3	3.3%
	Total (Average)	**1,720**	**40**	**(2.3%)**

Source: Questionnaire survey by JICA Study team

(6) Rural Electrification

Table 8.22 shows 491 households of Gurai Gram are electrified with coverage rate of 29 %. Villagers pay about Tk.250 per month a meter for electricity bills.

Table 8.22 Rural Electrification in Gurai Gram

No	Name of Para	Household (no.)	Nos. of HH electrified	Coverage (no./HH)
1.	Chila	21	15	71%
2.	Bania	58	20	35%
3.	Atka	109	10	9%
4.	Uttar	62	36	58%
5.	Fakir	15	15	100%
6.	Jal	85	27	32%
7.	Kuna	39	16	41%
8.	Masjid	248	40	16%
9.	Namasud	22	12	55%
10.	Dakhin	85	63	74%
11.	Purba	256	75	29%
12.	Ghosh	81	14	17%
13.	Pashchim	116	40	35%
14.	Shibir	107	5	5%
15.	Pal	121	75	62%
16.	Naogaon	205	7	3%
17.	Moddon	90	21	23%
	Total (Average)	**1,720**	**491**	**(29%)**

Source: Questionnaire survey by the JICA Study Team

(7) Agricultural infrastructure

Two private drying yards exist including parboiling plants, rice milling machine and storage in the gram. These drying yards with capacity of approx.1.5 ton per day, cover approximately 40 to 50 % of the total paddy harvested within Gurai. Farmers insist to sell paddy to these owners of private drying yards, or else at the market without parboiling.

(8) Education facilities

Seven schools exist in Gurai gram as shown in Table 8.23. There is no advanced school other than primary, therefore, villagers go out of the gram for higher education.

Table 8.23 School/Madrasha of Gurai Gram

No.	Name of Para	School	Area (m^2)	Nos. of student	Nos. of teacher
4.	Uttar	Primary	409	152	4
8.	Masjid	Madrasha	137	80	n.a.
11.	Purba	Primary	324	80	4
12.	Ghosh	Primary	147	150	4
13.	Pashchim	Primary	525	205	4
16.	Naogaon	Madrasha	688	404	13
17.	Moddon	Primary	205	153	4
Total (Average)		**-**	**-**	**1,224**	**33**

Source: Questionnaire survey by the JICA Study Team

8.1.7 Floods

(1) Flood environment

Gurai gram is located in a shallow Haor area near the course of Ghorauttar river which carries flow from Surma-Baulai, Mogra, Dhanu and Kangsha rivers to the south through Bhairab Bazar. Farmland of the village is not under protection of any submersible flood embankment to save Boro crop from early floods. The village mound, which is erosion prone due to monsoon waves, accommodates the settlements stretching about 1.2 km in north-south and 0.9 km in east-west direction. The mound is partly protected from wave erosion by brick walls on the eastern side for separated lengths of 190m and 20 m. Elsewhere on eastern, northern, north-eastern and southern sides there are protection works by indigenous method i.e. earthfilled gunny bags, vegetative cover, bamboo fencing etc.

Inhabitants of Gurai gram start preparing for annual floods in advance by collecting bamboo stakes, empty sacks and other local materials for protection against the wave erosion. Paddy is boiled and Chira, Muri, Gur and other rural foods are stocked. Cattle and poultry in the homesteads, culture fishery in the ponds are taken care of; valuable articles are shifted to secured places. In pre-flood days they get busy in preparation for the ensuing event. As they will be in a flood environment without proper warning and evacuation system in place, they have to make their own decision for evacuation by observing the natural symptoms like a cloudy sky, continuous south-eastern winds, flying of grasshoppers and/or the rising of water level. They know their village mound will be having the onslaught of waves in coming days, resulting in erosion of land with homesteads.

The wave erosion which is most serious problem facing the Gurai gram population, is a common phenomenon in each monsoon. Villagers have to fight a constant battle throughout the monsoon season to save their homesteads from this kind of erosion. The indigenous measures by putting bamboo fence, cement bag, brick and water hyacinth are crushed by severe wave action. The indigenous protection of the village mound, which they practice throughout their lives, dominates all their activities in the monsoon season draining most of their resources leaving very little for any productive works during the period of four to six months a year. This makes the people of Gurai increasingly insolvent every year. The flood related problems together with their economic insolvency make life of the people of Gurai more and more miserable. Clearly, they do not have the resources to cope with the problems.

(2) Inundation

Vulnerability to floods is assessed from the records of inundation caused by floods of three recent years: 1988, 1998 and 1999. Table 8.24 shows the areas of the village/paras that were inundated during the floods of these years. The inundated area includes homesteads in the village mound as well as the farmland in the Haor areas within the village. As the farmland constitutes nearly 90% of the village area and every year overwhelmingly large proportion of the same gets inundated in

monsoon, the overall inundation in 1988 was 93%, in 1998 was 89% and even in lean year of 1999 it was 77%.

Table 8.24 Inundation of 'paras' (homestead+farmland) in 1988, 1998 and 1999

Sl No.	Village/ 'paras'	Total Area (ha)	Inundation 88			Inundation 98			Inundation 99		
			Area		Duration (weeks)	Area		Duration (weeks)	Area		Duration (weeks)
			(ha)	%		(ha)	%		(ha)	%	
1	Chila para	8.6	8.6	100%	6	8.6	100%	8	8.3	96%	6
2	Bania para	11.1	10.9	98%	7	10.9	98%	7	10.4	94%	5
3	Atka para	26.4	26.1	99%	7	26.1	99%	7	24.6	93%	5
4	Uttar para	138.8	122.1	88%	7	122.1	88%	7	122.1	88%	5
5	Fakir para	6.0	6.0	100%	6	4.0	66%	8	4.0	66%	5
6	Jal para	28.0	27.7	99%	6	26.6	95%	7	26.0	93%	5
7	Kuna para	17.2	16.5	96%	6	16.5	96%	8	5.7	33%	5
8	Masjid para	76.3	75.5	99%	6	72.5	95%	8	72.5	95%	5
9	Namashud para	4.0	3.6	90%	7	2.1	53%	8	2.1	53%	5
10	Dakhin para	18.6	17.3	93%	6	17.3	93%	8	17.3	93%	5
11	Purba para	95.0	90.3	95%	6	90.3	95%	8	39.9	42%	5
12	Ghosh para	20.2	19.6	97%	7	15.8	78%	8	15.8	78%	5
13	Pashchim para	40.8	36.7	90%	7	35.5	87%	7	35.5	87%	5
14	Shibir para	37.2	35.0	94%	7	33.9	91%	7	33.1	89%	5
15	Pal para	11.8	10.0	85%	7	7.2	61%	8	7.2	61%	5
16	Naogaon para	19.4	17.8	92%	6	12.2	63%	8	12.2	63%	5
17	Moddon para	7.2	7.2	100%	7	3.7	51%	8	1.7	24%	5
	Gurai Bazar	2.4									
Total		**569.00**	**531.04**	**93%**		**505.18**	**89%**		**438.37**	**77%**	

Source: JICA Study Team

Table 8.25 the percentage of homestead areas only in the village mound that underwent inundation during the same flood years: 1988, 1998 and 1999. In the Haor areas, villages generally live on the raised mounds. Problem of inundation of the homesteads is not as acute as prevails in Char areas. However, in the severe floods of 1988 and 1998, the submergence of homesteads was 84% and 20% respectively. In the lean year of 1999 the inundation of homesteads was almost nil - only 3%.

Table 8.25 Inundation of 'paras' (homestead only) in 1988, 1998 and 1999

Sl No.	Village/ 'paras'	Homestead Area (ha)	Inundation 88			Inundation 98			Inundation 99		
			Area		Duration (weeks)	Area		Duration (weeks)	Area		Duration (weeks)
			(ha)	%		(ha)	%		(ha)	%	
1	Chila para	0.50	0.50	100%	3	0.20	40%	4	0.04	7%	1
2	Bania para	0.80	0.80	100%	3	0.26	32%	4	0.00	0%	0
3	Atka para	1.80	1.80	100%	3	0.88	49%	4	0.11	6%	1
4	Uttar para	1.70	0.27	16%	1	0.00	0%	0	0.00	0%	0
5	Fakir para	1.20	1.20	100%	3	0.00	0%	0	0.00	0%	0
6	Jal para	3.80	3.80	100%	3	1.41	37%	4	0.72	19%	1
7	Kuna para	1.40	1.40	100%	3	0.57	41%	4	0.00	0%	0
8	Masjid para	7.80	4.99	64%	2	0.00	0%	0	0.00	0%	0
9	Namashud para	0.60	0.60	100%	3	0.00	0%	0	0.00	0%	0
10	Dakhin para	1.20	1.20	100%	3	0.44	37%	4	0.00	0%	0
11	Purba para	3.60	3.60	100%	2	1.76	49%	4	0.00	0%	0
12	Ghosh para	3.00	3.00	100%	3	1.41	47%	4	0.18	6%	1
13	Pashchim para	1.50	0.74	49%	3	0.00	0%	0	0.00	0%	0
14	Shibir para	3.00	3.00	100%	3	0.75	25%	3	0.00	0%	0
15	Pal para	3.80	3.80	100%	3	0.91	24%	3	0.19	5%	1
16	Naogaon para	4.80	4.13	86%	4	0.00	0%	0	0.00	0%	0
17	Moddon para	2.70	2.70	100%	3	0.51	19%	2	0.00	0%	0
	Gurai bazaar	1.50									
	Total	**44.70**	**37.53**	**84%**		**9.11**	**20%**		**1.24**	**3%**	

Source: JICA Study Team

Table 8.26 presents the varying depths of inundation on the courtyard of houses during the same flood years: 1988, 1998 and 1999.

Table 8.26 No. of Inundated Houses with Depth & Duration in the Past Three Floods

Year	Total no. of houses in the para	No. of houses with maximum range of depth of flooding (cm)					No. of houses with duration of flooding (weeks)			
		<0	0-50	50-100	100-150	>150	<2	2-3	4-5	>5
1988	1,556	140	566	701	148	0	372	866	178	0
1998		1,047	337	172	0	0	17	381	113	0
1999		1,519	37	0	0	0	37	0	0	0

Source: JICA Study Team

Table 8.26 indicates that while the percent of homesteads inundation is more in 1988 (91%) than in 1998 (33%), percentage of the homesteads having 4-5 weeks duration of inundation is more in 1998 (22%) than in 1988 (13%).

(3) Flood damages

Table 8.27 shows the flood damages in Gurai gram during the floods in the years 1988, 1998, and 1999. Crops are not grown in the Haor areas during the monsoon flood. In some years, early

floods damage the Boro crops. Severe floods of the years 1988 and 1998 occurred between June and September when there was no crops in the field. In the lean year of 1999, there was no early flood that caused damage to Boro crop before harvesting. Loss of cattle and human lives occurred in 1988 and 1998, but damage to houses occurred only in 1988.

Table 8.27 Damages in 1988, 1998, 1999

Sl No.	Village/ 'paras'	Total Area (ha)	Damaged Cattle			Damaged House			Human life lost		
			1988	1998	1999	1988	1998	1999	1988	1998	1999
1	Chila para	8.6	7	4	0	0	0	0	0	0	0
2	Bania para	11.1	0	0	0	0	0	0	0	0	0
3	Atka para	26.4	16	10	0	0	0	0	0	0	0
4	Uttar para	138.8									
5	Fakir para	6.0	8	0	0	25	0	0	0	0	0
6	Jal para	28.0	0	0	0	0	0	0	0	0	0
7	Kuna para	17.2	0	0	0	0	0	0	0	0	0
8	Masjid para	76.3									
9	Namashud para	4.0	0	0	0	0	0	0	0	0	0
10	Dakhin para	18.6	25	18	`0	0	0	0	0	0	0
11	Purba para	95.0	18	14	0	0	0	0	0	0	0
12	Ghosh para	20.2	0	0	0	0	0	0	0	0	0
13	Pashchim para	40.8									
14	Shibir para	37.2	10	3	0	0	0	0	0	0	0
15	Pal para	11.8									
16	Naogaon para	19.4	0	0	0	0	0	0	0	0	0
17	Moddon para	7.2	2	0	0	0	0	0	5	2	0
	Gurai Bazar	2.4									
	Total	**569.0**	**86**	**49**	**0**	**25**	**0**	**0**	**5**	**2**	**0**

Source: JICA Study Team

(4) Vulnerability of Gurai mound against wave erosion

Gurai gram mound is situated in a shallow Haor area. The village mound has been subjected to wave erosion during the monsoon from east, north and south sides. The eastern periphery having a vast open fetch length of about 10 km in front, is the worst affected side while the north and south sides have a less significant rate of erosion. The wave generating winds blow mostly from the eastern and the north-eastern direction, while moderate winds blow from the south-eastern direction also. Generally, monthly maximum windspeed during the monsoon varies between 10 to 20 knots. On all the sides that are exposed to wave actions, erosion has intruded about 30m into the village mound, against the indigenous protection works, during the last 30 years. The average rate of mound erosion in the eastern side is about 1m per year. Erosion could be more without the indigenous protection.

Table 8.28 presents immediate and potential effects of wave erosion by para in Gurai gram.

Table 8.28 Vulnerability of Village Mounds Against Wave Erosion

Para no.	Name of para	Total		Vulnerable to erosion at present		Potentially vulnerable in near future	
		Houses (no.)	Households (no.)	Houses (no.)	Households (no.)	Houses (no.)	Households (no.)
1	Chila para	21	10	9	5	11	6
2	Bania para	39	18	11	5	20	10
4	Uttar para	81	41	6	3	32	15
5	Fakir para	28	13	8	4	11	5
6	Jal para	136	65	15	8	34	16
7	Kuna para	73	35	15	7	32	15
10	Dakhin para	56	27	10	5	25	12
11	Purba para	133	64	16	7	30	16
	TOTAL:	**567**	**273**	**90**	**44**	**195**	**95**

Source: JICA Study Team

(5) Existing floods and sheltering facilities

There is a tin roofed flood shelter in Gurai gram having a floor area of 2,032 m^2 in four sheds. It is quite dilapidated and can hardly accommodate 240 people. Many of the displaced people on the eastern side of the village mound having lost their homesteads to the wave erosion, found abode in the flood shelter since long. It is reported that the shelter was built by an NGO (MES) in 1974 and was never given maintenance thereafter.

(6) Flood warning, evacuation and sheltering

As per questionnaire survey result, there is no systematic flood warning system at work in any of the paras of the gram. When situation arises, people decide to evacuate by themselves observing the rise in water level and other natural indications indications, e.g. cloud cover and rainfall. Gurai is not inundated under high depth of water every year. Only a very small part of the settlement areas may be inundated under the normal floods.

(7) Overall constraints in Gurai

From Table 8.29, it can be seen that the main problem in Gurai is the wave erosion. The average rate of erosion of the mound due to monsoon waves is 1 m/year even with effort of the villagers to resist erosion by their indigenous means.

Table 8.29 Gurai Constraints: Priority of Mitigation as Considered by Villagers

Sl No.	Constrains	a. Homestead inundation	b. Erosion of the Village mound by wave action	c. Erosion of the homestead area by current	d. Lack of flood shelters for people and cattle	e. Lack of flood warning and flood preparedness	f. Others (lack of roads etc.)
	Suggested measures	a. Raising homesteads by earthworks	b. Provide protection against erosion of waves	c. Provide protection against erosion of homesteads	d. Construction of flood shelters for people and livestock	e. Installation of workable flood warning and dissemination system	f. Construction of roads and embankment
	Name of para	Degree of priority in % suggested for mitigation by people					
1	Chila para	20	65	5	5	5	0
2	Bania para	20	65	5	5	5	0
3	Atka para	30	50	10	5	5	0
4	Uttar para	10	65	5	10	10	0
5	Fakir para	10	70	5	10	5	0
6	Jal para	15	65	5	5	10	0
7	Kuna para	10	75	5	5	5	0
8	Masjid para	5	70	5	5	5	0
9	Namashud para	15	70	0	10	5	0
10	Dakhin para	15	55	5	10	10	5
11	Purba para	10	70	10	5	5	0
12	Ghosh para	15	50	5	10	20	0
13	Pashchim para	20	50	5	10	10	5
14	Shibir para	36	34	0	5	15	10
15	Pal para	18	65	0	7	10	0
16	Naogaon para	20	55	5	15	5	0
17	Moddon para	18	61	5	7	8	1

Source: JICA Study Team

8.1.8 Existing Organization

There are several organizations established with different purposes. Type of organizations, number, objectives, and activities are summarized in Table 8.30.

Table 8.30 Existing Organizations in Gurai

Type	Nos.	Name	Objectives	Activities	Leaders & members
Businessmen's organization	1	Gurai Bazaar	Maintain clean environment of the Bazaar, welfare to the members, shopkeepers & customers	The Bazaar committee does their duty and takes responsibility actively.	Business men , Village quack and political leaders.
School Committee	4	1. Gurai Gov. Primary school 2. Purba Para Reg. Primary school. 3. Maddha Gurai Reg. Primary school. 4. Pashchim Gurai Reg. Primary school.	Spreading of education, motivating students to go to school, award scholarship to poor students etc.	Motivating students to go to school, award scholarship to poor students etc. Taking care of teachers.	Business men, local political leaders, Elites of the village.

Type	Nos.	Name	Objectives	Activities	Leaders & members
Madrasha Committee	2	1. Biatir char Dakhil Madrasha. 2. Fayezia Aam Hafezia Madrasha.	Extending Islamic education	Welfare and develop madrasha; Take care of teachers; Appointment of teachers etc. Motivating the students to Islamic education.	Islamic elites and Business men.
Mosque Committee	3	1. Gurai Shahi Jame Mosque. 2. Maddha Gurai Mosque. 3. Biatir char Jame Mosque.	Development of Mosque, convincing and motivating to the people for prayer and religious activities.	Paying salary to Imam and Muazzin, To arrange Mela (Fair) and any other development activities of Mosque.	Islamic elites, Local political leaders, Businessmen.
Farmers association	2	1. Gurai North Para Krishi Unnayan Uzzal Somittee. 2. Konahati somittee.	Improve living standard of farmers.	Lending to farmers easily; Arrange agricultural seeds and manure	Farmers, Member of joint family and Businessmen.
Women's Organization	1	West Para Hindu Mohila Somittee.	To arrange household furniture.	Lending to the members with little interest to arrange house- hold furniture.	Housewives.
Deep Tube well owner's group	2	1. Uttar Para Deep Tubewell Mgt. 2. Dakshin Para Deep Tube-well Mgt.	Provide irrigation water	Proper irrigation to contracted farm land. Collection of irrigation fee from the farmers.	Landlord, large farmer, Medium farmer.
Juvenile's Club	1	Nobo Nur youth club.	To create opportunity for education, cultural programme.	Observance of National Day, To create opportunity for education, cultural programme.	Teachers of primary school, farmers, students.
NGO Groups	2	BRAC, PROSHIKA.	Human development	Strengthen women's affairs Spreading of education, lending for poultry, fishery, Grocery shopkeepers.	House-wives, Students.
BRDB Informal Groups	1	BRDB Mohila somittee (Bittohin)	Micro-credit, Interest free credit for housing.	Micro-credit, Interest free credit for housing.	Service holders, House-wives.
Social Development Organization	1	Social welfare	Education promotion, free coaching up to class-X, arrangement of social and cultural programme and any other social services.	Observance of National Days, Free coaching up to-X. Arrange marriage of unmarried women, Standing back to the affected people caused by natural calamity.	Student, Service holder, House-wives.
Women's group formed for road maintenance	1	CARE	Provision of livelihood for distressed women.	Work with repairing and developing road, plantation and other infra-structural work.	Women labour

Source: PRA by DICS, 2002

These organizations may be classified into several sectors. The Gurai bazaar committee, farmers' associations, and deep tubewell management committees are for economic development while

school committees, madrasha committees and juvenile's club are formed for education development. The mosque committee is to maintain Muslim culture, and other organizations are for social development including livelihood development, mainly targeting poor households including women. They are largely active, but face various problems with their facilities and materials, fund, etc.

8.1.9 Non-governmental Organizations' (NGOs) Activities

There are two NGOs active in Gurai. Both are Dhaka based, major national NGOs which extend their activities in the whole country. They target socially weak societies like landless poor, daily laborers, women, etc., with the objective of uplifting their living standard by empowering them through the provision of credit for income generating activities and training on agriculture, health, education, etc. A total of 1,154 people are involved in the activities. Their activities are summarized in Table 8.31.

Table 8.31 NGOs Active in Gurai

Name of NGO	Activities	# of target group beneficiaries in the village	Type of beneficiaries	Organizers	Sources of fund
PROSHIKA	Mass education, child education, human development, To strengthen women activities by forming female Somittees, Credit for breeding of Ducks & Poultry, Livestock, Fish-culture and Agriculture, 'Aie Thekey Dai Shodh' Program.	920 persons. Female: 540 and Male: 380. Number of Group: 46.	The landless men and women.	Dhaka based national NGO. Locally they have supervisors	Development partners: Canada, German, Denmark, Thailand and America
BRAC	Spread of education, Non-formal education, Credit for breeding of ducks and poultry, Fish culture, Small trade, Motivate farming female somittiees.	234 women. Number of group: 6.	The landless women.	Dhaka based national NGO. Locally they have supervisors	Development partners of: Australia, Japan and own fund of BRAC

Source: JICA Study Team based on PRA by DICS, 2002

One of the key activities to empower beneficiaries to be self-sustained is group savings. To start with, people need to be organized to form a samittee (group) comprising 20 to 25 members. Each of the samittee members saves Tk.5 to Tk.10 every month. The NGO provides loans to the members for two to three months after saving starts. Loans will be used for starting new income generating activities. Repayment will start in the following month. Training on IGAs, education, health programs, etc. are conducted at the cost of NGOs.

8.2 Problems and Constraints

As part of the master planning, problems faced by the local people in the Study Area were analyzed, and constraints to rural development in flood-prone Char and Haor areas clarified as reported in Chapter 4. More specific problems existing in the selected model project area in Haor are analyzed in this section to identify constraints to development of the Haor area, which would guide the model project formulation. A participatory approach is taken to reflect views and opinions of various stakeholders who are more familiar with the area. Two methods are used: project cycle management (PCM) workshops and participatory rural appraisal (PRA). The results of the PCM workshops and the PRA are summarized in Section 8.2.1 and 8.2.2, respectively. Based on them, constraints to be overcome by the planned rural development are identified in Section 8.2.3.

8.2.1 Problems Identified by the PCM

(1) PCM workshop results

A series of PCM workshops were organized and held in Gurai Union during the second fieldwork period. The objectives were to enumerate the existing problems for sharing by all the stakeholders and to clarify more important problems through discussions and mutual learning. The participants of the workshops included representatives of LGED, Nikli Upazila administration, DAE, NGOs, and local governments as well as villagers and the JICA Study Team (as the facilitators).

The target group for problem identification was defined broadly as the “villagers of Gurai gram” and the core problem as the “people in the Haor becoming poorer.” Through discussions, two main problems were identified as directly explaining the causes of the core problem: (1) repeated loss of property and (2) limited employment/income opportunities. Further, the causes of the two problems were identified as follows.

Repeated loss of property is perceived to result from inundation of homesteads, inundation and erosion of roads, and insufficient flood shelters as well as damages to households due to wave actions, and crop damage by early floods. The limited employment/income opportunities are due to lack of natural resources including land of high elevation and farmland for double cropping, poor roads and communications, lack of skilled human resources, and poor access to credit facilities. More specifically, agricultural income is low due to low productivity and lack of crop diversification caused by lack of agricultural training, inadequate use of agricultural input, poor access to market facilities, and low market prices.

(2) Problem structure analysis

The causal relationships between various problem factors identified for the core problem of aggravating poverty have been analyzed, and the problem structure constructed for Gurai gram in Haor as shown in Figure 8.2. This is the problem structure of aggravating poverty as perceived by

the villagers in Gurai gram.

As seen from the figure, most fundamental problem factors for the two main problems are erosion and flooding for repeated loss of property, and lack of natural resources for limited employment/income opportunities, but these problems are inter-related involving limited farmland for double cropping and lack of alternatives to farming during the wet season. In other words, these factors may be focused in formulating more effective measures against aggravating poverty.

It is interesting to note that problems rooted in socio-cultural norms of the traditional value system or related to the local political system, as revealed in Algar Char, do not appear in the problem structure as perceived by the people in Gurai. This may be because the society of Gurai is more stable with a longer history, in which Muslim and Hindu live together without conflict and the leaders of the two dominant political parties work cooperatively.

8.2.2 Problems Identified by the PRA

Participatory rural appraisal (PRA) of the existing conditions in Gurai gram was conducted by a local consulting firm under the JICA Study Team's guidance. The results, as presented in Section 8.1, largely confirm the PCM workshop outcomes but additional information and insights have been obtained as well.

Unlike most Char areas, erosion by wave actions rather than inundation by flooding is considered as the most serious problem in Gurai. Waves enlarge fishponds surrounding village mounds, thereby eroding the mounds and roads at their periphery. While inundation by smaller floods is perceived to be less serious than wave erosion, it tends to be more prolonged due to poor drainage. This is caused by the river morphology of adjoining basins as well as the soil of clay/clay loam.

In Gurai gram, cropping intensity is low as farmland suitable for double cropping is limited. The agricultural land is almost entirely submerged during the wet season, and paddy is practically the only Rabi season crop because of the heavy soil with high water contents. The dominant soil is also low in nitrogen and phosphorus nutrients. These are fundamental factors of low agricultural productivity and income in addition to other problems noted by the PCM, such as limited use of agricultural input and inadequate agricultural extension.

Population density in Gurai gram is generally higher than most Haor areas, and the effective population density per homestead area is extremely high. Agricultural land is limited for the large and growing population, and small and landless farmers are dominant. The population pressure has resulted in loss of some habitats and reduced the diversity of flora and fauna through land conversion for agriculture and settlement and tree cutting for fuel wood.

Despite the established livelihood activities such as fishery, fishnet making, sewing and embroidery, the income levels in Gurai are generally lower than in Algar Char. Still, villagers in Gurai spend a sizable portion of their income on flood/wave protection during the rainy season.

Discrimination against girls/women is rooted in the socio-cultural norms of the traditional value system. The resultant gender imbalance appears in land inheritance, nutritional conditions, wage rates, educational opportunities, health service availability, and access to finance. Early marriage and related social practices such as dowry also work against women.

Poverty is a problem factor for low enrollment and high dropout rates at schools as well as malnutrition. Other factors noted for poor educational performance are early marriage, lack of communication means, lack of awareness of the value of education, and schools closing during the flood season.

Most paras are electrified but the household electrification rate is only 29%. There are a comparatively small number of tube wells and sanitary latrines in Gurai than in Algar Char. There is one tin-roofed flood shelter but it is quite dilapidated.

8.2.3 Constraints to the Rural Development in Gurai

As clarified through the PCM workshops and the PRA, Gurai gram faces the same set of problems rooted in socio-cultural norms of the traditional value system but probably to a lesser degree than Algar Char. Literacy rates are much higher for both male and female, and opportunities for education and access to health services better. Also, the availability of credit facilities is better in the gram with one national agricultural bank and various other lenders extending loans to villagers. Gurai gram has traditional livelihood activities well established through its long history, which are still viable.

Despite these favorable conditions, the income levels in Gurai are generally lower than in Algar Char, and poverty and malnutrition are widespread. This is a reflection of the inherent natural conditions represented by erosion and flooding, and the poor endowment of natural resources including highlands and farmland for double cropping. This situation makes alternative livelihood activities during the wet season and investments to enhance agricultural productivity even more important.

Old and well established, the society of Gurai gram may have been well adapted to the unfavorable natural conditions and even to the harsh economic conditions. The recurrent expenditure on flood/wave protection seems to represent both villagers' receptive attitude and their intention to adapt themselves to flooding and erosion. The main constraint to the rural development in Gurai, therefore, may be the lack of mechanism to muster their collective intention as well as limited resources for sustainable flood/wave protection works and livelihood development. The local initiative is expected for these, utilizing the favorable political climate existing in the gram.

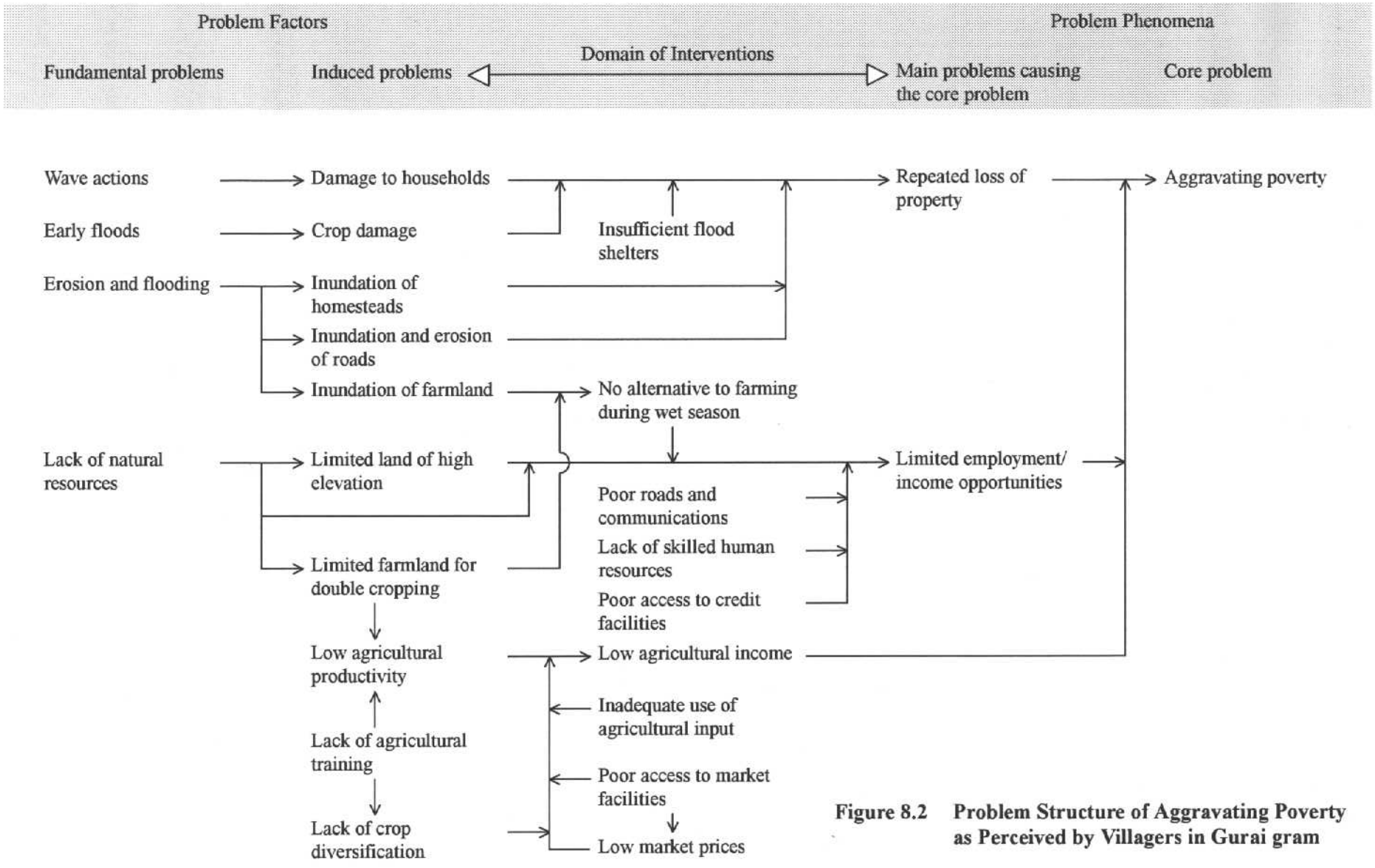


Figure 8.2 Problem Structure of Aggravating Poverty as Perceived by Villagers in Gurai gram

8.3 Development Plan

8.3.1 Flood-proofing and Improvement of Living Environment

(1) Considering Remedial Measures

(a) Flood-proofing

The main flood related constraint facing the village is erosion of the village mound due to waves during monsoon. Surveys show that about 30 meters for the length facing the waves have yielded to the wave action in 30 years time in spite of villagers continuous effort to check it by indigenous means like earthfilled gunny bags, chailla grass, bamboo fence etc.

There is no proper flood warning and dissemination system working in Gurai. When flood situation arises, people decide to take to a safer place by themselves observing the rate of rise in water level and other natural indications.

In consideration of the above, the following programs related to the flood proofing are proposed for the model project in Gurai gram:

- Protection of village mound from wave erosion, and
- Setting up a flood warning and evacuation system.

(b) Improvement of living environment

Out of eight paras of the village, seven paras are now facing the shortage of drinking water. Thus, the following are also proposed related to the improvement of living environment:

- Raised hand tubewells.

(2) Wave protection plan

Out of 17 paras of the village, eight paras are now facing the onslaught by the wave actions. These paras are situated on south, east and north sides of the village mound. The main onslaught by the waves come from the eastern side while the other two sides have it in a lesser degree. The number of households, which are vulnerable to the wave action at present, is 44. Additional 95 households are in a potentially vulnerable position as they are on lines next to the present vulnerable ones.

The approximate length of erosion is presented by para in Table 8.32. Average height of the village mound from the ground level is 2.5m. Location of protection wall needed are shown in Figure 8.3.

Figure 8.3 Plan of Proposed Retaining Wall

GURAI GRAM, GURAI UNION
NIKLI UZ, KISHOREGANJ DISTRICT
Scale.1:4,000

0 100 200m

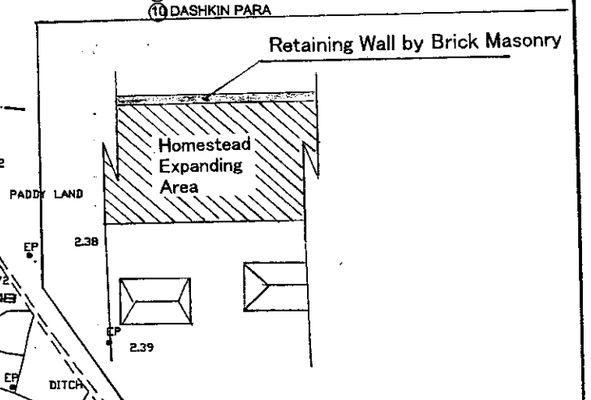
LEGEND

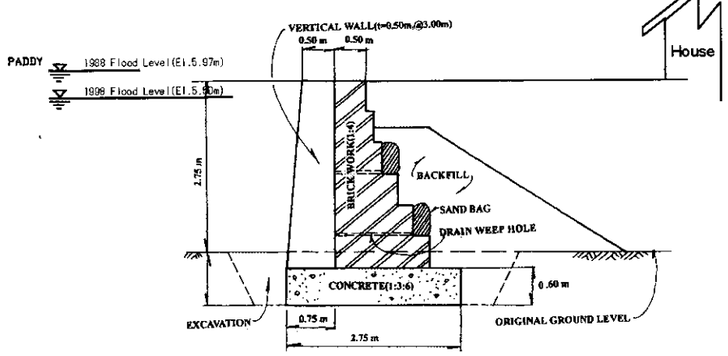
- PARA BOUNDARY
- KATCHA ROAD
- FOOT PATH
- VILLAGE MOUND
- POND / DITCH
- RIVER BANK
- HUT SHEAD
- TIN SHEAD
- BUILDING
- BRIDGE / CULVERT

NIKLI U.Z, KISHOREGONJ DISTRICT
GURAI **GRAM** , GURAI UNION

GURAI

1. CHILA PARA
2. BANIA PARA
3. ATKA PARA
4. UTTAR PARA
5. FAKIR PARA
6. JAL PARA
7. KUNA PARA
8. MASJID PARA
9. NAMASUDRA PARA
10. DASHKIN PARA
11. PURBA PARA
12. GHOSH PARA
13. PASHCHIM PARA
14. SHIBIR PARA
15. PAL PARA
16. NAOGAON PARA
17. MODDON PARA





PLAN OF PROPOSED RETAINING WALL

Table 8.32 Para-wise Erosion Length

Sl. No. of para	Name of para	Length of erosion (m)	Approximate intrusion of erosion into mound during last 30 years (m)
1	Chaila para	115	20
2	Bania para	230	20
4	Uttar para	307	20
5	Fakir para	154	30
6	Jal para	266	30
7	Kuna para	202	30
10	Dakhin para	227	20
11	Purba para	255	30
	TOTAL:	**1,756**	

Materials that may be used for the wave protection are (i) earth-only (ii) brick matressing (iii) sand-cement bags (iv) concrete blocks (v) brick blocks (vi) brick-chips covered by wire net (vii) RCC wall (viii) brick wall etc. There exist also some indigenous methods practiced for slope protection such as placement of Chailla grass (Hematheria protensa) with bamboo poles framework. This grass is resistant to decay even when submerged. Another vegetative measure is growing of Vetiver grass on the slope. The deep root of this grass is very effective for stabilizing embankments. Hijal and Koroch are two types of trees used for wave protection in Haor areas. However, full growth of them may take 5-15 years.

In recent days, three methods were planned by CARE and LGED for wave protection. They are RCC retaining wall, brick retaining wall and wave protection wall. These methods are proved to be effective from CARE pilot projects during 1997-2000. However, they have advantages and disadvantages over one another.

The comparative study of wave protection methods is shown in Table 8.33.

Table 8.33 Comparative Study of Erosion Protection Methods

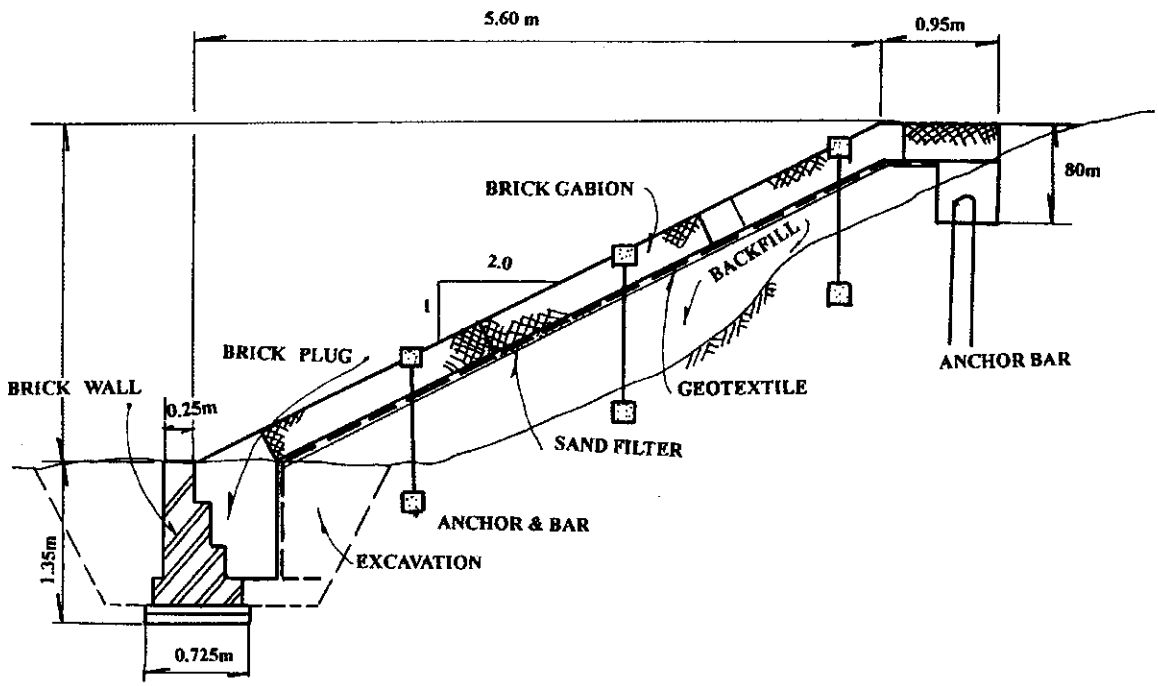
Type of Protection / Item of works for comparison ▽	Protection by						
	Gabion Brick chips with Koroch vegetation	Revetment by CC/brick blocks	Retaining wall by RCC wall	Retaining wall by Brick masonry	Vegetation on slope	Hijal/ Koroch vegetation only	Wave protection wall by RCC
	1	2	3	4	5	6	7
Major materials required: a.Brick b.Cement c.Sand d.MSbar e.wiremesh f.geo-tex g.Nursery	a,c,e,f,g	a,b,c,f,g	a,b,c,d	a,b,c	g	g	a,b,c,d
1 .Earth retaining or Not (Retaining type will provide max landuse)	No	No	Yes	Yes	No	No	No
	(-)	(-)	(+)	(+)	(-)	(-)	(-)
2 Availability of constn. Material	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(+)	(+)	(+)	(+)	(+)	(+)	(+)
3 Cost/unit (tk./meter)	10,200 plus Koroch cost	7,400	13,100	5,700	Low	Low	5,700
	(+)	(+)	(-)	(++)	(+++)	(+++)	(++)
4. Generation of employ-ment opportunity	Yes	Yes	Yes	Yes	Limited	Limited	Yes
	(+)	(+)	(+)	(+)	(+)	(+)	(+)
5 Requirement of O&M	Yearly	Yearly	3-5 years interval	3-5 years interval	2-3 years interval	No O&M reqd	3-5 years interval
	(+)	(+)	(++)	(++)	(++)	(++)	(++)
6.Can the villagers provide O&M themselves	No	No	Partly	Partly	Yes	Not reqd	Partly
	(-)	(-)	(+)	(+)	(++)	(++)	(+)
7. Security of the work	Pilferage possible	Pilferage possible	Pilferage not possible	Pilferage not possible	Somewhat possible	Pilferage Most possible	Pilferage not possible
	(-)	(-)	(+)	(+)	(-)	(--)	(+)
8.Durability of work	Medium durable	Medium durable	Highly durable	Highly durable	Not durable	Very durable	Highly durable
	(+)	(+)	(+++)	(+++)	(-)	(+++)	(+++)
9. Effectiveness to resist erosion	Effective	Effective	Highly effective	Highly effective	Not adequa-tely	Long term	Effective
	(+)	(+)	(+++)	(+++)	(-)	(+++)	(+)
10. Time required for construction	Medium time	More time consuming	More time consuming	Med time consuming	More time consuming	Most time consuming	More time consuming
	(+)	(-)	(-)	(+)	(-)	(--)	(-)
11.Possibility to increase mound land area	Yes	Yes	Yes	Yes	No	Yes	Yes
	(+)	(+)	(+)	(+)	(-)	(+)	(+)
Total points	**8 (+), 3(-)**	**7(+), 4(-)**	**14(+), 2(-)**	**17 (+)**	**8(+), 5(-)**	**17(+), 5(-)**	**13(+), 2(-)**

At present there are one place where wave protection measures have been implemented in Purba para. It was constructed about 15 years ago covering part of Purba para. The type of measure is a brick retaining wall for a length of 230m. According to the villagers the measure is very effective. They also showed a part of the wall which has been repaired by themselves.

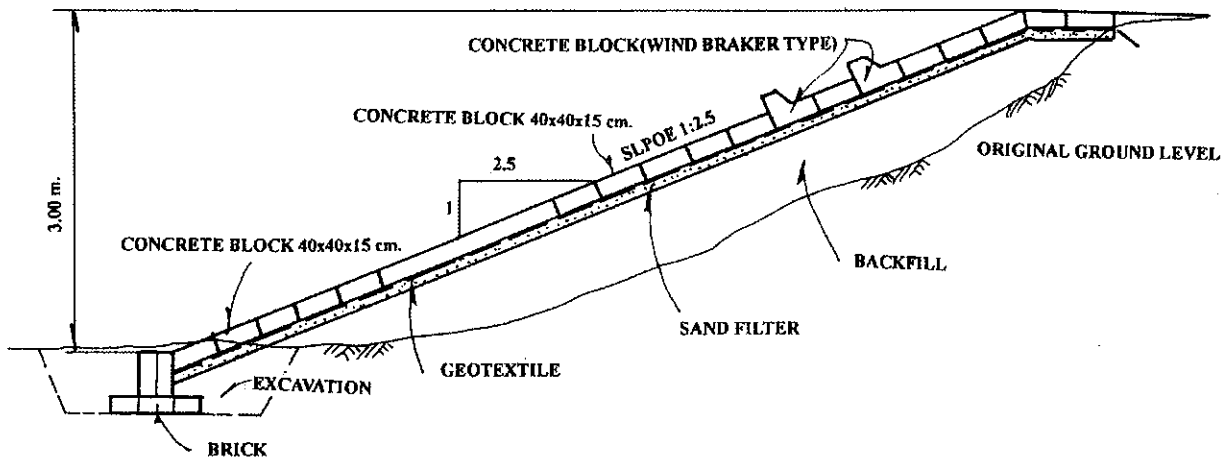
The villagers demand brick retaining wall - the same type they have already in Purba paras - for the protection of their mound.

In view of the comparative study, maintenance and public demand, brick retaining wall is recommended for construction for a length of 1,756m on north, east and south sides. Typical sections of revetment, retaining wall and protection wall by RCC are shown in Figures 8.4, 8.5 and 8.6, respectively.

Figure 8.4 Typical Section of Revetment

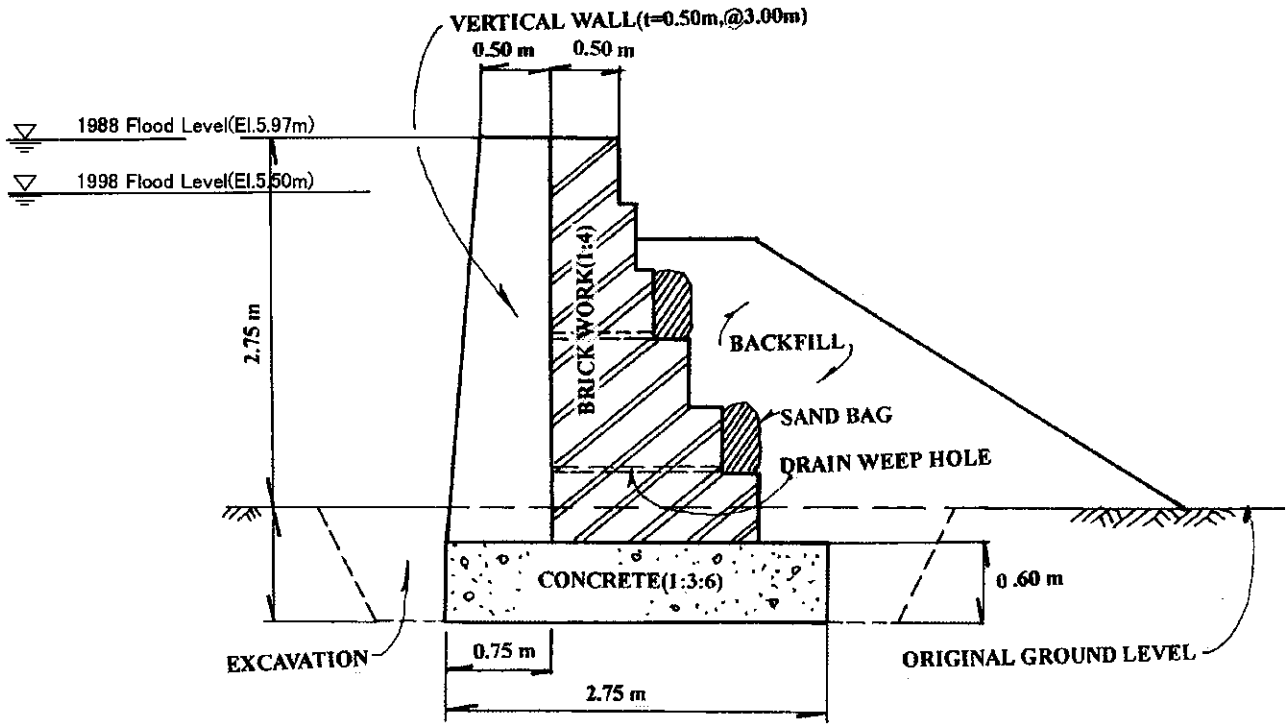


TYPICAL SECTION OF REVETMENT BY GABION BRICK CHIPS

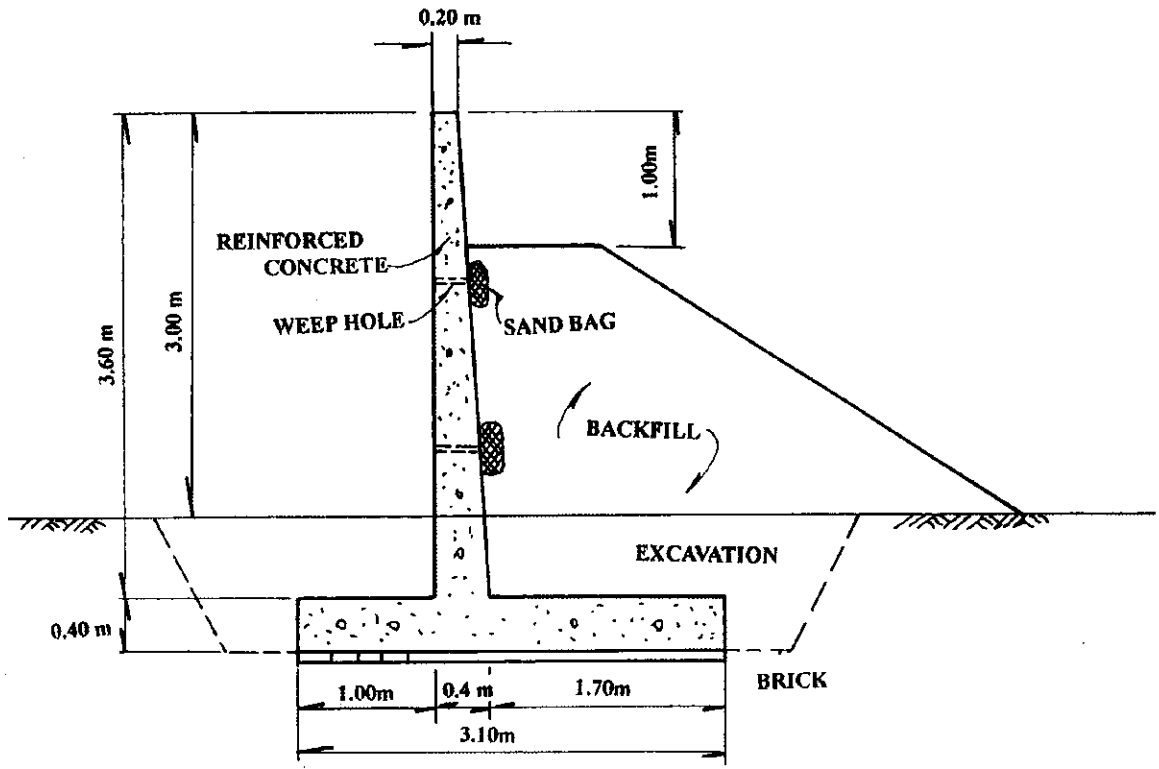


TYPICAL SECTION OF REVETMENT BY CC.BLOCK

Figure 8.5 Typical Section Retaining Wall

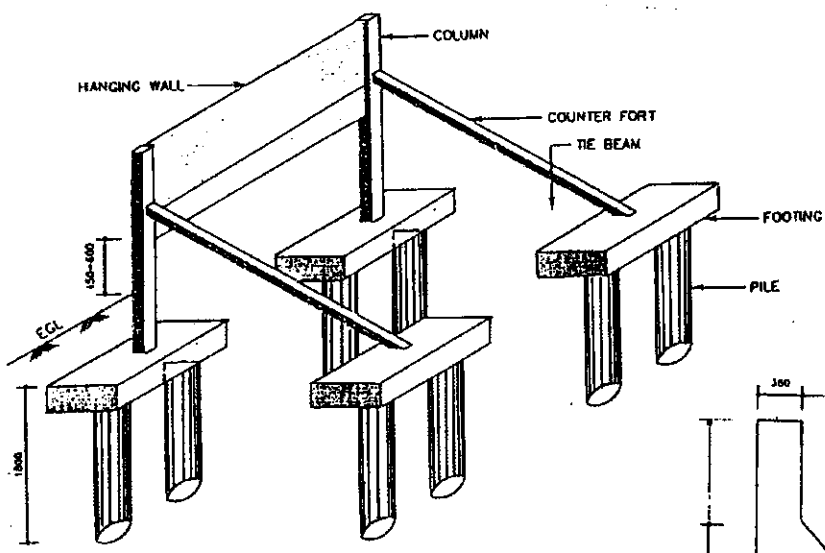


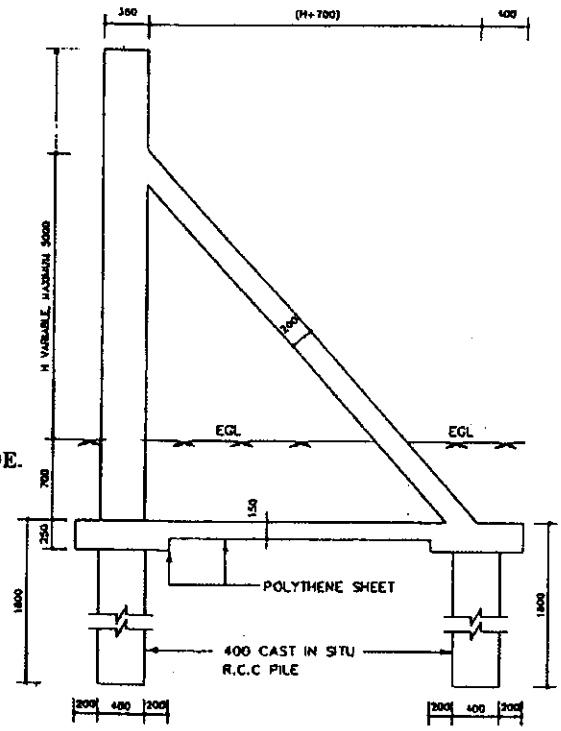
TYPICAL SECTION OF RETAINING WALL BY BRICK MASONRY



TYPICAL SECTION OF RETAINING WALL BY RCC

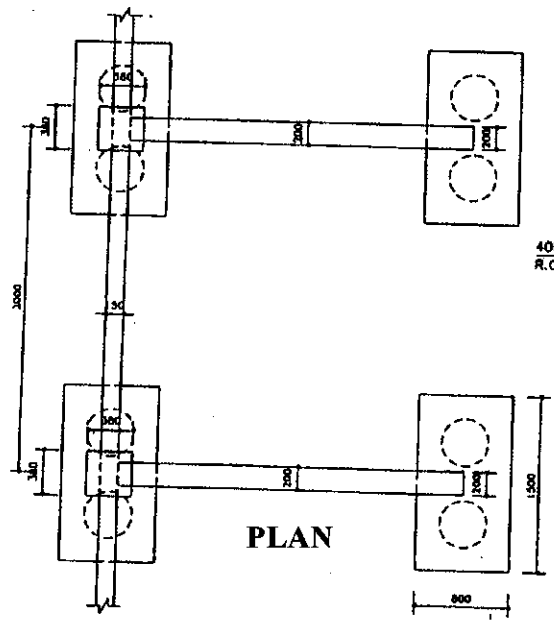
Figure 8.6 Typical Section of Wave Protection Wall by RCC



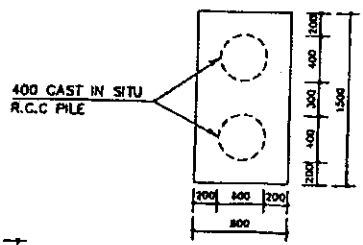


SECTION

ALL TIMBER,PARTS ARE REINFORCED CONCRETE MADE.
NO SCALE AND DIMENSIONS ARE MILI-METER.
EGL = EXISTING GROUND LEVEL



PLAN



FOOTING

TYPICAL SECTION OF WAVE PROTECTION WALL BY RCC

(3) Raised hand Tubewell

Taking into the policy of DPHE, mentioned in Subsection 7.3.1 (5), it is proposed that tubewell density in Gurai is to be increased to national level (75 population/tubewell) for each para. Existing numbers and tubewell density of the target para are summarized in Table 8.34. In consideration that some of existing tubewells were inundated during the 1998 flood, both installation of new tubewells and raising of existing tubewell pits are proposed. Accordingly the total number of requirement is 19 for new tubewells and 27 for raising respectively, as shown in Table 8.34.

Table 8.34 Proposed Numbers of Hand Tubewell in Gurai Gram

No	Name of Para	Population (no.)	Existing condition			Proposed numbers of tubewell		
			Numbers of well (no.)	Inundated in 1998 flood (no.)	Coverage (popl./well.)	Raising of existing well (no.)	Newly required (no.)	Coverage (popl./well.)
1.	Chila	148	1	0	148	0	1	74
2.	Bania	415	2	2	-	2	4	69
4.	Uttar	438	34	0	13	0	-	13
5.	Fakir	103	2	1	103	1	-	52
6.	Jal	597	4	0	149	0	4	75
7.	Kuna	272	10	10	-	10	-	27
10.	Dakhin	643	6	6	-	6	3	71
11.	Purba	1,833	18	8	183	8	7	73
Total (Average)		**4,449**	**77**	**27**	**(89)**	**27**	**19**	**(46)**

Source: Questionnaire survey by JICA Study team

According to result of random sampling survey by UNICEF aided technical assistant project in 1997, Nikli Upazila is affected by arsenic. It is recommended that the depth of tubewells should be more than 500 ft (150 m) to avoid effects of arsenic as defined by DPHE.

On the other hand, according to water sampling survey through EIA conducted by the JICA Study Team, trace arsenic contents were detected from a tubewell of 75 m depth, while there is no arsenic detected at tubewells with more than 80 m depth. Therefore, it is recommended that depth of new tubewells should reach up to 80 m depth.

As the depth of 80 m, however, is not the absolute depth for avoiding arsenic as well as iron, it is strongly proposed that water quality should be examined during the construction of hand tubewells to achieve a safe depth.

(4) Flood warning and evacuation system

Dissemination of flood warning

There is no proper flood warning and dissemination system working against wave actions due to monsoon from south-east during flooding in Gurai gram; similar to the situation of warning and dissemination system prevailing in most parts of the Country. Like the three pilot UZs under the

FFWC's dissemination activities, a system of dissemination of flood warning may be set up for Gurai also. There has been Disaster Management Committees (DMC) formed already at District, UZ and Union levels for all districts of Bangladesh. Gurai Union (in which the Gurai gram is situated) is under Nikli UZ. After receiving FFWC flood warnings, the UZDMC at Nikli will interpret the forecasted rise of water level in the context of the flood prone areas of the UZ. Should it be appropriate for Gurai Union, the information of flood warnings will be sent to the Union DMC through messenger. At present the Union is covered by mobile telephone network though the signal is very weak but expected to improve soon.

Organizing Gram Disaster Management Committee (GDMC)

After a message of warning is received from the Nikli UZDMC, the Union DMC will disseminate it through its Committee members, Volunteers and Chowkidars to Gurai Gram mound and other villages. Local school teachers, Imams of the mosques, members of the UP will play important roles in dissemination by announcing in schools, religious congregations, drum beating in markets and using microphones of the village mosques. Gram DMC, therefore, is proposed to organize those members of Gurai gram through the project. Gram DMC is basically composed of the representatives in all para committees.

The dwellers of Gurai gram, being informed of the impending floods, will look for appropriate shelters. The raised platform of the newly constructed market can serve as a good refuge place in time of need. In most cases, they will move by their own arrangement of boats. However, in some cases, the Union Disaster Management Committee under the support of the UZDMC and the district administration will arrange boats.

The existing flood shelter situated in Shibir para in the village mound may be repaired under the initiative of LGED.

Training on flood warning and evacuation

Training on flood warning and evacuation against to wave action during flooding is targeted to dwellers of Gurai gram who will be refugees as well as messengers to disseminate flood warning to the gram from Union DMC and Nikli DMC. The training program may be organized by FFWC, LGED and NGOs. Proposed components of training program are shown below;

Duration: one month (25 days net, two hours per day)
Number of trainee: 25
Training subjects and duration:

Main subject	Details of learning of subjects	Duration
1.General concept	1)What is the monsoon forecasting and warning dissemination	1day
2.Flood environment	1)Mechanism of monsoon, 2)Location of Gurai gram in the Haor area, 3)Signals of monsoon occurring	1day
3.System of flood forecasting	1)Organization of FFWC, 2)monsoon forecasting network, 3)Pilot project in Bangladesh, 4)Dissemination system of monsoon warning, 5)Identification of UZ DMC and UDMC	1day
4.Dissimenation of warning	1)Flow of dissemination from FFWC up to Union office, 2)Role of District and UZ offices,	1day
5.Establishing Gram DMC	1)Selection of disseminator, 2)Role of disseminators, 3)Role of warning receiver	10days
6.Sheltering	1)Reason of sheltering, 2)Location of sheltering places available,3)route of sheltering places, 4)Method of sheltering and guard of their property	5days
7.Post flood	1)Recovering of damage occurred by wave action	3days
8.Simulation of warning dissemination		3days
Total		**25days**

Source: JICA Study Team based on the information from Bangladesh Disaster Preparedness Centre.

Total costs: Tk.20,000

1. Honorarium for teacher: Tk.5,000/month x 3 teachers x 1 month = Tk.15,000
2. Training materials: Tk.200 per participant x 25 people = Tk.5,000

8.3.2 Livelihood Development

(1) Support services for livelihood development

While the “hard” measures will contribute to the creation of better living environment for the villagers, the “soft” measures will contribute to the improvement of their living standard and maintenance or upgrade of the living environment. Livelihood development shall be planned as the “soft” measures.

Although the villagers of Gurai will be the main players, external support is necessary to develop livelihood in the gram, given the constraints to further development identified in the previous section, including limited employment opportunities, lack of skilled human resources, low agricultural income, no alternative to farming during the wet season, etc.

Among the constraints, low agricultural income is attributed to the small land size, not the productivity, as the average paddy yield is recorded at nearly 6 tons/ha. Livelihood development, therefore, shall be planned through the provision of various support services to expand the opportunities for income generating activities as well as develop skills for the villagers of Gurai. Another option to be considered is to reduce the post-harvest losses after harvest at the field. Taking the very limited mound area into consideration, income generating activities to be promoted in Gurai shall be land intensive and shall not need large area, in principle.

The following support services will be provided primarily to the beneficiaries of the “hard”

measures, who will be responsible for maintaining wave protection facilities.

i) Poultry promotion (Duck rearing)

Low level of protein intake is another constraint to improve health conditions of local people. Poultry (duck) rearing technology will be transferred through training by a NGO and actual activities will be monitored and advice given by a block supervisor of Department of Livestock. Duck rearing will be promoted utilizing existing natural ponds inside the gram and borrow pits to be utilized for fish culture as mentioned above. Details of the training and estimated costs are shown below.

Duration: three months (72 days net, two hours per day)
Number of trainee per one batch: 20 people
Subjects and duration on training of duck rearing:

Main subject	Details of learning of subjects	Duration
General concept	1. Basic idea on duck rearing and 2. Economic aspect	3 days
Varieties	1. Breeds of ducks; 2. Selection of right breeds; and 3. Procurement of ducklings	4 days
Brooding	1. System of brooding; 2. Classification of brooders;	5 days
Housing and other facilities	1. Site selection; 2. Size of house; 3. Materials of house; 4. Design of house; 5. Litter treatment; and 5. Fixtures (nests, watering trough, and feeding troughs)	20 days
Feeds and feeding	1. Nutrients (water, carbohydrates, protein, minerals, and vitamines); 2. Feeding practices; 3. Composition of the daily diet; 4. Materials for feeds; and 5. Compounding of feeds	30 days
Health and hygiene practice	1. Diseases and prevention; 2. Vaccine and immunization; 3. Vaccination; 4. Diseases to be vaccined; 5. Vaccine preservation; and 6. Vaccine routine	10 days
Total		**72 days**

Source: JICA Study Team

Total costs: Tk.22,000
1. Honorarium for a teacher: Tk.6,000/month x 3 months = Tk.18,000
2. Training materials: Tk.200 per participants x 20 people = Tk.4,000

ii) Home gardening promotion with nutrition education

Home gardening shall be promoted utilizing the expanded mound area to improve nutrition status of local people in the light of their poor health status at present. Vegetable cultivation technology will be extended with certified seed distribution. Surplus amount of crop harvest can be sold at the local market. The target group will be women. This activity will be made jointly by DAE and NGOs. Details of the training and estimated costs are shown below.

Duration: three months (70 days net, two hours per day)
Number of trainee per one batch: 10 people
Subjects and duration of home gardening with nutrition education:

Main subject	Details of learning of subjects	Duration
General concept	1. What is home gardening; and 2. Value of vegetable.	3 days
Nutrition	1. Nutrition disorder; and 2. Vegetable and nutrition.	3 days
Site selection	Criteria for selection (water, drainage, soil fertility, solar radiation, etc.)	3 days
Site preparation	1. Soil preparation; and 2. Making drainage	3 days
Fencing	Fencing of home garden	3 days
Compost making	1. Basket and trench composting; and 2. Method of planting	5 days
Fertilizer application	1. Fertilizer and crop growth; 2. Fertilizer requirement; and 3. Timing of application	5 days
Vegetable growing	1. Cropping calendar; 2. Characteristics of vegetable; 3. Sowing; 4. Crop husbandry; 5. Harvest; and 6. Crop rotation	30 days
Diseases and pests	Diseases and pests and their control	15 days
Total		**70 days**

Source: JICA Study Team

Total costs: Tk.20,000

1. Honorarium for a teacher: Tk.6,000/month x 3 months = Tk.18,000
2. Training materials: Tk.200 per participants x 10 people = Tk.2,000

iii) Nursery development for social forestry

Useful tree species including mahogany, ipil-ipil, mango, jackfruit, Hijal, Koroch, etc., will be planted more on the mound as well as low land to improve natural environment as well as augment resources. For this purpose, a nursery will be established to grow seedlings for those species.

Technology on nursery establishment and seedling growing will be extended by Department of Forestry or environmental NGOs active in Haor areas. Some 20,000 seedlings will be grown every year. Details of the training and estimated costs are shown below.

Duration: two months (50 days net, two hours per day)
Number of trainee per one batch: 10 people
Training subjects and duration:

Main subject	Details of learning of subjects	Duration
General concept	1. What is social forestry; and 2. Value of trees.	3 days
Tree species	1. Useful tree species; 2. Characteristics of useful trees.	10 days
Preparation of nursery bed	1. Site selection; 2. Determination of size of nursery; 3. Land preparation;	4 days
Growing seedlings	1. Methods of multiplying seedlings; 2. Collecting seeds; 3. Preparation of pots; 4. Preparation of soils; 5. Preparation of locally available fertilizer.; 6. Filling pots with mixed soils; 7. Sowing seeds; 8. Planting cuttings; 9. Watering; 10. Shading; 11. Growth duration of seedlings; etc.	30 days
Marketing seedlings	1. Uprooting seedlings; 2. Sale of seedlings	3 days
Total		**50 days**

Source: JICA Study Team

Total costs: Tk.14,000

1. Honorarium for a teacher: Tk.6,000/month x 2 months = Tk.12,000
2. Training materials: Tk.200 per participants x 10 people = Tk.2,000

iv) Technical training on fish culture utilizing borrow pits

Utilizing borrow pits to be created for mound expansion, fish culture will be promoted. Fishery extension will be made by extension staff of the Department of Fishery. The target group will be landless farmers. Details of the training and estimated costs are shown below.

Duration: two months (50 days net, two hours per day)
Number of trainee per one batch: 10 people
Subjects and duration on training of fish culture:

Main subject	Details of learning of subjects	Duration
General concept	1. Basic idea on fish culture and 2. Economic aspect	2 days
Fish species	1. Fish species and characteristics	3 days
Fish rearing	1. Procurement of fingerlings; 2. Fish rearing plan (adequate size of fingerlings, rearing density, and preparation of fish pond); 3. Release of fingerlings into pond; 4. Rearing (feeding, and management of pond water); and 5. Harvest	30 days
Diseases and its prevention	1. Common diseases; 2. Causes of diseases; 3. Prevention and cure of diseases	15 days
Total		**50 days**

Source: JICA Study Team

Total costs: Tk.14,000
1. Honorarium for a teacher: Tk.6,000/month x 2 months = Tk.12,000
2. Training materials: Tk.200 per participants x 10 people = Tk.2,000

v) Training on entrepreneurship and business management for a parboiling plant operation

At present, some 50 % of the total paddy produced in Gurai are brought into the private dry yard in the gram for drying and processing, and the remaining are marketed in neighboring places outside the gram. This is due to limited capacity of the existing dry yard and parboiling plants in the gram. One possibility for augment income in the gram is to establish a new parboiling plant with dry yard and rice mill.

Through the training on entrepreneurship and business management, business minded enthusiastic villagers will be identified. The plant will be operated and maintained by organized village people. Owners of existing parboiling plants with dry yard in the gram will be fully involved in the business. Details of the business training and estimated costs are shown below.

Duration: four months (101 days net, two hours per day)
Number of trainee per one batch: 10 people
Subjects and duration on training of business on parboiling plant with dry yard and rice mill:

Main subject	Details of learning of subjects	Duration
General concept	1. Basic idea on business	3 days
Post-harvest of rice	1. Harvest of paddy; 2. Parboiling of paddy; 3. Drying paddy; 4. Rice milling; 5. Store rice; 6. Marketing	10 days
Parboil plant	1. Capacity of plant; 2. Designing of the plant; 3. Fuel; 4. Duration of parboiling; 5. Maintenance of parboiling plant	5 days
Drying yard	1. Drying capacity; 2.Designing drying yard; 3. Drying duration	3 days
Rice mill and storage house	1. Capacity of rice mill; 2. Mechanism of rice mill; 3. Capacity of storage house; 4. Construction of storage house; 5. Installation of rice mill; 6. Maintenance of rice mill;	20 days
Cost	1. Initial cost for establishing parboil plant, dry yard, storage and rice mill; 2. Cost of operation in drying yard with parboiling; 3. Cost of operation in rice mill and storage house; 4. Cost of laborers; and 5. Maintenance cost	40 days
Credit	1. Available credits for parboil plant business; 2. Application for credit; 3. Repayment schedule	10 days
Making profit	1. Estimate handling amount; 2. Setting handling charge; 3. Prepare balance sheet; 4. How to record financial transactions (bookkeeping)	10 days
Total		**101 days**

Source: JICA Study Team

Total costs: Tk.26,000

1. Honorarium for a teacher: Tk.6,000/month x 4 months = Tk.24,000
2. Training materials: Tk.200 per participants x 10 people = Tk.2,000

(2) Livelihood development

After the training, beneficiaries will start income generating activities under the supervision of NGOs and concerned government extension workers. Expected benefits of each activity are estimated in Table 8.35.

Table 8.35 Expected Benefits of Each Activity

Income generating activities	Scale	Unit	Quantity	Gross profit (Tk./year)	Total cost (Tk./year)	Net profit (Tk./year)
Duck farming	0.36 ha	nos. eggs	5,000	25,000	11,000	14,000
Social forestry	200 m^2	nos. seedlings	20,000	100,000	64,000	36,000
Inland fishery	0.36 ha	kg	720	36,000	16,500	19,500
Drying, parboiling & millng	400 m^2	ton	400	3,445,000	3,275,000	170,000

Source: JICA Study Team, Gender Development Research Center (GDRS) and Association for Community Health Services (ACHS)

8.3.3 Savings and Credit Scheme

The model project in Gurai combines, among others, wave protection works as the minimal structural measure for flood-proofing and support services for livelihood development under the enhanced flood-proofing. Additional income to be generated by these new livelihood activities is expected to be used partly for further flood-proofing as well as O&M of existing flood-related facilities. This is a step-wise process to enhance flood-proofing and to generate additional income,

supporting each other. To make this process operational in a sustainable manner, a mechanism needs to be established to allow relatively small amount of money revolve locally to support both flood-proofing and income generating activities.

The establishment and successful operation of a savings and credit scheme holds a key to the successful implementation of the project as a whole. A most appropriate scheme would be established through the model project implementation and replicated, with modifications if necessary, in other larger areas. A few alternative forms of the scheme may be tested through the model project. In this section, conditions to be satisfied by the savings and credit scheme are clarified first, and specific forms of the scheme for Gurai gram proposed.

(1) Conditions for savings and credit scheme

Many rural development projects include micro credit schemes to support income generating activities (IGAs) by villagers, usually provided by support of donors or the Government. These schemes often have a few common problems as follows (Subsection 7.3.3):

1) Disbursement is slow and limited as most villagers do not venture on new IGAs because of the risk involved, especially under flood-prone conditions;

2) Villagers may not use the credit effectively, resulting in low returns and low repayment rate; and

3) Credit administered by public agencies does not lead to a sense of ownership by the villagers, whose capacity is thus not augmented.

To minimize these problems, the credit scheme for the model project should be supported, at least in part, by a self-generating fund of potential beneficiaries, and by their IGAs, among others, to make it revolving. It should also be self-managed to develop management and economic capacity of the villagers with the sense of ownership. In sum, three key conditions for the savings and credit scheme for the project are risk reduction, responsibilities, and ownership.

(2) Components of savings and credit scheme

Three main components of any savings and credit scheme are (1) sources of funds, (2) allocation/distribution/disbursement methods, and (3) use of credit. Alternative schemes are conceived by combining different options for each component. Possible combinations are examined for the rural development in Char/Haor areas (Subsection 7.3.3).

Sources of funds for the credit scheme include the following:

- Savings, compulsory and voluntary, by potential beneficiaries,

- Seed capital to be provided by donors and/or the Government, and

- Matching fund, a variant of seed capital to be provided in proportion to savings by potential beneficiaries.

Possible criteria for allocating/distributing the seed fund to different project paras include the number of members of para committee (PC), amount of own savings, and demand for credit. Some portion of the seed capital may be allocated in proportion to the number of PC members. Distribution of the seed capital in proportion to own savings makes it operate as a matching fund. Allocation by demand for credit generally encourages economic efficiency.

Two main uses of credit are insurance against unexpected events such as flood damages and crop failure, and loans to be used for either IGAs or flood proofing/mitigation works. Pooling savings by PC members into a common fund for use against unexpected events inflicting on any member corresponds to mutual insurance. Such mutual cooperation as well as shared responsibilities would be an essential condition for the success of any savings and credit scheme.

(3) Savings and credit scheme for Gurai

Components

It is proposed that compulsory savings and surcharges to user fees of livelihood support services be combined for the model project in Gurai. This would help strengthen the linkage between flood proofing and livelihood development. Those who would benefit more from flood proofing have strong motivations to save more, or conversely, those who save more through availing of livelihood support services would benefit more from flood proofing.

Seed capital should be allocated only partly in proportion to the number of PC members to encourage the PC formation. The remaining bulk should be distributed in accordance with the amount of own savings, effectively making it a matching fund.

Credit should be used for both purposes: insurance against unexpected events and loans for IGAs and flood proofing/mitigation works. This would introduce more complicated management needs than in the case in which only loans are provided. It is necessary in any case, however, to supervise and monitor savings of PC members and allocation of the seed fund as well as credit and insurance payments at any given point in time.

Model operation

The model project in Gurai will be implemented first in Purba para with a population of 1,833 and 256 households. The average household income in the para is assumed to be Tk.29,000 corresponding to the average income of small farmers. Compulsory savings corresponding to 5% of the annual income may be applied to the households. This level is not excessive in view of the annual expenditure for wave protection currently borne by households in the para, which corresponds to 11% of the total household expenditure for small farmers. The total amount of savings will be Tk.371,200 per year.

The project will provide support services for several livelihood activities, but those generating additional income immediately are limited. It is assumed that 40% of trainees/beneficiaries for duck farming and inland fishery belong to Purba para in proportion to its household share. The total cost of Tk.11,000 would be borne by the beneficiary households, and 20% surcharges would applied and saved. This would generate only Tk.1,100 annually.

If the beneficiary households borrow to finance the costs of duck farming and inland fishery at an interest rate of 15% per annum, the total amount of interest payments will be Tk.1,650 annually. On the other hand, the profits from these activities would total Tk.13,400, far exceeding the repayment requirements. If some activities fail due to unexpected events, loans cannot be repaid and must be covered by savings. Default debts, however, would correspond only to 3.0% of the total amount of savings.

The wave protection works for Purba para will provide flood proofing against a 20-year flood. The total project cost for the para is estimated at Tk.2,900,000, including indirect costs and contingencies. The saving during the flood-free 20-year period will accumulate up to Tk.7,500,000. This amount is large enough to rebuild the flood proof measures even in the unlikely event of a 20-year flood demolishing the structure. In reality, the savings will be utilized for regular maintenance and repair of the facilities, and the cost to restore them after damages by a 20-year flood would be much smaller than the cost of initial construction.

8.4 Implementing Schedule

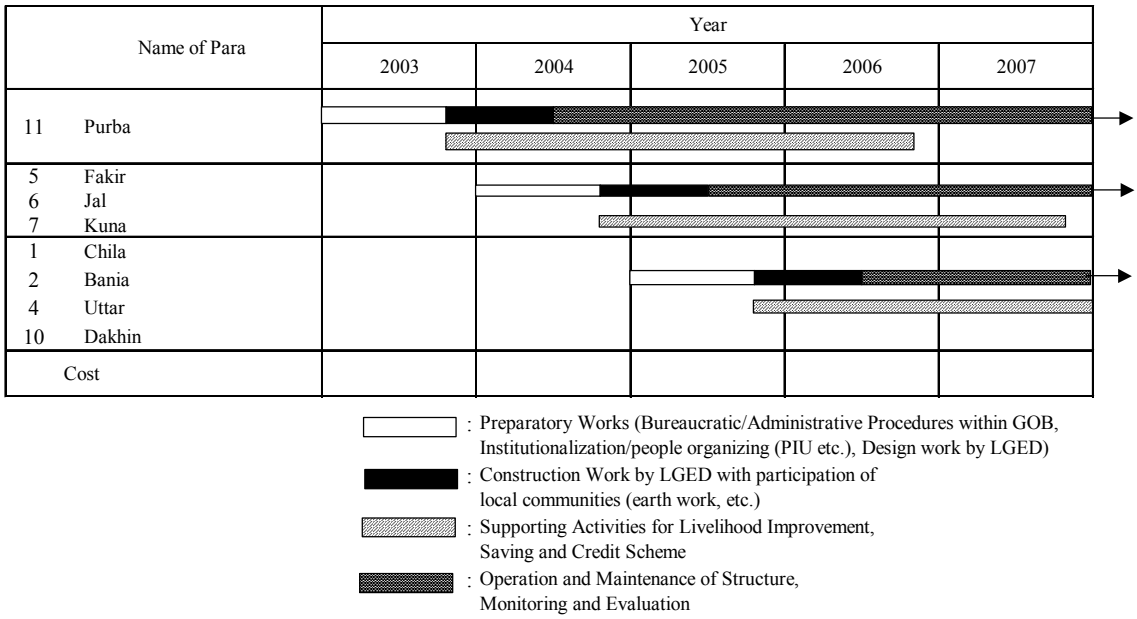
8.4.1 Overall Implementing Structure

For the implementation of the model project in Gurai, the same structure of implementing arrangements, as illustrated in Figure 6.4, would be established but only with essential elements initially. These elements are para committees in selected project paras, PIU composed of the LGED Upazila office and Upazila administration of Nikli, NGOs, Union Parishad of Gurai and the respective para committees, and PMO in the LGED central office.

8.4.2 Implementing Schedule

The implementation of the model project in Gurai will start from Purba para, which is more vulnerable to wave erosion than other paras, as it has the longest eastern boundary exposed to wave actions. It also has a wave protection wall covering a part of the eastern boundary constructed some 15 years ago, and thus most cost effective protection may be provided. In the subsequent phase, Fakir para, Jal para and Kuna para will be covered by the model project, followed by Chila para, Bania para, Uttar para, and Dakhin para. Implementing arrangements will be established during the wet season, followed by the implementation in the dry season, respectively.

Figure 8.7 Implementing Schedule



Proposed Measures by Para

Name of Para	Proposed Measures
1 Chila 2 Bania 5 Fakir 6 Jal 7 Kuna 10 Dakhin 11 Purba	①Wave Protection Plan、②Raised Hand tubewell、③Flood warning and Evacuation、④Support Service for Livelihood Development、⑥Saving and Credit Scheme
4 Uttar	①Wave Protection Plan、③Flood warning and Evacuation、④Support Service for Livelihood Development、⑤Saving and Credit Scheme

8.5 Project Cost

8.5.1 Summary of Project Cost

Project costs, composed of direct construction cost, indirect cost, contingencies and cost for land acquisition, total Tk.15,903,000, as summarized in Table 8.36. The direct cost covers "I. Flood proofing and improvement of living environment" as mainly structural measure and "II. Support services for livelihood development" as non-structural measure, are estimated at Tk.11,679,000 and Tk.96,000, respectively.

Table 8.36 Summary of Project Cost in Gurai Gram

(unit: '000 Tk.)

Description	Amount	Remarks
A. Direct Cost		
I. Flood Proofing and Improvement of Living Environment	**11,679**	
I-1 Mound protection	11,482	L=1,756 m
I-2 Raised hand tubewell	177	(19+27) nos
I-3 Training on Flood warning and evacuation	20	
II. Support Services for Livelihood Development	**96**	
II-1 Poultry promotion	22	
II-2 Home gardening promotion with nutrition education	20	
II-3 Nursery development for social forestry	14	
II-4 Technical training on fish culture utilizing borrow pit	14	
II-5 Training on entrepreneurship & business management for a parboiling plant operation	26	
A. Direct Cost Total	**11,775**	
B. Land Acquisition	**662**	
C. Indirect Cost	**1,531**	
I. Administrative cost	589	5 % of direct cost
II. Engineering fee	942	8 % of direct cost
D. Physical contingency	**1,178**	10 % of direct cost
E. Price contingency	**757**	5 % of total cost
Ground Total (A+B+C+D+E)	**15,903**	

8.5.2 Summary of Para-wise Project Cost

Para-wise project costs in each of eight (8) target para and common, costs to be allocated to all the target paras are summarized in Table 8.37. Costs for "Support services for livelihood development are included only in the common project cost.

Table 8.37 Summary of Para-wise Project Cost in Gurai Gram

(Unit: '000 Tk.)

Description	Amount
Common	**116.0**
I. Flood Proofing and Improvement of Living Environment	20.0
II. Support Services for Livelihood Development	96.0
1. Chila Para	
I. Flood Proofing and Improvement of Living Environment	**728.4**
2. Bania Para	
I. Flood Proofing and Improvement of Living Environment	**1,455.9**
4. Uttar Para	
I. Flood Proofing and Improvement of Living Environment	**1,863.8**
5. Fakir Para	
I. Flood Proofing and Improvement of Living Environment	**996.9**
6. Jal Para	
I. Flood Proofing and Improvement of Living Environment	**1,719.6**
7. Kuna Para	
I. Flood Proofing and Improvement of Living Environment	**1,307.6**
10. Dakhin Para	
I. Flood Proofing and Improvement of Living Environment	**1,439.4**
11. Purba Para	
I. Flood Proofing and Improvement of Living Environment	**2,147.9**
A. Direct Cost Total	**11,775.4**
B. Land Acquisition	**662.3**
C. Indirect Cost	**1,530.8**
I. Administrative cost	588.8
II. Engineering fee	942.0
D. Physical Contingency	**1,177.4**
E. Price Contingency	**757.3**
Ground Total (A+B+C+D+E)	**15,903.4**

8.5.3 Summary of Maintenance Cost

Annual maintenance costs composed of those for routine works every year and periodic works after each flood are summarized in Table 8.38, while repairing cost incurred by damages due to such a major flood as the 1998 flood is excluded from the maintenance work costs. Maintenance period for Mound protection wall is 30 years under well-maintained condition keeping by beneficially, while that of Raised hand tube well is at least 15 years in view of working life of the facility.

Table 8.38 Summary of Annual Maintenance Cost in Gurai Gram

(Unit: '000 Tk.)

	Description	Amount
I. Flood Proofing and Imprpvement of Living Condition		
I-1	Mound protection	211.6
I-2	Raised hand tubewell	18.5
	Maintenance Cost Total	**230.1**

8.5.4 Cost Sharing

Villagers provide the land for borrow pit, and bear the O&M cost and a part of construction cost.

Table 8.39 Share of Construction Cost

(Unit; Tk)

Name of Scheme	Construction Cost	Share		Number of Beneficial Households	Cost/HH
		Government (80～90%)	Villager (10～20%)		
1..Mound protection	11,482,000	9,186,000～ 10,334,000	1,148,000～ 2,296,000	621	1,850～3,700

Beneficial villagers bear 10～20% of construction cost. One villager shares about Tk.1,850～ Tk.3,700 for mound protection, equivalent to 8～17% of annual average income of Tk.22,000. Small farmers spend 6% of total expenditure for flood/ wave protection in the every rainy season. Villagers can choose the way of payment from cash or labor work. Cost sharing of beneficiary will be decided through the meeting between Para Committee and LGED in detailed design stage.

8.6 Project Evaluation

8.6.1 Social Evaluation

Positive social impacts are expected to the people of Gurai by the Project. The major positive impacts include: (i) stabilization of normal life, (ii) empowerment of local people, (iii) strengthening of social cohesiveness, (iv) improvement of health conditions, and (v) poverty reduction. They are explained in the following.

(1) Stabilization of social life

Established flood proof conditions under normal flood will assure the local people of stabilized social life. They will be released from uneasy life under the normal flood conditions. Hygiene conditions will be improved and normal schooling will be assured.

(2) Empowerment

Local people will be empowered by participating in the whole project process. Planning process will empower people by learning about flood preparedness, their roles and responsibility in the project through organizing themselves. They will be empowered further through implementation process by participating in various activities including construction of wave protection walls, training in income generating activities, savings and credit, and other group activities. Organized people will finally be responsible for regular operation and maintenance of wave protection wall as well as savings and credit activities to make the project sustainable.

Women will be empowered through home gardening and nutrition education, income generating activities such as social forestry, which is expected to raise their social status.

(3) Strengthening of social cohesiveness

The collective efforts of various activities by the organized people will strengthen social cohesiveness, which will contribute to the promotion of social morality and justice. Such strong ties will reduce the case of crimes and assure public security.

(4) Improvement of health conditions

Construction of wave protection wall and raising of hand tubewells will assure the normal life for the local people under the normal flood conditions. It will contribute to the improvement of hygiene conditions, which will reduce the chance of outbreak of epidemics like diarrhea and dysentery. Home gardening with nutrition education will also contribute to the improvement of their health status.

(5) Poverty reduction

Establishment of flood proof conditions under normal flood will prolong the normal life, which

will reduce the expenditure on flood mitigation. Income generating activities will be promoted mainly targeting poor people so that they could increase their income level. Improved health conditions through promotion of home gardening, through establishment of flood proofing conditions and through raising of hand tubewells, will reduce expenditure on medical care and increase available time for socio-economic activities. Savings and credit will also expand the chance to start new income generating activities.

Through the above impacts, living standard of the local people will be enhanced.

8.6.2 Economic Evaluation

(1) Methodology

Economic analysis is carried out for the purpose of evaluation for economical adequacy of the proposed projects both in the Char and the Haor areas. The analysis aims at assessing the projects in view of contribution to the national economy, and is carried out based on economic prices. On the other hand, financial analysis aims at assessing the profitability of individual household economies, and is carried out based on market prices, or financial prices. Economic prices are converted from financial prices by applying the conversion factor.

The project will give rise to many kinds of direct and indirect impact both tangible and intangible. In general, direct and tangible impact is quantitatively estimated as the benefits and, in comparison with the project costs, such economic indicators as Net Present Value (NPV), Benefit/Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR) are calculated. These three criteria can be summarizing as follows;

NPV = Discounted benefits – Discounted costs
B/C Ratio = Discounted benefits / Discounted costs
IRR = such discount rate as [Discounted benefits = Discounted costs]
(NPV = 0, B/C Ratio = 1)

(2) Basic evaluation criteria

Basic evaluation criteria, such as opportunity cost of capital, Standard Conversion Factor (SCF) and Shadow Wage Rate (SWR), adopted in this analysis is based on those stipulated in the Flood Planning Coordination Organization's Guidelines for Project Assessment (hereinafter called as "FPCO's GPA") prepared for the Flood Action Plan (FAP) in May 1992, and also in the "Estimation of Economic Prices of Selected Products for Use in Valuation of Water Management Projects in Bangladesh", published in March 1998 by Dr. Q Shahabuddin and Iqbal Ahmed Syed, updating version of FPCO's GPA (hereinafter called as "Updated GPA").

Basic criteria in these guidelines have been applied for water sector projects in Bangladesh by the Government of Bangladesh and foreign donor agencies since it was established. The National

Water Management Plan Project (NWMPP) Study, managed by Water Resources Planning Organization (WARPO) also applied these criteria. Basic evaluation criteria adopted in this analysis are mentioned below.

a) Project life

Project Life is set at 30 years considering utility life of the proposed facilities, except for Raised Hand Tubewell and Parboil Plant Operation. The project life of Raised Hand Tubewell and Parboil Plant Operation is set up by considering utility life of the main equipment, and is estimated at 15 years respectively.

b) Opportunity cost of capital

The opportunity cost of capital (OCC) is set at 12%, in accordance with the FPCO's GPA, is applied in this economic analysis. The rate stipulated in the FPCO's GPA was established in 1992, but has been used by GOB and foreign donor agencies for projects in the Country, and is still considered standard.

c) Pricing basis

All costs and benefits in this analysis have been expressed on a constant 2001/2002-price basis. Wholesale and consumer price index, and unit price index for major import and export items, derived from "Statistical Bulletin Bangladesh", published by Bangladesh Bureau of Statistics, are applied for the updating of historic costs and benefits to 2001/2002 levels.

d) Standard Conversion Factor (SCF)

The Standard Conversion Factor (SCF) is set at 0.90, in accordance with the Updated GPA, and is applied as SCF to convert financial prices to economic prices in this economic analysis. Other conversion factors as may apply to engineering works, constructions materials, agricultural inputs and outputs are derived from the FPCO's GPA and Updated GPA.

e) Shadow Wage Rate (SWR)

The normal wage rate is applied for the financial analysis. In case of economic analysis, SCF of 0.90 is applied for skilled labor. SWR for unskilled labor, on the other hand, is 0.84, as in the Updated GPA.

(3) Project costs

Purpose of the economic analysis is to assess economical adequacy of the proposed projects in view of national economy, therefore, project costs accumulated in this analysis is the total cost including both flood proofing projects and support services for livelihood development. Project costs comprise direct and indirect cost, and annual operation and maintenance cost. Economic costs

of the proposed projects are converted from financial prices by applying conversion factor.

The projects costs in economic terms is estimated at Tk.13,746,000, and annual operation and maintenance costs is estimated at Tk.207,000. In addition to these figure, initial investment costs and annual O&M costs for livelihood development activities are considered in the economic analysis, so that evaluating total impact on national economy. As a total, the project cost and O&M cost in Gurai gram are Tk.14,410,000 and Tk.3,107,000 respectively.

(4) Project benefit

The project will give rise to many kinds of tangible and intangible, direct and indirect benefits. Tangible benefits are those that can be expressed in monetary terms. Following are expected benefit derived from implementation of the proposed projects.

Table 8.40 Expected Benefits Generated by Proposed Model Projects

Project Component	Project Purpose	Expected Benefit
Wave Protection Plan	· Mitigating damages of wave action ·Providing safe living space	·Damages on homestead mounds are mitigated ·Villagers who have to migrate other place can stay in the village (Beneficially; 140 households)
Hand Tubewell	·Improving health condition and personal hygiene	·Safety drinking water is provided ·Number of people suffering from diarrhea and dysentery are decreased (Beneficially; 1,311 households)
Flood Warning and Evacuation System	·Providing safe life during flood season	·Flood damages on human life, household property and livestock are mitigated (Beneficially; all villagers)
Technical Extension of Fish Culture Development Utilizing Borrow Pit	· To assure livelihood of local small fishermen	·Fishermen's income are increased (Tk 19,500 per year)
Poultry Promotion (duck)	·Improving nutrition condition	·Income generation (Tk 14,000 per year) ·Easy to gain additional nourishment source
Training on Entrepreneurship and Business Management for a Parboiling Plant Operation	· To increase employment opportunities in flood season	·Income generation (Tk 170,000 per year) ·Job opportunity is increased (28 labors, including temporary labor)
Home Gardening Promotion with Health and Nutrition Education	· Improving nutrition status especially for women and children	·Infant mortality and maternity death are decreased ·Easy to gain additional nourishment source
Nursery Development for Social Forestry	·Improving natural environment as well as augment resources	·Income generation (Tk 36,000 per year) (Beneficially; 30 households)
Saving and Credit Scheme	· To help poor people to start income generating activities	·Insurance against unexpected events such as flood damages are established ·Common fund for income generation and flood proofing activities is established

a) Wave Protection Plan

The mound protection project is planned to protect village mound from wave action that occurred in rainy season, and to provide villagers safety living space. In spite of villager's effort to protect

mound erosion by their traditional way, which is estimated at Tk.1,360 per household, eastern side of the village mound in Gurai Gram has been eroded year by year. The village mound is the only space for living in safe through whole year in Hoar area. In other ward, villagers could not keep their social, economical, and political life unless there are no mounds in this area. The price of land speaks eloquently the strict situation; farmland (low land) price is estimated at Tk.74 per m2, while price of homestead area is estimated at Tk.250 per m2, about 3 times higher than the farmland price.

Eastern edge of village mound in Gurai gram have been eroded 1 m per a year. As a total, 43,890 m^2 of homestead area will be disappeared after 30 years. Economic value of those homestead area is assessed at Tk.7,725,000 in financial price, and amount of property losses including villager's houses, tubewells, one primary school and three historical buildings, is estimated at Tk.10,621,500.

In addition to this, the damages on economic activities caused by 140-household migration are considered in the project benefit. Economic activities of 140-households are substituted for Boro paddy production. Around 75 ha of paddy field is assumed to be cultivated by the beneficially, and value of output at yield of 6.2 t/ha is estimated at Tk.3,045,000. Amount of production excluding inputs cost is estimated at Tk.2,116,000, and value added in processing process including parboiling, drying, and milling process, is estimated at Tk.1,294,000. As a result, total benefit of wave protection plan is estimated at Tk 2,586,000 per year in financial term.

b) Raised Hand Tubewell

Purpose of the project is to reduce water supply coverage rate up to national level of 75 people per tubewell. In this analysis, number of villagers under the out of coverage rate, 483 households in Gurai Gram, is defined as people who cannot access safety water. The amount of water demand from these villagers in economic price is estimated at Tk.86,400 per annum.

Safe water, which used as drinking, washing, and cooking purpose, is much important in view of keeping and improving personal health and hygiene condition. Many of villagers have used washing water from pond near their homestead area at present. The pond water is sometimes polluted by disease-causing bacterium, parasitism and virus, and it cause diarrhea. Diarrhea is one of main reason of high infant mortality, and force patient to spend much time and money. The project will help to reduce the incidence of water-borne disease and will have positive impact on health and personal hygiene. However, this sort of benefit is difficult to express in the monetary term, and is not included in the project benefit.

c) Support services for livelihood development

There are 5 types of support services proposed in Gurai Gram, which are Technical Training on Fish Culture Utilizing Borrow Pit, Poultry Promotion (duck), Training on Entrepreneurship and Business Management for a Parboiling Plant Operation, Home Gardening Promotion with Health and Nutrition Education, and Nursery Development for Social Forestry.

Through these service activities for livelihood development, villagers will be able to gain profit to improve their living standard. On the other hand, villagers themselves provide annual operation and maintenance cost of the proposed flood proofing projects. The profit from livelihood development activities also enables villagers to participate in and keep flood-proofing activities. Total amount of annual net benefit is estimated at Tk.239,500.

Promotion of home gardening would contribute to ensure minimum caloric intake for vulnerable population. Increase of household income would be accompanied by increase of expenditure for food, and is directly correlated with nutritional status. With increased per capita income, the extent of child malnutrition such as stunting, wasting and underweight would be decline.

(5) Evaluation results

Economic analysis is carried out on the basis of the proposed projects, which are expected to generate direct and tangible benefits. Economic validity of the projects is assessed on the basis of three criteria, NPV, B/C Ratio and EIRR. The results of the analysis are summarized in Table 8.41.

Table 8.41 Result of Economic Analysis

Project Component	NPV (Tk.)	B/C	EIRR (%)
Wave Protection Plan	318,022	1.03	15.6
Hand Tubewell	148,727	1.79	38.7
Technical Training on Fish Culture Utilizing Borrow Pit	43,182	1.30	18.8
Poultry Promotion (duck)	27,466	1.37	23.7
Training on Entrepreneurship and Business Management for a Parboiling Plant Operation	876,547	1.06	45.0
Nursery Development for Social Forestry	22,489	1.07	15.7
Total	**1,362,413**	**1.05**	**17.3**

The above result shows that the proposed projects are economically feasible as a total. Result of economic analysis in view of EIRR is 17.3%, and B/C ratio at discount rate of 12% is 1.05. The major benefit is generated by wave protection plan, raised hand tubewell and parboiling operation. The opportunity cost of capital in Bangladesh is around 12%, and the results of total evaluation satisfy the evaluation criteria. Details of the economic analysis are shown in the Annex G.

8.6.3 Financial Evaluation

(1) Methodology

Financial analysis is carried out to assess individual household economy, and profitable projects are the target of the analysis. Such projects as wave protection plan, hand tubewell, and flood warning

and evacuation system are excluded from financial analysis, because these projects are not profitable. Financial analysis is conducted by using actual market prices, or financial prices.

(2) Project cost

Project cost comprises direct and indirect project costs, and annual operation and maintenance cost. Financial costs used in this analysis are expressed in market price in 2001/2002. The total projects cost in financial terms is estimated at Tk.3,366,500.

(3) Project benefit

Project benefit is also express in market price in 2001/2002. Those profitable projects as fish culture utilizing borrow pit, poultry promotion (duck), parboiling plant operation, and nursery development for social forestry are evaluated in the financial analysis. The total amount of the project benefit are estimated at Tk.3,616,000.

(4) Evaluation results

The results of the analysis are summarized in Table 8.42.

Table 8.42 Result of Financial Analysis

Project Component	NPV (Tk.)	B/C	FIRR (%)
Technical Training on Fish Culture Utilizing Borrow Pit	41,741	1.26	17.8
Poultry Promotion (duck)	30,517	1.37	23.7
Training on Entrepreneurship and Business Management for a Parboiling Plant Operation	813,721	1.05	36.0
Nursery Development for Social Forestry	25,722	1.07	15.8

The above result shows that the all support services for livelihood development is financially feasible. All results of FIRR are more than 13%, the interest rate of medium term agriculture sector loan in Bangladesh. According to Grameen Bank's estimation, the rate of return on pond fishery, duck farming, and rice mill at first year are estimated at 76%, 72%, and 25% respectively.

(5) Sensitivity analysis

Sensitivity analysis is the effective measures for testing the risk of the Project. Among 5 support services for livelihood development, NPV of parboiling plant operation is quite large. NPV shows magnitude of the project, and the result of financial analysis for the parboil operation might be mush different under different conditions. Further more, Hoar area sometimes, once per three years, hit by early flood (flash flood), and amount of paddy production is reduced in such year. Therefore, parboiling plant operation should be analysed in sensitivity analysis. The analysis is made for the following cases;

Case 1 : Increase in project costs by 10%

Case 2 : Increase in project costs by 20%

Case 3 : Decrease in procurement of Boro paddy by 20%

Case 4 : Decrease in procurement of Boro paddy by 50%

Case 5 : Combination of (2) and (4)

The result of sensitivity analysis for the parboiling project is summarized in Table 8.43.

Table 8.43 Result of Sensitivity Analysis for Parboiling Plant Operation

Conditions	FIRR (%)
Case 1 Increase in project costs by 10%	32.5
Case 2 Increase in project costs by 20%	29.6
Case 3 Decrease in procurement of Boro paddy by 20%	27.6
Case 4 Decrease in procurement of Boro paddy by 50%	14.1
Case 5 Combination of (2) and (4)	10.7

The result shows that decrease in handling amount of paddy products is more sensitive to the parboiling plant operation than increase in project cost. In case procurement of boro paddy decreases 20%, FIRR resulted in 27.6%, more than 15%, the effective interest rate for running capital loan at Bangladesh Agriculture Bank. On the other hand, if procurement of paddy decreases to 50%, the result shows 14.1%, financially unfeasible. When decreasing rate is 40%, FIRR resulted in 18.8%. Therefore, it can be said that the operators of parboiling plant, organized village people, have to keep operation more than 60% of plant capacity.

8.6.4 Technical Evaluation

The development work proposed for Gurai is construction of 1,784 m of brick wall for the purpose of protection against wave erosion during monsoon. It will be a retaining wall in nature. The ground in the locality has adequate bearing capacity to support the 2-3 m high brick wall with normal foundation. LGED built about 230m of such wall in Purba para about 15 years ago. The existing wall is now in good shape and is resisting well against the wave erosion in the part of the para where it is situated. The brick wall does not require heavy maintenance. However, the village people carry out the small repair works themselves when required.

Bricks and cement are available in plenty in Bangladesh. The materials are available also in nearby locations of Gurai gram. As the village is well connected by road with the neighboring bazaars, carrying of construction materials to site in dry season will be quite feasible. The village people can carry out the repair works by themselves when required as they are doing the same for the existing part of the brick wall at present.

8.7 Environmental Impact Assessment (EIA)

8.7.1 Objectives, Scope and Procedure of EIA

(1) Objectives of EIA

The environmental impact assessment (EIA) is conducted as part of the feasibility study of the model projects for rural development in flood-prone Char and Haor areas. The objectives of the EIA are (1) to identify key environmental issues related to the model projects, (2) to evaluate potentially significant impact, (3) to recommend possible mitigation/abatement measures for significant adverse impact, and (4) to propose a monitoring program for the significant environmental issues identified. Through the initial environmental examination (IEE) conducted as part of the master planning, some important issues to be addressed during the EIA have been identified. They include (i) involuntary settlements, (ii) increase in domestic and other wastes, (iii) change in vegetation, (iv) degradation of ecosystem with bio-diversity, (v) negative impact on fauna and flora, (vi) destruction of wetland, (vii) soil erosion, (viii) changes in hydrological regimes, and (ix) sedimentation.

(2) Scope of EIA

The model project areas have been selected also through the master planning. In Haor areas, Gurai gram has been selected for the formulation of a model project. The model project for Gurai gram contains the following measures that may have significant environmental impact:

1) Wave protection works, and
2) Provision of raised hand tube-wells.

The successful implementation of the model project would lead to its replication in other areas where other project components would be involved, such as the following:

3) Provision of community latrines,
4) Construction/reconstruction of submersible roads, and
5) Construction/reconstruction of submersible bridges/culverts.

The environmental impact shall be assessed for these measures.

(3) Procedure of EIA

Field surveys were conducted in Gurai gram to examine the existing conditions in more detail, focusing particularly on those aspects related to the possible significant environmental issues identified as listed above. The existing laws and regulations related to the project were reviewed. Based on these, and referring also to the EIA guidelines prepared by JICA, potentially significant impact was assessed by environmental aspect through discussions between local environmentalists and the JICA Study Team. Both positive and negative effects were identified, and the significance

of each effect rated into five classes from 1, very low, to 5, very high, for positive effects and from 1, insignificant, to 5, severe, for negative effects.

8.7.2 Summary of EIA

The results of the EIA are summarized in Table 8.44. As seen from the table, the proposed project components would have mostly positive effects and insignificant negative effects on most environmental elements. Only for some environmental elements, some project components would have moderate (rated 2), significant (3), very significant (4) or severe (5) negative impact. The main negative effects and their possible mitigation measures are summarized below.

(1) Demographic issues

Population increase

Population will increase in Gurai gram as a result of enhanced flood proofing by wave protection works and construction of submersible roads and bridges. To cope with this increase, it is necessary to create employment opportunities so that local shifting cultivators and temporary migrant workers can settle permanently. Training and other support measures for livelihood development are to be provided by the model project at costs to the beneficiaries. These measures would ensure that only those who contribute to augmenting local resources to be used for continual flood proofing and livelihood development be encouraged to settle. At the same time, a family planning program should be strengthened to suppress the high natural growth of population.

Drastic change in population composition

The same project components that will cause the population increase may lead to drastic changes in the composition of the local population. In addition, the construction of submersible bridges/culverts would bring in construction workers, and some of them may decide to settle after the construction. The same measures as described above should be taken.

(2) Economic activities – income disparities

Physical/structural measures of the project would have asymmetric effects on different people, depending on their residence and social status among others. Thus, income disparities may increase as a result of project implementation. Such adverse effects would be minimized by effecting the participatory approach with the para committee as the main implementing agency.

(3) Health and sanitation

Increased use of agrochemicals

As flood protection works are provided, various livelihood activities are expected to develop, including irrigated agriculture with increased use of agrochemicals. Improved availability of

agrochemicals may encourage excessive or abusive uses. In addition to agricultural extension for proper use of agrochemicals, an information and education campaign should be undertaken to make people aware of the possibilities and risk of chemicals accumulation in soil and water. It should cover immediate actions to be taken in case of chemicals intake and accumulation.

Residual toxicity of agrochemicals

The same measures as described above should be taken to promote awareness among people on the toxicity of agrochemicals available in their communities. Specifically, the information and education campaign may be tied with the agricultural extension program for effectiveness.

Increase in domestic and other human wastes

Moderate effects are anticipated directly associated with the provision of community latrines, and the anticipated population increase due to flood proof and other structural measures may also increase domestic and human wastes. Enhanced awareness on sanitation by recent projects has lead to increased needs for sanitary latrines. Introduction of community latrines, therefore, should be subject only to further health and sanitation education including training for proper handling and disposal of human wastes by local communities. A domestic wastes disposal program should be prepared as the population increase is observed.

(4) Biological and ecological issues

Change in vegetation

Change in vegetation is anticipated as a result of wave protection works and provision of community latrines. To minimize negative effects, the existent topsoil should be transferred to and kept at another place while homestead plinths are raised, and then put back over the raised homestead land. Alternatively, vegetation cover should be provided by planting trees in the plinth raising areas.

Negative impact on important or indigenous fauna and flora

Wave protection works could destroy or damage habitats of some fauna. Depending on the existing fauna and flora, as identified through a baseline survey, specific habitat conditions including burrows and bushes should be restored.

Degradation of ecosystems with biodiversity

The existing ecosystems may be degraded significantly by wave protection works, not only through changes in flora and fauna but also due to hydrology, soil conditions, farming practices, and other factors. These changes and effects cannot be predicted in advance. Therefore, an experienced ecologist should be engaged for monitoring during the construction period, immediate actions may be taken to resolve negative effects as foreseen/observed, and a continual monitoring program

should be formulated.

Destruction of wetlands and peat lands

Moderate destruction of wetlands and peat lands is anticipated in association with wave protection works. While such construction methods that would minimize negative effects should be carefully adopted, the monitoring program mentioned above should also cover this aspect of environmental impact.

(5) Soil and land resources – soil erosion

Wave protection works and construction of roads would involve excavation and compaction of earth materials. During the construction, grading would result in bare, un-vegetated soil that may be susceptible to accelerated erosion by wind, rain and flooding. To minimize soil erosion during and after the construction, proper design should be adopted for slopes, submersible roads and homestead areas, and construction methods carefully selected. For these purposes, an erosion control plan should be prepared, including standard best management practices such as tree planting, slope protection works, and re-vegetation of barren slopes immediately after the construction.

(6) Landscape and mining resources – damage to landscape

Moderate effects on landscape are anticipated due to wave protection works and construction of roads and bridges. Negative effects would be minimized by proper design of civil works and arrangements of houses and other structures.

8.7.3 Overall Evaluation

From the EIA summarized above, it is clear that the flood proofing would bring some adverse effects on the natural and living environments. It is also true that complete flood proofing is not feasible. Any flood proofing intervention, therefore, would better aim at protecting and enhancing the livelihood of the project area, while providing an adequate level of flood proofing. Livelihood development and flood proofing should only be undertaken in mutually supportive steps. With this view, the following are recommended to ensure sustainable livelihood development with enhanced resources capacity.

(1) Agriculture and soil

The local Boro varieties should be replaced by HYV early maturing variety e.g. BRR-28. Just after receding of floodwater, chili, potato, mustard and high yielding groundnut should be cultivated. Khira, Bangi, and watermelon may be introduced in this area. To protect the homestead from soil erosion, Dhancha should be extensively cultured around the homestead. This will also serve as fuel, and soil fertility will be increased.

An awareness program should be introduced, tied with the agricultural extension program, to reduce the use of pesticides, which in turn will reduce the likelihood of the anticipated toxicity of soil.

(2) Ecological resources

The original topsoil should be put back over the filled earth after raising the plinth level for plants, grasses and weeds to cover the ground. Ground-covering plants such as Benna ghas (Vetivaria zizaniodes), Durba ghas (Cynodon dactylon), and Motapata ghas (Axonopus compressus) may also be introduced.

To recover biodiversity in the clustered house area, it is desirable that bushy plants (e.g., bamboo) and ground-covering plants be planted. To restore habitats for amphibians, lizards and other species, burrows may be provided on the homestead.

(3) Socio-economic issues

Appropriate compensations for those who will not move voluntarily need to be planned in consultation with all the affected stakeholders. To reduce income disparities, the less privileged need to be involved in development projects with micro credit, small and cottage industries and other support measures.

Proper planning is required to reduce domestic and other human wastes. Garbage bins and community latrines need to be constructed at suitable locations easily accessible by the local residents.

The project includes the provision of raised hand tube wells in the area. In Gurai gram, the tube wells water quality is within the allowable limits as specified by the Bangladesh Drinking Standard though the arsenic content of water sample from one of the tested tube wells was just above allowable limit (0.055mg/l). Therefore, the location and depth of tube wells should be carefully selected to minimize the risk of the mineral toxicity in drinking water.

Table 8.44 Possible Environmental Impact Matrix for EIA on Gurai gram

Proposal projects and Programs	Class I					Class II		Class III			Class IV			Class V					Class VI		Class VII										Class VIII				Class IX			Class X						Class XI				Class XII		Class XIII	
Environmental Elements	Planned residential settlement	Involuntary resettlement	Substantial changes in the way of life	Conflict among communities and people	Impact on native people	Population increase	Drastic change in population composition	Changes in bases of economic activities	Occupational changes and loss of job opportunities	Increase in income disparities	Adjustment & regulation of water or fishing rights	Changes in social and institutional structures	Changes in existing institutions and customs	Increased use of agrochemicals	Outbreak of endemic diseases	Spreading of endemic diseases	Residual toxicity of agrochemicals	Increase in domestic and other human wastes	Impairment of historic remains and cultural assets	Damage to aesthetic sites	Changes in vegetation	Negative impact on important or indigenous fauna and flora	Degradation of ecosystems with biological diversity	Proliferation of exotic and/or hazardous species	Destruction of wetlands and peatlands	Decrease of tropical rain forests and wildlands	Destruction or degradation of mangrove forests	Degradation of coral reefs	Soil erosion	Soil salinization	Deterioration of soil fertility	Soil contamination by agrochemicals and others	Devastation or desertification of land	Devastation of hinterland	Ground subsidence	Change in surface water hydrology	Change in ground water hydrology	Inundation and flooding	Sedimentation	Riverbed degradation	Impediment of inland navigation	water contamination and deterioration of water quality	Water eutrophication	Sea water intrusion	Change in temperature of water	Air pollution	Noise pollution	Damage to landscape	Impediment of mining resources exploition
1. Wave protection plan	+3	-1	+3	+2		-2	-2	+3	-1	-2	-1	+1	+3	-2			-2	-2	+2		-2	-3	-3		-2						+3	-1	+1	-1				-1						-1	-1	-2	
2. Provision of raised hand tube-well			+3	+2												-1					+1																									
3. Provision of community latrine	+1		+3	+2												-1		-2			-2	-2																			-1							
4. Construction/reconstruction of submersible road	+3	-1	+3	+2		-2	-2	+3	-1	-2	-1	+1	+3	-2	-1	-1	-2	-2	+2			-2	-1		-1				-3			-1	+1	-1					-1					-1	-1	-2	
5. Construction/reconstruction of submersible bridge/culvert	+3	-1	+3	+2		-2	-2	+3	-1	-2	-1	+1	+3	-2	-1	-1	-2	-2	+2																				-1						-1	-1	-2	

Environmental Elements

I. Social issues II. Demographic issues III. Economic activities
IV. Institutional and custom related issues V. Health and sanitary issues
VI. Cultural asset issues VII. Biological and ecological issues
VIII. Soil resources IX. Land resources X. Hydrology
XI. Water quality and temperature XII. Atmosphere
XIII. Landscape and mining resources

Environmental Impact Score

Applicable columns with the following impact degree are marked with " positive impact (+) or negative impact (-) "
Positive impact: Very high (+5), high (+4), moderate (+3), low (+2), very low (+1)
Negative impact: Severe (-5), higher (-4), moderate (-3), low (-2), very low (-1)