

7.3 Development Plan

7.3.1 Flood-proofing and Improvement of Living Environment

(1) Considering remedial measures

(a) Flood-proofing

The plinth raising aims at securing flood free homestead during the normal flood so that household works and some livelihood activities could be continued without being confined to houses. The homestead raising in five of the seven paras of Algar Char gram would be feasible so far as the stability of the char against flood-induced river erosion is concerned. The five paras of the village have not been affected by river erosion in more than 20 years and there is no sign of erosion in their immediate vicinity.

As there exist three school cum flood shelters developed by CARE in 2000 in Algar Char gram above the 1988 flood level, inclusion of such item has not been considered under the model project program, although the total capacity of the three shelters is only 340 persons. Most of the flood victims coming from the two remote paras (Zolil dewani para and Mehar munshi para) find their place only on the open-air village roads which are barely 4 m wide and can sustain only under a normal flood. In case of a severe flood, open-air refuge place comes in dire shortages due to increased number of evacuees.

Floods come suddenly in case of char areas through the Brahmaputra-Jamuna river. Besides flood shelter and refuge place facilities, flood warning and dissemination system is essential in flood-prone areas.

In consideration with the above, the following programs related to the flood-proofing are proposed:

- Raising plinth of homestead area,
- Raising a ground to make a refuge place, and
- Establishing effective flood warning system.

(b) Improvement of living environment

The approach road to Algar Char government primary school proposed for a sheltering place, is required to be raised up. Zalil dewani para and Maher munshi para do not have a sufficient number of hand tubewells.

In consideration with the above, the following programs related to the improvement of living environment are proposed:

- Approach road to school, and
- Raised hand tubewells.

(2) Homestead raising

In principle, the homestead raising shall be implemented in a stable char that has not been affected by flood induced erosion for at least 20 years. Two of the seven paras of Algar Char namely Zolil dewani para and Maher munshi para are at present vulnerable to river erosion. Hence these two paras are excluded from the consideration of development by homestead raising. Out of the remaining five paras, CARE has carried out works of homestead raising in two paras: Jalal sarker/Hossain member para and Razzak chairman para. Therefore, these two paras are also excluded from the present development program of homestead raising. The remaining three paras, namely Mokbul bepari para, Aklas member/Samad Fokir para and Joynal member/Hassan Khalifa para will be taken up for homestead raising under the model project of Algar Char gram.

Table 7.36 shows that there are 25 houses which went under 50-100 cm of inundation for 2-3 weeks even under the normal flood of 1999. It is apparent that the locations of the 25 houses are at the lowest elevation in the settlement areas of the paras.

Table 7.36 Number of Houses in 3 paras with Depth

Sl.no	Name of para	Year	Total no. of houses in the para	No. of houses with nmaximum range of depth in cm of flooding					No. of Proposed Homestead Raising
				0	0-50	50-100	100-150	>150	
2	Mokbul bepari para	1999	59	48	10	1	0	0	11
4	Akklas member/ Samad fokir para	1999	238	216	12	10	0	0	22
5	Joynal member/ Hassan khalifa para	1999	225	197	14	14	0	0	28
Total			522	461	36	25	0	0	61

Source: JICA Study Team

Those 61 houses submerged under 0-100 cm of water in 1999 flood, should be raised against the severe flood level of 1998. From the leveling survey the following information regarding elevation of the settlement areas of the three paras have been obtained. An image picture of homestead raising is shown in Figure 7.3.

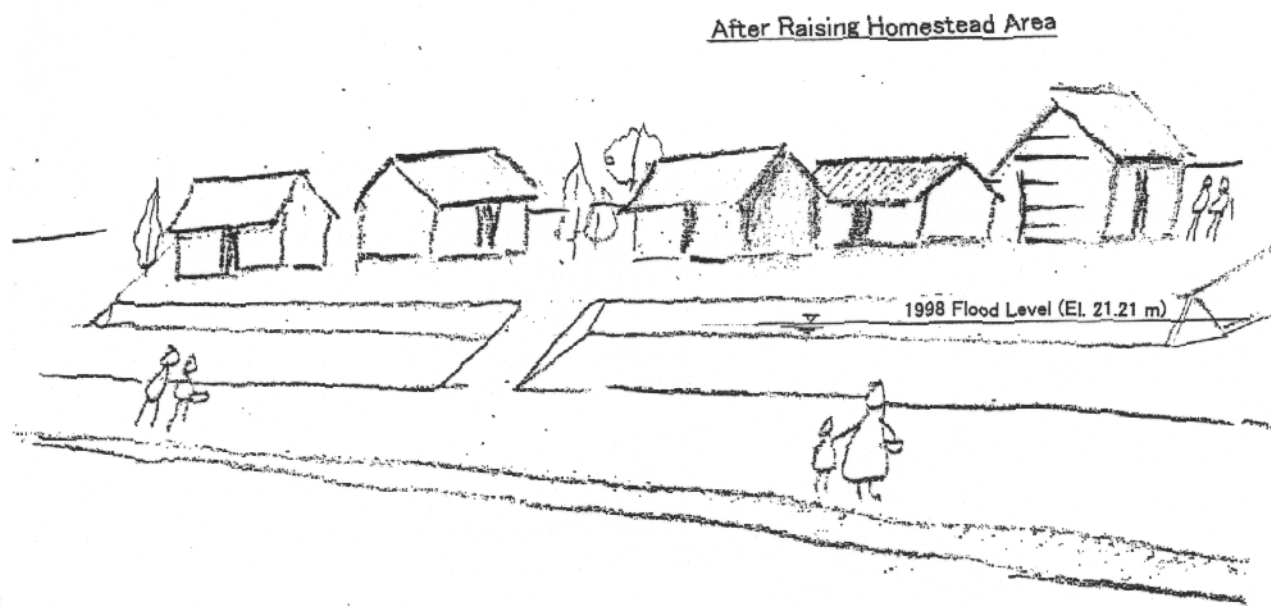
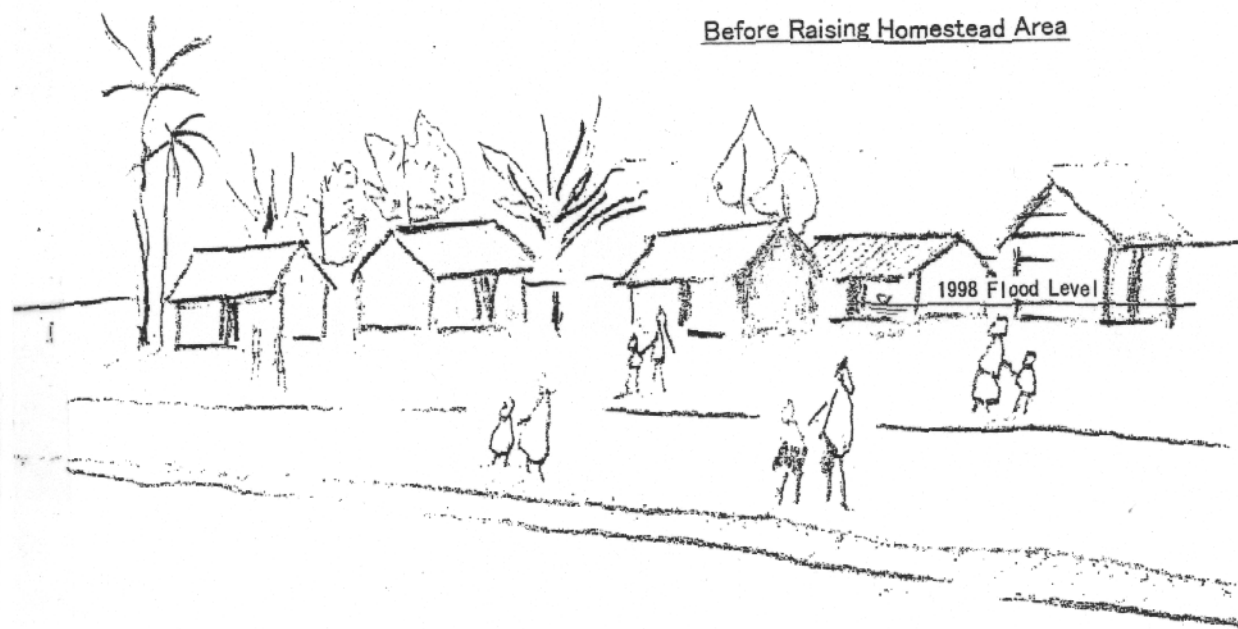
Table 7.37 Levels of Settlement Areas

Flooding depth (cm)	Elevation of settlement area (m)	Elevation of 1998 flood mark (m)	Difference between lowest elevation of settlement and 1998-flood mark (m)
0-50	20.25	21.2	0.95
50-100	19.75	21.2	1.45

Source: Questionnaire survey by JICA Study team

As per FAP 14/FAP23 recommendation, free board for homestead in the char areas is taken as 0.30m. The volume of earth for raising of homesteads/household in three paras is estimated as summarized in Table 7.38.

Figure 7.3 Picture of Homestead Raising



PICTURE OF HOMESTEAD RAISING

Table 7.38 Earthwork Volume in Homestead Raising

Sl no of para	Name of para	No. to be raised	Average area (m ²)	Average height of fill including freeboard 30 cm (m)	Volume of earth (m ³)
2	Mokbul bepari para	10	100	1.25	1,250
		1	100	1.75	175
4	Aklas member/ Samad fokir para	12	100	1.25	1,500
		10	100	1.75	1,750
5	Joynal member/ Hassan khalifa para	14	100	1.25	1,750
		14	100	1.75	2,450
	TOTAL	61			8,875

Source: Questionnaire survey by JICA Study team

(3) Sheltering place by raising school ground

There are three school-cum-flood-shelters having total capacity of 340 persons. Obviously, this is insufficient. Most of the evacuees, therefore, take refuge on the open-air space in front of the school cum shelter and on the un-submerged parts of village roads, which too comes in acute shortages during a severe flood. Therefore it will be imperative that an open-air raised refuge place be implemented in the village. In Aklas member/Samad fokir para there is a primary school (Algar Char Government Primary School) having in front an open ground measuring 60 m x 75m. This should be raised to develop as a refuge place for about 1,500 people and their cattle.

Area of the ground is approx. 4,500 m², present average elevation is 20.40 m and the level of fill will be at 21.66 m (1988 flood level) plus free board. The free board may be considered 0.60 m (Table 7.39).

Table 7.39 School Ground Raising

School ground area (m ²)	Average present ground level (m)	1988-flood level in the area (m)	Free board (m)	Proposed EL of raising (m)	Total height of raising (m)	Total volume of earthwork (m ³)
4,500	20.40	21.66	0.60	22.26	1.86	8,370

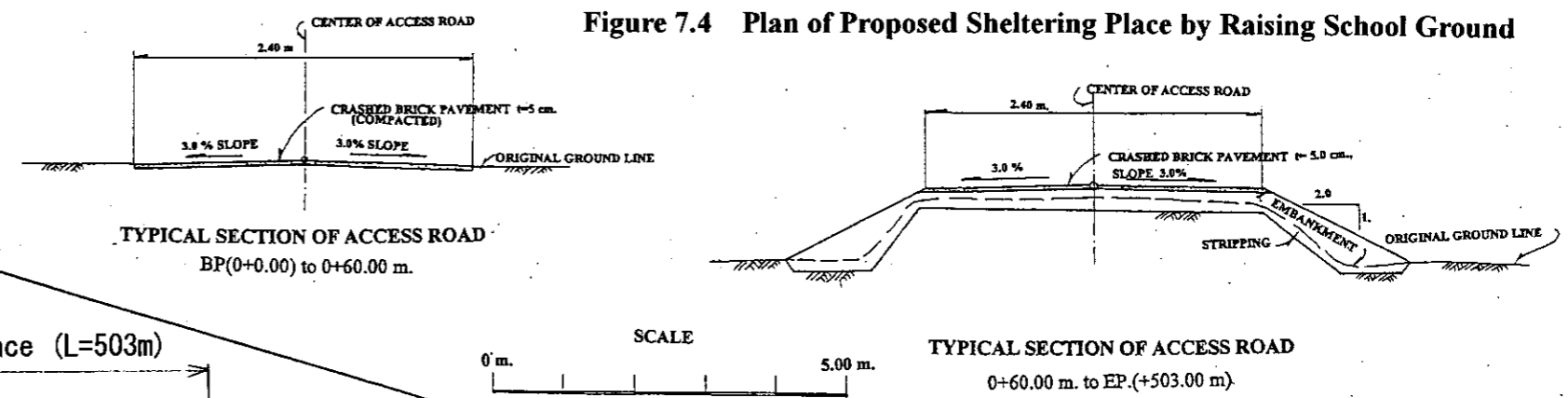
Source: Questionnaire survey by JICA Study team

(4) Approach road to sheltering place

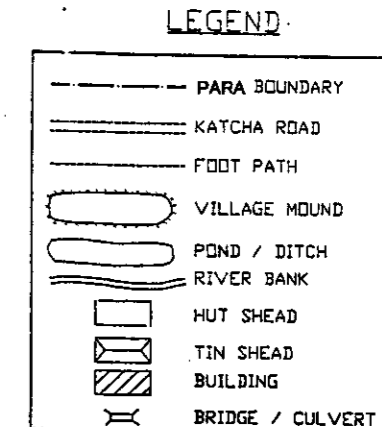
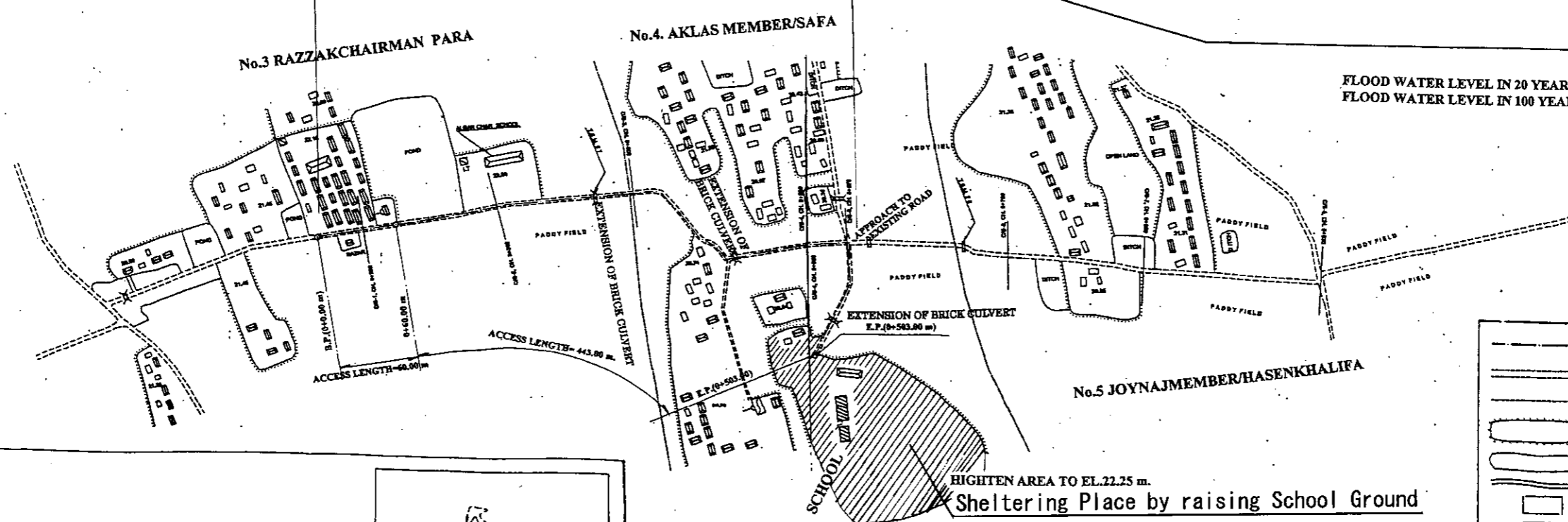
The approach road to the above sheltering place of Algar Char government primary school's ground, located at Aklas member/ Samad fokir para (No.4), is required to be raised up for evacuation use before and during flood. Design elevation is proposed at 21.50 m, the same as designed homestead raising in consideration of evacuation from their homestead areas.

A total length of the approach road to be raised is proposed to be 503 m by earth filling involving three culverts as appurtenant works. The road slope will be protected by turfing with Binna supa grasses and tree plantation such as Sissoo and Rain trees. A plan of proposed open shelter and approach road are shown in Figure 7.4.

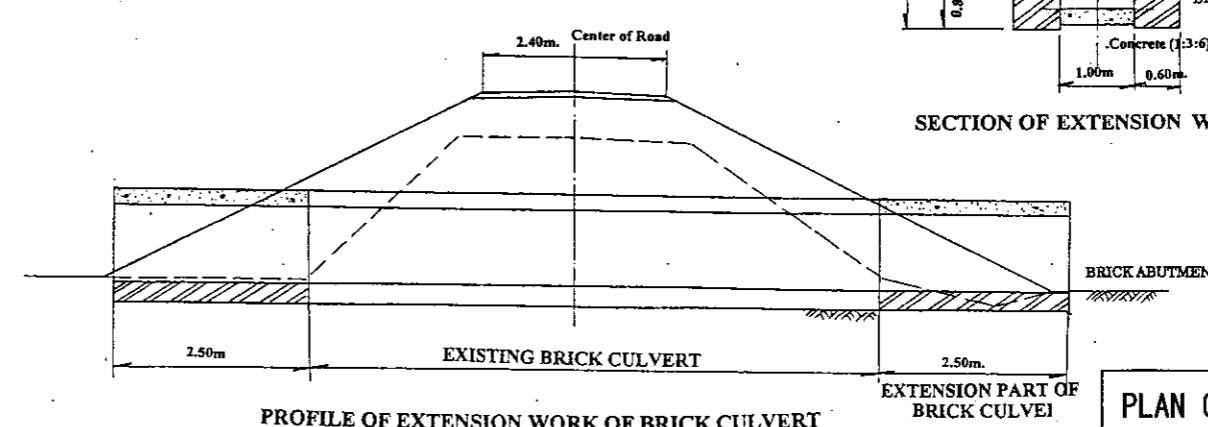
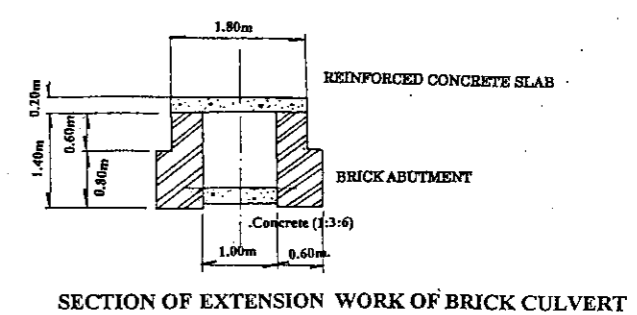
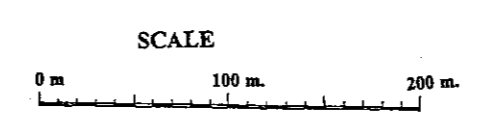
Figure 7.4 Plan of Proposed Sheltering Place by Raising School Ground



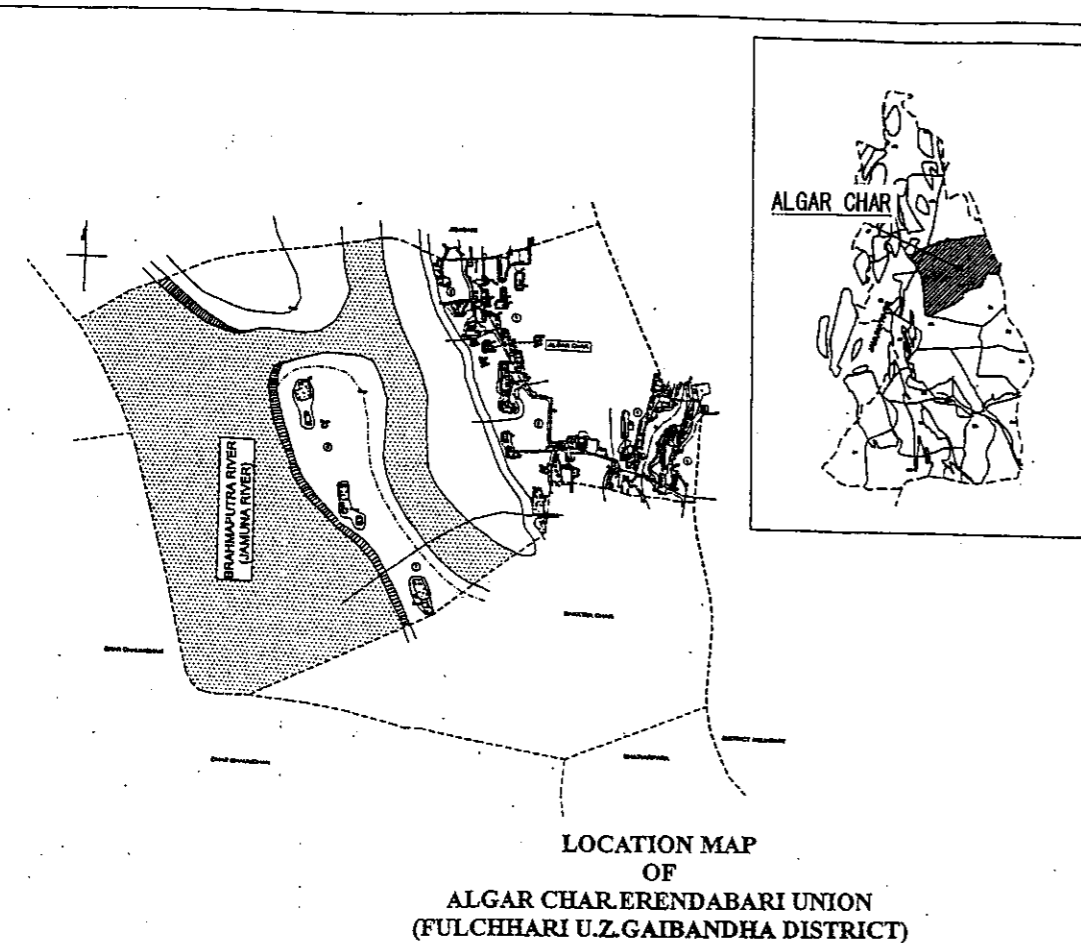
Approach Road to Sheltering Place (L=503m)



**PLAN OF
ALGAR CHAR.ERENDABARI UNION
(FULCHHARI U.Z.GAIBANDHA DISTRICT)**



PLAN OF PROPOSED SHELTERING PLACE BY RAISING SCHOOL GROUND



(5) Raised hand tubewell

The policy of DPHE (Department of Public Health Engineering) states the number of users per tubewell be reduced to 105 persons per tubewell as a tubewell density to be attained by the end of the fifth five-year plan (1997 July to 2002 June) based only on the numbers of tubewells installed by DPHE. After DPHE implemented rural water supply program, the target has already been achieved with 101 persons/tubewell in 2000. On the other, the sector also promoted the private organizers to implement various hand tubewell projects in rural areas; therefore, the actual tubewell density at present is assumed to be 75 persons per tubewell including private tubewells in the Country.

Accordingly, following numbers of tubewells are required either by raising pit of existing tubewells or installing new tubewells of which a total number is 11 to the target paras, as shown in Table 7.40.

Table 7.40 Proposed Numbers of Hand Tubewell in Algar Char 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)
2.	Mokbul bapari	262	5	0	52	-	-	52
4.	Aklas member/ Samad fokir	579	12	0	48	-	-	48
5.	Joynal member/ Hassan khalifa	563	15	0	38	-	-	38
6.	Zolil dewani	158	4	4	-	3	-	53
7.	Maher munshi	187	2	2	-	2	1	62
Total (Average)		1,749	38	6	(46)	5	6	(51)

Source: Questionnaire survey by JICA Study team

According to water sampling survey through EIA conducted by the JICA Study Team, arsenic contents are detected from hand tubewells of 17 m depth, while there is no arsenic detected at tubewells with more than 20 m depth. Therefore, it is recommended that depth of new tubewells should reach up to 20 m depth.

As the depth of 20 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.

(6) Flood warning and evacuation

Dissemination of flood warning

There is no proper flood warning and dissemination system working in Algar Char 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 dissemination system may be set up for Algar Char gram also. Disaster Management Committees (DMC) have been formed already at District, UZ and Union levels for all districts of Bangladesh. Erendabari Union (in which the village of Algar Char gram is situated) is under Fulchhari UZ. After receiving FFWC flood warnings, the UZDMC at Fulchhari will interpret the forecasted water level in the context of the flood prone areas of the UZ. Should it be appropriate for Erendabari Union, the information of flood warnings will be arranged to be sent to the Union DMC.

The HQ of Fulchhari UZ happens to be on the other bank of the Brahmaputra river. During the dry season, boat communication from Algar Char gram to Fulchhari UZ HQs is easily possible. During the wet season, when a flood warning is likely to be communicated, transmission of warnings to the Union by messengers may not be easy and on time. At present the Union is not covered by mobile telephone network. Therefore, a 2-way wireless system between Fulchhari and Erendabari Union will be necessary to transmit the flood warnings of the FFWC through the UZ Disaster Management Committee.

However a 2-way wireless system is too costly to cover only one Union. Therefore as far as flood warning and dissemination system by wireless would not be covered by FFWC project, a message is to be transmitted by a speed boat by taking within one hour from Fulchhari UZ.

Organizing Gram Disaster Management Committee (GDMC)

After a message of warning is received from the Fulchhari UZDMC, the Union DMC will disseminate it through its Committee members, volunteers and Chowkidars to Algar Char 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 Algar Char gram through the project. Gram DMC is basically composed of the representatives in all para committees.

The dwellers of Algar Char gram, being informed of the impending floods, will look for appropriate shelters. In most cases, they will move by their own arrangement of boats. However, in some cases, the Gram and Union Disaster Management Committee under the support of the UZDMC and the district administration will arrange boats as it was done before.

Training on flood warning and evacuation

Training on flood warning and evacuation is targeted to dwellers of Algar Char gram who will be refugees as well as messengers to disseminate flood warning to the Gram DMC from Union DMC and Fulchhari UZ DMC. The training program may be organized by FFWC, LGED and NGOs. Proposed components of the 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 flood forecasting and warning dissemination	1day
2.Flood environment	1)Mechanism of flood, 2)Location of Jamuna river and Algar char gram, 3)Signals of flood occurring	1day
3.System of flood forecasting	1)Organization of FFWC, 2)Flood forecasting network, 3)Pilot project in Bangladesh, 4)Dissemination system of flood warning, 5)Identification of UZ DMC and UDMC	1day
4.Dissimination 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 flood damage	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 1month = Tk.15,000

2. Training materials: Tk.200 per participant x 25 people = Tk.5,000

7.3.2 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 upgrading of the living environment. Livelihood development shall be planned as the “soft” measures.

Although the villagers of Algar Char will be the main players of livelihood development, external support is necessary in the beginning, given the constraints to further development identified in the previous section, including decreased agricultural production, inadequate use of agricultural inputs, low market prices, dominance of traditional farming, etc.

Among the constraints, decreased agricultural production is attributed to the inadequate use of agricultural inputs and dominance of traditional farming. Limited employment opportunities are another constraints to improve livelihood conditions. While trying to improve agricultural productivity through extension, livelihood development shall be enhanced through the provision of various support services to expand the opportunities for income generating activities as well as develop skills for the villagers of Algar Char.

Under the limited land area for homesteads and poor economic activities, livelihood development activities to be promoted shall not need wide homestead area for non-farm economic activities, and ideally take advantage of the land specificity in terms of soil, climate, etc., for farming economic activities, in principle.

The following support services will be provided primarily to the beneficiaries of the “hard” measures, who will be responsible for maintaining flood proof conditions as well as improve their living standard.

Home gardening promotion with nutrition education

Home gardening will be promoted utilizing raised homestead area to improve nutrition status of local people through maximum use of the limited available land, in light with poor health status at present. Vegetable cultivation technology will be extended with certified seed distribution. This should be accompanied by nutrition education to enhance the awareness of the people. This activity may be promoted by NGOs. Target group will be women. 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

Training subjects and duration:

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

Poultry promotion

Poultry rearing (layer chicken) technology will be extended by extension worker of Department of Livestock or NGOs. This activity will be promoted mainly for utilizing a limited homestead area of individual houses. Target group will be landless women. Details of the training and estimated

costs are shown below.

Duration: three months (78 days net, two hours per day)

Number of trainee: 10

Training subjects and duration:

Main subject	Details of learning of subjects	Duration
General concept	1. Basic idea on poultry and 2. Economic aspect	3 days
Varieties	1. Indigenous vs. improved and 2. Improved varieties	3 days
Location of poultry farm & farm house	1. Location; 2. Building houses; 3. Litter system of housing; 4. Size of houses; 5. Materials for litter; 6. Heat management; 7. Humidity management; 8. Light management; 9. Timetable for light; and 10. Importance of air circulation	16 days
Food, nutrition and water	1. Food and food habits; 2. Food ingredients; 3. Role of different ingredients; 4. Nutrition status of different ingredients; 5. Preparing a balanced diet; 6. Water and water pot; and 7. Alternative foods	8 days
Health and hygiene practice	1. Diseases and prevention; 2. Vaccine and immunization; 3. Vaccination; 4. Diseases to be vaccinated; 5. Vaccine preservation; and 6. Vaccine routine	11 days
Diseases and its prevention	1. Common diseases; 2. Viral diseases; 3. Bacterial diseases; and 4. Other diseases	19 days
Modern system	Deep litter system	7 days
Chicks rearing	1. Deep litter; 2. Care & maintenance of deep litter; 3. Temperature control; 4. Natural system; 5. Artificial system; and 6. Food and water	8 days
Layer rearing	1. Food requirements and 2. Other requirements	2 days
Broiler rearing	Broiler rearing	1 day
Total		78 days

Source: JICA Study Team based on the information from Satkhira Unnayan Sangstha.

Total costs: Tk.20,000

1. Honorarium for teacher: Tk.6,000/month x 3 months = Tk.18,000

2. Training materials: Tk.200 per participants x 10 people = Tk.2,000

Skill training on hand weaving (embroidery)

Current weaving activity by women in the gram will be upgraded by skill training. Women will be organized to form a producers group. With the improved skills, quality products will be brought outside markets for sale by NGOs. Details of the training and estimated costs are shown below.

Duration: 2 months (35 days net), two hours per day

Number of trainee: 10

Training subjects and duration:

Main subject	Details of learning of subjects	Days
Basic knowledge of embroidery	Introduction & importance of embroidery	5 days
Introduction & system of embroidery machineries	Type and use of embroidery machineries	5 days
Various types of threads clothes and needles	-	10 days
Type of drawing	-	5 days
System of colors and combination	-	5 days
Drawing making	-	5 days
Total		35 days

Source: JICA Study Team based on the information from Bangladesh Masjid Mission

Total costs: Tk.14,000

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

Mulberry plantation and cocoon production

The JICA Study Team sees sericulture development in the gram promising. To promote it, mulberry trees will be planted after training on mulberry tree cultivation conducted at first. Mulberry fruits will also be utilized for jam making in the long run. The target group will be landless farmers. This will be promoted by NGOs. Details of the training and estimated costs are shown below.

Duration: 90 days (75 days net), two hours per day

Number of trainee: 10

Training subjects and duration:

Main subject	Details of learning of subjects	Days
Mulberry cultivation		
Soils	1. Suitable soils for mulberry; 2. Soil improvement	2 days
Variety of mulberry trees	1. Mulberry species and varieties; and 2. Identification of varieties	2 days
Production of saplings	Cuttings and grafting	4days
Cultivation techniques	1. Growth characteristics of mulberry; 2. Farming practices; and 3. Training and harvest	15 days
Diseases and pests	1. Major diseases and control; and 2. Major pests and control	10 days
Silkworm rearing		
Varieties of silkworm	1. Silkworm varieties; and 2. Production of eggs	2 days
Rearing techniques	1. Growth characteristics; 2. Rearing room and equipment; 3. Rearing plan; 4. Preparation for rearing; 5. Rearing of young silkworm; 6. Rearing of grownup silkworm; and 7. Mounting and harvest of cocoons	30 days
Diseases and pests	1. Major diseases and their control; Major pests and their control; and 3. Other types of damage and their control	10 days
Total		75 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

All the training will be conducted at a primary school in Algar Char gram during evening time.

(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 7.41.

Table 7.41 Expected Benefits of Each Activity

Income generating activities	Nos. of beneficiaries	Unit	Production	Gross profit (Tk./year)	Total cost (Tk./year)	Net profit (Tk./year)
Poultry (layer)	50	Chicks	1,200	54,000	129,000	150,000
		Eggs	90,000	225,000		
Local embroidery (Nakshikatha)	10	Nos.	360	288,000	206,460	81,560
Mulberry planting	1	Sapling	5,000	5,200	3,300	1,900
Cocoon production	20	kg	2,800	260,000	130,000	130,000

Source: Gender Development Research Center (GDRS) and BRAC

7.3.3 Savings and Credit Scheme

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 Algar Char proposed.

(1) Common problems of micro credit schemes

Many rural development projects include micro credit schemes to support income generating activities (IGAs) by villagers. Those schemes provided by support of donors or the Government have a few common problems. First, most villagers do not venture on new IGAs because of the risk involved. This is particularly true under flood-prone conditions, in which villagers' efforts may turn out to be futile. Consequently, disbursement would not proceed as expected even if collateral requirements are relaxed or replaced by collective guarantee by organized people.

Second, villagers are usually not strongly motivated to use the credit effectively. They tend to take concessionary loans as more or less gifts given directly or indirectly from the Government, and may not be sufficiently conscious of repayment requirements. Investments may not generate sufficient returns for villagers to make repayments. Third, credit administered by public agencies would not lead to a sense of ownership among potential beneficiaries. Overall, the credit scheme would not be utilized much, or utilized only in the way to deplete the fund without revolving, and the capacity of villagers would not be augmented.

(2) Conditions for savings and credit scheme

As clarified through the case studies of ongoing rural development projects presented in Section 3.11, one of the conditions for successful project implementation is to establish a self-managed credit program. Such a program should be supported, at least in part, by a self-generating fund of potential beneficiaries, and by IGAs of villagers, among others, to make the fund revolving. The revolving fund would not only ensure the sustainability of the rural development project supported by responsibilities of the beneficiaries but also develop their management and economic capacities through its operation with the sense of ownership. Thus, three key conditions for the savings and credit scheme for the project are risk reduction, responsibilities and ownership.

(3) 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.

Sources of funds

Sources of funds for the credit scheme include savings by potential beneficiaries, seed capital to be provided by donors and/or the Government, and matching funds. Savings should constitute the main body of the fund to develop responsibilities among potential beneficiaries. Compulsory savings are successfully used in a few rural development projects (e.g., South Asia Poverty Alleviation Programme supported by UNDP, and Poverty Alleviation Project by BRDB). Alternatively, surcharges may be introduced to user fees of support services for livelihood development. Potential beneficiaries have motivations to pay such surcharges that would be effectively used either to increase the chance of success for their livelihood activities or to reduce the risk.

Seed capital would be an effective means to increase the motivations of potential beneficiaries to save, as used in a few recent projects. A matching fund is its variant; instead of providing in lump sum initially as in the seed fund, it is provided in proportion to revealed performance of the beneficiary such as the amount of savings.

Allocation/distribution/disbursement methods

Methods and criteria for disbursement may be established separately. Only the allocation/distribution of the seed capital is discussed here. 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.

Use of credit

There are two main uses of credit. One is for insurance against unexpected events such as flood damages and crop failure, and the other is for loans, which may 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. To ensure accountability of such a scheme, avoiding abuse by any member, more elaborate management would be required.

(4) Savings and credit scheme for Algar Char

It is proposed that compulsory savings and surcharges to user fees of livelihood support services be combined for the model project in Algar Char. 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. For the model project, essential options for both sources and use of funds should be included in the savings and credit scheme so that management issues would be clarified through initial implementation and modifications of the scheme made for subsequent implementation.

(5) Model operation of savings and credit scheme for Algar Char

The model project in Algar Char will be implemented first in Aklas member/Samad fokir para with a population of 579 and 114 households and Joynal member/Hassan khalifa para with a population of 563 and 111 households. The average household income in these paras is assumed that, of the four income generating activities supported by the project, the poultry and local embroidery would be undertaken in these paras as they bring early returns. It is further assumed that the project would benefit 31 households for poultry and two households for embroidery, covering the 33 households in the two paras benefiting from the homestead raising.

Compulsory savings corresponding to 5% of the annual income may be applied to the households benefiting from livelihood support services, and the remaining 192 households may save only 3% of the annual income. The total amount of savings will be Tk.222,000 per year. The total annual cost of the two livelihood activities by the 33 households to be supported by the project is calculated at Tk.121,000. This would be borne by the beneficiary households, but 20% surcharges would be applied and saved as a fund against unexpected events. The total amount of surcharges to be accumulated will be Tk.24,000 per year.

If the beneficiary households borrow to finance the costs of the new livelihood activities at an interest rate of 15% per annum, the total amount of interest payments will be Tk.18,000 per year. On the other hand, the profits from the livelihood activities would total Tk.110,000 per year, if successful, six times larger than the total interest payments. If some livelihood activities fail due to unexpected events, loans cannot be repaid and must be covered by savings. The total amount of savings, including both compulsory savings and surcharges, would be Tk.246,000 per year, more than twice as large as the maximum amount of default debts. Otherwise, the fund will accumulate after the repayment of all the loans to expand the credit availability by more than two times.

The first phase of the model project in Algar Char will provide flood proofing against a 20-year

flood for the two paras. The total project cost for these two paras, consisting of para wise costs and sharing of common costs in proportion to population, is estimated at Tk.1,880,000, including indirect costs and contingencies. The compulsory savings and surcharges during the flood-free 20-year period will accumulate up to Tk.4,168,000, after allowing for the annual O&M cost allocated to the paras in proportion to population. 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 surplus would be used to further enhance the level of flood-proofing.

As a whole, the savings and credit scheme proposed for Algar Char would support the continuous operation of the project facilities and livelihood activities, and generate additional funds to allow expansion of coverage by the flood proof measures. Specifically, the livelihood activities to be supported by the project would generate ample profits for interest payments; compulsory savings combined with surcharges to the beneficiary would be large enough to cover occasional default debts; and the surcharges will accumulate to allow insurance coverage against 20-year floods. A key to the successful operation of the model project is proper management of the savings and credit scheme to maintain sound cash flow and debt-saving conditions at all times.

7.4 Implementing Schedule

7.4.1 Overall Implementing Structure

For the implementation of the model project in Algar Char, 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 Fulchhari, NGOs, Union Parishad of Erebdabari and the respective para committees, and PMO in the LGED central office.

7.4.2 Implementing Schedule

The implementation of the model project in Algar Char will start from Aklas Member/Samad Fakir para and Joynal Member/Hasan Khalifa para, which are vulnerable to inundation with 82% of proposed homestead raising. The latter has no shelter facilities but may benefit from a Local Project Society organized for the CARE project. In the subsequent phase, Mokbul Bepari para, Zolil Dewani para, and Maher Munshi para will be covered by the model project.

In each project para, a series of community workshop would be initiated by LGED Upazila officer and conducted by a selected lead NGO. At the initial workshop, the model project as formulated would be presented first, clarifying its approach, proposed components, and expected effects. Para people should be made aware of costs involved in the project and cost sharing expected to be born by them in the project implementation and management. Some project components may be modified in accordance with the ability and willingness to share costs by the para people. Involvement of other stakeholders and the division of responsibilities among them would also be established.

The establishment of implementing arrangements through the series of community workshops would take place during the wet season. Successful people organizing at para with the consensus among them on cost sharing and management responsibilities is a prerequisite for the model project to proceed for the implementation. If successful in this step, the project would be implemented in the subsequent dry season as illustrated in Figure 7.5.

Figure 7.5 Implementing Schedule

Sl. No. and Name of Para	Year				
	2003	2004	2005	2006	2007
4 Aklas member/Samad fokir					
5 Joynal member/Hassan khalifa					
2 Mokbul bapari			(*)		
6 Zolil dewani					
7 Maher munshi					

- : Preparatory Works (Bureaucratic/Administrative Procedures within GOB, Institutionalization/people organizing (PIU etc.), Design work by LGED)
 : Construction Work by LGED with participation of local communities (earth work, etc.)
 : Supporting Activities for Livelihood Improvement, Saving and Credit Scheme
 : Operation and Maintenance of Structure, Monitoring and Evaluation

(*) Including School Ground Raising and Approach road to School

Proposed Measures by Para

Sl. No. and Name of Para	Proposed Measures
2 Mokbul bapari	
4 Aklas member/Samad fokir	① Homestead Raising, ⑤ Flood Warning and Evacuation, ⑥ Support Service for Livelihood Development, ⑦ Saving and Credit Scheme
5 Joynal member/Hassan khalifa	
6 Zolil dewani	④ Raised Hand Tubewell, ⑤ Flood Warning and Evacuation
7 Maher munshi	
4 Aklas member/Samad fokir	② School Ground Raising, ③ Approach Road to School
5 Joynal member/Hassan khalifa	

7.5 Project Cost

7.5.1 Summary of Project Cost

Project costs composed of direct construction cost, indirect cost, contingencies and cost for land acquisition total Tk.3,401,000, are summarized in Table 7.42. The direct cost covers “I. Flood proofing and improvement of living environment” as mainly for structural measure and “II. Support services for livelihood development” for non-structural measure, estimated in Tk.2,264,000 and Tk.74,000, respectively.

Table 7.42 Summary of Project Cost in Algar Char Gram

(unit: '000 Tk.)

Description	Amount	Remarks
A. Direct Cost		
I. Flood Proofing and Improvement of Living Environment	2,264	
I-1 Sheltering place by raising school ground	817	A=4,500 m ²
I-2 Approach road to sheltering place	484	L=503 m
I-3 Homestead raising	935	61 H/H
I-4 Raised hand tubewell	8	(1+5) nos.
I-5 Flood warning and evacuation	20	
II. Support Services for Livelihood Development	74	
II-1 Home gardening promotion with nutrition education	20	
II-2 Poultry promotion	20	
II-3 Skill training on hand weaving	14	
II-4 Mulberry plantation and cocoon production	20	
Direct Cost Total (A)	2,338	
B. Land Acquisition	363	A=10,674 m ²
C. Indirect Cost	304	
I. Administrative cost	117	5 % of Direct cost
II. Engineering fee	187	8 % of Direct cost
D. Physical Contingency	234	10 % of Direct cost
E. Price Contingency	162	5 % of total cost
Ground Total (A+B+C+D+E)	3,401	

7.5.2 Summary of Para-wise Project Cost

Para-wise project costs in each of five target paras and common costs to be allocated to all the target paras, are summarized in Table 7.43. Costs for “Support services for livelihood development” are included only in the common project cost.

Table 7.43 Summary of Para-wise Project Cost in Algar Char Gram

(Unit: '000 Tk.)	
Description	Amount
1. Common	1,395.1
I. Flood Proofing and Improvement of Living Environment	1,321.1
II. Support Services for Livelihood Development	74.0
2. Mokbul bapari Para	150.1
I. Flood Proofing and Improvement of Living Environment	150.1
4. Aklas member/ Samad fokir Para	342.4
I. Flood Proofing and Improvement of Living Environment	342.4
5. Joynal member/ Hassan Khalifa Para	442.5
I. Flood Proofing and Improvement of Living Environment	442.5
6. Zolil dewani Para	2.6
I. Flood Proofing and Improvement of Living Environment	2.6
7. Maher munshi Para	5.5
I. Flood Proofing and Improvement of Living Environment	5.5
Direct Cost Total (A)	2,338.2
B. Land Acquisition	362.9
C. Indirect Cost	304.0
I. Administrative cost	116.9
II. Engineering fee	187.1
D. Physical Contingency	233.8
E. Price Contingency	161.9
Ground Total (A+B+C+D+E)	3,400.9

7.5.3 Summary of Maintenance Cost in Algar Char Gram

Annual maintenance costs composed of those for routine works every year and periodic works after each flood are summarized in Table 7.44, 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 Sheltering place, Approach road, and Raised homestead area is 30 years under well-maintained conditions, on the other hand, that of hand tube well is estimated at 15 years in view of working period of the pump facility.

Table 7.44 Summary of Maintenance Cost in Algar Char Gram

(Unit: '000 Tk.)	
Description	Amount
I. Flood Proofing and Improvement of Living Condition	
I-1 Sheltering place by raising school ground	28.2
I-2 Approach road to sheltering place	20.3
I-3 Flood warning and evacuation	0.0
I-4 Homestead raising	53.5
I-5 Raised hand tubewell	1.3
Maintenance Cost Total	103.3

7.5.4 Cost Sharing

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

Table 7.45 Share of Construction Cost

(Unit: Tk.)

Name of Scheme	Construction Cost	Share		Number of Beneficial HH	Cost HH
		Government (80 ~ 90%)	Villager (10 ~ 20%)		
1. Sheltering place by raising school ground	1,301,000	1,041,000 ~	130,000 ~	225	600 ~
2. Approach road to sheltering place		1,171,000	260,000		1,200
3. Homestead raising	935,000	748,000 ~ 841,000	94,000 ~ 187,000	61	1,500 ~ 3,000

Beneficial villagers bear 10 ~ 20% of construction cost. One villager shares about Tk.600 ~ Tk.1,200 for sheltering place, equivalent to 2 ~ 4% of annual average income of Tk.28,000. For homestead raising, one villager shares about Tk.1,500 ~ Tk.3,000, equivalent to 5 ~ 11% of annual income. 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.

7.6 Project Evaluation

7.6.1 Social Evaluation

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

(1) 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 homestead raising, training in income generating activities, savings and credit, and other group activities. Organized people will finally be responsible for regular operation and maintenance of road and flood shelter 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 poultry rearing, hand weaving, etc., supported by the Project. Through these activities, it is expected that their social status will be enhanced.

(2) 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.

(3) Improvement of health conditions

Homestead raising 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.

(4) Poverty reduction

Establishment of flood proof conditions under the normal flood will allow to sustain the normal life, reducing the cost for rehabilitating the damaged houses by flood. 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.

7.6.2 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 impacts, 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;

$$\text{NPV} = \text{Discounted benefits} - \text{Discounted costs}$$

$$\text{B/C Ratio} = \text{Discounted benefits} / \text{Discounted costs}$$

$$\text{IRR} = \text{such discount rate as } [\text{Discounted benefits} = \text{Discounted costs}]$$

$$(\text{NPV} = 0, \text{B/C Ratio} = 1)$$

(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 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. The project life of Raised Hand Tubewell is set up by considering utility life of the main equipment, and is estimated at 15 years.

b) Opportunity cost of capital

The opportunity cost of capital (OCC) is taken at 12%, in accordance with the FPCO's GPA. 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, applied to convert financial prices to economic prices in the economic analysis. Other conversion factors as may apply to engineering works, construction 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.3,361,000, and annual operation and maintenance costs is estimated at Tk.92,970. 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 are

estimated at Tk.4,000,000, and Tk.512,400 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 7.46 Expected Benefits Generated by Proposed Model Projects

Project Component	Project Purpose	Expected Benefit
Homestead Raising	· Providing safe living space, designed against 1998 flood level	·Flood damages on human life, household property and livestock, up to 1998 flood level, are mitigated ·Living in peace mind whole year round, up to 1998 flood level (Beneficially; 61 households)
School Ground Raising	· Providing sheltering place against 1988 flood level, and safe life during flood season	·Flood damages on human life, household property and livestock, up to 1988 flood level, are mitigated (Beneficially; 255 households and their livestock)
Approach Road to School	·Providing refuge place against 1988 flood level	·Flood damages on human life, household property and livestock, up to 1988 flood level, are mitigated (Beneficially; 255 households and their livestock)
Raised Hand Tubewell	·Improving health condition and personal hygiene	·Safety drinking water is provided ·Number of people suffering from diarrhea and dysentery are decreased (Beneficially; 37 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)
Homestead 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
Poultry Promotion (chicken)	·Improving nutrition condition	·Income generation (Tk 150,000 per year) ·Easy to gain additional nourishment source (Beneficially; 50 households)
Skill Training on Handicraft	·To increase options for income generating activities · To increase employment opportunities in flood season	·Income generation (Tk 81,560 per year) ·Status of women is improved ·Job opportunity is increased (Beneficially; 10 villagers)
Mulberry Plantation for Sericulture Promotion	·Income generation	·Income generation (Tk 131,900 per year) ·Job opportunity is increased (20 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) Homestead raising

Purpose of the project is to provide safety living space to villagers, and to mitigate flood damages on their houses and household properties. Beneficiary of the project is 61 homesteads/ household located in three paras in Algar char Gram, Mokbul Baparie para, Aklas Member and Samad Fokir para, Joynal Member and Hasen Khalifa para. Through implementation of the project, flood damage up to 1998 flood level (1/20 flood probability) will be mitigated. Steps for calculating the project benefit are summarized as follows.

First, flood damage record on village house, household properties, and homestead mounds are collected from villagers through questioner survey. Second, based on the damage records in the benefited para, correlation between amount of damages and flood probability are analyzed. Third, amount of flood damages up to 1/20 flood probability are accumulated, and then, annual flood damage are estimated. As a result, annual flood damages on village house, household properties, and homestead mounds are estimated at Tk.2,930 in economic term.

b) School ground raising

School ground will be raised to develop as refugee place for about 1,500 villagers (255 households) and their livestock. Height of the ground is enough safe up to 1988 flood level, 1/100 flood probability. Beneficially of the project are those villagers living in Aklas Member and Samad Folir Para, Mokbul Baparie Para, Joynal Member and Hasen Khalifa Para, and their neighbors. The project benefit generated by the project is amount of mitigated damages on livestock. Steps for calculating the project benefit are summarized as follows.

First, flood damage record on livestock is collected from villagers through questioner survey. Second, based on the damage records in the benefited para, correlation between amount of damages and flood probability are analyzed. Third, amount of flood damages up to 1/100 flood probability are accumulated, and then, annual flood damage on livestock are estimated. As a result, annual flood damages on villager's livestock is estimated at Tk.317,000 in economic term.

In cease, the beneficially take another mitigation measures against 1988-flood level, for example, raising their homestead area by themselves and individually, the cost for raising homestead is estimated at Tk.21,000 per household. Total cost of the case is estimated at Tk.4,700,000 in financial price, above three times larger than Tk.1,301,000, total cost of raising school ground and approach road to the school.

c) Approach road to school, and flood warning and evacuation

Approach road to raised school will be used for refuse place for neighboring villagers. The project benefit is difficult to separate from those of raising school ground, and is included in the school project. Flood warning and evacuation is carried out to support villager's safety evacuation, and the benefit is also included in the school ground-raising project.

d) 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, 37 households in Algar char 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.2,700 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 may cause diarrhea. Diarrhea is one of main causes 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.

e) Support services for livelihood development

4 types of support services are proposed in Algar char Gram, which are home gardening promotion, poultry promotion, skill training on handicraft, and sericulture promotion. Through these service activities for livelihood development, villagers will be able to gain profit to improve their living standard. It is likely that with increase household income, per capita expenditure on nutritious food, sanitation and health care will increase. All these together will have positive impact on life expectancy, particularly on the reduction of infant and child mortality.

On the other hand, villagers themselves have to manage to raise annual operation and maintenance fund of the proposed flood proofing projects. The profit from livelihood development activities also enables villagers to participating and keeping flood-proofing activities. Total amount of annual net benefit is estimated at Tk.363,500 in financial price.

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, Net Present Value (NPV), Benefit/Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR). The results of the analysis are summarized in Table 7.47.

Table 7.47 Result of Economic Analysis

Project Component	NPV. (Tk.)	B/C	EIRR (%)
Homestead Raising	-286,467	0.76	10.0
Scholl Ground Raising, Approach Road to School, and Flood Warning and Evacuation	69,276	1.04	15.7
Raised Hand Tubewell	-1,869	0.83	9.3
Poultry Promotion (chicken)	425,337	1.51	32.2
Skill Training on Handicraft	274,249	1.22	36.9
Mulberry Plantation for Sericulture Promotion	178,056	1.20	19.1
Total	403,118	1.07	16.9

The above result shows that the proposed projects in Algar Char gram are economically feasible as a total. Result of economic analysis in view of EIRR is 16.9%, and B/C ratio at discount rate of 12% is 1.07. The opportunity cost of capital in Bangladesh is around 12%, and the results of total evaluation satisfy the evaluation criteria. The major benefit is generated by such livelihood activities as handicraft production, mulberry plantation and sericulture, and chicken rearing.

All evaluation criteria for homestead raising shows negative figure; NPV indicates minus, B/C is less than one, and EIRR is less than opportunity cost of capital. It should be noted that economic analysis is good at evaluating those projects, which generate tangible benefit, however, there are so many intangible benefit/ impacts generated by flood proofing type projects. For example, security of life and peace of people's mind, generated by implementation of disaster mitigation project, is difficult to assess in monetary terms in general. Therefore, even if the result of economic analysis is not feasible, there are such cases that the project is evaluated from view of social aspect such as Basic Human Needs (BHN).

7.6.3 Financial Evaluation

(1) Methodology

Financial analysis is carried out to assess individual household economy, and the only profitable projects are the target of the analysis. The projects for homestead raising, school ground raising, etc., are not suitable for financial analysis because these projects are not profitable. Financial analysis is conducted by using actual market prices, so called financial prices.

(2) Project cost

Project costs comprise direct and indirect project costs, and annual operation and maintenance costs. 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.468,760 per annum.

(3) Project benefit

Project benefit is also express in market price in 2001/2002. Those profitable projects as poultry promotion, skill training on handicraft, and mulberry plantation and cocoon promotion are evaluated in the financial analysis. The total amount of the project benefit is estimated at Tk.363,400 per year.

(4) Evaluation results

The results of the analysis are summarized in Table 7.48.

Table 7.48 Result of Financial Analysis

Project Component	NPV. (Tk.)	B/C	FIRR (%)
Poultry Promotion (chicken)	472,766	1.51	32.2
Skill Training on Handicraft	305,072	1.22	37.0
Mulberry Plantation for Sericulture Promotion	198,099	1.20	19.1

The results show that all support services for livelihood development is financially viable. Among three activities, skill training on handicraft, Nakshi katha waving, is the most profitable. As for these livelihood activities, we can refer to another evaluation results. According to Grameen Bank's estimation, the rate of return at first year on poultry production, handicraft (Nakshi katha) production, and sericulture are estimated at 35%, 292%, and 38% respectively.

7.6.4 Technical Evaluation

The proposed development in three of the seven paras of Algar Char gram in raising the homesteads involves simple earthworks only. Only the homesteads, which have some land to spare earth from, will be finally chosen for raising. Therefore, availability of earth will not pose any problem. As per the existing system, the villagers whose houses are taken up for raising will temporarily take out their existing structures for facilitating the earthwork. After the earthwork is completed they will again erect their houses on the raised grounds. Immediately after completion of earth works the house owners will take vegetative protection against erosion of homesteads. As the houses in char areas are built with such materials that can be moved away in time of need, the temporary removal of the houses and their resetting will be technically possible. As per the existing practice, as they did in CARE projects, the house owners will carry out O&M of the raised earthworks in homestead area as soon as it becomes necessary.

The raising of the school ground of Algar Char Government Primary School for a refuge place is also simple earthwork of a similar nature. At present the ground is vacant. Borrow earth will have to be taken by the local initiative from the nearby fields. CARE did the similar kind of work in other paras of the village in 2001 in raising the three school platforms to convert them

school-cum-shelters with the local initiative. The School Committee will do vegetative protection on the periphery of the raised ground through the local initiative. O&M will be possible in this case also by the local people.

7.7 Environmental Impact Assessment (EIA)

7.7.1 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 Char areas, Alga Char gram has been selected for the formulation of a model project. The model project for Alga Char gram contains the following measures that may have significant environmental impact:

- 1) Raising plinths of homesteads, and
- 2) Providing 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) Clustering houses on high platforms,
- 4) Providing community latrines,
- 5) Constructing/reconstructing submersible roads, and
- 6) Constructing/reconstructing submersible bridges/culverts.

The environmental impact shall be assessed for these measures.

(3) Procedure of EIA

Field surveys were conducted in Alga Char 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.

7.7.2 Summary of EIA

The results of the EIA are summarized in Table 7.49. 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 Alga Char as a result of raising plinths of homesteads, clustering houses on high platforms, and constructing submersible roads. To cope with this increase, it is necessary to create employment opportunities so that local shifting cultivators and temporary migrant workers can settle permanently to augment local resources to be used for continual flood proofing and livelihood development. 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. Also a skill-training program should be introduced to help young immigrants as well as local residents find employment opportunities both inside and outside of the project area.

(2) Health and sanitation

Residual toxicity of agrochemicals

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

Increase in domestic and other human wastes

Moderate effects are anticipated associated only with the provision of community latrines. Enhanced awareness on sanitation by recent projects has led to increased needs for sanitary latrines as reported in Section 7.1.4. 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.

(3) Biological and ecological issues

Change in vegetation

Change in vegetation is anticipated as a result of homestead raising. 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

Homestead raising 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 homestead raising and house clustering, 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 to significant destruction of wetlands and peat lands is anticipated in association with homestead raising and house clustering. 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.

(4) Soil and land resources

Homestead raising and house clustering 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.

(5) Landscape and mining resources

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

7.7.3 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

In Char areas, quick maturing trees may be planted in highest ridge sites and ‘Dhaincha’ on lower land to minimize soil erosion even if no structural measures are considered. More fertilizers for silty soil and more manure/compost for sandy soil should be used to increase yields. Early summer crops such as maize, sorghum, cheena, kaon, groundnut, and sweet potato may be cultivated to further secure agricultural outputs of these areas. Pesticides should be provided to support these activities.

(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 grow and 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 premises.

(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 Algar Char, groundwater from a depth of about 17m contains a high level of iron (12.8 mg/l) and arsenic (0.06mg/l), both beyond the allowable limits for drinking water. Raising hand tube wells itself will not solve this problem, for it will only prevent floodwater intrusion. To reduce the risk of the mineral toxicity in drinking water, tube wells should be installed in deeper aquifer, preferably over 30m deep.

