

Char Development and Settlement Project Phase IV Bangladesh

Feasibility Study of Cluster of Chars

Integrated Main Report

April 2014

Government of Bangladesh / IFAD / Government of the Netherlands

Implementing Government Agencies:

- Bangladesh Water Development Board (BWDB)
- Ministry of Land (MoL)
- Local Government Engineering Department (LGED)
- Department of Public Health Engineering (DPHE)
- Department of Agriculture Extension (DAE)
- Forest Department (FD)
and NGOs

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Appendix 2 Feasibility Study of Cluster of Chars, TA Contribution

List of Abbreviations/Glossary

ADP	Annual Development Plan
AE	Assistant Engineer
AEO	Assistant Extension Officer
Aman	Monsoon season rice
Bahini	Armed gang
BC	Bitumen Carpeted
Boro	Winter season rice
BWDB	Bangladesh Water Development Board
CDS	Coastal Development Strategy
CDSP	Char Development and Settlement Project
DAE	Department of Agriculture Extension
DG	Director General
DC	Deputy Commissioner
DPC	Deputy Project Coordinator
DPHE	Department of Public Health Engineering
DPP	Development Project Pro forma
DTL	Deputy Team Leader
EKN	Embassy of the Kingdom of the Netherlands
EMG	Embankment Maintenance Group
FE	Field Engineer
FF	Farmers Forum
FO	Field Officer
Ghat	Landing place for boats
GMC	Group Management Committee
HBB	Herring bone bond
HFPF	Health and Family Planning Facilitator
ICS	Improved Cooking Stove
ICZM	Integrated Coastal Zone Management
IFAD	International Fund for Agricultural Development
IMED	Implementation Monitoring and Evaluation Division
IRRI	International Rice Research Institute
Jamabandi	Settlement case
Jotdar	Powerful person having big agricultural farm
KAP	Knowledge Attitude Practice
Khabuliyat	Deed of agreement
Khal	Canal, creek
Khas	Government owned land
Khatian	Record of right
Killa	Earthen raised field, used as shelter for cattle
LADC	Local Area Development Committee
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
LGI	Local Government Institution
Madrassa	Religious school
MoL	Ministry of Land
Mouza	Small geographical unit
MRA	Micro finance Regulatory Authority
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PA	Project Agriculturist
PC	Project Coordinator
PCD	Project Coordinating Director

PD	Project Director
PIM	Project Implementation Manual
PMC	Project Management Committee
PP	Project Pro forma
PSF	Pond with Sand Filter
PTO	Project Technical Officer
PTPS	Plot To Plot Survey
PWD	Public Works Datum (local topographical level)
(S)QCE	(Senior) Quality Control Engineer
QC team	TA Quality Control team
Rabi	Crop season from November/ December to March
RDC	Revenue Deputy Collector
RFLDC	Regional Fisheries & Livestock Development Component (former DANIDA funded project)
RMG	Road Maintenance Group
RPA	Reimbursable Project Aid
Samaj	Local community
SAE	Sub assistant Engineer
SDE	Sub divisional Engineer
SE	Superintendent Engineer
SFG	Social Forestry Group
SO	Sectional Officer
SLS	Social and Livelihood Support
TA	Technical Assistance
TBA	Traditional Birth Attendant
TL	Team Leader
ToT	Training of Trainers
TUG	Tube Well User Group
UP	Union Parishad
Upazila	Sub-district
WARPO	Water Resources Planning Organisation
WBM	Water Based Macadam
WMA	Water Management Association
WMF	Water Management Federation
WMG	Water Management Group
WMO	Water Management Organization
XEN	Executive Engineer
XO	Extension Overseer

Executive Summary

1. **Area:** East and southeast of the embankment of polder 59/3B land emerged in the Lower Meghna River since the beginning of the 1990s. The land formation continued by fresh deposits of sediment. Currently the area is 3,230 ha. It consists of a cluster of eight chars, located in Subarnachar- and Companiganj Upazilas in Noakhali District.

2. **Population:** Settlers started to migrate into the area about 15 years ago, removing the trees planted by the Forest Department and occupying the land without a land title. Total population is nearly 11,000, settled in 2,100 households. Main occupations are farming, daily labour, fisheries and small business; 78% of the households have an annual income lower than Taka 24,000. About the same percentage has food security for a period less than six months in a year.

3. **Physical conditions:** Nearly 94% of the area has an elevation between 3 m. and 5 m. PWD. The highest parts, up to 7 m. PWD, are situated in the east, adjacent to polder 59/3B. The area is unprotected. Polder 59/3B drains through the study area. Tidal movements bring sediments into the network of khals, affecting the drainage capacity. Of the area around 82% is cultivable land, 4% is taken by homesteads, 9% by large fish projects and 5 % is used for other purposes.

4. **Integrated programme:** The study proposes to initiate a CDSP-type of project in the area. This means a multi-sectoral and multi-agency development programme, with a distinct role for both government agencies and NGOs. The programme should cover the following fields: water management (Chapter 2), internal infrastructure (Chapter 3), land settlement (Chapter 4), agriculture (Chapter 5), livestock (Chapter 6), fisheries (Chapter 7) and social forestry (Chapter 8). In addition it is advised to have a specific social- and livelihood component (Chapter 9). Such an approach requires specific governance related arrangements (Chapter 10). The integrated approach follows the principles of Integrated Coastal Zone Management, as reflected in the Coastal Zone Policy of Bangladesh.

5. **Water management:** High water level during spring tide in monsoon time is 3.46 m. PWD in this part of the Lower Meghna. No further sedimentation of the land surface can be expected, with a view on present land levels. The drainage system is dominated by 13 major khals; drainage capacity is impeded by sedimentation. Tidal waters also bring salinity into the area. Rainfall amounts to 2.9 m. per year. In case of three days of rainfall, nearly the whole area (98.7%) would remain flooded. A water management plan has been developed with a peripheral embankment (15.84 km. sea facing and 6.95 km interior); nine regulators (five with one vent, one with two vents and three with three vents); re-excavation of drainage channels and excavation of a link canal. The proposal is based on the assumption that a cross dam will be constructed between Noakhali main land and Urir Char, which will accelerate the sedimentation process in the Lower Meghna. Design criteria have been adapted because of the anticipated changes in climate.

6. **Internal infrastructure:** The area has presently hardly any infrastructure. The earthen roads are not well maintained and can only be used by small cars in winter time. There are some deep tube wells, two cyclone shelters, a few small bazaars and one Asrayan (clustered village) complex. It is proposed to upgrade the existing rural roads (20 km.) and construct new ones (3.9 km.), including three bridges and ten culverts. Based on a future population of 2,500 households, the plan provides for five cyclone shelters, 155 deep tube wells and 2,500 pit latrines. Also five public toilets and five rain water harvesting schemes are proposed.

7. **Land settlement:** It is estimated that of the 2,100 households living in the area, 1,880 (nearly 90%) are occupying land without a land title. However, only 23% of the area is khas land and thus available for settlement for landless households. A major part of the land (34.8%) has already been officially settled, while 8.3% is under settlement process. A considerable area (23.9%) is declared as land for shrimp- and fish cultivation (a decision that is being challenged in court). Ancestral claims rest on 9.5% of the land. It has to be noted that experience has learned that for adequate public infrastructure, about one quarter of the land is required.

8. **Agriculture:** Agriculture production is impeded by salt water intrusion, soil salinity, diseases, lack of support services and an inadequate marketing system. The aman (monsoon) rice is practically the only crop, with some vegetables and oil seeds in winter time (rabi). Cropping intensity stands at 110%, while yields are low (1.23 ton per ha. for paddy). Implementation of the water management plan would stop flooding and would create a fresh water environment. Water levels could be controlled and gradually soil

salinity would decrease. It is projected that cropping intensity is 160% after five years and 185% after 10 years, largely caused by an expansion of the area under aus-rice (spring time) and rabi-crops. Introduction of high yielding varieties can more than double the rice yield. This intensification will lead to higher use of agrochemical inputs. At present 35% of households grow vegetables on their homesteads; this is likely to increase to 50% given the improved circumstances. The Department of Agriculture Extension has to expand their services to the area, while NGOs can support households in homestead agriculture. The plans for the road network will facilitate marketing of produce.

9. Livestock: In the vulnerable environment of char areas, livestock has a strong element of risk aversion. It is seen as a reliable source of income for small farmers and landless families. However, as in the case of agriculture, lack of support services and a poor marketing system are hampering livestock development, in addition to shortage of feed and animal diseases. The higher agriculture production will lead to more availability of crop residues that can serve as fodder. It is expected that that will boost the livestock population. Efforts will have to be undertaken to strengthen the support services, through NGOs. Supplies of vaccination have to be increased and assured with the assistance of the Department of Livestock Services and the private sector. Information of settlers about market conditions and a reduction in the role of the presently dominant middlemen through collective bargaining, will lead to higher prices. The improved communication network and the establishment of small chilling units would significantly improve the marketing possibilities.

10. Fisheries: Nearly 9% of households are directly depending on fisheries for their livelihood. They are involved in fishing in closed water bodies (ponds, ditches), in wild fisheries (khals and floodplains), or in fishing outside the area (Meghna river and beyond in the Bay of Bengal). The planned water management system will affect the present, limited, wild fisheries in the area. The size of the floodplains will be reduced and fish migration from the river into the system of khals is no longer possible or at least highly restricted. Cultured fisheries in ponds, ditches and in the six large fish farms will on the other hand be greatly benefitted. The lack of floods and salt water intrusion will encourage households and the big commercial fish farms to invest in intensified aquaculture methods. It is recommended that NGOs will provide extension services for fisheries. Establishment of a fish hatchery in the area would address the demand for fingerlings. Marketing would be improved if funds are allocated for establishment of proper fish landing facilities (for off shore fishing), an auction shed and an ice plant.

11. Social forestry: Forestry development started by the Forest Department in 1992, but immigration of settlers at the end of that decade led to complete deforestation. At present there is not much forest coverage in the study area. It is recommended that the Department renews its presence with a substantial forestry programme with mangrove plantations on the newly formed mudflats of the Lower Meghna river, close to the coast; with strip plantation along all the roads and channels and along the whole length of the embankment; with foreshore plantation in front of the sea facing part of the embankment; and with plantation on grounds of public institutions (like cyclone shelters, schools, mosques). NGOs should be given the responsibility to promote and support agro-forestry on homesteads. It is standing policy in Bangladesh to apply the social forestry approach. Men and women from the area, organised in Social Forestry Groups, are involved in planning, implementation and maintenance of the forestry schemes and are rewarded through benefit sharing arrangements.

12. Social and livelihood component: Although many of the proposed activities have a distinct social impact and will favourably influence the livelihoods of the settled families, it is recommended to emphasize the importance of these aspects by a specific social and livelihood component, to be carried out by NGOs, as is the case in CDSP IV. The strategy is basically to render micro-finance services targeted at women (better credit facilities will stimulate productive pursuits) and to provide social and economic services that are not being delivered by the government at this early stage of development of the area. Subjects to be covered are: group formation (exclusively women) and micro finance; health and family planning; education; water and sanitation; homestead agriculture and value chain development; livestock development; fisheries; legal and human rights; disaster management; and awareness on the environment and on climate change. It is foreseen, with a view on the size of the area and of the population, that establishment of two branch offices is required, by either one or two NGOs.

13. Governance: As indicated earlier, it is recommended to frame the multi-sector interventions in a multi-agency programme. As in CDSP III and IV, it is recommended that the following six partner agencies participate: Bangladesh Water Development Board, Local Government Engineering Department, Department of Public Health Engineering, Ministry of Land, Department of Agriculture Extension and Forestry Department. An Inter-Ministerial Steering Committee and a Project Management Committee would function as coordination mechanisms. The Department of Livestock Services and the Department of

Fisheries would support the programme through training efforts and supply of inputs. The private sector would have also a role in input supply and in marketing of crops, fish and livestock products. The involvement of NGOs was explained in the previous section. Important is the support and active involvement of local government institutions, especially at the level of the Union Parishad. The significance of field level institutions for a successful char development programme can hardly be underestimated. That is why much attention will be given to the formation and support of Water Management Groups, Farmer Forums, Social Forestry Groups, Tubewell User Groups and micro-finance groups. As much as practically possible, Labour Contracting Societies will be engaged for earth work and other construction activities like market development and latrine production.

14. Environmental impact: The environmental assessment shows that there are no significant adverse effects in case the infrastructure development is indeed carried out. The availability of fresh water would be increased, while much more land would be flood free. The higher use of agrochemical inputs in agriculture might reduce soil fertility and threaten water quality. But the controlled water management system and a greater awareness among farmers would facilitate abating water pollution. The composition of flora will change. The abundance of wetland plants will be reduced, while presence of economically interesting plant species will become more dominant. The planned embankments will interfere with migration of aquatic animals. An Environmental Management Plan has been developed, primarily to mitigate the negative influences. Mitigation measures include promotion of use of organic fertilizers and of natural methods of pest control, arranging of grazing land outside the embankment and construction of fish-friendly sluices. The plan includes monitoring of key environmental components.

15. Social impact: The social impact of the proposals would in general be favourable. Physical security for the settlers would improve a great deal (embankment, cyclone shelters, roads, skills in disaster management). Economic and food security would be much better. The upswing in local production and the economic development in general will increase and diversify the income streams and will open up employment opportunities. The higher production in agriculture, fisheries and livestock are bound to decrease the periods of food shortages of large sections of the population, as was proven in previous CDSP-project areas. It is expected that more service providers, both from the government and from the private sector, will be encouraged to come to the area because of the economic development and the better communication network. Health status will be improved by the improved food security, including a higher availability of high protein food, as well as by the targeted interventions of the social- and livelihood component. That component will increase the access for children to primary education. The cyclone shelters can serve as school buildings. The social position of settlers will be enhanced (land titles, participation in field level institutions), especially for women.

16. Costs and benefits: Total costs of the proposed package of interventions amounts to Taka 10,944.40 lakh. This total includes provisions for costs of operation and maintenance during the programme period and 5% inflation during that period. The amount equals US\$ 14.27 million or Euro 10.55 million at present exchange rates. The interventions would lead to a stream of economic benefits, such as higher production in agriculture and fisheries, a growth in livestock population and income through social forestry activities. A comparison of costs and benefits in the economic analysis has resulted in an Economic Internal rate of Return (EIRR) of 21.60% and a Financial Internal Rate of Return (FIRR) of 16,26%. This is well above the opportunity costs for capital in Bangladesh of 12%. Also the sensitivity analysis indicates that the EIRR will consistently be considerably higher than 12%. Indirect effects on the economic developments, as the influx of banks and other economic relevant institutions, have to been taken into account in the analysis.

Chapter 1 Introduction

1.1 Background and objectives

The Inception Report of the Char Development and Settlement Project (CDSP) - IV states that the project will undertake three feasibility studies in areas where in the future development programmes for chars might take place. It further states that these future areas have to be located within the overall study area, essentially the central, dynamic part of the coastal zone of Bangladesh. This area is bordered in the east by the outfall of the Muhuri River and the Chittagong coastline. In the west, the border is formed by the Tetulia River which is on the west of Island of Bhola (Bhola District). In the north, the area follows the coastline of Feni, Noakhali and Lakshmipur Districts. After a rigorous process of selection, the decision was taken to take up a cluster of chars in Noakhali District (see below in 1.3.1) in the first feasibility study. A key element in the selection process was the comparison of a long list of chars assessed on the basis of results of reconnaissance surveys. For each of the chars, a short report was prepared. The collected information was reflected in the Terms of Reference (ToR) for the study, which can be found in the Annex of the present report.

The main objective of the study is to assess the technical, economic, social and environmental feasibility of developing the chars in the study area. The aim is to present the feasibility study report to the Government of Bangladesh and to development partners (international donor agencies) in order to ascertain whether the proposed development plans are feasible out of a policy point of view and subsequently to secure funds and technical support necessary for the implementation of the proposed package of interventions.

1.2 Methodology

The overall coordination of the feasibility study was in the hands of the Technical Assistance (TA) team of CDSP IV, under responsibility of the Project Management Committee (PMC), chaired by the Project Coordinating Director (PCD) of the Bangladesh Water Development Board. The Terms of Reference for the study were drafted by the TA team and approved by the PCD and PMC. The study is financed by funds from the TA budget.

The responsibility of actually undertaking the study has been split up. The major part has been sub-contracted after a tender-procedure to a consortium of a Bangladeshi firm and institute: Development Design Consultants Ltd. (DDC) and the Institute of Water Modelling (IWM). The tender was issued by the main consultant of the TA team, Euroconsult Mott MacDonald. The DDC/ IWM consortium covered water management, internal infrastructure, agriculture, livestock, fisheries, forestry, environmental impact and the cost-benefit analysis. The TA-team itself took up the task to prepare the parts of the study on the social- and livelihood/NGO component, and the parts on land settlement, governance and social impact. **The Report of DDC and IWM (Appendix 1)**, and the **Report on the TA Team Contribution (Appendix 2)** form appendices to this **Integrated Main Report**. This Integrated Main Report integrates all different sections and is a great deal shorter than the combined original reports. It provides a comprehensive presentation of the main findings.

The methodology of preparing the reports basically followed four phases: establishing base-line conditions and constraints; identification of interventions; analysis of impact; formulating the overall proposed plan. The information was obtained through both primary and secondary data collection. The DDC/ IWM report gives an overview of all field surveys that have been undertaken. The study was carried out in the period from mid-February 2013 to January 2014.

1.3 Study area

1.3.1 Main characteristics

The construction of the two Noakhali cross dams in 1957 and 1964 respectively, led to accretion of a huge land mass along the coast of Noakhali. Much of the area that emerged was protected, including polder 59/3B. After completion of that polder, land accretion started outside the new embankment and continued over the last two decades. The land that was formed in that period forms the core of the feasibility study area (see Fig. 1.1 for a base map). The study area is located in Noakhali District. The cluster of chars

consists of Char Kandakar, Char Mozammel, Char Banani, Char Akramuddin, Char Alauddin and Char Torab Ali (all under Mohammadpur Union in Subarnachar Upazila) and Char Pollabi and Char Gangchil (in Char Elahi Union of Companiganj Upazilla). The area covers 3,230 ha. Nearly 94% of the area has an elevation between 3 to 5 m. PWD, while another 3% is higher than 5 m. Total population settled in the area is 10,775. There are 2,100 households. Of the total area of 3,230 ha 82.2% is cultivable land, 4.2% is taken by homesteads, 8.8% by fisheries projects. The remaining nearly 5% of the land is used for other purposes.

1.3.2 Population

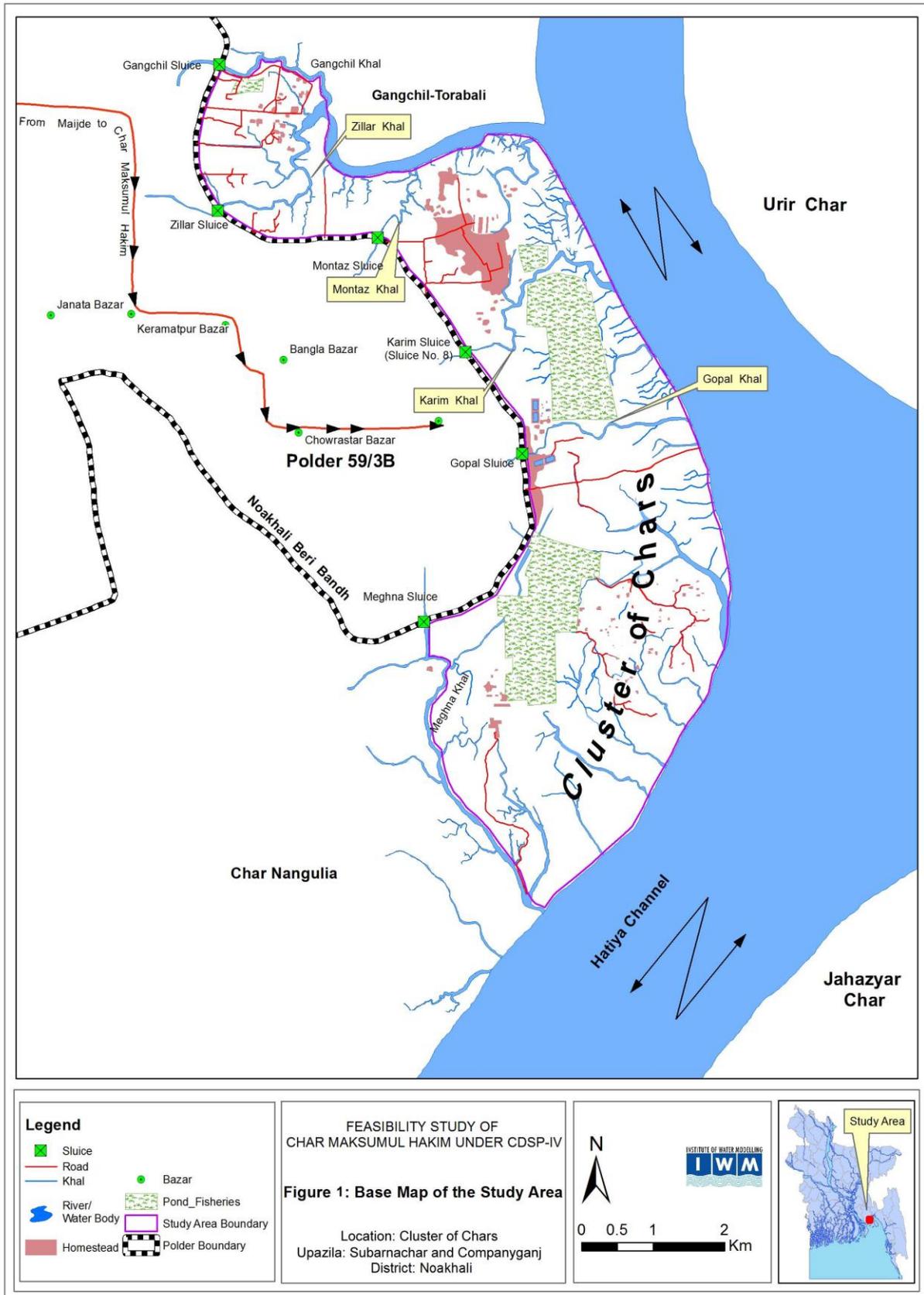
People started to migrate to the area even before the year 2000 (310 households, or 14.7% of present population). In the period 2001-2005 373 households moved in (17.8%), from 2006-2010 901 households (43%), and from 2011-2013 515 households (24.5%).

Of the total current population of 10,775, 5,635 are males and 5,140 females. It is a young population: 48.2% are in the age group 0-15 years, 30.3% is between 16 and 34, 17.6% between 35 and 59, and only 3.8% is 60 and older.

1.3.3 Occupational pattern, income and expenditures

Of the households, 49.4% mentioned farming as main occupation, followed by farm daily labour (15.1%), non-farm daily labour (9.9%), fishermen (8.8%) and small business/trade (5.5%). The remaining part of nearly 17% is in salaried service (government, NGO), or are share croppers, artisans and house wives. Nearly half (45%) of the households report an annual income of less than Taka 12,000 (mostly daily labour and fishermen). 34% has between taka 12,000 and Taka 24,000 (small farmers, livestock holders), 15.5% between Taka 25,000 and Taka 60,000 (mainly farmers and small business/trades men), 5.4% between Taka 60,000 and Taka 120,000 (small business, foreign remittances). A very small group of 0.1% has an income more than 120,000, mostly from foreign remittances. In general, most of the income is spent on food, followed by clothing, agricultural inputs, house repairs education and medical treatment.

Figure 1 Base map Cluster of Chars



1.3.4 Status of food security

More than three quarter of the settlers has food security for a period of six months or less (45.7% for up to three months, 32.2% up to six months). Nearly half of the households (45.7%) had food security only for 3 months in the year. These sections of the populations were dependent on purchases on the market for up to 50% of their consumption. Table 1.1 gives an overview.

Table 1.1 Status of food security of households

Food Security Period	Percentage of Households	Produce of own land (%)	Purchased from Market (%)
3 months	45.7	50	50
6 months	32.2	55	45
9 months	20.6	60	40
12 Months	1.0	95	5
Surplus food in the year	0.5	98	2

1.4 Time frame

1.4.1 Lead time to implementation

CDSP IV runs till the beginning of 2017. If the now proposed programme is not taken up earlier, this would mean a start of implementation, three years later than the completion of this first feasibility study. Then there is the period of implementation itself, which will be three to four years. In these years, a number of important variables might change. For instance factors that will have a significant effect on the proposed package are the expected growth in the number of households in the study area and the increase in prices of construction. To take into account the foreseen continued migration into the area, the study has assumed a number of 2,500 households (instead of the present figure of 2,100) for planning purposes (for example for internal infrastructure such as cyclone shelters and tube wells, and NGO activities). Because the lead time to the start of implementation is uncertain, the overall cost estimate has been increased with 5% to take care of inflation at least during the implementation period. The budget has to be adjusted, if needed, at the time of decision making on the implementation.

1.4.2 Long term time frame

Because of the dynamic environment in coastal areas, in particular in the central, estuary part of the coastal zone, the feasibility studies in CDSP, including the current one, have taken a time frame of 20 years. This means in essence that the cost-benefit analysis is based on a period of 20 years that the project will be operational and that benefits can be generated. However, as far as the impact of climate change is concerned, a time horizon till 2050 is taken, 36 years from now (see next section). This has been done out of caution. It makes it more likely that infrastructure will still be functional after 20 years and it provides a hedge against changing insights in the process of climatic changes.

1.5 Impact of climate change

The coastal area of Bangladesh is extremely vulnerable to climate change because of its flat deltaic topography with very low elevation. Bangladesh is experiencing climate related hazards like floods, cyclone, storm-surge, tidal bore, river bank erosion, salinity intrusion and drought. The impact of these phenomena will aggravate due to climate change. This is likely to affect the function and operation of water infrastructure, if it is not planned and designed considering the change in precipitation, temperature, sea level rise and storm surge levels. But it also has consequences for productive sectors as agriculture, livestock and fisheries. Selections of crop varieties and species of cultured fish have to be revised, taking into account different climatic circumstances. In livestock, it is likely that higher temperatures will increase the incidence of animal diseases. The anticipated effect of climate change as far as water management is concerned, is overtopping of embankment, damage of drainage systems, water-logging, crop damage and

decline of livelihood opportunities for farmers and fishers. Current water management practices may not be robust enough to cope with the impacts of climate change. It demands improved incorporation of information about current climate variability and climate change into planning and design of water infrastructure. Increase of precipitation and sea level rise in the changing climate may cause prolonged drainage congestions in the proposed project area, if these drivers are not included in designing the drainage systems.

In the present study, projection on temperature, precipitation, relative mean sea level rise and increase of cyclonic wind speed have been established for the project area based on reports of the Intergovernmental Panel on Climate Change (IPCC) and literature review. Relative sea level change is the local change in sea level relative to the elevation of the land at a specific point on the coast. Relative sea level change is a combination of both global and local sea level change due to changes in estuarine processes. There is very little data, evidence, and knowledge on subsidence, resulting in a decrease of land levels, in Bangladesh. The draft copy of IPCC's Assessment Report no. 5 was published in September 2013, where global sea level rise is given in different emission scenarios. Under a moderate emission scenario, and taking into account a subsidence rate of 1 mm, the relative mean sea level rise would be 22 cm along the coast of the study area in 2050. Precipitation is projected to increase with 6%. In addition a 5% increase in cyclonic winds is considered.

Incorporation of the above climate change parameters in the design of protection schemes and drainage systems requires some changes compared to currently applied design criteria. A greater drainage capacity is needed, achieved by an increase in the size of the regulators and capacity of drainage channels. In assessing the height and slope of the sea facing embankment, incorporating a 22 cm sea level rise and 5% increase of cyclonic wind speed, means an increase of the crest level with 31 cm.

Chapter 2 Water management

2.1. Introduction

2.1.1 Objective

The study area started accreting in the beginning of the 1990s in the Lower Meghna river, outside the embankment of polder 59/3B, roughly between the outfalls of Gangchil khal and Meghna khal. In the meantime the land has reached such a level that empoldering can be considered. The objective of the water management part of the feasibility study is to make an assessment of the present situation and current constraints in water management (see below 2.2), develop a water management plan that addresses the main constraints and contributes to the overall development objective of a CDSP type of project (2.3) and produce a cost estimate of such a plan (2.4).

2.1.2 Methodology

The data collection process consisted primarily of field surveys and measurements to gather primary data. A topographic survey was conducted. Water levels (in monsoon time) and discharge in drainage khals were measured, as well as the sediment load and salinity. An inventory was made of the existing drainage network. This included the six water control structures of polder 59/3B. These structures connect the study area with that polder. Historical rainfall data were collected from a station not far away in Noakhali District. This collection process was followed by a hydrological analysis and the development of a drainage model. In such a way, the basis was formed for formulating the baseline condition and identifying solutions to improve the situation. The technical details can be found in Chapter 3 of Appendix 1 (Final Report of DDC/IWM)

2.2 Present situation and constraints

The topographic survey reveals that the eastern part of the area is much lower than the western part. The eastern part has an average land level of about 3.7 m PWD. The highest parts are located along the embankment of polder 59/3B, with elevations between 4 and 6 m. PWD. Average level of the whole study area is 4.2 m. There exist some low elevations in the middle part where some ponds are situated, being used for fish cultivation. The substantial land area having elevations between 3 m PWD and 5 m PWD occupies more than 93% of the study area. About 3% of the area has elevations more than 5 m PWD. The rest 4% is below 3 m PWD. Since the level of high water at spring tide in monsoon time is 3.46 m. PWD, it can be expected that sedimentation of the land surface by sedimentation will no longer occur in nearly the whole area.

The drainage pattern of the study area at base condition is dominated by 13 major khals having a length of 36 km. The drainage efficiency of these khals has become poor as the khal sections are reduced due to the deposition of sediment over the year during tidal flooding. High tide inundates the area twice in a day, bringing sediments into the existing khal network. Delayed drainage in the study area is one of the major constraints for the inhabitants, impeding agriculture production. The sedimentation of the drainage khals also hampers the drainage of polder 59/3B, because many of the khals are the outfalls of the regulators of that polder. Sediment reduces the capacity of the outfalls and blocks the flap gates of the sluices. To address the problem, the Water Management Groups build temporary earthen cross dams across khals of around 100m - 200m in front of the regulators during beginning of the dry period. This prevents sediment coming in close to the regulator. When the drainage of the khals in Polder 59/3B gets increased during beginning of monsoon the earthen dams are removed.

Based on a rainfall of three days duration, the model gives as present inundation situation: flood free: 0.55% of the area; inundation up to 0.3 m. 0.71%; 0.3 to 0.9 m. 17.03%; 0.9 to 1.8 m. 61.15%; 1.8 m. to 3.6 m. 20.56%. This gives a total flooded area of 98.74%. Annual rainfall is on average approximately 2.9 m.

2.3 Water management plan

2.3.1 Planning scenarios

In planning the design of the water management system, the study team considered two options. These are (i) the study area as a single polder (ii) the study area as a cluster of polders. In view of the availability of the effective area, social acceptability, costing, impact on drainage, environmental viewpoints, etc., the concept for the study area as a number of individual polders has been discarded. After having decided to make a design with a single polder, two different scenarios were considered, based on two different assumptions. Assumption no. 1 is that no cross-dam will be built between Urir Char and Noakhali mainland. Assumption no. 2 is that such a cross-dam will indeed be constructed. As can be seen further in this section, the second assumption is the most probable one and has been taken as starting point for the final proposal for the future water management system. But in order to provide as much information as possible on the two different scenarios, both assumptions have been elaborated by the study team.

Based on the above two assumptions IWM has conducted model simulations and has provided assessments on the impact on drainage of the study area. It appears that the drainage of the study area would not be affected by siltation within a short period of time if the cross dam is built between Urir Char and Noakhali. The immediate impact of drainage congestion will take place only in Gopal Khal as its outfall is located very close to the planned cross dam location. All other major drainage canals located north and south of Gopal Khal will be less affected and appear to be operable for a longer time period of 15 to 20 years.

The analysis resulted in the following interventions for each of the scenarios:

- Scenario without cross dam

The structural interventions adopted under this assumption related with the water management issue are: 10 drainage cum flushing sluices of varying number of vents, re-excavation of 12 internal drainage khals, 15.85 km sea facing peripheral embankment and interior embankment along 2 drainage khals namely Gangchil khal and Meghna khal.

- Scenario with cross dam

The water management related structural interventions adopted under this assumption are: 9 drainage cum flushing sluices of varying number of vents, re-excavation of 12 internal drainage khals, sea facing peripheral embankment, interior embankment along 2 drainage khals namely Gangchil khal and Meghna khal, and a new link canal excavation to connect Gopal khal with Samitir khal at their outfall.

As already indicated, the final proposal is based on the second scenario, based on the assumption that the cross dam between Noakhali mainland and Urir Char will be built. This choice is essentially based on two considerations. Firstly, because there are plans in the making to construct the dam: A feasibility study is ongoing at the moment and funds for construction are being arranged. Secondly, even if the dam is not built, the natural sedimentation will continue and will result in the same situation as with the cross dam in a few years.

As was argued in section 1.5, climate change is a factor that has to be reckoned with in planning water management solutions, especially in a deltaic environment as the study area. The analysis and formulation of the proposal for interventions, including the design parameters, are consequently based on the "with climate change" conditions. Concretely, a relative sea level rise of 22 cm, an increase of 6% in precipitation and an increase of 5% of cyclonic wind speed has been assumed.

2.3.2 Proposed interventions

To summarize, the final package of water management interventions has been based on a choice for one single polder and on the assumption that the cross dam between Urir Char and Noakhali mainland will be constructed, while changed climate conditions have been taken into account. The construction of the dam would change the drainage pattern. The proposed sluice at the outfall of Meghna khal may be not functioning due to sedimentation. So, to avoid congestion, a link canal has been proposed from the outfall of Meghna khal to Samitir khal. At the outfall of Samitir khal, a 2-vent sluice is proposed. Overall, the proposed interventions are:

- Embankments: 15.85 km sea facing peripheral embankment; 7.0 km interior embankment along Meghna- and Gangchil khal
- Regulators: three 3 vents regulator at downstream of Zillar khal, Karim khal and Samitir khal; one 2 vents regulator at downstream of Montaz khal; five 1 vent regulators at downstream Rajar khal, Ahamadullah khal, Old Gopalkhali khal, Azad Gher khal and Abashan khal
- Re-excavation of 12 internal drainage khals of in total 27 km.
- Link canal of 7.5 km from outfall of Gopal khal to outfall of Samitir khal

2.3.3 The new situation

The model results show that a substantial drainage improvement would occur if the abovementioned interventions are indeed implemented. Presently, in case of three days of rainfall, 98.7% of the area would remain flooded. In the new circumstances, 8.57% of the area remains flooded i.e., about 91.5 % area becomes flood free. Water levels can be controlled by the regulators. The embankment would stop salt water intrusion. This would dramatically improve the conditions for agriculture production (see Chapter 5).

2.4 Cost estimates and benefits

2.4.1 Costs

Table 2.1 presents the summarized costs of the proposed water management infrastructure.

Table 2.1 Summarized costs of proposed water management infrastructure (Lakh Taka)

Sl. No.	Project Infrastructures	Length/ No/cum	Unit	Rate (Tk.)	Amount as per schedule rate 2013
1.	Drainage Sluice				
	1.1. 1 Vent dr. Sluice (1.5 x 1.8 m)	5	No	160	800
	1.2 2 Vent dr. Sluice (1.5 x 1.8 m)	1	No	200	200
	1.3 3 Vent dr. Sluice (1.5 x 1.8 m)	3	No	280	840
2.	Embankment				
	2.1 Sea dyke	15.84	Km	150	2376.00
	2.2 Interior dyke	6.95	Km	120	834
3.	Re-excavation of channel	562889	Cum	121.95	686.44
4.	Excavation of link canal	187629	Cum	121.95	228.81
Total					5965.25

2.4.2 Benefits

The benefits of the water management plan as presented above are multitude. The peripheral embankment provides a much safer environment for the people in the study area. The embankment means a huge step forward in their physical security. Economic prospects will become much brighter because of the improved environment for productive activities as crop agriculture and cultured fisheries. The embankment, in combination with the regulators and the re-excavated drainage channels creates a fresh water environment in which water levels can be controlled and which will gradually lower soil salinity. This will boost the agriculture production, while settlers will be inclined to invest more in fish ponds. Although grazing facilities will be reduced, livestock is expected to benefit from the increased availability of fodder. The proposed water management system is likely to improve the drainage situation in the adjacent polder 59/3B as well.

Chapter 3 Internal infrastructure

3.1 Existing infrastructure

3.1.1 Communication network

There is no permanent road network within the study area except 17 earthen roads with a total length of 19.685 km. These roads are at the western side linked with the western peripheral embankment of polder 59/3B. The earthen roads are in very bad condition and movement in the monsoon season is problematic. Most of the roads are inundated during high tide in the rainy season. They obviously need maintenance and further development. Within the study area there is no road suitable for cars that can be used throughout the year. A small car or microbus can ply during the dry season only.

3.1.2 Tube wells and sanitary facilities

There are 10 to 12 deep tube wells in the study area. The tube wells are the main source of water supply. There are shallow tube wells as well, but they are inadequate, due to the possibility of arsenic pollution of the drinking water. Sanitation facilities in the area are almost zero. Most of the household are using katcha latrines. A very limited number of households are using a single pit latrine.

3.1.3 Ponds

Of the study area, almost 1% is occupied by homestead ponds and ditches. Almost in every homestead there is a small pond/ditch to collect rain water for domestic use. It is also used as water for cattle. Ponds and ditches become dry during the pre-monsoon period and are filled up in the rainy season. There are about 10-15 moderately large ponds in the study area, used by people for culture fishery and other domestic uses, covering an area of 8.04 ha. There are six large size private fish farms in the study area. All of the farms have started aquaculture activities. Total area of the fish farms is 282.80 ha. For more information on the fish farms, see Chapter 7.

3.1.4 Other infrastructure

The infrastructure in the area appears to be well developed in the north- eastern side and not so much in the southern part. There are six sluices in the embankment of polder 59/3B. There are two cyclone shelters, two primary schools, some small bazars along the embankment of polder 59/3B, one Asrayon complex (clustered village) and six mosques.

3.2 Proposed internal infrastructure

3.2.1 Multipurpose cyclone shelter

Emergency cyclone shelters are proposed to enhance the degree of security for the people in times of tidal bores and cyclones. The shelters can also be used for other purposes like educational institution, place of social gathering etc. There are 2,100 household in the study area. In view of the likelihood that this number will further increase, assuming an increase to around 2,500 households, five shelters have been planned for, taking as basis roughly 500 households per cyclone shelter. Shelter sites are selected in densely populated area preferably near market places and mosques. The proposed places are: 1) Near Haji Jame Mosque 2) Near Sagor kamal Jame Mosque 3) Samitir Char 4) Near the mosque adjacent to Partex group fish project 5) Char Alauddin. The final sites for the shelters will ultimately be decided after discussion with the population.

3.2.2 Water supply and sanitary facilities

The presence of 2,099 households would require 140 tube wells, applying the standard of 15 families per well. A future increase in households to about 2,500 will result in a higher number of families per tube well. Since there are 10-12 existing deep tube wells, this leaves a balance of 130 new wells. The proposed installation of 155 new wells takes into account water supply for cyclone shelters, Mosques and public toilets. A provision of five rain water harvesting schemes has been kept for locations where deep tube wells are not feasible.

One single pit latrine is provided for each family. With the expectation of more immigration, 2,500 latrines are taken up in the proposal. Provision of a public toilet is considered at five places.

3.2.3 Rural roads, bridges and culverts

New rural roads will significantly improve the communication within the study area and with the adjacent areas, by connecting the area with the feeder roads and the embankment. The proposed new and to be developed existing roads are R2 type of LGED standard: Its specifications will be: crest width - 3.7m; side slope - 2:1m; crest level - 5.00m PWD. It is proposed to construct a little over 3 km of new roads, in addition to the nearly 20 km. of existing roads. The exact location of the new roads will ultimately be decided after discussion with the settlers.

The road alignment has provisionally been set in such a way that the number of bridges and culverts required are as low as practically possible. Provision of three bridges has been kept. For cross drainage, a number of pipe culverts are planned for, to be located at appropriate places.

3.2.4 Overview and cost estimates and benefits

- Proposed internal infrastructure

Table 3.1 provides an overview of the proposed internal infrastructure, as well as of the estimated costs to build the infrastructure. It is recommended that land is allocated for markets, secondary schools and graveyards. Construction of these facilities has however not been taken up in the plan.

- Cost estimate

Table 3.1 Proposed internal infrastructure and estimated costs (in Lakh Taka)

Sl. No.	Infrastructure	Length/No.	Unit	Cost	Total Cost
1.	Rural roads (Type R-2)				
	Existing earthen road development	17.86	Km.	10	178.6
	New earthen road	2.36	Km.	20	47.2
2.	Bridge 20m span	1 Nos.	each	70	70
	Pipe culverts	10	each	4	40
3.	Multipurpose Cyclone shelter	5 Nos.	each	160	800
4.	Deep tube well	155	each	0.85	131.75
5.	Single Pit latrine	2500	each	0.04	100.00
6.	Public Toilets	5	each	11	55
7.	Rain Water Harvesting Schemes	5	each	1	5.0
8.	Pucca Road	4	km	90	360
Total Cost					1787.55

- Benefits

The upgraded and expanded road network will contribute to the greater safety of the char population by enhancing the possibilities for them to go to safer places. At the same time the roads will stimulate economic activities and thus promote the general economic uplift of the area. Markets, workshops and shops will emerge, providing employment opportunities and income for the settlers. The cyclone shelters obviously increase the security of the population, while the possibility of establishing schools in the buildings, increases the educational opportunities, especially for children. The deep tube wells will improve the health status of the population and will lessen the daily workload of the women. Sanitary facilities have a direct positive health impact.

Chapter 4 Land settlement

4.1 Introduction

Land settlement is an essential component of the CDSP-project, right from the start of CDSP I in 1994. The ultimate aim of this component is to provide hitherto landless households with a title on the land in newly developed chars. Since that first phase a total of 20,827 khatians (land title documents) have been distributed by the Ministry of Land in the framework of CDSP. Monitoring exercises indicate that over a period of on average 12 years, 80% of the original settlers still lived in the area and of these, 85% still had their original allocation of land.

Providing a title, directly contributes to the main objective of CDSP: improving the livelihoods of settlers in coastal char areas. Families in these new chars come from different areas, often from locations where erosion occurred and land was lost. It considerably broadens the asset base of the households. The legal security that the document gives to the settlers will stimulate them to invest in their newly acquired land, which will have a positive effect on the agricultural production. Being landowners, the social status of the households is enhanced and the self-confidence of the settlers is increased.

According to Government regulations, newly emerged land has to be distributed to the landless (Policy for settlement of agricultural khas land of 1997), including a title on the land to a maximum of 1.5 acre per household. It is the task of the Government to apply the law and initiate and complete the process of land settlement (providing eligible households with a title). The Ministry of Land is one of the partner implementing agencies of CDSP. In the project innovative procedures are followed which bring the whole settlement process closer to the people, are more transparent, shorten the duration and make it far less costly for the settlers.

4.2 Present situation

4.2.1 The study area

The size of the area of this study is 8,038 acres or 3,254 ha. This figure is based on records with the various Ministry of Land offices and on the findings of the members of the engineering section of the feasibility study team. Of the total area, 3,788 acres (1,534 ha) are under Subarnachar Upazila and the remaining 4,250 acres (1,720 ha) are under Companiganj Upazila, both In Noakhali District. There is some uncertainty about the exact location of the boundary between Subarnachar and Companiganj Upazila. As both Upazilas are a part of Noakhali District this issue can be solved by the District administration. The number of households in the area is estimated at around 2,100. The present status of the land is reflected in Table 4.1, giving Mouza- and Upazila wise information. It shows that the overall, gross area of all mouzas is 22,627 acres (9,179 ha), of which slightly more than one third is in the study area. Of the 8,038 acres in the study area, 2,800 acres have already been officially settled; only a small part has been distributed to people actually living in the area. For 669 acres the settlement process was on-going at the time of the study (October 2013). On 763 acres valid ancestral claims exist (with a maximum from people living outside the study area). Another 1,920 acres have been declared by the Ministry of Land as shrimp land, or is illegally occupied by some influential land grabbers to be used as shrimp culture land. The clustered village (Asrayon) occupies 12 acres. Since not much public infrastructure exists, it is likely that settlers that migrated to the area and do not have a land title occupy most of the remaining part of 1,875 acres. These 1,875 acres would be available for the land settlement programme in the proposed project. Table 4.1 presents a summary of the status of the land in the study area.

Table 4.1 Status of land under the feasibility study area

Upazilla	Mouza	Mouza total area (in acre)	Area under Feasibility study	Area(in acre)						Available for settlement
				Already settled	Under settlement process	Declared or illegal Shrimp Mahal	Clustered Village /Asrayan	Ancestral land	Misc. (Court case, etc.)	
1	3		4	5(a)	5(b)	5(c)	5(d)	5(e)	5(f)	6
Subarnachar	Char Khandakar	1912.92	100.00	0	0	0	0	0	0	100.00
	Char Mozammel	333.48	150.00	0	0	0	0	0	0	150.00
	Char Banani	424.83	424.83	0	0	0	0	0	0	424.83
	Unsurveyd Banani	1000.00	500.00	0	0	0	0	0	0	500.00
	Char Akramuddin	3171.12	1235.56	99.83	0	730.00	0	405.73	0	0
	Char Alauddin	2664.66	932.33	66.27	0	564.06	0	302.00	0	0
	Torab Ali	6032.00	446.00	362.00	0	29.00	0	55.00	0	0
Upazilla Total		15539.01	3788.72	528.10	0	1323.06	0	762.73	0	1174.83
Companiganj	Char Pollabi	3009.66	3009.66	1797.10	668.56	532.00	12.00 (Asrayan)	0	0	0
	Unsurveyd Pollabi	700.00	700.00	0	0	0	0	0	0	700.00
	Gangchil	3381.47	540.00	1025.00	0	65.00				0
Upazilla Total		7088.11	4249.66	2272.10	668.56	597.00	12	0	0	700.00
Grand Total		22627.12	8038.38	2800.20	668.56	1920.06	12.00	762.73	0	1874.83

4.2.2 Official settlement and illegal occupation

As the table above shows, a considerable part of the total area of 2,800 acres that have officially been settled is situated in Char Torab Ali and Char Gangchil (combined 837 acres). This is partly the result of land settlement efforts in those mouzas under CDSP II. Then 219 households received land with each 1.5 acres on average, which makes 330 acres in total. According to information of local sources, much of the remaining settled area (approx. 2,470 acres) is in the hands of people living outside the area. Although not present in the area, these absentee landowners do own the land in a legal manner. As mentioned earlier, around 2,100 households are living in the area (in October 2013). Assuming that approximately 220 of these households have a legal title means that about 1,880 are illegally occupying land, the aforementioned 1,875 acres. Of these 1,880 households, 310 have been settled in an Asrayan (clustered village) constructed by the government agencies.

In addition, there are 21 shrimp projects, occupying approximately 1,920 acres of land in the feasibility study area. This land was declared as shrimp land by the Ministry of Land, most probably based on the outcome of an inter-ministerial meeting in February 2004. The High Court has declared that the status of that meeting was not legal. But it is still uncertain whether in fact the decision with regard of the declaration of shrimp land still stands or should be regarded as invalid. Nijera Kori, a reputed national NGO, started a court case on this matter. This case however is still pending. The ultimate fate of the 1,920 acres is therefore as yet uncertain.

4.2.3 Meeting supply and demand

The demand side for the available khas land essentially will consist of the demand for land by the households that are already settled in the area and have no khatian (around 1,880). In addition, there will be demand from government agencies for land needed for development of public infrastructure as embankments, roads, cyclone shelters etc. Experience has learned that about 25% of an area is needed for such collective investments.

The available supply consists of 1,875 acres, the size of the khas land at the moment. There are no claims from the Forest Department. Applying proportionally the rule of 25% requirement for infrastructure, of the 1,875 acres only 1,406 acres is available for allotment to landless households. If this land is indeed given to the households that have settled in the area and have no official land title (approx. 1,880), each household could receive 0.75 acres. This would mean that a sizable land settlement program can be undertaken in the study area. In case the earlier mentioned pending court case is decided in favor of Nijera Kori, another 1,920 acres would become available as khas land and would be available for distribution among landless families.

4.2.4 Proposed interventions

The following interventions are proposed as part of the land settlement programme in the Cluster of Chars in Subarnachar and Companiganj Upazilas.

- The status of the decisions taken during the inter-ministerial meeting of 12 February 2004 has to be monitored. The outcome will have a significant impact on the amount of khas land that would be available for the land settlement programme.
- As was done in previously CDSP phases, a plot-to-plot survey should be undertaken in order to define the demand for land from the already present settlers. If available resources would allow it, it could be considered to start this survey in the CDSP IV period. That would give a clear overview of the situation before the proposed new project would start.
- It is important that the Ministry of Land takes the decision to apply the CDSP procedure for the settlement process in the proposed project. This procedure contains less steps, is therefore shorter, is more transparent, closer to the people and also less costly for them.

4.3 Costs and benefits

4.3.1 Costs

Implementation of the land settlement component of the proposed project will be the responsibility of the Ministry of Land. NGOs however could assist in informing the settlers about their land rights and about the settlement procedures. The Ministry of Land has to make staff available for the implementation, belonging to offices at different levels of the Ministry. The Ministry might attract additional staff for the purpose, but this staff could possibly be drawn from other areas where currently no settlement is ongoing. No extra costs would be involved, since all staff is covered under the existing budget of the Ministry of Land. The plot-to-plot survey will however bring extra costs. With a view on the size of the project area and the experiences to date, it can be estimated that about Taka 60 lakh are required for the survey. Under the responsibility of the Ministry of Land a number of households have to be resettled, because they have settled in areas where infrastructure will be built. Costs involved with the resettlement can roughly be estimated to be Taka 600 lakh; so total costs would be Taka 660 lakh.

4.3.2 Benefits

It is difficult to translate the benefits of the land settlement efforts into a particular amount in Taka. Experiences have shown that the provision of land titles contributes to an economic and social transformation of the communities concerned. The security that they indeed own the land, will lead to extra investments in the land and presumably to higher production levels. There are likely to be less sharecropping arrangements in favour of more own cultivation. Immaterial benefits are the enhancement of the social status and increase in self-confidence. As can be witnessed in areas where CDSP has been operational, prices of land will considerably go up, further strengthening the asset-base and making it easier to obtain loans, if needed.

Chapter 5 Agriculture

5.1 Introduction

Agriculture is the dominant productive sector in the study area. For around 65% of the families, the main occupation is related to agriculture, either as farmers or as daily labourers. The proposed water management interventions, explained in the previous chapter, are expected to have a significant impact on agriculture. In the cost/benefit analysis of the proposed package of interventions, the economic benefits generated in the sector due to the improved water management situation are a key factor. Below, attention is given first (5.2.) to the current situation in the area, reviewing present production figures and constraints. In section 5.3 a future scenario is described, taking into account the changes brought about by, mainly, the peripheral embankment and the improved drainage system. Other measures are required as well, such as a higher level of extension services, and credit- and marketing facilities.

5.2 Present situation

5.2.1 Cropping pattern, cropping intensity and total production

At present, nearly 80% of the crop is produced by local varieties of transplanted aman rice (July-December). There is no rice cultivation in the aus (March-July) or boro (December-May) season. In winter, some rabi crops are grown, such as pulses (khesari, mungbean), oilseeds (groundnuts, linseed), tubers (sweet potatoes), spices (chillis), and vegetables (tomatoes, ladies fingers and brinjal). The cropping intensity is 110%: single cropping aman 70% and double cropping aman 20% and rabi 20%.

Table 5.1 Present crops, area (ha), yield (t/ha) and production (tons)

Crops	Crops Name and area (%)	Area (ha)	Yield (t/ha)	Production (ton)
	1	2	3	4
Rice	Aus (Local)		-	
	Aus (HYV)		-	
	T.Aman Local (90%)	2390	1.23	2940
	T.Aman HYV		-	
Rice Total		2390		2940
Pulse	Khesari (5%)	133	0.60	80
	Mung (2%)	53	0.45	24
Oilseeds	Linseed (1%)	26	0.50	13
	Ground nut (2.5%)	66	0.90	59
Spices	Chilies (dried) (1.5%)	44	0.45	18
Tubers	Sweet Potato (3%)	80	5.0	400
Vegetables				
S. Vegetables	Ladies finger (2%)	53	1.25	66
W. Vegetables	Brinjal (1.5%)	40	1.85	74
	Tomato (1.5%)	40	2.40	96
Non Rice Total		531		830
Grand Total		2921		3770

5.2.2 Presence of extension services and use of inputs

Extension services from the side of the government are totally absent in the study area. Half of the farmers report that they received some support from NGOs.

The use of agrochemicals is still low in the area. Pesticides are only used in the cultivation of aman paddy. Fertilizers (urea and TSP) are applied in both rice production (in total 35-50 kg. per hectare) and growing of rabi crops (total ranging from 25 to 55 kg. per hectare). About 60% of the cultivated area is ploughed with a power tiller, the remaining part with animal power.

5.2.3 Homestead agriculture

The average homestead area, including pond, is 0.13 acre. The older households have more trees and vegetable crops than the more recent settlers. There are many vegetables that are cultivated in the homesteads and in the banks of the ponds. The major ones are cucumber, gourds, okra, amaranths (lalsak), tomato, brinjal, etc. At present proper planning and management of homestead vegetable productions are lacking. Women usually take initiative and care of the homestead vegetable production.

5.2.4 Constraints

Farmers mention the high soil salinity, intrusion of saline water and high tidal surges as the main factors damaging the crops. These are followed by loss of crops caused by insects and diseases. The lack of support services is also felt to be a major constraint in agriculture production. In addition there are problems with landownership, high prices of agricultural inputs and low prices of produce. The absence of proper marketing facilities contributes to the low prices.

5.3 Future scenario

5.3.1 Projected cropping intensity

Table 5.2 shows that the cropping intensity is likely to rise to 160 in five years and 185 in ten years. The increase is largely due to expansion in areas under rabi and aus crops. This is a realistic expectation, because cropping intensities in older CDSP areas have reached over 200.

Table 5.2 Present and projected cropping intensities (%)

Name of the Chars	Year after poldering	Rabi/Boro Season	Kharif-I/Aus Season		Kharif-II/Aus Season		Cropping Intensity (%)
		Non-rice Crops	Aus rice		T-Aman		
			HYV	Local	HYV	Local	
Cluster	Base Situation (Present)	20	-	-	-	90	110
Cluster	5 th year of poldering	50	14	6	15	75	160
Cluster	10 th year of poldering	60	30	5	40	50	185

5.3.2 Future crop yields and production

A shift from local varieties to HYV aman rice can result in a yield increase of more than 100%, from 1.23 ton to 3 ton per hectare. For most rabi crops, yield increases will be less spectacular, but still significant: from 20% for tubers, to nearly a doubling of yield for pulses.

The combination of a higher cropping intensity and higher yields will result in considerably higher overall production. The combined total of rice and non-rice produce is currently 3,770 tons, and is projected to increase to 7,935 tons in the fifth year after empoldering and further to 10,698 tons after ten years.

This development is largely due to the more favourable situation created by the proposed water management system. The control over water levels and better drainage by the excavation of khals and establishment of regulators, the prevention of salinity intrusion and damage by storm surges by the embankment, and the gradual decrease in degree of soil salinity are major contributing factors.

5.3.3 Homestead production

Currently, 35% of households are growing homestead crops. It is assumed this will increase to 50% if the proposed interventions are carried out. Average plot for vegetable production is about 3 decimals. Not only the total area under home stead agriculture will expand, also yields will benefit from the improved environment. Yields of vegetables will be higher, on average possibly up to 50% more: ladies fingers from

40 to 60 kg for an average homestead, red amaranth from 20 to 30 kg, tomatoes from 40 to 52 kg and brinjal from 50 to 70 kg.

5.3.4 Support services and marketing

To achieve the projected cropping intensity of (185%) from the 110% at present, after ten years, support services need to be improved and strengthened. DAE has to expand its extension network to the study area and has to work closely with the Farmers Forums (see 10.4). Effective collaboration with NGOs (especially with regard to homestead production) should be established. Experiences in previous CDSP phases warrant the use of productivity zones to target the extension services to households in different areas of the newly created polder. It can be expected, again based on experience in earlier CDSP areas, that branches of banking will open in the area, once the banks are convinced economic development will take off. Supply of credit beyond money lenders would be vital for an improved agricultural sector.

The construction of rural roads will facilitate the communication between farming households and markets. But it is essential that suitable marketplaces are developed.

5.4 Costs and benefits

5.4.1 Costs

The costs for the proposed package of support services are estimated to be Taka 40 lakh per year, based on experiences in CDSP projects: demonstration farms Taka 10 lakh; preservation of seeds, incl. purchase of container and training) Taka 5 lakh.; training and extension Taka 15 lakh.; workshops/seminars Taka 5 lakh; and establishment Taka 5 lakh.

5.4.2 Benefits

It should be noted that the net cultivated area after implementation of the infrastructure interventions will decrease from 2656 ha to 2386 ha. Table 5.3 shows a rice production increase with 5022 ton and non-rice production with 1,906 ton per year ten years after empoldering. The value of these incremental benefits can be estimated at Taka 1,011 lakh. The net benefits generated by the higher homestead production can be put at Taka 14.01 lakh, assuming 50% of the households will put 3 decimal under homestead agriculture.

Table 5.3 Development in production and cropping intensity

	crops	Crops Area		Crops Production		Cropping intensity (%)
		Area (ha)	(%) Increase	Production (ton)	(%) Increase	
Present (baseline)	Rice	2390	-	2940	-	110
	Non rice	531	-	830	-	
5th yr of poldering	Rice	2624	9	5833	98	160
	Non rice	1192	124	2102	154	
10th yr of poldering	Rice	2982	24	7962	170	185
	Non rice	1432	169	2736	230	

Chapter 6 Livestock

6.1 Introduction

For the country as a whole, the livestock sector accounts for 3.2% of GDP and for 11% of agricultural GDP. In unprotected areas, these figures are probably higher, given the low crop production and the ample availability of grazing land. Livestock generates income and is at the same time a valuable source of high quality protein. It also provides, to a limited extent, draft power for crop production and transport. In the estuarine environment, livestock has a strong element of risk aversion. In the vulnerable environment of char areas, it is seen as a reliable source of cash income for small farmers. The large and influential farmers often own large herds of buffalo and cattle that graze on the newly accreted lands.

6.2 Present situation

6.2.1 Livestock population

Based on a sample survey among households, it is estimated that the total number of cattle/buffalo owned by settlers is approximately 3,000 (with an average value per animal of Taka 16,850), of goats/sheep 3,500 (Taka 2,100), of chicken/duck 26,000 (Taka 39) and pigeons 100 (Taka 263). Average income is around Taka 12,000 per year, which means that livestock forms a significant part of household income.

6.2.2 Support services and marketing

The extension support from the government is very limited. One para-vet is covering the area, providing on demand support mainly for de-worming and occasionally vaccinating animals. The para-vet is however not working under supervision of the Upazila Livestock Development Officer. Artificial insemination is almost unknown in the area. Such services are available in distant townships, while the charges are very high. Farmers are very much dependent on middlemen in marketing their livestock and livestock products. Spot prices are decided upon by the middlemen, with high profit margins for them. Cattle and goats are herded and marketed in Noakhali and Chittagong by the middlemen, while chicken, ducks and eggs are collected door by door by petty traders and are then marketed in small townships in Noakhali. Farmers cannot estimate the actual value of what they are selling and are consequently receiving less money than they ought to.

6.2.3 Constraints

The most important constraints as seen by the settlers was the shortage of feed, especially when there is a standing rice crop in the field and animals are essentially restricted to the homesteads. Small farmers have little access to distant newly accreted land with urir grass. Poor housing for the animals was considered to be a second major constraint, followed by animal diseases (bacterial diseases, parasitic infestation). Other factors impeding further livestock development are the poor genetic quality of animals, the inadequate marketing system and the lack of support services.

6.3 Future livestock development

6.3.1 Growth in livestock population

In case the study area is protected by a peripheral embankment, as proposed in Chapter 2, the grazing facilities for large livestock will be reduced. However, the cropping intensity and total crop production is expected to become significantly higher (see Chapter 5). This will have a positive effect on the availability of crop residues. This increased supply of fodder will ultimately result in a higher growth of the livestock population. Based on expectations for CDSP IV areas, the following growth annual figures are applied: cattle/buffalo 2.8%; goat/sheep 5.2%; chicken/duck 7%. The increases will occur in the first six years and will stabilize from the 7th year onwards. The number of cattle/buffalo is projected to be around 3,600 at that time; goat/sheep around 5,000 and chicken/duck around 43,000.

6.3.2 Support services

Because the Regional Fisheries and Livestock Development Component (RFLDC), supported by Danida, is no longer operational, it is recommended that in a future char development programme, the livestock sector is included in the social- and livelihood component, to be executed through NGOs. These NGOs should appoint staff with livestock development expertise. Initial development efforts address the constraints. Farmer training should be oriented towards improvements of low input systems and services should concentrate on vaccination, other basic animal health care services, and limited supplies of key inputs for semi-scavenging poultry and backyard fodder. The government department, the Department of Livestock Services (DLS), should be involved in particular in training activities and supply of vaccines. See also Chapters 9 and 10 (especially sections 9.3.6. and 10.4.2.).

Links with the private sector should be maintained for supply of veterinary inputs. A good example is the South Noakhali CBO Association, which already has links with the government and with private sector suppliers. The private sector is of course vital as well for the necessary expansion of the network for marketing livestock and livestock products.

6.3.3 Training of farmers

NGOs should revise or develop curricula for training of farmers in livestock related subjects. The training should be targeted at the members of field level institutions such as the credit- and savings groups of the NGOs, the Water Management Groups, Farmer Forums and the Social Forestry Groups (see section 10.4.). Especially the Water Management Groups should play a central and coordinating role. In each group resource persons should be identified (Poultry Workers and Community Livestock Workers). They should be trained by the Upazila Officer of DLS. The training programme requires close cooperation with government departments, apart from DLS, such as the Bangladesh Water Development Board (involvement of Water Management Groups), Department of Agriculture Extension (training of members of Farmer Forums) and the Forest Department (training of Social Forestry Group members).

6.3.4 Marketing of livestock and livestock products

Organized farmer groups should be better informed about the livestock market value chain, so they can bargain for better farm gate prices for their products. Collective bargaining should be promoted, reducing the risk of overexploitation by the operating middlemen. The process would include: contact with input sellers and establishment of input sellers close to the communities; marketing workshops and publication of market promotional materials; establishment of contracts with milk processing facilities; negotiations with DLS to have access to inputs on a priority basis; promotion of home consumption of high quality animal protein and include in each household diet.

Milk and milk products are highly perishable and deserve priority in any development oriented intervention. Since fresh milk fetches the highest price, simple rural hygienic milk collection and processing can be introduced by installation of electric/diesel operated milk chilling vats. This can be integrated with the national milk marketing network, through the NGOs. Hygienic milk products like ghee, cheese, yoghurt etc can be produced and marketed to distant markets. The company Milk Vita is known to have installed one chilling vat in the region, which transports milk products to the market in Dhaka.

6.4 Costs and benefits

6.4.1 Costs

As said, the foreseen development of the livestock sector is especially connected to the growth of the agricultural sector. Livestock benefits indirectly from the investments in crop agriculture. The increase in yields and cropping intensity, leading to a much higher crop production, will result in a growth in supply of fodder. This will tackle one of the major constraints and will stimulate development of the livestock activities.

Additional costs are related to the proposed improvement in support services and training of farmers. This will be done by NGOs. Consequently, these costs are included in the cost estimate of the NGO component, as reflected in Chapter 9, especially section 9.4.

6.4.2 Benefits

In the estuarine environment, livestock production is considered as a strong element of risk aversion in farming systems and a good stock of large animals is considered as an important hedge against financial distress. Livestock and poultry raising offers a reliable source of cash income for small farmers and daily labour households. Small ruminants and poultry are easy to acquire and can be reared on very little land with little costs. The proposed interventions would reduce preventable mortality and morbidity of domestic animals. The number and productivity of the existing herd of cattle, buffalo, goats are expected to increase. The expected increase in numbers of livestock population will occur over a period of six years and expected to stabilize in the 7th year of project implementation. The expected incremental benefits from livestock population growth are presented in Table 6.1. No reliable data on increase in productivity of livestock (milk and meat) in the area are available. So it has not been included in the benefit stream.

Table 6.1 shows that the growth in numbers of livestock represents an incremental value of nearly Taka 90 lakh per year from the seventh year after implementation of the interventions.

Table 6.1 Estimated incremental values of livestock population growth (in Lakh Taka)

Year	Incremental Value of Livestock			
	Cattle/ Buffalo	Goat/ Sheep	Chicken/Duck	Total
1	0.00	0.00	0.00	0.00
2	8.33	2.02	0.44	10.79
3	16.65	4.22	0.94	21.81
4	25.96	6.66	0.81	33.42
5	35.08	9.20	2.06	46.34
6	44.69	11.91	2.70	59.30
7	71.29	14.91	3.41	89.62
7-19	65.52	18.02	4.19	87.74

Chapter 7 Fisheries

7.1 Introduction

The cluster of chars under the study is inhabited by approximately 2,100 households. Currently 8.77% households are directly dependent on fishing for their livelihoods. Most fishing activities are carried out outside the char areas, mainly in the river Meghna, Hatya Channel and in the Bay of Bengal. At present the fisheries activities by individual households on both open and close water bodies in the study area are very limited. There are six large commercial fish farms in the area.

7.2 Present situation

7.2.1 Closed water fisheries

- Ponds and ditches

Closed water bodies for culture fisheries include ponds, ditches and borrow pits. They vary in size from 10 to 20 decimals, occupying about 1 % of the study area, creating a total of 30 ha of closed water bodies. Ditches were created by excavation of earth for raising platforms for house construction. Pond fish culture practices by the farmers are not yet developed in the char, mainly due to the lack of adequate knowledge about aquaculture and non-availability of quality and sizeable fish fries. Only a few local farmers practise aquaculture in their ponds by stocking fish fries of rui, catla, mrigala and tilapia obtained from the local fish 'venders'. In the ponds having no regular dykes, the juveniles of wild fish and shrimp /prawns are allowed to enter into and grow up for 6-7 months before harvesting. Present average production rate is 284 kg/ha/yr. There are 4 borrow pits along the embankment of Char Lakshmi of polder 59/3B covering a total area of 25 ha. People catch fish from these water bodies which get stocking from the wild sources during the tides and floods. Present production rate of borrow pits is about 284 kg/ha/yr. Present total annual fish production from these ponds and ditches and borrow pits is about 15.62 MT/year.

The farmers use feed and chemical fertilizers very rarely, some use decomposed cow dung. The cultured ponds suffer from flooding in most of the years, especially at high tides during the monsoon. The major problem of pond fishery however lies in the procurement of fish fries. The present source of supply of fish fry is the 'venders', whose fish fries are found under-sized, unhealthy, and mixed with unwanted species of fishes.

- Large fish farms

There are six large size private fish farms close to Rajar khal and Karim khal. Total area of the farms is reported to be 282.80 ha. All of the farms have already started aquaculture activities, but have yet to be organized to reach full potential. More than 30% of the land under their possession is still vacant. Some ponds with irregular dykes are found to be in use for rearing the wild fish and prawn juveniles, which are naturally stocked during flood from wild sources. These farms procure post larvae of Bagda from Cox's Bazar and fries of major carps and other varieties of fish from hatcheries at Feni, Comilla and Chittagong. Fish produced in these farms are transported to major markets in Noakhali and Comilla Districts and to wholesale markets of Dhaka. Fish production was reported to be 166.20 MT annually and the rate of production was 588 kg /ha/year.

7.2.2 Capture fisheries in khals and flood plains

Open water fishery in the study area is mainly practised in khals and rivers and on floodplains. There are 12 khals, having an estimated total water area of 123 ha, while the depth ranges from 6 to 8 feet. Total depressed flood plain area is about 160 ha. These floodplains remain disconnected with khals and rivers during the dry period. Fishermen catch mainly wild fish and prawns in both fresh and brackish water in open water bodies like borrow pits, khals and the floodplains. They are forming unique habitats for different species of carps, cat fishes, snake heads, and different types of indigenous species of fish. The gear and crafts used for catching fish from these water bodies are: berjal, moijal, vailjal, cast net, behundi jal etc. Crafts used are small size mechanized and non- mechanized boats, country boats, 'dhangi' etc.

The annual fish/shrimp catch from these water bodies is about 16.48 MT from khals and 28.16 MT from floodplains.

7.2.3 Fishing outside the study area

Fishermen catch fish outside the study area, in the Meghna River, the Hatiya and Sanwdip channels and in the inshore and offshore areas of the Bay of Bengal. At the end point of the Meghna khal, at village Char Kanak, about 50 to 60 large and small sheds were found along the bank of the khal and the Meghna River. The local fishermen reported that they use the sheds for their temporary lodging and store for the fishes. About 40-60 fishermen and about 100 fishing boats were found at the site during the visit. There are about 100 boat owners each owning 1 to 4 fishing boats and the fishermen catch fish using these boats on share basis. The percentage of share varies with the season and also on the basis of the species and size of fish caught.

7.2.4 Total current fish production

The total fish production at the moment is estimated at 226.46 MT: 181.82 MT from closed water bodies (ponds/ditches 15.62 MT and large fish farms 166.2 MT) and 44.64 MT from open waters (16.48 MT from khals and 28.16 MT from floodplains). The marine fisheries production in waters outside the project area is not included in the total.

7.3 Fish production if project is implemented

The proposed infrastructure development as described in Chapters 2 and 3 are expected to create substantial positive impacts on fish habitats and productivity of different fisheries production systems in the area.

7.3.1 Fish production in closed water bodies

- Ponds and borrow pits

In project condition, ponds will be free from frequent flooding by tidal and cyclonic storm surges. A favourable physical environment and dependable pond water levels will encourage pond owners and fish farm owners to adopt semi-intensive or intensive pond fishery production modes. This means careful selection of species, higher rate of stocking based on a prescribed number of fingerlings, increased use of inputs as fertilizer and feed. Under the "with project" condition, average annual production rate of household ponds can easily be increased to 1,560 kg/ha/yr using semi intensive method of culture. Borrow pits may be leased out to genuine fishermen and supported by extension services to adopt better culture practices.

- Fish farms

Safe physical environment, proposed ice plant for fish preservation at fish landing centre and better road communication will encourage large fish farm owners to adopt intensive production methods, raising production level to 3,000 kg/ha/yr.

7.3.2 Open water fisheries production

- Flood plains

With project interventions, the flood plain is expected to reduce to 84 ha, but the permanent linkage between floodplains and khals and rivers will be restored. Enhanced connectivity of flood plains will facilitate fish migration and increase productivity. It is expected that floodplain productivity will increase from present level of 176 kg/ha/yr to 200 kg/ha/yr.

- Khal fisheries

Khals will be re-excavated for improvement of drainage systems. The re-excavated khals will retain water during the dry period covering December to April with the support of water control structures. This will create a better habitat for increasing natural fish production in the khals, provided no serious obstructions are made to movement of brood fish and shrimp species. It is expected that khal fisheries production will increase from present level of 134 kg/ha/yr to 160 kg/ha/yr with project condition.

7.5.3 Fish habitat areas and total expected production

As can be seen in Table 7.1, in case the project is implemented, the total fish production per annum at the full development level is estimated to be 970.68 MT. This is an increase of 744.22 MT (valued at Taka 895.10 lakh) compared to the present production of 226.46 MT. Full development level of production will be reached in the fourth year after project completion.

Table 7.1 Fish habitat areas and production under “with project” condition

Habit Type/production system	Area (ha)	Production rate (kg/ha/yr)	Total Production (MT)
Open water			
Khal	123	160	19.68
Flood Plain	84	200	16.80
Sub total	207		36.48
Close Water			
Ponds, B. pits	55	1560	85.80
Large fish farms	282.8	3000	848.40
Sub total	312.8		934.20
Total			970.68

7.4 Development plan

As remarked earlier, the proposed infrastructure is expected to increase the overall fish production in the study area. This positive development would be supported further if additional interventions would be undertaken and promoted. A summary of such measures follow below.

7.4.1 Marketing system

The fish marketing system in the study area is poor and inadequate. Transportation of fish to the markets by the fish traders is difficult due to inadequate supply of ice and lack of proper road communications. The traders sell the fish either to the shops of Subarnachar or to the whole sale markets of Maizdi town. The fish caught by the fishermen from the Meghna river and estuary are mainly sold in the market of Steamer Ghat (west of the area). Catches from the Sandwip and Hatiya channels and the sea are sold in Chittagong and other suitable areas. The fishermen community does not get the proper prices for their catches due to the poorly organized marketing system and marketing facilities. The situation warrants construction of a fish landing platform with facilities for fish preservation. Minimum facilities related to safe berthing, fish landing, fish auction sheds, and ice plant for preservation of fish, will be necessary. An appropriate site for creating the facilities would be on or near the banks of Noakhali Khal or the Meghna River. The estimated total cost of boat landing platform and ancillaries is Taka 50 lakh.

7.4.2 Development of culture based fisheries

After construction of the proposed embankment, the empoldered area will be a flood-free and fresh water zone creating congenial physical conditions for improved culture-based fishery in the area. Measures are recommended for improving culture-based fishery in the area, such as construction of new ponds and rehabilitation of the existing ponds by individual households to make them suitable for aquaculture; selection of fish species should have a scientific basis; culturing fish in paddy fields during rainy season when sufficient water is available for 4-5 months should be promoted; easy access to the banks for financial supports to the fishermen should be ensured. Culture of Golden Prawn in ponds should be promoted. If prawn fries in sufficient quantities can be made available either from the natural sources or from the hatcheries, it is possible to raise 2 crops in a year and about 2 MT/ha of prawn can be produced annually. About 20% of ponds (6 ha) can be brought under prawn culture.

7.4.3 Extension services

Services provided in the area by the Department of Fisheries are insignificant. In previous CDSP phases, extension efforts were supported by the Regional Fisheries and Livestock Development Component (with

technical assistance and funds from Danida). However, this project is no longer operational. It is recommended to give NGOs the responsibility of providing technical support to fishery activities. The Department of Fisheries should be involved by imparting training to members of field level institutions (see section 10.4.) as aquaculture resource persons.

7.4.4 Establishment of fish hatchery

High quality fish seed is the most important requirement for aquaculture development. With the possible increase in the number of individual cultured ponds and big fish farms adopting intensive production modes in a protected environment, the demand for fish fry/fingerlings shall increase manifold. Presently the individual pond owners and big fish farms procure fry/fingerlings from hatcheries in Comilla and Cox's Bazar. This means that there is a bright prospect for the establishment of a hatchery in the project area. The Department of Fisheries may take the initiative for the establishment of a fish hatchery on partnership basis with the private sector, preferably involving one of the large fish farms operating in the project area. Involvement of the private sector is essential for early construction of the hatchery and proper operation and maintenance to ensure sustained supply of fish fry.

7.4.5 Development of fisheries in open water bodies

The proposed water control structures should be made fish friendly as much as possible. Re-excavation of khals will obviously improve fish habitat. A further increasing of fish and prawn stock can be achieved by an intelligent use of the water control structures and special devices. Control of the frequent piracy in the fishing grounds by the Coast Guards needs to be strengthened.

7.5 Costs and benefits

Apart from the Tk. 50 lakh for a landing platform for seagoing fishing boats, no specific costs have been budgeted for the improvement of fisheries in the study area. Most of the monetized benefits are a consequence of the water management related infrastructure. The costs of improved extension services through the involvement of NGOs are taken into account in the chapter concerned.

The increase in fish production is estimated to be Taka 895.1 lakh per year. The greater availability of fish will lead to greater food security and a higher protein intake, leading to a better health status. It also can contribute to diversification of income of the settlers.

Chapter 8 Social forestry

8.1 Introduction

8.1.1 Functions of forestry

The benefits of forestry development in char areas can broadly be divided into three groups: greater safety; improved ecological circumstances and a better economic situation for the settlers. In case of the here recommended social forestry approach, a fourth benefit is added: integration of local people into afforestation activities.

- Safety

There is ample empirical evidence in the coastal belt that coastal plantations have added protection against tidal bores and storm surges. Devastation of infrastructure and loss of lives have been significantly smaller in areas that were protected by a coastal forest.

- Ecological

Coastal forests, in particular mangroves, further stabilize the newly emerged areas. They stimulate biodiversity and conserve coastal ecosystems. Trees have a dampening impact on soil erosion, while organic matters are contributing to the fertility of coastal soils.

- Economic

Forests provide timber for building houses and fuel for cooking purposes. In addition trees give fruits for human consumption, medicinal herbs, and fodder for animals. By participating in social forestry activities, settlers generate an extra stream of income.

- Social

The social forestry approach, involving male and female settlers through group formation, provides employment to the people, and it enhances their self-confidence and self-esteem by acquiring skills and knowledge. Social forestry can contribute to the homogeneity of communities.

8.1.2 Social forestry approach

The government has enacted specific Social Forestry Rules in 2004, amended in 2010. Essential elements in the social forestry approach are the participation of local people in planning and implementation of forestry development activities, the formation of Social Forestry Groups as institutions to realise the participation and agreements between governmental agencies and the Social Forestry Groups on sharing of the benefits of forestry development. For different type of activities (as for example agro-forestry, road/embankment/khal plantations, and foreshore plantation, different sharing arrangements will be applicable. For strip plantations along roads etc. for instance, the distribution of benefits would be Forest Department 10%, land owning government agencies 20%, SFG-members 55%, Union Parishad 5%, Tree Farming Fund 10%. For foreshore plantations it would be Forest Department 25%, SFGs 55%, land owners 20%, Tree Farming Fund 10%.

8.2 Present situation and constraints

The Forest Department started afforestation of the area in 1992. In the early years of 2000, settlers started to migrate into the char and gradually all planted trees were cut and the land was transformed from forest to agricultural land. Currently there are no forestry development activities in the area and the forest coverage is low. Trees mostly can be found on the homesteads. Main constraints for development of forests were the needs of the settlers for agricultural land, thereby encroaching on land of the Forest Department and destroying the vegetation. As in other char areas, this led to a tense relation with Forest Department staff. The uncertainty about land entitlement and the fact that cattle grazes throughout the area, are other detrimental factors. A renewed presence of the Forest Department and vigorous application of the social forestry approach, combined with the need of the people for fuel wood and additional income, will facilitate successful forestry interventions in the future.

8.3 Proposed interventions

The char is thought to be stable. The coastline however needs improved protection. Forestry can contribute to this protection by mangrove plantation along the coastline and by foreshore plantation, directly in front of the proposed sea facing embankment. Further are recommended: plantation along embankments, roads and canal banks, plantation in homesteads and on areas of public institutions.

- Mangrove plantation

It is proposed to establish mangrove plantations on the newly deposited mudflat in the Meghna River from the mouth of the Gangchil khal to the mouth of the Meghna khal. The mudflat is subjected to tidal inundation, with a depth of 75-90 cm. It is estimated that approximately 400 ha are available for mangrove plantation. If the plan for a cross dam between Noakhali mainland and Urir Char is indeed implemented, the land accretion will be accelerated and more mudflats will become available for mangroves. Suitable mangrove species are Keora, Baen and Gewa. As seedlings of these mangrove species are not locally available, a nursery should be established for this purpose. The mangrove plantation will be the responsibility of the Forest Department, through the Social Forestry Groups, to be formed from settlers in the project area, closest to the plantation. Each of the members of the SFG could be allocated one hectare of plantation.

- Foreshore plantation

The foreshore plantation is meant for a length of 10 km outside the proposed embankment that has a total length of 22.79 km. The plantation will have an average width of 100 m., raised on mounds with a size of 10x2.25x0.9 m. The whole planted area will be 100 ha. Proposed species to be planted are Jhaw, Kat badam, Hybrid acacia, Nishinda, Babul, Tetul, Arjun and Jarul. The Forest Department will implement the plantation, through SFG's. Activities like vacancy filling, thinning and pruning will be done by SFG members under supervision of Forest Department staff. The foreshore plantation will protect the newly created embankment against wind and wave action and will contribute to the livelihoods of the settlers.

- Embankment plantation

Trees should be planted along the full length of the 22.79 km. of embankment (sea facing and interior). At the river facing side of the embankment the plantation model is proposed to be as follows: 1st row will be planted with Arhar as live hedge within 30 cm from the bottom; 2nd row: Jhaw, Hybrid acacia, Mahgani, Gamar, neem and Bot; 3rd row: Rajkoroi, Sissoo, Arjun; 4th row: Babul, Khoye Babul, Kadam, Jarul, Jam, Kat badam and coconut; 5th row: Dhancha as live hedge at the toe of the slope. On the country side slope of the embankment the model should be: 1st row will be planted with Arhar as live hedge within 30 cm from the starting of the slope; 2nd row : Jhaw, gamar, Neem, Khejur, Amloki, Arjun, Haritaki, Piara, Epil-epil; 3rd row: Jam, Jalpai, gab, Kadam, Jarul, Narikel, Arjun, Haritaki and coconut. Seedlings can be procured from local public and private nurseries. In addition, interested SFG members could be trained by Forest Department staff to raise seedlings.

- Roadside plantation

The overall length of the proposed roads is 23.59 km. The slope of these roads should be protected by trees. There will be two rows of plantation at each side of the road: 1st row will be planted with Arhar as live hedge on both side of the road within 30 cm from the starting of the slope; 2nd row will be planted with tree species at each side of the road at a distance of 30 cm down from the Arhar line. The plantation spacing will be 2 m x 2 m between the tree species. In case of coconut inter planting distance will be 6 m.

- Plantation along khals

The banks of nine khals in the area are suitable to be planted, for a total length of 25.5 km. The proposed model is to have two rows of plantation: 1st row will be planted with Arhar as live hedge on both side of the canal bank within 30 cm from the starting of the slope; 2nd row will be planted with tree species on both sides of the canal bank at a distance of 30 cm down from the Arhar line. The plantation spacing will be 2 m x 2 m between the tree species.

- Homestead plantation

The homesteads of all the 2,100 households in the area are the target of this component. With guidance and supplies from NGOs, households will be stimulated to plant trees in their own homesteads. The size of the plantation will of course depend on the available space. Suitable species are Am, Jam, Kanthal, Kul, Dewa, Piara, Lebu, Coconut etc. Trees will be selected for fuel wood purposes, the provision of fruits and medical herbs.

- Plantation in public institutions

Community institutions as schools and madrasas, mosques, bazaars and cyclone shelters will be approached to participate in a tree planting programme. Also in this case the plantation will depend on the space that is available. Preferred species would be, among others, Maghoni, Jhaw, Sissoo, Raintree, Arjun, Neem etc. Bot trees may also be planted at public places like hats, bazaars and junction of roads.

8.4 Costs and benefits

8.4.1 Costs

Table 8.1 Plantation costs (Lakh Takas)

Mangrove plantation	Tk. 88.00
Foreshore mound plantation	Tk. 229.76
Embankment plantation	Tk. 36.86
Roadside plantation	Tk. 24.56
Canal bank plantation	Tk. 22.03
Homestead plantation	Tk. 3.55
Institution plantation	Tk. 0.27
Total plantation cost	Tk. 405.03

Added to these costs of plantation (Tk. 40.503 million) should be costs for capacity building and mobilization (Tk. 1.08 million). Total costs would amount to Tk. 41.583 million

8.4.2 Benefits

Table 8.2 Expected income generated by forestry

Sl. No.	Activities	Expected income (Million Tk)
1	Mangrove plantation	12,236.00
2	Foreshore mound plantation	1,183.00
3	Embankment plantation	553.56
4	Roadside plantation	217.5
5	Canal bank plantation	252.19
6	Homestead plantation	717.85
7	Public/community Institutions plantation	16.68
	Total amount (Million Taka)	15,176.78

In addition to these financial benefits, the people and the area will benefit from the forestry development programme as proposed here, because of the function of forests in char areas related to safety, social relations and the ecology, as described earlier in 8.1.1.

Chapter 9 Social and livelihood component

9.1 Introduction

Following the practice in CDSP IV, it is proposed that a social and livelihood component will be undertaken in the study area, implemented through Non-Governmental Organisations (NGO). Although many of the suggested interventions in the fields of water management and the productive sectors have a considerable social impact and will influence the livelihoods of the settlers, it was felt that a few aspects deserved more attention. This chapter sets out the activities in such a programme. It starts with an overview of the strategy and the subjects to be covered (9.2.). In section 9.3 a summary is given of the proposed interventions in each of the subject wise sub-components. The chapter closes (9.4.) with an overview of the estimated costs.

As mentioned, it is estimated that the area has around 2,100 households with a total population of approximately 10,000. The settlers are currently served by only two NGOs, who are active in micro finance. Two NGO-MFIs have micro-finance operations in the study area, Grameen bank and Sagorika Samaj Unnayan Sangstha (SSUS). Currently 20 groups of 478 members and 380 borrowers in micro-credit groups in the project area are operated by Grameen Bank (300) and SSUS (178). They work adjacent to the embankment of polder 59/3B, not in the deep area of the chars. They work only with micro finance; no other activities are performed by them.

9.2 Strategy for NGO support

9.2.1 Objectives

The social and livelihood component implemented by NGOs would have the following objectives: providing essential services to support poverty reduction, both in an economic (productive) and social sense (such as health, education, disaster management and household-level climate change adaptation), that cannot be provided by government agencies at this early stage of development of the char area concerned; delivering micro-finance services, which will enable poor people to take advantage of the improved environment and infrastructure; supporting the activities of government implementing agencies, such as for water and sanitation, where NGOs can form tube well user groups and organize the installation of latrines; promoting human rights and legal awareness, especially for women.

9.2.2 Subjects to be covered

The social and livelihood support programme has been divided into the following sub-components:

- a) Group Formation, Micro-finance and Capacity Building
- b) Health and Family Planning
- c) Education
- d) Water and Sanitation
- e) Homestead Agriculture and Value Chain Development
- f) Poultry and Livestock
- g) Fisheries and aquaculture
- h) Legal and Human Rights
- i) Disaster Management
- j) Awareness on environment and climate change

9.2.3 Number of NGOs

Based on the estimate of the current population and the expected migration of more settlers in the years to come, it is the intention to support the establishment of two branch offices in the area, either by one or by two NGOs. These offices will each serve a particular part of the char, each part with an estimated 5,000 to 7,500 people.

9.3 Proposed NGO services for the study area

As indicated under 9.2.2, the proposed programme will have 10 components. Below, the intended activities are dealt with component wise.

9.3.1 Group Formation, Micro-finance and Capacity Building

As well as paying for the cost for group formation, it is proposed to fund capacity building of group members/ clients and NGO micro-finance staff. Since the micro-finance in the project areas will be relatively new, it will be important for members to learn about micro-credit management, micro-credit discipline, rules and regulations, and to have a basic knowledge of Income Generating Activities (IGA) management. Organizing women char dwellers into NGO groups will be the main institutional platform for offering financial services (savings and credit) and for delivering other services. Micro-finance and other development services are expected to continue even after the end of the project. Projections for group formation are based on an estimated population of 2,500 households in the project. This is higher than the estimate of the present number of households, but it takes into account the expected increase in the period between the time of this study and actual implementation. Also during the project period itself a further increase can be expected. It is assumed one woman from each household will become a member of a group based around micro-finance. Assuming an average group has 25 members, a total of 100 groups will be needed.

As a regular activity the NGO(s) will mobilise group member savings and use a part of this fund to lend out as micro-credit to the group members. Selected NGO(s) must be able to mobilise resources from institutions like PKSF, the major institutional lender for micro-credit in the country. Capacity building will focus on both NGO staff as well as the members of the groups.

9.3.2 Health and Family Planning

The findings of review of the health and family planning aspects during the inception and formulation missions in the project areas as well as experience of the on-going CDSP-IV project reveal critical health and family planning challenges and concerns of the char dwellers. Activities will focus on training, especially Health and Family Planning Facilitators (who will form the backbone of the component) and Traditional Birth Attendants (15 in each NGO branch); clinical services (each branch will have a clinic, run by a Medical Assistant); supply of medicines, contraceptives and TBA-kits; awareness raising and linkages with other health programmes, in particular the vaccination programme.

9.3.3 Education

Human resource development is at the core of Bangladesh's development efforts and access to quality education is critical to poverty reduction and economic development. In the previous phases of CDSP there was no arrangement to implement an educational programme. Children of school going age cannot go to school due to lack of available educational institutions and are deprived from even primary education. A high rate of illiteracy is hindering development initiatives. In the study area there are no government or NGO schools. Among others, activities will include supply of logistics, advance money for school establishment, one teacher for each school and training for NGO-staff. The aim is to establish 15 non formal primary schools in each NGO branch.

9.3.4 Water and Sanitation

It is proposed to install 155 DTWs in the project area (see Chapter 3). Also, every household will receive a latrine under the project. Both interventions are to be implemented by DPHE. The role of the NGO(s) will be to assist DPHE to: (i) select sites for installation, select and form water (tube-well) user groups, collect their contributions, train representatives of user-groups on repair and maintenance of tube-wells; (ii) facilitate distribution and installation of latrines; and (iii) provide training to NGO staff (the NGO staff will provide training to the members of the tube well user group on health and hygiene).

9.3.5 Homestead Agriculture and Value Chain Development

While DAE will implement a component aimed at developing field crops, the NGOs will focus on homestead agriculture (fruits and vegetables). They will also promote tree (fruit and timber) nurseries operated by NGO group members and promote planting of trees around homesteads. The focus of the activities will be promotion of new and improved varieties and technologies through training and high value crop demonstrations. An Agriculture Coordinator will be appointed in each NGO branch office. Training of farmers, demonstrations and dissemination will be the main activities. In respect of value chain development, crop and non-crop products will be identified through rapid assessment of their potential for creating employment, and increasing sales and income. The products could be high value new vegetables, fisheries and livestock, any non-crop processed food and non-food items with good potential in the area. Each branch will implement one value chain development activity each year for five years. A lump-sum amount of Tk 100,000 is allocated for each value chain development project (a total of Tk 500,000 for five years).

9.3.6 Livestock

In previous CDSP phases, livestock development did not form a part of the project. The Danida supported Regional Fisheries and Livestock Development project (RFLDC) was operational at the same in the same areas and took care of the livestock sector. Because the Danish programme has ceased to exist, it is proposed to make NGOs responsible for livestock development, including poultry. Important activities will be the selection and training of vaccinators and paramedics for livestock; supply and preservation of vaccines (to be collected from the Department of Livestock Services and other available sources) and medicines. Each NGO will have one specialised staff member.

9.3.7 Fisheries

As in the case of livestock, it is proposed to entertain fisheries activities through NGOs. Major activities will be selection and training of farmers. The training will focus on selection of species and feed, pond management, raising and distribution of fingerlings and demonstration. Each NGO will have a fisheries coordinator.

9.3.8 Legal and Human Rights

Experience in CDSP IV shows that settlers lack good knowledge on property rights, in particular on land rights and on family laws (marriage law, registration). This places settlers in a vulnerable position regarding getting land ownership, the most valued asset. Besides, women rights issues within the family and rights issues in the wider society need to be addressed. The objective of the sub-component is to inform the members and community about several critical laws, human rights issues through training and other awareness raising activities. This activity will benefit from links to agencies that promote human and legal rights – such as Oxfam and Action Aid. With regard to the land rights and procedures to obtain a land title, close cooperation will be pursued with the Ministry of Land. Training of group members will be the most important intervention. A Legal and Human Rights Coordinator will be responsible for the training.

9.3.9 Disaster Management

The remote coastal project area is specifically vulnerable to natural disasters as cyclones and storm surges. The emphasis will be on awareness on preparedness, disaster management, and mitigation issues. A relation will be developed with the Union Disaster Management Committee. This organization is responsible for the implementation at local level of a major disaster management initiative in Bangladesh. Training of group members and NGO-staff will be the main activity.

9.3.10 Awareness on Environment and Climate Change

The combination of its location, a high population density, poor infrastructure and low resilience to economic set-backs makes Bangladesh, in particular its coastal zone, vulnerable to climatic risk. An essential strategy to mitigate the consequences of this global phenomenon is to assist local communities in adaptation to the gradually evolving changes circumstances. The situation fully justifies efforts to raise awareness about climate change and the environment. The focus will be on training of group members and on introduction of simple measures, like, for example, use of an improved cooking stove and raising plinths of houses.

9.4 Costs and benefits

9.4.1 Costs

Table 9.1 Summary of budget for social and livelihood component (in Lakh Taka)

SI No	Sub- Components	Total
1	Supervision & management cost	
1,1	Supervision & management cost for Coordination office	97.230
1,2	Supervision & management cost for branch office	30.793
1,3	Baseline survey & others activities cost	12.670
A	Total of Supervision & Management cost (1.1-1.3)	140.692
2	Group formation and microfinance	
2,1	Support for group formation	22.310
2,2	Beneficiary capacity building MF group members only	37.132
2,3	MF staff capacity building	8.177
2,4	Beneficiaries risk fund(Credit Insurance)	3.750
B	Total of Group Formation & Microfinance (2.1-2.4)	71.370
3	Health & Family planning	324.155
4	Water & Sanitation programme	43.661
5	Disaster Management programme	28.344
6	Legal and human rights	35,145
7	Agriculture & Value chain	
7,1	Value Chain Development	5.987
7,2	Agriculture Development	35.497
8	Education and Development	149.615
9	Climate Change and Development	114.146
10	Poultry and livestock programme	37.458
11	Fisheries Development	34.096
C	Total of Programmes Support (3-11)	808.104
	Grand Total (A+B+C)	1020.166

Total costs of Taka 1020,166 lakh are calculated for a period of six years.

9.4.2 Benefits

It is expected that the social- and livelihood component will lead to both social and economic beneficial results for the settlers in the study area. Because the groups to be formed by the NGOs consist exclusively of women, the proposed activities will in particular support the improvement of the status of women. The training in legal and human rights can further strengthen their position. The health- and education sub-components will improve the health status and will increase the access for children to primary education.

The support from NGOs for the formation of Tube well User Groups and the training in hygiene subjects will also contribute to better health conditions. The support in selection of sites will facilitate the installation of tube wells, which will lessen the burden of women in their daily task of collecting water. The attention for disaster management will enhance the physical security of the people in emergencies, and can be seen as complementary to other measures such as the establishment of cyclone shelters, improved road network and the protective embankment.

The economic benefits are generated by the involvement of NGOs in homestead agriculture, fisheries and livestock, and in the income generating activities for women. Households will generate more income through these activities, and this will contribute to the general economic uplift of the chars.

Chapter 10 Governance

10.1 Introduction

Governance issues are a key factor in the success of any development effort. Here, the concept of governance is focused on the institutional environment. The question is which institutions have to be involved for proper implementation of the interventions proposed in this report. The fact that interventions are proposed in so many different sectors highlights the conviction that a sectoral programme cannot address the poverty and vulnerability of char settlers. Meaningful and sustained changes can only be brought about by a multitude of activities framed in an integrated programme. This follows the principles of Integrated Coastal Zone Management as reflected in the Coastal Zone Policy and Coastal Development Strategy of the Government of Bangladesh. Similar principles were also adopted by the successive ongoing and previous phases of CDSP projects. In reviewing the institutional environment, this chapter starts with governmental agencies (section 10.2), followed by local government institutions (LGI) in 10.3 and field level, community based institutions in 10.4. The chapter ends with a closer look at the benefits of institutional development.

10.2 Government implementing agencies

10.2.1 Present situation

Presence of government agencies is hardly felt in the study area. The Forest Department was the first government agency to be present when it began afforestation in the early 1990s. But after in-migrating settlers started to cut trees in order to have agricultural land, the presence of the department was discontinued. The Ministry of Land entertained a limited land settlement programme in a part of the study area, particularly in the Companiganj Upazila. An Asrayan clustered village was established. BWDB was involved in the construction of the embankment of polder 59/3B and in the formation of Water Management Groups around the sluices in that embankment. These groups, with support of BWDB, maintain the outfalls that are located within the study area. No other national government agencies are currently active in the area.

10.2.2 Future involvement of government institutions

The package of interventions, as set out in the previous chapters has to be implemented by six implementing agencies (BWDB, LGED, MoL, DAE, DPHE and Forest Department). This is also the case in the ongoing CDSP IV project. These agencies should internalize the lessons from CDSP and apply them in the development programme in the new chars. All agencies should make enough field staff available to plan and implement the programme.

- Bangladesh Water Development Board (BWDB)

BWDB will be responsible for construction of all water management structures (see Chapter 2) as embankment, sluices and drainage channels. It will also be the task of BWDB to form, train and support the Water Management Organization (see 10.4.) as per National Water Policy and Guidelines for Participatory Water Management (GPWM). The WMGs should be provided with an office. As part of the maintenance plans, BWDB is responsible for major maintenance of the water management infrastructure so far built and maintained in the previous phases of the project (CDSP I to IV).

- Local Government Engineering Department (LGED)

It is the responsibility of LGED to construct much of the internal infrastructure (see Chapter 3) such as roads, cyclone shelters and bridges/culverts. LGED will cooperate with the Water Management Organizations (WMOs) in drafting maintenance plans and will take care of maintenance of the infrastructure built in previous phases of CDSP.

- Department of Public Health Engineering (DPHE)

DPHE will construct the water and sanitation facilities such as deep tube wells, latrines and public toilets. If required it will assist in the formation and training of the Tubewell User Groups (see 10.4.).

- Ministry of Land (MoL)

On behalf of MoL concerned land administration of Noakhali District and of Subarnachar- and Companigonj Upazila will implement the land settlement programme. Through organizing meetings it will disseminate information on the procedures of the programme to the settlers. It will carry out a plot-to-plot survey. The Ministry will initiate and complete all the steps in the land settlement programme.

- Department of Agriculture Extension (DAE)

The introduction of sustainable agricultural technologies to the farmers of the new chars, using the latest available knowledge and information, is the main responsibility of DAE. It will be implemented through a process of training, motivation and other extension services. Farmer Forums (see below in 10.4.) are the most important partners in the process. The Department will work for forming those Farmer Forums with assistance of WMOs. DAE will start its work with analysing the potential of new chars by identifying agriculture zones. See Chapter 5 on the agricultural sector.

- Department of Forest (FD)

The Forest Department will restart its presence in the new chars by implementing all activities dealt with in chapter 8. Summarizing, these are plantations along the embankment and in front of embankments (foreshore), along the roads, around institutions and along canal banks. Agro forestry will be carried out by NGOs on homesteads. The social forestry approach will be applied in partnership with Social Forestry Groups. The Department will be responsible for formation, training and support to the Social Forestry Groups.

The activities in the livelihood/NGO component also require close linkages with the Department of Fisheries and the Department of Livestock Services. The involvement of these two Departments will essentially be at Upazila level, through supplying veterinary inputs, conducting training of members of Water Management Groups as resource persons and advise on the formulation and/or revision of NGO training curricula.

10.2.3 Coordination

Largely through the experiences with successive CDSP-I, II, III phases and the on-going phase IV, a sort of 'best practice' with regard successful coordination and cooperation among the different implementing agencies has emerged over the years. Based on the principle of common planning and individual implementation, an integrated development model that has proven to be successful is to have one overall project concept paper as an umbrella, followed by individual project pro-formas (DPPs) for each of the individual partner agencies. An Inter-Ministerial Steering Committee (IMSC) forms the policy level forum, while the Project Management Committee (PMC) forms the regular coordinating platform for implementing and review all progress, problems and bottlenecks.

10.3 Local Government Institutions

10.3.1 Present situation

The whole cluster of chars that constitute the feasibility study area is located in Noakhali District. Char Kandakar, Char Mozammel, Char Banani, Char Akramuddin, Char Alauddin and Char Torab Ali form a part of Subarbachar Upazila, all under Mohammadpur Union. Char Pollabi and Char Gangchil are in Companiganj Upazilla, Char Elahi Union. See section 4.2.1 on the size of the areas of each char. The concept of char development in an integrated manner is well known in the offices of Noakhali District and the two Upazilas because of the long years of CDSP projects activities in this region. Also Mohammadpur Union has experience with CDSP-II and CDSP-IV activities and Char Elahi Union with CDSP-II activities.

10.3.2 Future Scenario

It is proposed that in a future char development programme, strengthening of the local government institutions, in particular the Union Parishad, is a part of the package of institutional development interventions. The UPs are expected to provide and coordinate support to the WMOs and to participate in the drafting of the yearly maintenance plan. It will be responsible for executing a part of that plan by taking care of routine and periodic maintenance for a number of structures. The UP has an important role in the linkage between WMOs and other field level institutions, government implementing agencies and other government line agencies.

10.4 Field Level Institutions

10.4.1 Present situation

The degree of organization among the settlers in the feasibility study area is very low. Apart from a number of mosque and market committees, informal committees working for mobilizing landless and a few NGO groups, there is no institutional capacity at field level to plan for and participate in a multi-sectoral development effort. There is therefore a compelling case to promote community-based or field level institutions that can enhance the cohesion in the social fabric of the society and can be involved in the development activities in the different stages and different cycles of the project. The future scenario as described below is largely based on the CDSP experiences.

10.4.2 Future situation with a view on the proposed programme

In view of contents of the proposed package of interventions, it is envisaged that the programme will work with the involvement of the following field level institutions: Water Management Organizations, Tube Well User Groups, Labour Contracting Societies, Farmer Forums and Social Forestry Groups. Each of these institutions is elaborated upon below. The NGO credit and savings groups are not mentioned here, because they have been dealt with in Chapter 9. The section ends with giving attention to the requirements for implementation of a fisheries- and livestock component, as part of the programme.

- Water Management Organizations (WMO)

Participatory water management will be the central feature in the char development programme. In this respect the "Guidelines for Participatory Water Management" (GPWM) as approved by the Ministry of Water Resources (MoWR) in 2001 will be followed. The Guidelines recognize Water Management Organisations at three levels: Water Management Federation, Water Management Association and Water Management Groups. Considering the planned water infrastructure, five WMGs will be formed in the cluster of chars as follows: WMG-1 in the outfall area of Zillar sluice; WMG-2 in the outfall area of Montaz sluice; WMG-3 in the outfall area of Korim sluice; WMG-4 in the outfall area of Gopal sluice; WMG-5 in the outfall area of Meghna Market sluice area. The mentioned sluices are located in the embankment of polder 59/3B. Members of the WMGs will be elected through mass meetings. Women representation will be ensured at about 50% in the general membership of WMGs and at least 30% in all the management committees of the WMGs. Whether a Water management Association will be formed, can be decided in the course of implementation of the programme.

- Tube Well Users Groups (TUG)

With the direct involvement of partner NGOs, Tubewell Users Groups (TUG) will be formed for all planned deep tube wells to be installed in the project area. The members of the TUG will be 100% women with the size of in average 15 in every group. For each of the planned 155 tube wells TUGs will be formed. TUGs will be responsible for collection of contribution money from all the members and for operation and maintenance of the tube wells.

- Labour Contracting Societies (LCS)

This is a form of field level institution that may be engaged instead of contractors for earth work for construction of roads and embankments, and for canal re-excavation. Also maintenance work can be done by LCSs. They can also be engaged in the production of single pit latrines as experienced in CDSP-IV. The concept of LCS is to form a group of labourers from the local area. If it is socially acceptable women

can also form a LCS, as was experienced in CDSP-III and IV. The LCS is enlisted as D-class contractor with the implementing agencies. The size of LCS may vary based on the volume and nature of work, with maximum 70 members in one group. For latrines production the group may have a maximum of 15 members. In the GPWM, it is mentioned that at least 25% of the earthwork will have to be executed by the involvement of LCS. The LCSs are organized by the NGOs or by the WMOs.

- Farmers Forums (FF)

Following DAE extension policy, the group approach will be adopted in all agricultural extension activities. The size of each Farmer Forum will be around 30 members. Women participation will be at least 30%. A Farmer Forum is a group of settlers with farming as their main occupation and interested in new technologies, willing to participate in all agricultural project activities (crop production, demonstration, field days, and exposure visit/motivation tour). It will be decided at a later stage exactly how many groups will be formed in the cluster of chars. But based on the present household information it is estimated that around 10 Farmers Forum (each covers around 200 hhs) could cover the planned DAE interventions in the study area.

- Social Forestry Groups (SFG)

To ensure peoples participation in the afforestation activities, a social forestry approach will be taken through which the settlers will be involved in planning, implementation, monitoring, maintenance and management of the plantations. For this purpose, Social Forestry Groups will be formed each for every 2 km of roadside plantation, 1.5 km of embankment plantation, 20 ha of foreshore plantation and 20-30 ha of mangrove plantation. Each group will have 20-30 members, with roughly 60% men and 40% women. It can be expected that around 55 SFGs (for embankment 15, for road 10, for foreshore 10 and for mangrove 20) have to be formed in the cluster of chars.

As mentioned before, the inclusion of livestock- and fisheries activities in the programme is new. In previous CDSP phases, RFLDC was still operational and implemented this kind of interventions in CDSP areas as well. RFLDC however no longer exists and therefore another implementation mechanism has to be introduced. As mentioned before, it is proposed that NGOs will be responsible for implementation of livestock- and fisheries activities, with active involvement of field level groups, especially the WMGs, FFs and SFGs and the credit-and savings groups formed by the NGOs. Attention should be given to the following issues.

There is a need for new curricula for the credit- and savings groups of the NGOs, offering a practical orientation and focusing the content much more on low-input systems (semi-scavenging poultry and homestead fodder development for stall fed cattle and goats). A training programme for the integration of livestock rearing and aquaculture for SFG members should be introduced by the Forest Department. Follow-up training for aquaculture and cattle rearing should be arranged for Farmer Forums through coordination between DAE and the Departments of Fisheries and Livestock Services.

Service provision in the fisheries and livestock sectors should be coordinated through the Water Management Groups. Resource persons should be identified in each WMG and training organized for them as Poultry Workers, Community Livestock Workers (for vaccination and health care of ruminants) and Aquaculture Resource Persons (for management of fish seed nurseries). The training of these Resource Persons may be organized through the Upazila Livestock Officer (ULO) and the Sagorika SUS veterinarian in the livestock sector, and through the Upazila Fisheries Officer (UFO) and private hatcheries in the aquaculture sector. Stakeholder workshops in the two sub-sectors have to be organised to develop the respective input supply and service networks.

Chapter 11 Environmental and social impact

11.1 Introduction

In the previous chapters (2 to 10), an outline has been presented of the present situation and of the proposed measures to develop the chars in the study area. The chapters covered water management, internal infrastructure, land settlement, agriculture, fisheries, livestock, social forestry, institutions and NGO support. The present chapter dwells on the impact of the combined proposed interventions. It looks first at the impact on the environment (in section 11.2) and then at the influence the development programme would have on the social situation of the char settlers (section 11.3).

11.2 Environmental impact

11.2.1 Methodology of assessment

Environmental assessment is a regulatory requirement (Environmental Conservation Act 1995). In carrying out the assessment, the standard code of practice was applied. The Guidelines of the Department of Environment and the Guidelines for Environmental Assessment of Water Management (FCDI) Projects of WARPO of 2005 were followed. Throughout the process both local people and experts were consulted. The type of proposed interventions belongs to the so-called "Red Category" and hence the procedures for that category are in force.

11.2.2 Summary of the assessment

The implementation of the proposed interventions, in particular the construction of water management structures (like embankment with regulators and related structures, re-excavation of channels) and afforestation around the embankment, would substantially protect the area from flooding, saline water intrusion, tidal surge and storms, and it will avoid drainage congestion.

The water management infrastructure will create a changed environment in the area, in particular by increasing the availability of fresh water, because saline water is no longer rushing in with each tide. Because saline water intrusion is prevented, it is expected that over time shallow ground water will become fresh as well. The extent of flooded areas and duration of flooding will sharply decrease.

Through the water management structures and improved water management institutions, water pollution could be controlled, offsetting the increased use of agrochemicals due to the intensification of agriculture. The increased use of fertilizers and pesticides are a potential threat to water quality and consequently to aquatic life.

The project area topography is expected to change with much more flood free land and land with less than 30 cm. inundation. It is estimated that 91% of the area will fall under these two land types after implementation of the project. This new dry land can be used especially for infrastructure and agriculture development. However, the loss of inundated areas will hamper wild fisheries.

Soil fertility may reduce due to intensive cultivation. On the other hand, the area will be largely free from drainage congestion and over the years soil salinity will be reduced due to the leaching effect of monsoon rains.

With the implementation of the project the overall scenario of accretion and erosion will remain unchanged. These processes will be heavily influenced by the construction of the Urir Char to Noakhali mainland cross dam, and not so much by the package proposed in this report. Sedimentation of drainage channels in the area itself will no longer happen, because regulators will keep the sediment rich water (especially in winter) outside the area.

The composition of flora will change. The abundance of wetland plants will reduce because of the fact that the flood plain is disappearing. The project would have direct positive impact on the establishment of economically important plant species (banana, coconut, palms, teak, mahogany, rain tree and common

wet and winter vegetables) resulting in higher production of fruits, food, fodder, construction material and firewood, improved protection from wind through provision of shelter and shade, and reduced soil erosion.

The embankments will interfere with aquatic animal migration causing gradual elimination of aquatic animals like crabs and migratory fishes within the project area. Frogs, lizards and turtle population also will decline due to shrinkage of their habitat, change of land use pattern and increased human population pressure. However, pests like rat population are expected to increase due to expansion of possibilities of shelter in embankments and the increased availability of crops. The population of fresh water turtles will have a chance to develop, but hunting by the settlers will make this development unsustainable.

The package of interventions will have a significant impact related to economic production in the area. Salinity intrusion and tidal flooding in the project area will be controlled, resulting in higher cropping intensity and higher yields in agriculture, for instance by promotion of High Yielding Varieties. The higher use of fertilizers and pesticides that comes with growing HYV crops, will have to be mitigated by implementation of, for example, Integrated Pest Management measures, promotion of organic fertilizer and raising awareness among farmers.

Flood and salinity free homestead areas would be ideal for backyard gardens. Homestead fruit and vegetables production will increase.

With the control of flood through improved drainage, overall flood plain inundation area and duration will reduce. But re-excavation of channels (27 km) and holding of water in the water bodies in dry season for irrigation and fish culture would have positive impacts. The structures at drainage khals will stop fish migration and natural recruitment in the area.

After implementation of the project, inland capture fisheries will be influenced because fish migration from the Meghna River to the drainage khals and floodplain will be blocked by the peripheral embankment and sluices. Brackish water dependent fish species (chiring, chewa, koral, pungas, topsi, etc.) will decrease. However, fresh water dependent fish like shol, taki, punti, shing, etc. will increase. Other impacts are the reduction in diversity and resilience of natural fisheries resources and a shift from wild fisheries to culture fisheries. The interventions will protect both seasonal and perennial water bodies from flood and tidal surge damage. It can be expected that this will encourage farmers to invest more in culture fisheries.

With the implementation of the project, reduced flooding might prevent wet court yard conditions for livestock. A higher paddy production will increase the available amounts of straw as stall feed. The project interventions are expected to positively influence the growth of livestock production by containing preventable mortality and morbidity. Use of animals for draught power is likely to be limited.

11.2.3 Mitigation measures and monitoring

An Environment Management Plan (EMP) has been drawn up with the following elements: compensation plan; mitigation plan, enhancement plan; monitoring plan; institutional set-up; and people's participation. Compensation is required, for instance, for land owners that lose land because of construction activities. Mitigation measures include among others, promoting the use of organic fertilizing matters and of minimizing use of agrochemicals, stimulating the practice of Integrated Pest Management, arranging of grazing land in- and outside the embankment, using fish-friendly regulators. Similar elements are taken up in the enhancement plan. A number of environmental components (like flooding, surface water quality, soil quality, ground water table etc.) have to be monitored. The implementing agencies would be responsible, each for their own field of work and expertise. The costs of carrying out the EMP are estimated at Taka 10.5 million a year.

11.3 Social impact

Based on evidence in areas where CDSP was operational in the past, the impact of the combination of CDSP-type of interventions as proposed in this feasibility report on the socio-economic situation of the people in the areas concerned is considerable. Data collected through monitoring and through other survey methods in CDSP I, II and III areas justify the conclusion that those interventions will lead to a

transformation in the social and economic circumstances. This transformation can best be summarized as more security and less vulnerability. There is no reason to suppose that this will be much different in the study area of the cluster of chars.

11.3.1 Physical security

Settlers will experience a greater physical security, due to the construction of a protective embankment, cyclone shelters and roads that will bring them quicker to more save inland locations if a storm surge strikes the area. The physical security is further enhanced by the improved law and order situation, as has been the case in earlier phases of CDSP.

The official titles on land possession, to be provided through the land settlement programme will give security in a legal sense. At the same time this will encourage farmers to invest in their land, increasing the chances of higher production.

11.3.2 Economic and food security

The economic benefits, leading to more security in an economic sense, have been elaborated upon in the previous sections. It can be added here that access to markets to sell the produce that is not consumed inside the area will be improved, and will probably lead to better prices. Previous CDSP areas also show a sharp increase in markets in the area itself. Increasing the access for imported goods in many cases has also led to lower prices of these goods because of lower transportation costs and increased competition. The upswing in local production and the greater accessibility will lead to an increase in employment opportunities (see also next section). An important development for landowners, including all the households that will receive a land title, is that the price of the land will most likely increase substantially.

A sample survey among households in CDSP I, II and III areas shows that food security has improved significantly, with an overall decline in the number of households that experience some periods of food shortage from 61% to 52% in a period of five years. Also the average number of months of food shortage has fallen. The most critical months are October/ November, followed by July/ August. This development is largely due to the increases in agricultural production and the greater employment opportunities. As reported in section 1.3.4., more than 75% of the households in the study area had food shortages for a period of six months or more.

11.3.3 Delivery of services

The general development of char areas has led, as was demonstrated in previous CDSP phases, to establishment of service delivery mechanisms, from the government, from NGOs and from the private commercial sector. The government has expanded its presence in those char areas by introducing educational and health services as well as by maintaining law and order on a higher degree. The impetus in economic development will stimulate banks to open branches, while shops will be established for, for instance, selling agricultural inputs. Accessibility of services will improve due to the expanded road network.

11.3.4 Health and education

Although the CDSP type package of interventions do not have a specific orientation towards delivery of health and education services, actually this is limited to parts of the proposed NGO-programme, the health and education situation will indirectly be benefitted from the proposed project. The cyclone shelters that will be constructed are multifunctional and can be used as school as well. It is common practice in char areas that primary schools are established in these shelters. It takes usually sometime between completion of construction and completion of all the formalities to have a government school in the building. The proposed project could assist by facilitating this process. There are a few examples that cyclone shelters are used as (temporary) health units.

Health of the settlers will be improved by the supply of drinking water through the provision of tube wells and by the provision of sanitary latrines. Also the greater variety in agricultural produce (especially vegetables), and the increased supply of fish and dairy products will benefit the health situation. The health and family planning sub-component of the social and livelihood/NGO programme is obviously geared towards better health, especially but not exclusively for women.

11.3.5 Social position of settlers

The institutional development efforts of the project through the establishment of a series of field level, community based organizations, will lead to a greater cohesion among the households. Helped by the economic uplift this will lead to more vibrant and resilient char communities. The project will strengthen the position of the settlers in the struggle over control of natural resources. The provision of a title on land is of course a prime example. The formation of Water Management Groups will enhance the fair and equitable way of using water resources. Social forestry activities promote equity in the sharing of benefits of public land. This will all lead to an increased self-confidence of the people. This is further enhanced by the fact that settlers will no longer be controlled by jotdars that were involved in the illegal settlement after migration into the newly emerged lands. Probably, tenancy arrangements will improve in favour of labourers.

11.3.6 Gender issues

It is expected that the proposed project will have an impact on the lives of women in a practical sense, but at the same time it will also improve their social position and status. The greater employment opportunities within their own area will reduce the relatively high number of female headed households. Seasonal outmigration will become less necessary, which means that men can stay more with their families. This should lessen the burden of work on the women. They will also benefit in a practical manner by the fact that tube wells for drinking water will be dramatically increased, shortening the average time women have to spent on collecting clean water. Through the envisaged training and credit facilities supplied by NGOs combined with the general economic uplift, possibilities of employment for women will be enhanced. Women have greater possibility to create their own stream of income. The proposed project will encourage an active and more equal participation of women in groups such as the Water Management Groups, Farmer Forums and Social Forestry Groups. The Tubewell User Groups will consist exclusively of women. The experiences in other areas have learned that such participation will increase the ability of the women to speak up, both in their own household as in public matters. The khatians (land titles documents) will be signed by both the husband and wife (actually, it is CDSP's policy to have the women signs first). This fully recognizes a woman's right on land. It will considerably strengthen their asset base and economic security, and increase their bargaining power within their households. Considering all these developments, it is justified to expect that the social position and status of women will be strengthened in case the project is implemented.

11.4 Conclusion

The environmental assessment has indicated that the implementation of the interventions as proposed in this report will not lead to a significant negative impact on the environment in the area. In order to mitigate any adverse influences, the Environmental Management Plan has to be made a fully integrated part of further project documents, such as the project pro forma and tender documents.

The proposed programme would have an important and favourable impact on the social and economic situation of the char settlers. The assessment makes clear that on essential issues as physical and economic security, health and education, delivery of services, and gender, the proposed interventions will have a positive influence, often in a significant manner. Empirical evidence from areas where previous CDSP phases were operational, reinforce such expectations. In case the implementation itself has adverse consequences for families, for instance through loss of land and relocation because of infrastructure development, the compensation component of the EMP can provide support.

It is realistic to suppose that the proposed package of interventions can pass the clearance procedure successfully.

Chapter 12 Costs and benefits

12.1 Overview of costs of proposed package of interventions

Table 12.1 presents a component and year wise overview of project costs.

Table 12.1 Costs by components and years (in Lakh Taka)

Bangladesh

CDSP

Expenditure Accounts by Years -- Base Costs

(BDT Lakh)

	Base Cost				Total
	1	2	3	4	
I. Investment Costs					
A. Water Management Infrastructure					
1. Drainage Sluice					
1 vent Sluices	-	240.0	320.0	240.0	800.0
2 vent Sluices	-	60.0	80.0	60.0	200.0
3 vent Sluices	-	252.0	336.0	252.0	840.0
Subtotal	-	552.0	736.0	552.0	1,840.0
2. Embankment:					
Sea dyke	712.8	950.4	712.8	-	2,376.0
Internal dyke	250.2	291.9	291.9	-	834.0
Subtotal	963.0	1,242.3	1,004.7	-	3,210.0
3. Re excavation of khal					
Re excavation of Dr khal	137.3	274.6	274.6	-	686.4
Re excavation of collector canal	45.8	91.5	91.5	-	228.8
Subtotal	183.1	366.1	366.1	-	915.3
Subtotal	1,146.1	2,160.4	2,106.8	552.0	5,965.3
B. Forestry					
1. Mangrove Plantation	17.6	70.4	-	-	88.0
2. Foreshore Plantation	-	91.9	114.9	23.0	229.8
3. Embankment Plantation	-	11.1	14.8	11.1	37.1
4. Road side Plantation	-	7.4	9.9	7.4	24.7
5. Homestead Plantation	0.6	0.9	0.9	0.6	3.2
6. Public Institution	0.1	0.1	0.1	0.1	0.3
7. Canal Bank	-	7.3	7.3	7.5	22.0
8. Other Cost	2.5	2.5	2.5	2.5	10.0
Subtotal	20.8	191.6	150.4	52.2	415.1
C. Agriculture	10.0	10.0	10.0	10.0	40.0
D. Fisheries	12.5	12.5	12.5	12.5	50.0
E. Internal Infrastructure					
1. Road works					
Kachha road	202.2	23.6	-	-	225.8
Pucca road	-	180.0	180.0	-	360.0
Subtotal	202.2	203.6	180.0	-	585.8
2. Bridge & Culvert					
Bridge	-	21.0	24.5	24.5	70.0
culvert	-	20.0	20.0	-	40.0
Subtotal	-	41.0	44.5	24.5	110.0
Subtotal	202.2	244.6	224.5	24.5	695.8
F. Social Facilities					
1. Cyclone Shelter	240.0	400.0	160.0	-	800.0
2. Public Toilet	22.0	22.0	11.0	-	55.0
3. Rain Water Harvesting	-	2.0	2.0	1.0	5.0
4. Single pit latrine	20.0	20.0	40.0	20.0	100.0
5. Tube well	26.4	39.5	39.5	26.4	131.8
Subtotal	308.4	483.5	252.5	47.4	1,091.8
G. O & M during Construction	-	-	-	238.6	238.6
H. Engineering & Administration	29.7	59.4	57.0	21.6	167.7
Total BASELINE COSTS	1,729.6	3,162.0	2,813.7	958.8	8,664.2
Physical Contingencies	34.6	63.2	56.3	19.2	173.3
Price Contingencies					
Inflation					
Local	-	80.6	218.8	127.2	426.7
Foreign	-	-	-	-	-
Subtotal Inflation	-	80.6	218.8	127.2	426.7
Devaluation	-	-	-	-	-
Subtotal Price Contingencies	-	80.6	218.8	127.2	426.7
Total PROJECT COSTS	1,764.2	3,305.9	3,088.8	1,105.2	9,264.2

Estimated costs have been mentioned in the individual chapters of each of the components. Table 12.1 depicts all the costs and makes a preliminary year wise distribution. The total costs of the project would be Taka 9,264.20 lakh.

However, to this amount the costs of the land settlement programme (Taka 660 lakh. for surveys and re-settlement), and of the livelihood component to be implemented by NGOs (Taka 1,020.2 lakh.) have to be added. The overall total costs for the proposed programme would thus be Taka 10,944.4 lakh. This would equal US\$ 14.27 million or Euro 10.55 million at current exchange rates (US\$/Tk. 76.7 and Euro/ Tk. 103.7 respectively).

Annual costs for Operation and Maintenance (O&M) after completion of the new infrastructure are estimated at Taka 188.16 lakh. As can be seen in Table 12.1, in the cost estimate a cost item (Taka 169.80 lakh.) for O&M costs during construction is taken up. Annual costs for implementation of the Environmental Management Plan are estimated at Taka 105 lakh.

12.2 Economic benefits

12.2.1 Overview

The economic benefits generated by the proposed interventions can be summarized as follows

- an increase in the value of agricultural production through a higher cropping intensity and increase in yields;
- an increase in production of homestead gardening;
- a higher production of livestock products;
- the creation of an additional stream of income through aquaculture in individual ponds and higher production in big fish farms;
- the creation of income for the settlers as a result of the social forestry activities.

These benefits have been considered in the benefit stream of the project for the economic analysis. In addition to these sectoral benefits, the above mentioned production increases, supported by the improved transport network, will result in a stimulation of general economic activities in the study area. This indirect impact has not been included in the analysis, because it would be difficult to quantify.

12.2.2 Benefits per component

- Field and homestead agriculture

Agricultural benefits would primarily accrue due to prevention of salinity intrusion, better flood management and improved drainage systems. The proposed dykes and improved drainage systems together would reduce flood depths of different land categories leading to greater use of high yielding varieties of crops, increase in cropping intensities and higher crop yields. These interventions would also help reduce soil salinity. Full benefit from the agriculture sector will be achieved in year 10 after empoldering. At full development stage, total rice production will reach 7,962 MT per annum from present 2,940 MT. HYV varieties of rice will be the major contributing factors. Total non-rice crop productions will increase to 2,738 MT from present level of 829 MT. The annual incremental benefits from agriculture at full development level occurring after ten years of project implementation, is estimated as Taka 1,011 lakh.

At present, 35% of households (out of a total of 2,100 households) are growing some homestead vegetables under traditional practices. Under project condition, it is assumed that 50% of the households will grow homestead vegetables adopting modern practices, supported by better extension services. On average with 3 decimals of land for vegetable production, 1,050 households will put a total 3150 decimals (12.75 ha) of land for homestead vegetable production. Net benefits from homestead vegetables production are estimated as Taka 14.01 Lakh per annum.

- Fisheries

The incremental fisheries production would come from capture fisheries in the re-excavated khals and from the floodplain; and from aquaculture in individual ponds and large fish farms in the study area. Fisheries annual net benefits from different production systems without project, and with project at the full

development level, expected to occur in the 8th year of project life. With project conditions, incremental fisheries production is estimated to be 744.34 MT, valued at Taka 895.10 lakh.

- Livestock

The project interventions would reduce preventable mortality and morbidity of domestic animals and an opportunity for growing more fodder. The number and productivity of the existing herd of cattle, buffalo and goats are expected to be increased. The expected increase in numbers of livestock population will occur over a period of six years and is expected to stabilize in the 7th year of project implementation. No reliable data on increase in productivity of livestock (for instance milk production) in the area are available. So it has not been included in the benefit stream. The incremental value of livestock through growth in overall numbers is taken as benefit (Taka 87.74 lakh on annual basis).

- Forestry

Revenue will be generated by sale of woods and fruits of plantation trees. The programme participants will provide labour in the nursery and during plantation on basis of benefit sharing arrangements. Thus the project will earn huge revenue from the social forestry programme and generate employment in the rural area. Annualized benefits are estimated at Taka 1,442 lakh.

12.2.3 Summary of economic benefits

The total net benefits of the project per annum at full development stage at financial prices are estimated as Taka 3,524.30 lakh.

A summary of sector-wise annual net benefits at full development stage are given in Table 12.2.

Table 12.2 Summary of annual net benefits

Sectors/Sub sectors	Benefits (Tk. Lakh)	Remark
Agriculture	1011.16	Major benefits will start to accrue from 5 th year and full benefits at 10 th year.
Homestead Gardening	14.0	Throughout the project life
Open Water Fisheries	11.52	Full benefits at 6 th year
Close Water Fisheries	883.58	Full benefits at 8 th year
Livestock	87.74	Full benefits at 7 th year
Social Forestry	1442.0	Annualized benefit. Benefits will accrue through year 5 to year 15 of rotation period.
Commercial Gains (3.7%)	74.30	Commercial gains due to multiplier effects
Total benefits	3524.30	

12.3 Comparison of costs and benefits

12.3.1 Economic and financial analysis

The economic indicators are computed to judge the economic viability of the proposed package of interventions. These indicators include Net Present Value (NPV), Benefit Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR). Following the normal practice in CDSF projects, the costs of social infrastructure have not been taken into account in the economic analysis, nor the costs of the NGO-programme. The analytical results of the economic analysis (at 12% Discount Rate) are: an NPV of Taka 4,901.8 lakh, a Cost-Benefit ratio of 1.93 and an EIRR of 21,60%. The results indicate that the project would be economically viable, as it secures a rate of return that fairly exceeds 12%, the opportunity cost of capital, presently used by all sectors of the economy in Bangladesh.

To assess whether the proposed investments are financially sustainable, a financial analysis has been carried out on the basis of market prices and interest rates. This resulted in a Financial Internal Rate of Return (FIRR) of 16.26%, well above the opportunity costs for capital in Bangladesh of 12%.

12.3.2 Sensitivity analysis

The economic analysis of projects is generally based on uncertain future events and imperfect data. Also certain risks are inherent in project planning and implementation. So a sensitivity analysis of the Base Case EIRR has been conducted, based on variations in the level of costs and benefits, implementation and gestation periods due to various uncertainties and risks involved in the project investment. The findings of the sensitivity analysis are summarized in Table 12.3.

Table 12.3 Results of Sensitivity Analysis (Base Case EIRR: 21.60%)

Assumptions for Sensitivity Analysis	EIRR (Percent)
20 percent increase in Project costs	18.75
20 percent decrease in Project benefits	18.13
Cost over-run and benefit reduction by 20 percent both occurring simultaneously	15.47
Lag in benefits accrual by two years	17.05

The results of the sensitivity analysis presented above, show that in all cases, the Project is not sensitive to any of the above assumptions, as the calculated EIRR stays well above 12 percent. Based on the results of the sensitivity analysis, it can be concluded that the proposed project is economically viable, and therefore, recommended for implementation.

Annex: Terms of Reference

1. Introduction

1.1 Background

The Inception Report of CDSP IV states that the project will undertake three feasibility studies in areas where in future char development programmes might take place. These future areas have to be located within the overall study area, essentially the central, dynamic part of the coastal zone of Bangladesh. This area is bordered in the east by the outfall of the Muhuri river and the Chittagong coastline. In the west the border is formed by the Tetulia river. In the north, the coastline of Feni, Noakhali and Lakshmipur Districts is followed. After a rigorous process of selection, the concerned authorities decided to take Char Moksumul Hakim in Noakhali District as the area for the first of the series of feasibility studies.

A key element in the selection process was the comparison of a long list of chars, based on the results of reconnaissance surveys. For each of the chars a short report has been written. Much of the information used in these Terms of Reference is derived from the report on Char Maksumul Hakim and from subsequent field visits.

1.2 Objectives

The objective of the feasibility study is to prepare a report which will be submitted to the concerned authorities for their consideration whether the required means will be made available to implement and facilitate the recommended interventions in the study. The study therefore has to fulfil the standard rules and guidelines applied by the Bangladesh government in such cases. The study will develop a set of interventions that will contribute to the overall objective of CDSP: to reduce poverty and hunger for poor people living on newly accreted coastal chars, which would be achieved via improved and more secure livelihoods.

1.3 Methodology

The preparation of the study should follow these general phases:

- establishing base-line conditions
- identification of possible interventions that will contribute to the abovementioned overall objective
- analysis of impacts and costs of the interventions
- formulating the overall proposed plan, setting priorities with regard to activities and time tables.

The preparation should adapt as much as possible a participative approach, especially with regard to the identification and prioritisation of activities. At different stages both the local population and the concerned institutions should be informed about the progress of the work. More methodological issues are included in chapter 2 on the detailed activities to be undertaken.

These Terms of Reference cover the overall feasibility study. However, a part of the study will be carried out by a Bangladeshi firm or institute, to be sub-contracted by the project, while another part will be done by the Technical Assistance team (TA team). Below, in the headings of the various sections on the subjects to be covered, it is indicated whether that section will be taken care of by the sub-contracted firm or institute, or by the TA-team. Based on these overall Terms of Reference, specific Terms of Reference for the sub-contracted firm or institute and for the TA team are available. If required, the TA team can hire additional staff on a short term basis to support the study activities.

The duration of the study will be nine months.

1.4 Study area

Char Moksumul Hakim emerged in the early 1990's in the lower Meghna river. The Forest Department started afforestation in 1992. In 2003, the first households started to migrate into the char, mainly from Hatiya-, Companiganj- and Sandwip Upazila. Gradually all planted trees were cut and the land was transferred from forest into agricultural land. The char is located outside the embankment of polder 59/3B. The study area is in the north bordered by Gangchil khal and Gangchil sluice. It follows the embankment of

polder 59/3B to the south till Meghna sluice and Char Nangulia. In the east the area is bordered by the Meghna river. The overall area is estimated to be approximately 5,000 hectares. At present, there are no signs of erosion. The char is thought to be stable. The average land level is around 4 m (PWD). If the plan for a crossdam from Noakhali mainland to Urir Char is indeed implemented, the already occurring land accretion in the area adjacent to the study area will be accelerated.

The reconnaissance survey indicated that nearly 13,000 people, in just under 3,000 households, have settled in the char (June 2012). Preliminary investigations show that area is mostly khas land. The main professions of the people are farming, fishing and daily labour.

Following the local given names, the char actually exists of four parts (from south to north): Char Akram Uddin, Samity Char, Char Moksumul Hakim and Char Alauddin. In this report the whole area will be called Char Moksumul Hakim. The greatest part of the area is under Subarna Char Upazila, Noakhali District. In the north, near Gangchil khal, a part is under Companigonj Upazila of Noakhali district, while a small adjacent part is under Sandwip Upazila of Chittagong District.

2. Activities

2.1 Main features of study area and population (sub-contracted firm)

An overall picture of the present physical features of the area and current the population in the area should be presented, including the following elements:

- short description of the development of the char since its emergence
- land levels and land use (see also under 2.2)
- total population, with number of households and average household size
- main occupations and sources of income of the settlers
- the status of food security in terms of the number of months that food is available for the different social strata

2.2 Water management (sub-contracted firm)

The following tasks should be performed as far as water management (and related to that, land suitability) is concerned:

Make a basic topographic and drainage map for the present situation, based on existing information available with CDSP IV and new topographic (land levels) and hydrographic (cross section khals) measurements. Observations during field visits and interviews will add to the understanding of the area. This map should clearly identify the drainage units in the considered area, the drainage network, the depth-duration characteristics of the drainage congested areas and the origin and destination of the drainage waters. Design drainage discharges for each of the drainage units should be established. The scale of the map should be 1:15000, while the map should show contour-lines with contour-intervals of 10 cm.

Map the present salinity situation: intrusion and duration of the presence of saline water for concentrations above a selected concentration for rice tolerance (e.g. 8 dS/m).

Make flood maps: depth and duration of tidal flooding in critical periods for agricultural practices (for instance transplanting of T. Aman).

In order to obtain a first impression of the groundwater situation, collect and analyse samples of water produced by the few existing tube wells.

Based on the above maps and established drainage patterns and discharges: identify bottlenecks and develop interventions (such as, for instance, drainage works and possibly embankments), to overcome these bottlenecks. Designing an optimal internal drainage system might include shifting the present boundaries with adjacent drainage units, shortening of drainage channels, and cutting across boundaries of drainage units (drainage from and towards other drainage units). In case any embankments are proposed, type and height of embankments have to be established taking into account BWDB practices and experiences. Also the results of the latest relevant climate change studies have to be considered.

Make a map clearly showing the location of the proposed interventions, including the drainage network

Prepare drainage, salinity and flood maps for the situation with interventions.

Based on the above information: make land suitability maps, indicating the potential for certain cropping patterns and corresponding yields. The practice of agricultural zoning maps applied in CDSP III and IV should be given attention.

A cost-estimate of all proposed water management interventions should be made (with reference to section 2.14 on cost/benefit analysis); this cost-estimate should take into consideration the increase in rates that is likely to occur in the period till actual implementation of the study recommendations.

In view of the earlier mentioned process of sedimentation in adjacent areas in the Meghna river, analyse the impact of this process on the drainage situation in the study area and in polder 59/3B; in case this situation is expected to worsen dramatically in the next 20 years, options for a future drainage pattern should be developed; for this section of the feasibility study cooperation with the Institute of Water Modelling (IWM) is required; the support of IWM will be covered by a separate contract between the project and IWM.

2.3 Internal infrastructure (sub-contracted firm)

Although there is not much significant internal infrastructure present in the char, the study team should start with making an inventory and continue with preparing a plan for the development of public infrastructure for the char. The most important type of internal infrastructure for char areas are:

- transport related infrastructure as roads, bridges and culverts
- social infrastructure such as cyclone shelters, deep tubewells, sanitary facilities, community ponds, killas and, if required, clustered villages.

The infrastructure should be planned for a population that can be expected in future. The size of the future population can be estimated by dividing the total area of khas land available for settlement of landless households by 1.5 acre, being the maximum allocation for each household.

An estimate of the total numbers of each of the structures should be made. The location of all structures should be clearly identified on a map. The map should also show the proposed road network.

The costs of the proposed infrastructure should be estimated (see 2.14), taking into account increase in rates in the period until implementation will take place.

2.4 Land settlement (TA team)

The work on land settlement should focus on the issue of supply and demand: how much khas land is available for distribution among landless households, versus the demand for land from households that have already settled in the area, based on a maximum allotment of 1.5 acre per household. To address this equation, the following activities have to be undertaken:

- report on the present status of land settlement; provide mouza-wise information on the total area of the mouza, the area that has already been officially settled, the area that is in process of settlement, and the balance of land that is available for future settlement; please note that experience in previous CDSP-projects have indicated that around 20-25% of land is required for public infrastructure, and thus cannot be used for settlement of households; special attention should be given to the big fish farms that are present in the area; their legal status and the future of those fish projects should be a part of the analysis
- investigate whether there is any border issue between Noakhali- and Chittagong district with the area in the northern part, between Companigonj- and Sandwip Upazila
- determine the number of households already settled in the char that have as yet no official land title
- determine the possibility of providing the already settled households that have no legal land title with a plot of 1.5 acre
- assess the possibility of settling additional households that are as yet not present in the area.

In addition a plan for future activities should be developed aimed at facilitating the settlement process.

This plan will include an estimate of the involved costs (see 2.14).

2.5 Agriculture (sub-contracted firm)

For agriculture, the team is required to:

- map the existing cropping pattern, cropping intensity and yields for each of the crops grown in the field; give attention to the existing of crops that are currently grown

- describe the present status of homestead gardening
- analyse the present methods of cultivation
- analyse the support system, including the extension services currently provided and the supply of agricultural inputs
- assess the current practice of selling agricultural produce
- analyse the main factors hampering agricultural production, including at homesteads
- develop recommendations to make the cropping patterns more suitable to the char environment, and to increase the cropping intensity and yields; give attention to the possible impact of climate change on coastal agriculture;
- also formulate recommendations for homestead gardening
- make a projection of future cropping intensity and yields, taking into account the suggested interventions with regard to water management (see 2.2) and the interventions recommended in this section
- make an estimate of the costs of the recommendations for field agriculture and homestead gardening (with reference to the required cost/benefit analysis, see 2.14)
- determine the difference in production between the situation before and after the proposed interventions (including the ones related to water management) for field agriculture and homestead gardening (see 2.14).

2.6 Livestock (sub-contracted firm)

With regard to livestock activities in the area, the study will:

- review the present situation of the livestock sector (poultry, small ruminants, cattle), including the role of livestock in the household economy
- analyse the production and marketing systems and identify the bottlenecks that impede further development of the sector
- describe the present status of diseases and their treatment
- prepare a plan with recommendations for measures to be taken in support of livestock activities in the char
- estimate the costs of the proposed measures regarding livestock development (see 2.14)
- make an estimate of the increase in livestock production after introduction of the proposed measures (see 2.14).

2.7 Fisheries and aquaculture (sub-contracted firm)

This part of the study has to focus on:

- an assessment of the importance of fisheries and aquaculture for the livelihood of settlers in Char Moksumul Hakim
- an analysis of the current production systems (inland fisheries, marine fisheries, aquaculture in ditches and ponds)
- an analysis of the present marketing system (if applicable)
- the development of possible interventions to develop the sector, including the provision of extension services
- an assessment of the impact of the proposed water management interventions (see 2.2) on fisheries and aquaculture
- estimate the costs of the proposed interventions (see 2.14).
- make an estimate of the difference in fish production between the situation before and after the proposed interventions (see 2.14).

In this section special attention should be given to the large fish projects (aquaculture) in the char. Both the benefits for the local population and their wider economic importance should be reviewed. The expected future of these projects should also be assessed (see also section 2.4 on land settlement).

2.8 Social forestry (sub-contracted firm)

Forestry has multiple functions in char development (stabilisation of land, buffer against tidal surges and storms, promotion of bio-diversity, income creation through involvement of local population). The following tasks have to be undertaken in the framework of this study:

- describe briefly the forestry situation since the emergence of the char area and elaborate upon the present status of forest in the char by making an inventory of the forestry coverage and the presence of any social forestry activities
- analyse the bottlenecks that have adversely influenced forestry development
- prepare a forestry development plan for the char area, including road plantation, plantation in homesteads, plantation on the grounds of public institutions, embankment- and foreshore plantation (if applicable); the plan should also assess the possibilities of mangrove plantations on land emerging in areas adjacent to or close by char Moksumul Hakim, taking into account the acceleration of accreted land in case a cross dam to Urir Char is constructed
- make an estimate of the costs of the proposed development plan (see 2.14)
- make an estimate of the additional production of forest products due to the proposed development plan and of the extra stream of income for the local settlers from their involvement in social forestry activities (with reference to 2.14).

2.9 NGO component (TA team)

The proposed interventions in the study area should contain a social- and livelihoods support component, to be implemented by NGO's. This NGO programme will cover the following fields:

- Group formation, micro-finance and capacity building
- Health and family planning
- Water and sanitation
- Homestead agriculture and value chain development
- Legal and human rights
- Disaster management and climate change (see also 2.13.)

The size of the programme should be based on the expected number of households that will be settled in the study area (will be determined in section 2.4). With reference to the required overall cost/benefit analysis (see 2.14), an estimate of costs for the whole programme has to be made.

2.10 Governance issues (TA team)

Governance related issues can be seen at three levels:

National government agencies: One of the striking features of CDSP is the fact that six governmental departments (BWDB, LGED, DPHE, Ministry of Land, DAE, Forestry Department) share the objectives of CDSP and closely cooperate and coordinate in undertaking activities. A key coordinating mechanism is the Project Management Committee (in which all six departments are represented). It is the intention that, in case the recommended interventions for Char Moksumul Hakim are carried out, the implementation will follow the same arrangement. If proposed activities are beyond the purview of the six departments, the feasibility study team should suggest the modality of implementation. This will, for instance, be the case for the fisheries and livestock sectors.

Local government level: The study should describe the involvement of local government bodies in the proposed activities in Char Moksumul Hakim. More specifically, these bodies are the Upazila Parishad of Subarna Char Upazila and the Union Parishad of Mohamedpur Union. The support of both councils would be vital for successful implementation of project activities and should be ascertained. The role of the councils in the activities should be defined.

Field level institutions: The institutional scenario at grass root level in CDSP areas show a combination of community based organisations that already existed and institutions instigated by the project (such as Water Management Organisations, Local Area Development Organisations, Farmers Forums, Social Forestry Groups, NGO groups, Labour Contracting Societies).

- An inventory should be made of the community based organisations that are already present and active in Char Moksumul Hakim. An example is that people living in the char (so, outside the embankment) are member of Water Management Groups of polder 59/3B.
- A plan should be prepared, with a view on the proposed interventions in sections 2.2 to 2.8, of either broadening and strengthening the existing institutions or forming new ones. For each of the types of the proposed institutions the number should be indicated, as well as the size in terms of specific number of members (gender specific)

- Also, for each the role and responsibilities should be spelled out. Special attention should be given to the involvement of the population in mangrove plantation and maintenance through the social forestry approach.
- The plan should elaborate on the benefits and possibilities of formation of NGO groups.
- Costs of all proposed interventions should be estimated (see 2.14).

2.11 Social impact and impact on livelihoods (TA team)

The feasibility study report will clearly indicate what the effect of the proposed intervention is on the social and livelihood situation of the char settlers. One of the main aims of undertaking project activities in Char Moksumul Hakim is to contribute to a socio-economic transformation similar to what can be observed in other CDSP areas. This change in livelihoods is well documented (see for instance Technical Report no. 7 of CDSP III, December 2010, Impact of the Char Development and Settlement Projects I,II and III). In describing and analysing the expected effects in the study area, the following elements have to be highlighted:

- the economic benefits (see also section 2.14), including access to markets
- the diversification in income
- the employment opportunities
- the level of poverty and food security
- the access to social services
- the change in security and vulnerability of the settlers
- the position and status of women.

2.12 Environmental impact (sub-contracted firm)

A comprehensive Environmental Impact Assessment (EIA) is required for the development of Char Moksumul Hakim. This EIA shall be in accordance with the government guidelines, provided in the WARPO Guidelines of 2005. Technical Report no. 19 of CDSP II, Guidelines for Environmental Impact Assessment of CDSP activities, also gives valuable information. The scope of the work should include:

- review of existing information and identification of environmental issues related to CDSP type of activities
- description of the relevant institutional, legal and policy framework
- collection of baseline data on the present environmental condition
- analysis of the key environmental issues, with a view on the interventions proposed in this feasibility study
- analysis of possible, more environment-friendly alternatives
- preparation of an Environment Management Plan, including a mitigation component
- preparation of an Environmental Monitoring Plan
- a cost-estimate of the Environmental Management Plan, of the mitigation measures and of the Environmental Monitoring Plan should be included.

In a concluding section, the EIA should clearly state

- the gains which justify implementation of the proposed interventions
- an explanation of how the environmentally adverse effects could be minimized
- provisions for proper follow-up surveillance and monitoring.

2.13 Impact of climate change (sub-contracted firm)

It is likely that climatic changes will have an impact on the situation on low-lying areas of coastal Bangladesh. The feasibility study should make an effort to provide insight in what this impact would mean for the proposed development activities in Char Moksumul Hakim.

- The study should endeavour to reflect on, in general, the influence of climate change on the situation in Char Moksumul Hakim. The latest widely accepted reports should be used for this assessment.
- More specifically, this section of the feasibility study report should dwell on the impact of climate change on the sustainability (durability) of the proposed interventions (especially with regard to water management, internal infrastructure, agriculture, livestock, aquaculture and forestry).
- In addition, concrete consequences for, for instance, design parameters for structures, selection of crop- and fish varieties and similar issues shall be described. On the subject of climate change, a time horizon of 20 years should be applied.

- Recommendations will be formulated if any special measures should be taken to support the settlers in Char Moksumul Hakim to cope with the consequences of climate change. This could be in the range of raising awareness, support for community based adaptation to special institutional arrangements to deal with natural disasters (see also 2.9).

2.14 Costs and benefits: financial and economic analysis (sub-contracted firm)

An analysis of costs and benefits should be made, paying attention to the following issues.

As far as the cost side is concerned, the major cost components in the proposed package of interventions are:

- costs of water management related infrastructure as excavation of drainage channels and (possibly) construction of embankments and sluices
- cost of construction of economic activities related internal infrastructure as roads, bridges, culverts, killas and community ponds
- cost of construction of social facilities (cyclone shelters, deep tube wells, sanitary facilities)
- operation and maintenance (O&M) costs in the period after project completion
- costs of recommended interventions as far as agriculture, livestock, fisheries/aquaculture and social forestry are concerned
- costs of the land settlement plan
- costs of institutional development measures.

As is normally the practice, the category of the abovementioned social infrastructure does not have to be taken into account in a cost-benefit analysis.

With regard to the benefits, a distinction can be made between social and economic benefits. The social benefits are, among others: the increased physical security for the settlers by the construction of embankments and cyclone shelters, a great increase in access to drinking water and sanitary facilities; increased legal security by issuing of land titles to the char population.

As economic benefits can be counted:

- an increase in the value of agricultural production through a higher cropping intensity and an increase in yields (see 2.5)
- an increase in production of homestead gardening (see 2.5)
- a higher production of livestock products (see 2.6)
- the creation of an additional stream of income through aquaculture in community ponds and possibly individual ponds (see 2.7)
- the creation of income for the settlers as a result of the social forestry activities (see 2.8)
- a stimulation of general economic activities caused by the abovementioned production increases and supported by the improved transport network (an effort should be made to quantify this benefit).

These economic benefits should form a part of the cost-benefit analysis.

Specific tasks that have to be performed are:

- make a selection of the costs that can reasonably be related to the economic benefits
- calculate the total of these economy related investment costs
- calculate the expected economic benefits
- make an estimate of the expected O&M costs
- make an estimate of O&M costs and of economic production in the present (without project) situation
- on the basis of these data calculate the Financial Internal Rate of Return (FIRR) and the Economic Internal Rate of Return (EIRR)

Please note that the methodology applied should be acceptable for the Bangladesh authorities. In this respect the Guidelines prepared by WARPO should be followed and conversion factors to come to economic costs and benefits as approved by WARPO should be used. The economic life of the proposed project should be assumed to be 20 years.

In CDSP, valuable reports have been published on the subject of cost/ benefit analysis. It is strongly recommended to consult these reports while implementing this part of the assignment. See for instance

- Technical Report no. 26 (CDSP I), June 1999, The Costs and Benefits of Char Development
- Technical Report no. 18 (CDSP II), September 2005, Cost benefit analysis
- Feasibility study under CDSP III, Economic Analysis of Char Nangulia, Noler Char and Caring Char, March 2008.