



Bangladesh University of Engineering and Technology
Department of Urban and Regional Planning
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Terms of Reference for
Rural Infrastructure Improvement Project in Haor Region of Bangladesh

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1. Background

1.1 Introduction

Haor areas have distinctive hydro-geological settings and it is situated in the north-eastern part of Bangladesh covering 1.99 million hectares in Bangladesh. According to BBS, 2011 almost 20 million people are residing in this area. This region consists of Sylhet, Sunamganj, Habiganj, Maulvibazar, Netrokona, Kishoreganj and Brahmanbaria. These areas facilitate biodiversity, fisheries, water storage, regulation, filtration, carbon sequestration, migratory birds.

Table 01- The total area, haor area and number of haor in north-eastern region in Bangladesh

District	Total area in Ha	Haor area in Ha	No. of Haor
Sunamganj	367000	268531	95
Sylhet	349000	189909	105
Habiganj	263700	109514	14
Maulvibazar	279900	47602	3
Netrokona	274400	79345	52
Kishoreganj	273100	133943	97
Brahmanbaria	192700	29616	7

The haor area contributes significantly in the economy because it is enriched with a lot of natural resources. This region gets water from the Shillong Plateau, border of India. Primarily, Flash flood is the main disaster which affects the agricultural sector, threatens the haors condition and its surrounding people. Unfortunately, inhabitants of the haor areas are comparatively poorer than other regions of the country as they have to sit idly during the wet monsoon (May to October). As a result, they live below the poverty line (Chowdhury, 2014; HILIP, 2011). Overall poverty head count rates (HCR) of 0.45-0.55 for Sylhet, Habiganj, Sunamganj is higher than the western divisions of Bangladesh. A number of causes, including crop losses from early or flash floods and erosion, inadequate access to markets, particularly during the rainy season, and isolation from traders and services, contribute to the haor region's widespread problematic issues. More than 28% of haor people live below the lower poverty

line (BHWDB 2011). The yearly changes in the landscape that occur during the monsoon season in the haor areas put tremendous strain on the haor people's means of subsistence. In addition, the pattern of basic services (health, education, power, transportation, and utilities) must be adjusted according to seasonal variations, and most of the time, individuals must migrate to other cities in order to make a living (Nahar et al., 2017)

The Haor Basin, a saucer shaped depression, is used during the dry period (December to Mid-May) for agriculture and as a fishery area during the wet period (June to November) (Harvard 2013). In last 30 years, the Haor area has been hit at least 9 times by pre-monsoon flash floods coming from the steep uplands within the Assam and Meghalaya hills, damaging the nearly ready-to-harvest boro crop in each occasion (Parvez et al., 2021; Humanitarian Coordination Task Team, 2018). In 2017, the north-east region of the country was hit by early monsoon flash flood at the end of March, about two and half months earlier than the usual flooding time in haor (Dey et al., 2021). A loss of about a million tons of boro crops occurred as a result of flash flooding and heavy rains that damaged embankments and drowned more than two lakh hectares of agricultural land (The Daily Star, 2017).

Many people live in hatis, the highest peaks of the basin, so that their houses will not be inundated during flash flooding season. Still as the houses are located on the edge of the peaks, there is a perpetual risk of inundation and erosion with the rise of floodwater. The population density of the hatis is high. Families in these homes subsequently face the ongoing risk of being displaced. In 2012, an approximate of 3,000 shelters were destroyed or partially destroyed as a result of the flash flooding (Humanitarian Coordination Task Team, 2018). In case of major inundations, most families temporarily take accommodation in nearby schools where they often stay for several weeks. One study conducted in Nikli upazila under Kishoreganj district found homestead erosion, occurrence of flash flood, lack of hygienic sanitation and migration to be top four vulnerabilities (Sarma, 2010). So, a comprehensive disaster resilient infrastructure is badly needed by the inhabitants.

According to Haor Master Plan, 2012, 32 km regional highway, 88 km submersible district roads, upgradation of 2,875 km rural roads including development of 496 km submersible embankment into submersible rural road have been proposed to accelerate rural connectivity. It is also stated that traffic and passenger will be increased from 1.62 to 2.25 and 12 to 17 million respectively. Simultaneously, under the inland navigation, freight transport is likely to be increased from 11.40 to 14.77 billion ton-km and passenger will be increased from 4.65 to 6.02 billion passenger-Km. A total of 5,00,000 employments will ensue within a span of ten

years owing to development of inland navigation. It is estimated that a developed inland navigation system in the haor area would save 50 million liters of diesel and 1,25,000 tons of CO₂ emission annually because of lower fuel consumption. This will significantly reduce the impacts of climate change. It has been stated in 8th five year plan that, multimodal transport development for Haor regions can be merged with the presence pace of development (GED, 2020b).

A total of 63 rural markets have been proposed to be constructed in the plan. 200 food godowns will be constructed within the vicinity of each growth center or rural markets. However, these growth centers in addition to planned housing are restricted around upazila and district towns only. It is required to select the location considering socio-economic benefits.

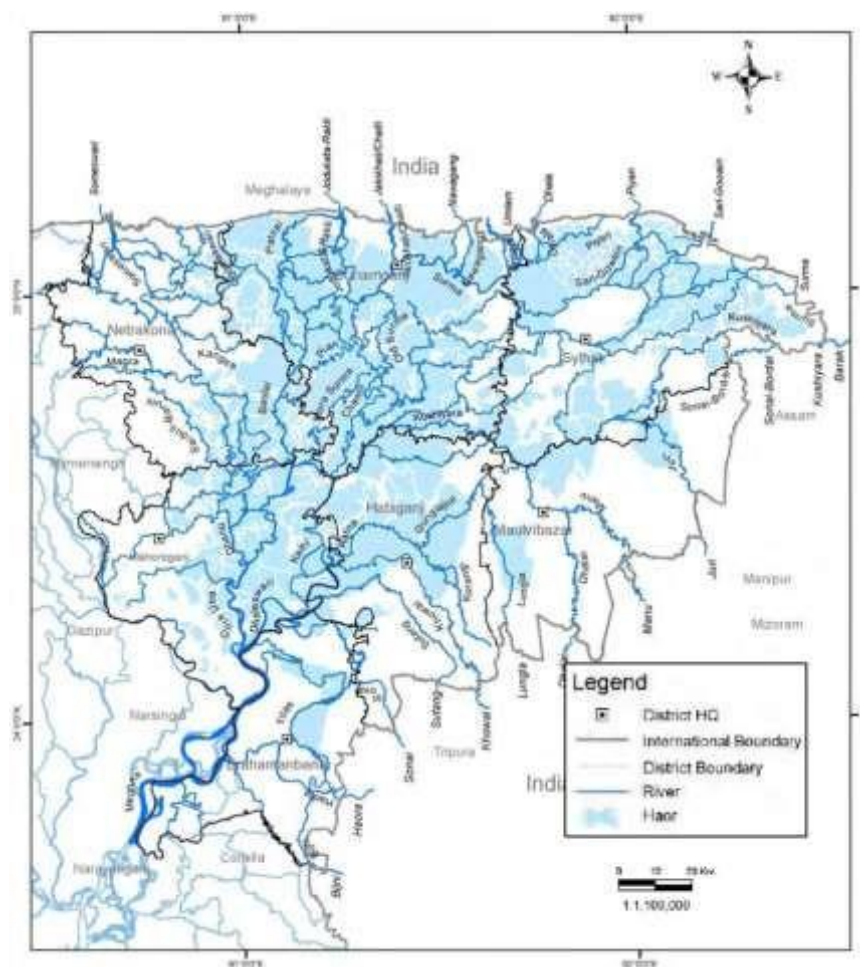
Lack of proper sanitation facilities in flood-prone areas particularly during the flood period is the main factor worsening health problems and causing severe environmental degradation. Leakage of effluents from latrines into the groundwater is a significant pollution problem. In response to these issues, sustainable and community-based flood proof hygienic sanitation system has been endorsed in Haor area (GoB, 2012). Moreover, In Delta Plan, 2100 e National Strategy for Water and Sanitation in Hard to Reach Areas 2011 considers haor region. However, the sustainability of community-based sanitation system is yet to be assessed. Flood zoning and management, rejuvenation of the network of rivers and khals through dredging and de-siltation work are also of pivotal importance. So, a feasibility study is urgent to take to approach into the implementation phase. Under this canopy of so many activities, the key goals- improved standard of living and stronghold against disaster vulnerability may remain far from reaching if not properly integrated. Under the context stated above, rural infrastructure improvement in the haor region is required to integrate their activities to ensure resource efficiency and pave the way for planned infrastructural improvement. In Khulna and Barishal, where rural improvement project-I has been completed, the mark of success is evident. Village markets and growth centers have been established, employment opportunities have been created, women have got separate spaces in the village markets, transportation system has improved and led to increased marketing of agro-based products, sanitation system has been improved and so on. However, no such project has been envisaged in the Haor area. A lot of benefits can accrue if similar project is extended to Haor region (GIZ, 2014).

2. Project Objectives

The objectives of the project that are to be fulfilled by consultancy are:

- a) To conduct feasibility study of integrated rural transport network of Haor region.
- b) To find out potential location of village markets including necessary embankment needed for it considering socio-economic development in the Haor region.
- c) To assess the strategy of sustainable and community-based flood proof hygienic sanitation system of Haor region.
- d) To enhance disaster resilience of the infrastructure through preparation of disaster preparedness programme, contingency plan and improving green infrastructure in the Haor region.

3. Planning Area (Spatial and Temporal Dimension of the Project)



Map 01: Haor of North-East Region of Bangladesh (Source: Haor Master Plan, 2012)

The Rural Infrastructure Improvement Project is to be carried out spanning the whole haor region. It includes seven districts. They are- Sylhet, Habiganj, Maulvibazar, Netrokona, Kishoreganj, Brahmanbaria, Moulavibazar. The proposed actions that are to be completed by the consultancy services will also have to accommodate the whole haor region by taking proper representative samples.

4. Consultancy Services

4.1 Duration of Consultancy Services:

Approximately 24 months from the date of the signing of the agreement with the executing agency for the project.

4.2 Team Composition:

Project Team:

Position	Number	Man-Month
Team Leader	1	08
Deputy Team Leader	2	24
Urban Planner	3	24
Structural Engineer	2	06
Geotechnical Engineer	2	06
Environmental Specialist	1	04
GIS Specialist	1	06
Hydrologist and Morphologist	2	05
Wastewater Management Engineer	1	06
Finance Expert	1	03
Supporting Staff		
Office Manager	1	10
Surveyor	3	06
CAD Operator	1	06
Total	21	

4.3 Required Qualifications and Responsibilities of the Expert:

Position	Qualification	Experience	Responsibility
Team Leader	Master's degree from Urban and Regional Planning/ Civil Engineering/Urban Economics or a related field.	At least 15 years experience in Design/ Construction/ Supervision/ Management as Team Leader/Project Manager in planning, design and construction of any infrastructure related project.	<ul style="list-style-type: none"> •Overall liaison with executing and implementing agencies including reporting to the respective agencies on progress of work being carried out by the team •Coordination and supervision of the input, technical design work and output of the Consultants team.
Deputy Team Leader	Minimum Bachelor degree in Urban and Regional Planning/ Civil Engineering or a related field	At least 10 years of professional experience in Design/ Construction Supervision/ Management of infrastructural projects.	<ul style="list-style-type: none"> • Work under the overall guidance of the team Leader and in close collaboration with the Project Director •Engage central government including local government

			<p>officials and key project stakeholders</p> <ul style="list-style-type: none"> •Quality control of work carried out and delivered by the team with close collaboration with individuals and project stakeholders •Overall management and administration of the consultant contract
Urban Planner	Minimum Bachelor degree in Urban and Regional Planning	At least 5 years of professional experience in urban planning, especially in infrastructural projects or related.	<ul style="list-style-type: none"> •To supervise survey activities •To collect all basic information regarding feasibility study, carry out relevant studies, and prepare report
Structural Engineer	BSc / Post Graduate in Civil/Structural Engineering	At least 5 years experience as an infrastructure engineer	<ul style="list-style-type: none"> •Key support to Team Leader with project QA management. •Design of all structural components of the project including initial costing. •Preparation/review of technical

			<p>specification for structural design.</p> <ul style="list-style-type: none"> •Apply knowledge of construction methods.
Geotechnical Engineer	BSc/Post Graduate in Civil/ Geotechnical Engineering	At least 10 years of experience in Geotechnical engineering.	<ul style="list-style-type: none"> •Scheme design and detailed design of large structure foundations incl. initial costing. •Foundation construction methods. •Foundation design including piling and foundations in soft soils and seismic zones.
Environmental Specialist	Bachelor/Master in civil/Environmental Engineering or its equivalent	At least 5 years experience as Environmental specialist in major infrastructural projects	<ul style="list-style-type: none"> •Undertake project EIA/ IEE to GoB requirement. •Develop EMP including implementation plan and budget. •Updating the IEEs or EIAs, as required •Conduct climate vulnerability and risk assessments

			<p>for proposed infrastructure investments to be financed through ensuing project loans</p> <ul style="list-style-type: none"> • Provide recommendations and guidelines for a step-by-step approach for incorporating climate proofing and DRR interventions in projects.
GIS Specialist	Bachelor in Civil Engineer/URP or any relevant field	At least 5 years experience as GIS Specialist in any infrastructure project	<ul style="list-style-type: none"> • Perform GIS based spatial analysis, networking and 3D analysis
Hydrologist and Morphologist	Bachelor in Water Resource Engineering/Civil Engineering or its equivalent	At least 05 years experience as Hydrologist and Morphologist Specialist of Major Bridge/Road Project Experience in water flow modelling	<ul style="list-style-type: none"> • Carry out all Hydrological and Morphological Surveys and Analyses to facilitate the fixation of alignment and preparation of design. • Identify catchment areas which administrate the supply and drainage of water in

			and around the construction area, •Identify morphological characteristics of the rivers and canals in and around the construction sites.
Finance Expert	Bachelor degree in Finance/Accounting/Business, or a related field.	At least five (5) years of experience in evaluating the financial and cost aspects of an infrastructural project.	<ul style="list-style-type: none"> • Prepare cost comparisons of different proposal options • Carry out cost benefit analysis Produce cost estimates of proposed concepts.

Required Qualifications of Supporting Staffs:

Position	Qualifications	Experience
Office Manager	Diploma in Civil Engineering	At least five (5) years of experience in any infrastructural project
Surveyor	Bachelor degree in Statistics	At least five (5) years of experience in any infrastructural project
CAD Operator	Bachelor degree in Geology or related field	At least five (5) years of experience in any infrastructural project

5. Scope of the project and activities to be carried out by consultant

5.1 Study on Socio-economic condition

i) Demographic condition

Study on demographic condition of the local people is of pivotal importance. For this study, the data on current population, age, gender, density, income, occupation, physical and social infrastructure facilities, housing pattern and condition, employment generation will be collected in the context of the haor region. This would broaden the way to provide adequate different services, physical and social infrastructures by maintaining vulnerable group friendliness and suitability according to one's age and sex. For this, secondary data must be collected from sources such as BBS or any other reliable institutions. If some data are not available and not up to date, then a primary survey would be conducted. The location, time, and the number of people along with their identities must be preserved while conducting the survey for collecting the requirement of service facilities in the sample locations. Both the number and the nature of migrants (whether temporary or permanent) and type of migration (in migration and out migration) are necessary to know the viability of establishing infrastructure and service facilities such as village market, embankments, improved sanitation system. Knowing the key reasons and factors behind the migratory movement would facilitate the assessment of people's needs for required change in infrastructural condition, e.g., village markets, roads, embankment, sanitation etc. The underlying causes behind such migration would facilitate further improvement program.

A combination of PRA tools (social mapping, resource mapping, transect diagram, seasonal diagram), FGD (focus group discussions) and KII are required to be conducted in parallel to ensure rigorous and effective mass participation in the process of the socio-economic survey.

iii) Requirement of women's section market

One of the key features of rural improvement infrastructure projects accomplished in Khulna and Barisal division is the inclusion of women's market section in the village markets. However, it needs to be assessed how a particular society views activities of women in the economy. Again, if women are mostly busy in agricultural activities or household chore, then a women's market section may remain idle most of the time. To judge all these considerations, in-depth interviews including FGDs, and questionnaire surveys are needed.

5.2 Feasibility study of transportation and communication

i) Analysis of existing transportation and communication system and transportation needs

An analysis exhibiting the existing transportation and communication system in comparison to socio-economic analysis would reveal present condition and needs to improve the infrastructure.

ii) Delineation of flood flow, sub flood flow and flood free zone

GIS based analysis, remote sensing should be used to delineate flood flow, sub flood flow and flood free zones. Thus, it will be known which roads are more vulnerable. As a result, additional measures can be taken to protect these establishments. Land routes and water transport can be delineated safely.

iii) Study on integrated transport- rail, waterway, and road

National multimodal transport policy, 2013 endorses an integrated transportation system consisting of road, railway, waterway and airway (GoB, 2012).

Various documents like- Haor Master Plan, 2012, National Multimodal Policy, 2013, National Land Transport Policy, 2004 should be thoroughly reviewed for this. Following that, further survey is required to assess freight movement, especially during flood. Due to prolonged submerged condition of a large segment of the haor basin, water transport facilities are highly needed to facilitate government health and family planning workers in their field visits and to conduct the mobile clinic. Water transportation is a very important and essential component of the economic activity of the region. However, navigation network is deteriorating due to sedimentation in the adjoining rivers (GoB, 2012). A GIS based analysis is to be carried out to find the roads that are built in flood prone or sub-flood prone zone and the disturbance of such roads to water movement. Potential ways to integrate water movement so that the flow of people and goods are continuous even during flash flood are also to be described. Case studies of such an example in other countries are also preferred illustrations.

iv) Study on developing IT based communication system

In order to build up a strong communication system, especially for spreading disaster signals, the National Information and Communication Technology (ICT) Policy was introduced in 2009. It covers some statements which could be directly linked to the development of different sectors in the Haor area. They are- development of industrial production system by ICT, education and Research in the ICT sector, employment through ICT development in

exportimport technology, improvement of medical facilities, developing E-commerce, E-business, internet and telecommunication facilities, environment, climate and disaster management through ICT, overall development by means of ICT (GoB, 2012). As the Haor region is characterized by remote and disconnected areas, flash flood and land erosion as its aftereffects, building an IT based technology is a formidable challenge. A report containing such potential barriers including the promising ways to overcome them through community involvement need to be submitted.

5.3 Location of village markets, paved embankment and ghat

i) Assessing potential location of village markets and required area

The village market's potential location must be demarcated to foster the rural economy. The location of a village market should be chosen considering the existing and proposed road network. An approximate area required for each village market along with the required facilities (cold storage, warehouse, repair shop etc.) are required to be calculated. It would also be accompanied by an analysis of distance from the roads, ghat, embankments and from surrounding towns.

ii) Suitable location of construction of paved embankment and ghat

Embankments are necessary for construction of future bridges and transportation over boats without bridges. Other than in-depth interviews, key informant interviews, focused group discussions pertaining to local peoples' movement, hydrological surveys to assess water current, water depth survey, engineering surveys need to be conducted after the location of village market, existing and proposed transportation infrastructure are properly earmarked given that such data are not available.

5.4 Study on sustainability of strategy of sustainable and community based flood proof hygienic sanitation system in Haor area

Sanitation system is extremely poor in the Haor area. As previously mentioned, one study by Sarma, 2010 concluded that sanitation is the third most vulnerability issue. It needs to be developed and made at least hygienic. A hygienic lavatory entails three characteristics- confinement of waste, barrier between squat holes and pit, venting out of foul gases. A household level questionnaire review needs to be carried out to know which households lack hygienic latrine, whether they agree to community based sanitation system or not and if so, the terms and conditions they put with it. Required borehole data, information of the nature of soil

and aquifer structure, wetland location in respect to toilet facilities need also to be studied on to long term viability of community based sanitation system. If these data are not available, separate tests need to be collected. The Haor master plan contains a lot of provisions in this regard. They need to be reviewed too.

5.5 Incorporation of cross cutting issue

i) Gender and disaster risk reduction

According to national sustainable development strategy, 2011, gender and disaster risk reduction, climate change and good governance are the cross cutting issues. Gender issues in all the above aspects need to be included. Women's vulnerability and ways to include them in decision making need to be properly addressed. The area is frequently hit by flash flood, especially during the monsoon season. Hence, every infrastructure needs to be made disaster resilient. In every above aspect, how climate change is being resisted needs to be separately pinpointed.

5.6 Formulation of disaster preparedness programme and contingency plan

According to Barua et al., 2016, the haor region lies in the moderate and high disaster risk region. The occurrence of flash flood takes the most drastic appearance and thousands of people migrate following the disaster. There is a correlation between remoteness, social deprivation, and out of school children rates. Education in the Haor Basin is disrupted each year during the flash flooding period, as parents do not let their children attend school due to fear of drowning (Humanitarian Coordination Task Team, 2018). So, a disaster preparedness programme must be prepared to remedy the problem. A suitable contingency plan needs to be prepared too following a thorough review of Haor master plan and other relevant policies, plans and programmes. As already mentioned, the Haor region are prone to landslide due to occurrence flash flood. Separate interventions for them, especially for hatis who live in high la need to be sorted out.

5.7 Formulation of Haor afforestation programme (Green infrastructure)

i) Analysis of changes in rural forestry

A map must be prepared through GIS showing past 20 years' gradual forestry change in the haor basin. The potential causes of such depletion and ways to recover it need to be elaborated too.

ii) Listing of flood resilient trees, shrubs and herbs

The typical haor vegetation areas have been classified into nine categories, which are 1) Submerged plants, 2) Free floating plants, 3) Rooted floating plants, 4) Sedges and meadows, 5) Floodplain grassland, 6) Reed swamp, 7) Fresh water swamp forest, 8) Crop field vegetation and 9) Homestead vegetation. A dense canopy harbors an ample number of mature trees standing ten to twelve meters tall (GoB, 2012). Accordingly, trees, shrubs and herbs that are flood resilient and withstand erosion must be planted. So, herbs, shrubs and trees that best suit the local climate are to be figured out. Required descriptions: benefits, local history, best season to plant them, ways of maintenance, contributions to homestead need to be detailed out too.

5.8 Financial and economic analysis

i) Calculation of expected revenue

Calculation of revenue earned if infrastructure is built on proposed location needs to be done. The calculation should be submitted in terms of IRR (Internal rate of return), BCA (BenefitCost ratio) and NPV (Net Present Value). All the financial costs need to be calculated in terms of parametric budget estimate method.

ii) Total economic benefits

Total economic benefits include both financial earnings and social outcome. Shadow pricing of all the proposed infrastructure, if properly built, need to be calculated.

6. Time Schedule for Submission of Reports and Maps

6.1 Format for List of Reports to be Submitted (hard and soft)

Deliverables	Language	Format	No. of copies	Submission Period	Payment Schedule
RIIP- Feasibility Inception report	English	PDF	1	Within 4 months after signing of contract agreement	15 % of the estimated budget
		Printed	3		

Socio-economic survey report	English	PDF, Excel, Word	1	Within 9 months after signing of contract agreement	30% of the estimated budget
		Printed	3		
		Powerpoint presentation			
Traffic and transportation survey report	English	PDF, Excel, Word	1	Within 11 months after signing of contract agreement	
		Printed	3		
		PowerPoint Presenataion			
Interim Report	English	PDF	1	Within 13 months after signing of contract agreement	35% of the estimated budget
		Printed	5		
Draft Final Report	English	PDF	1	Within 20 months after signing of contract agreement	
		Printed	5		

Final report	English	PDF	1	Within 24 months after signing of contract agreement	20% of the estimated budget
		Printed	10		
		PowerPoint Presentation			

All printed copies will be spiral bindings.

6.2 Format for Map and Digital Information:

1. Software: ARC GIS version 3.5 NT/Arc GIS/Arc/View
2. GPS: accuracy 0.5 meter
3. Grid (on Tic Points) Geospatial reference should be indicated in each sheet
4. Map layering: Particular feature or group of features should be in separate layer (coverage detailed from attached)
5. Input Data: Sources should be mentioned
6. Digitizing (location accuracy) 0.002 inches
7. Media: For digital copy CD and Floppy, Pan Drive
8. For original hard Copy: Mylar paper/matt paper
9. Title Blocks

6.3 Format for Submission of maps:

Description	Scale	No. of copies to be submitted	
		Draft	Final
Base map	1"=330'	5	10
Physical feature survey (flood-flow, sub-flood flow and flood-free zone)	1"=330'	5	10
Socio-economic survey	1"=330'	5	10
Field survey	1"=330'	5	10

Road network	1"=330'	5	10
River/khal	1"=330'	5	10

6.4 Printing and Submission of maps

- a) Mouza map (Sheet size 30"×40" and scale 1:1980)
- b) Survey map (Sheet size 30"×40" and scale 1:1980)
- c) Base map (Sheet size 30"×40" and scale 1:1980)

7. Suggested Content of the Reports

Inception report

1. Project background: A brief introduction of the context that makes project vital
2. Study area appreciation: Finding suitable representative study areas covering the whole haor region.
3. Rural infrastructure information needs: Information that are needed to conduct the surveys, delineate location for village markets, embankments or of any other relevance.
4. Implementation issues: Issues that may arise during the implementation phase including ways to address them.
5. Project management support: The annual project cycle and organization of the technical assistance.
6. Activities for the first year of consultancy

Socio-economic survey report

1. Existing demographic condition: Summary of existing demographic conditions like-income, age, sex, employment types, migration etc.
2. Social and resource mapping based on section-1
3. Analysis: Analyzing the data
4. Women, disabled, aged and the poor: Describing the potential obstacles faced by the women, disabled, aged and the poor, ways to overcome them and opportunities to improve the condition of them.
5. Major findings
6. Recommendation and Conclusion

Traffic and transportation survey report

1. Delineation of flood flow, sub flood flow and flood free zone
2. Analysis of existing transportation infrastructure
3. Analysis of 'No intervention' situation
4. Feasibility and scope of integrated multimodal transportation
5. Projected future needs based on socio-economic analysis

RIIP- final feasibility report

1. Introduction and background
2. Study area selection and methodology
3. Summary of socio-economic survey
4. Summary of traffic and transportation survey
5. Potential location of village markets
6. Assessment of community based flood proof hygienic sanitation system in Haor area
7. Potential location of paved embankments
8. Disaster preparedness programme
9. Contingency plan for flood, land erosion and cyclone
10. Haor afforestation programme: It should contain the names of herbs, shrubs, and plants that fall within 9 categories specified in the master plan, map showing past 20 years' forestry change along with descriptions on their potential causes behind it and ways to mitigate them
11. Financial and economic evaluation
12. Recommendation and Conclusion

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