Final Report

Environmental Impact Assessment (EIA) Study

For

The Proposed Sachna-Golakpur Road Under Sunamganj Road Division, Sunamganj

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River Research Institute, Faridpur

Ministry of Water Resources
Government of the People's Republic of Bangladesh

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Abbreviations

AAQ	Ambient air quality
ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BCSAP	Biodiversity Conservation Strategy and Action Plan
BCCSAP	Bangladesh Climate Change Strategic Action Plan
BIWTA	Bangladesh Inland Waterways Transport Authority
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD	Biological oxygen demand
BWDB	Bangladesh Water Development Board
CAMS	Continuous air monitoring station
CEGIS	Center for Environmental and Geographic Information Service
CNG	Compressed Natural Gas
COD	Chemical oxygen demand
DAE	Department of Agriculture Extension
DC	Deputy Commissioner
DO	Dissolved oxygen
DoE	Department of Environment
DoF	Department of Fisheries
DLO	District Live Stock Office
DPHE	Department of Public Health Engineering
DWASA	Dhaka Water Supply and Sewerage Authority
DWSSDP	Dhaka Water Supply Sector Development Project
EA	Executing agency
EC	Electrical Conductivity
ECA	Environmental Conservation Act
ECA	Ecologically Critical Area
ECC	Environmental clearance certificate
ECR	Environmental Conservation Rules
EIA	Environmental impact assessment
EMP	environmental management plan
ESIA	Environmental and Social Impact Assessment
FAD	Fish Aggregating Device
FGD	Focal Group Discussion
FPCO	Flood Plan Co-ordination Organization
FS	Feasibility study
FWIP	Future-with-Project
FWOP	Future-without-Project
GoB	Government of Bangladesh
GPS	Global Positioning System
GRC	Grievance redress committee
GRM	Grievance redress mechanism
GPA	Guidelines for the Project Assessment
GPWM	Guidelines for Participation of Water Management
IEC	Important Environmental Component
IEE	Initial environmental examination
IESC	Important Environmental and Social Components
IUCN	International Union for Conservation of Nature
LGED	Local Government Engineering Department
LLP	Low Lift Pump
JICA	Japan International Cooperation Agency
km	Kilometer
mg/l	Milligram per liter

mld	Million liters per day
MoEF	Ministry of Environment and Forest
MRTB	Ministry of Road Transport and Bridge
MSL	Mean Sea Level
NWRD	National Water Resources Database
NCA	Net Cultivable Area
NCS	National Conservation Strategy
NGO	Nongovernment organization
NEMAP	National Environmental Management Action Plan
O&M	Operation and maintenance
PCM	Public consultation meeting
PIA	Project Influence Area
PIO	Project Implementation Officer
PMU	Project management unit
PPM	Parts Per Million
PPTA	Project preparatory technical assistance
PWD	Public Works Department
RHD	Roads and Highway Department
RoW	Right of way
RRA	Rapid Rural Appraisals
RRI	River Research Institute
SEIA	Socio-economic impact assessment
SPM	Suspended Particulate Matters
SPS	Safeguard Policy Statement
SRDI	Soils Resources Development Institute.
SS	Suspended Solid
TDS	Total Dissolve Solid
THMMM	Topographical-Hydrological-Morphological Mathematical Model Study
UNCED	United Nations Conference on Environment and Development
WARPO	Water Resource Planning Organization
WHO	World Health Organization
WF	World Fish
WQS	Water Quality Standards

Glossary

Aman: Group of rice varieties grown in the monsoon season and harvested in the postmonsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.

Arat: Generally an office, a store or a warehouse in a market place from which Aratdar conducts his business.

Beel: A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.

Boro: A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.

Haor: A back swamp or bowl-shaped depression located between the natural levees of rivers and comprises of a number of *beel*s.

Jhupri: Very small shed for living, made of locally available materials. One type of houses used by very poor community members.

Kacha: A house made of locally available materials with earthen floor, commonly used in the rural areas.

Kanda: Kanda is a land that forms undulation and a slightly higher than agricultural land. This type of land remains fallow or use as cattle grazing or crop thrashing in dry season.

Khal: A drainage channel usually small, sometimes man-made. The channel through which the water flows. These may or may not be perennial.

Kharif: Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).

Kutcha Toilet: The earthen made latrin consist of a hole without cover.

Low Land: Low Land Land which normally is flooded from 180 cm to 275cm deep of water during the flood season.

Medium Low Land: Medium Low Land Land which normally is flooded lesser than 180 cm during the flood season.

Rabi: Dry agricultural crop growing season; mainly used for the cool winter season between November and February.

Very Low Land: Very Low Land Land which normally is flooded deeper than 275 cm during flood season.

Water sealed: A water sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simply pits dug in the ground in which human waste is deposited. A water sealed latrine has a bowl fixture that has a set amount of water retained in it. It is operated on the pour to flush system. These types of latrines can be connected to a septic tank system.

Executive Summary

Project Background

The proposed Sachna-Golakpur Road will be constructed in Sunamganj district. The road will connect Jamalganj and Dharmapasha upazila under Sunamganj district. Currently, there is no direct road communication facility between these two upazilas. So, people around this region are facing severe communication problems due to lack of smooth road communications. To overcome this issue, the Roads and Highways Department (RHD) has initiated to construct a road between Schana bazar to Golakpur Bazar to facilitate smooth communication from Jamalganj to Dharmapasha. If the proposed road will be constructed Sunamganj town will be connected with Netrokona and Mymensingh towns as well as with Dhaka city through RHD Sunamganj-Netrokona-Mymensingh-Dhaka road. At present the RHD regional road (R370) terminates at Sachna Bazar and Dharmapasha. It is essential to construct the missing stretch of the road between Sachna Bazar and Dharmapasha. The people of Jamalganj upazila have no easy way to travel to Netrokona, Mymensingh, Dhaka and other western parts of the country. Similarly the people of Dharmapasha upazila have no easy access to Sunamganj, Sylhet and other towns located in the north eastern part of Bangladesh. In order to connect these two upazilas Jamalganj and Dharmapasha, it is essential to construct the proposed Sachna-Golakpur road link.

The location of the proposed road is low-lying area surrounded by beels, haors, rivers, khals and human settlements. During monsoon this area goes under water more than six months. Construction of this Sachna-Golakpur road link is the most challenging task as this proposed road will be run through parallel to the Surma River within environmentally and hydrologically sensitive low lying haor area. Road embankment along the haors creates obstruction to natural flow of water and is subjected to wave actions. Moreover, rainfall on the adjacent Indian state Magalaya largely affects flooding in the study area. Most of the rivers in this area are originated from nearby hilly area of India. These rivers are extremely flashy and transport both the water and a huge amount of sediment originated mainly from hills as the result of excessive rainfall. Therefore, sudden heavy rainfall creates heavy pressure on the water resources system and consequently on agriculture, fisheries, ecology and livelihood resources in this region.

Under the above circumstances and to achieve the legal requirement of the proposed project, RHD has appointed River Research Institute (RRI) to conduct the Environmental Impact Assessment (EIA) for ‘the Proposed Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj’.

Project Interventions

The study area lies in Sunamganj district of the North East Region of Bangladesh. The proposed road will connect between Sachna Bazar of Jamalganj upazilla and Golakpur Bazar of Dharmapasha upazilla and therefore, the road will link between Sunamganj and Netrakona. The main objective of the proposed Sachna-Golakpur road project is to establish a direct and shorter roadway communication between Sunamganj and Dhaka (Sunamganj-Natrokona-Mymensingh-Dhaka).

There is three alternative road alignment options have been developed according to baseline and hydro-morphological conditions. Among three developed road alignment alternatives, Option-1 is selected as preferred road alignment according to numerical model investigation by RRI. For option-1, the total length of the Sachna-Golakpur road link is about 12.2km. The starting and end points of the road at Sachna and Golakpur ends are 322778.6E, 2768014N and 313144.7E and 2761803N. Ten numbers of

bridges on the proposed road link are needed to keep the existing hydrological regime undisturbed. The design water level of the road varies from 8.52mPWD to 8.55mPWD from Golakpur end to Sachna Bazar end. The required freeboard considering wave runup is 1.05m. Therefore, the formation level of the road varies from 8.57mPWD to 8.60mPWD. On the other hand, formation level of the same varies from 9.57mPWD to 9.60mPWD from Golakpur end to Sachna Bazar end respectively. During an extreme event about 3000m^3/s of discharge may occur over the floodplain to the northwest of the Golakpur limit of the proposed road. In order to connect the proposed road link with national road network of RHD the existing road there has to be upgraded with provision for safe and smooth passage of this discharge.

Rationale of the EIA

EIA is a legal requirement of the DoE under provisions of the Environmental Conservation Act (ECA), 1995 and the Environmental Conservation Rules (ECR), 1997of Bangladesh. According to these rules, construction/reconstruction/expansion of flood control embankments, polders, and dykes etc., andconstruction/reconstruction/expansion of road (regional, national, & international) are fall into the Red category. Therefore, the proposed Sachna-Golakpur Road project is considered under the Red category. This EIA report will be required to get the site clearance as well as environmental clearance from DoE.

Aim of the study

The aim of undertaking the Environmental and Social Impact Assessment (ESIA) of the proposed Project New Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj is to provide baseline data/information, to determine the likely potential environmental impacts (beneficial and adverse) associated with the project activities and to provide mitigation measures. The ESIA is also provides an Environmental Management Plan (EMP) to mitigate and compensate the impacts.

Approach and Methodology

The EIA study has been conducted following the guidelines for study of water sector projects of the Water Resources Planning organization (WARPO), 2005. The methodology for the ESIA study includes literature review, reconnaissance field visits and discussions with government and non-government official regarding management of water bodies and road construction authorities and other officials, consultation with the stakeholders who are directly or indirectly impacted after the road construction, primary and secondary data collection, bounding, identifying Important Environmental Components (IECs), analyses of environmental, social and institutional data and compilation of a report incorporating an EMP. Impacts of the Sachna-Golakpur road on the IECs pertaining to Physical environment, Environmental quality, Water Resources, Land Resources and Agricultural environment, Fisheries resources, Ecological resources and Socio-economic resources have been assessed.

Project Impacted Area

To conduct the environmental impact assessment, the project impacted area (PIA) has been established considering the maximum length of proposed all three road alignments. The maximum proposed road length 17.7 km has taken the major axis of the oval shaped actual project area. To cover the sufficient receiving of environmental condition in accordance with the impacts of the project, 50% of area added with actual project area as the PIA.

Limitations

The communication barrier in project site is major limitation of this study. The study site is in under water more than 6 months a year. Inundation of the working site, other wetland problems, hampered data collection during wet season and lack of communication system including roads and vehicles are the major constraints during dry season. Moreover, time limitation to conduct ESIA is another barrier.

Environmental and Social Baseline

The Environmental and Social Baseline (ESIA) of the Sachna-Golakpur road project has been established in respect of existing physical, biological and socio-economic environment in project site. The baseline condition is illustrated in this report in the following aspect:

Physical environment

The climate of the study area is subtropical monsoonal with an average annual rainfall of approximately 4,000 mm. Over 80% of the rain falls during the monsoon season from June to October. From June to October the rainfall is very high. Winter rainfall is very low. The temperature varies in summer from 40^{o}C to 30^{o}C whereas the same in winter are 18^{o}C and 10^{o}C respectively. The yearly average humidity is 79% and sunshine is 6.4 hour/day. The annual mean wind speed is 7.3 km/hour. However, extreme wind speed recorded is 168 km/hour. Average annual evapotranspiration is 1550 mm/year.

The study area is characterized by high earthquake prone site and falls under Zone-I. Seismic coefficient of this zone is 0.08g.

Climate Change

In order to assess the change in climatic factors, trend of annual variations of the meteorological parameters were analyzed. The major impact caused by climate change is the rise in temperature. The variation of mean annual temperature was recorded at Sylhet station. The average temperature is found to be gradually increasing in this area. In last 50 years, the mean annual temperature has experienced a rise of about 0.022°C per year. The increase in mean annual temperature affects the rate of evaporation and thus rainfall intensities. Spring season has been shortened and monsoon has been shifting towards May. These days, monsoon starts from the month of May and lasts up to mid -October. Due to such timing, water scarcity is often observed in the Boro season. This phenomenon affects the cropping patterns as well as the biodiversity and ecosystem of the study area. The rainfall intensities and patterns have also been changed and an extreme consequence it is affecting the study area. In the last 60 years the annual rainfall of the study area decreased by 1.165mm per year at Sylhet. Along with the other factors, average humidity also experienced a slight change. The average annual relative humidity increased 0.018% per year in last 55 years at Sylhet region.

Environmental quality

Air quality of the project area is quite good.The air quality parameters such as CO, O_3, NO, NO_2, SO_2 are within the range of standard values of DoE (2005) guideline. The noise level in the project site is also reasonable.

The water quality parameter including temperature, pH, Dissolved Oxygen (DO), Electrical Conductivity (EC), Total Dissolve Solid (TDS), Resistivity, Salinity, Phosphate (PO_4^-), Sulphate (SO_4^-) and Nitrate (NO_3^-) were measured in-situ condition in the study area. The measured water quality parameter in surface water and ground water are within the standard value provided by DoE (ECR, 1997) in the study area.

Water Resources

The main source of inflow to the region is from the Barak river which enters Bangladesh at Amalshid. At the border, the Barak bifurcates to form the Surma and Kushiara rivers, the two main rivers of the eastern part of the region. These two rivers receive most of the flashy river flows which enter the region from the Meghalaya Plateau and Tripura Hills. Rainfall on the adjacent Indian state Magalaya largely affects flooding in the study area. Therefore, the Surma-Kushiyara basin (or haor area) receives water from the transboundary catchments of the Meghalaya, the Barak and the Tripura.

A complex network of rivers, channels, khals, beels and haors are the main features in the study area. The Surma is the main river in the study area, and the other two important rivers are the Rakti and Baulai. Sachna Bazar and Jamalganj upazila head quarter are situated on the right and left bank of the Surmariver, respectively. Some of the haors and beels at and around the project area are Halirhaor, Sonirhaor, Pakhnarhaor etc. Drainage pattern throughout the study area follow the land gradient, sloping from north to south and from either side of the study area towards the Surma (Nawa River) and Baulai channel.

Siltation is more likely a key problem in the study area. The Surma and Baulia River is silted up from upstream along with high flow. Sedimentation has been taken place in the river both upstream and downstream over the years. Like siltation, erosion is also take place in the study area. Both bank of the Surma River erodes every year at the study area. Surma River is an important route for navigation in this region. It flows by the side of the Sunamganj district town, Jamalganjupazila head quarter, Sachna Bazar and Golakpur Bazar.

Land Resources and Agricultural environment

The project area is located in the agro-ecological zone of Sylhet Basin (4573 sq. km) (AEZ-21). There are cultivable lands, human settlements, some uncultivable lands and water bodies. Besides there are a number of hats, bazars and growth centers. As the study area is in haor area, the commercial and industrial establishments are insignificant. Copping patterns are determined by the seasonal floods and Agriculture is the main output of the region.The net cultivable area (NCA) is about 75% of the total area 21610 ha. Other 7 % and 18 % of areas are covered by settlements and water bodies respectively. The study area is dominated by very low land (67%) which is followed by medium low land (24%) and low land (09%) of the NCA. The soil texture is dominated by Silt and organic matter content varies from 3.40to 8.07% in entire study area.

Rice is the dominant crop in the project area. The total cropped area is around 16316 ha of which rice occupies around 14031 ha and the remaining 2447 ha of land is covered by non-rice crops. The annual total production is about 106,564 metric tons of which the total rice production is about 50897 metric tons. The total production of non-rice crops (such as tomato, chili, groundnut, potato and mustard) is about 55,667 metric tons. The overall cropping intensity in the study area is around 133%. Irrigation used in dry season to grow rice and vegetables. Irrigation coverage of the project area

is about 86% of the total NCA during the dry season. Mostly manual labor is used for cultivation in the study area as mechanized cultivation is very rare in this Haor region. The labor requirement is vary throughout the year. A large number of populations of the study area earn their livelihood through work associated with raising cattle and poultry. According to local people, the main constraints of the study area are siltation, drainage congestion, over rainfall, flash flood, hailstorm, cyclone and drought.

Fisheries resources

The study area is an important source of fisheries. Open water fish habitat of this project area includes rivers (Surma, Baulia and others), seasonal floodplain and beels. The diversity of wetland habitats, seasonal inundation and fluctuation of water regime and connectivity of the haor/beels rivers and khals make the haor suitable for capture fisheries production of this area. 76.6% fish are coming from floodplains. Connectivity among the rivers, haor/beels, channel, khals, etc. are the way to fish migration of this area. Fish species migrate vertically and horizontally to the rivers, and other water bodies of the area as part of their life cycle. Overall fish migration situation is moderate in the study area.

Fish habitat is primarily classified under two categories capture fishery and culture fishery. River, beel and floodplain are considered under capture fish habitat. The most of the fish production is coming from capture fisheries and culture fish are very limited. A large number of fishing net/gears are used for fishing. Some common fishing gears in the study area are current jal, Berjal, Urainnajal, Tanajal, Thelajal etc. About 10% of fishers have fishing boat and 90% have fishing net. Fish are catching all the year round in the Surma River. Organized catch and open catch two distinct seasons are identified in the haor/beel. Due to lack of the communication systems in the study area, fish marketing and postharvest facilities are poor.

There is a gradual decline in the production trend of capture fisheries over decade in the study area due to indiscriminate fishing and shrinkage of fish habitat. Most of the river and beel habitat fishes use floodplain as feeding and breeding ground. Silting up of beels and canals reduces the depth as well as water volume negatively impacting fish production. The exploitation pressure is very high and no care is taken as to the future of fish stock in the haor areas. Fishermen use sometimes nets with too small mesh gear to catch as much fish as possible gradual bringing many species to extinction. There is no effective enforcement of the fish conservation act.

Ecological resources

The study area encompasses one of the bio-ecological zones, namely the Haor basin. The Haor basin is an internationally important wetland ecosystem. The study area consists of human settlement haors, beels, and river systems. The study area surrounded by the Surma and Baulia rivers along with many haors like Pkhnar Haor, Haliar Haor, Shanir Haor etc. which supports a habitat of rich bio-diversity. Both rivers and haors are made up of a complex of habitats whose diversity supports exceptionally rich fish faunas. Haors and beels are connected to the rivers and natural river functioning depends on the diversity in form of these various habitats and the inter-connectivity between them, with uninterrupted flows along the main channels and the seasonal invasion of the haor and its water bodies. Crop land is major land type in all over the haor area including the study area. The agricultural land is mainly vegetation type. Cropping patterns are determined by the seasonal floods with rice as the most dominant crop. Cropland supports various avifauna and reptiles. Beels and other water bodies support a good amount of free floating aquatic vegetation.

Floodplains and wetlands are very good place for birds. In the study area, many birds are observed in floodplains and wetlands including dry land habitat such as homestead, open woodland, scrub and grass land. The common birds in the study area are duck, kingfisher, titra, sparrow, wagtail, dove, crow etc. There is no endangered wild species are present in the study areas.

Socio-economic environment

The study area belongs to Sunamganj district. Jamalganj and Dharmapash aupazilla covers 85% of the study area and 15% under Bishwambarpur and Tahirpur. According to BBS population and housing census 2011, the total population of Jamalganj upazila is 167,260 while total population is 223,202 in Dharmapasha upazila. The number of male and female population is almost equal in the project site. The gender ratio ranges from 101 to 104.The literacy rate in the study area is 32.5% of which male literacy is 34.6% and female literacy is 30.2%. The average size of the household in the study area ranges from 5.3 to 5.9 members. Agriculture was reported by the local people is the mainstay of their mode of livelihood. Most of the households in the study areas are using tube-well water (groundwater) for drinking purpose. About 50% of the households are dependent on surrounding river/pond water for domestic use. 96.3% of general household get the facility of drinking water from tube-well, 0.3% from tap and the remaining 3.4% household get water from other sources for drinking. In the Jamalganj Upazila, 28.5% of general household have sanitary latrine, 61.6% non-sanitary latrine and 9.9% have no toilet facility. However, in the Dharmapasha Upazila, 21.2% of general household have sanitary latrine, 66.3% non-sanitary latrine and the remaining 12.5% have no toilet facility. Both Jamalganj and Dharmapasha upazila have electricity supply from the Rural Electrification Program. 26.9% of the general households in Jamalganj Upazilla and 13.5% in Dharmapash aupazilla have the electricity connection in their households.The most of the income comes mainly from agriculture (65%) and fishing (25%), selling labour (5%)and 5% engage in service (Govt. and non govt.). Most of the expenditure is for household consumption (59%) and housing (35%) in the study area. The health disability of the population in the study area is not noticeable and there are no indigenous peoples and traditional tribal lands in the study area.

Stakeholder Consultation and Disclosure

Several public consultation meetings were conducted with the participation of local people, the representative of government and non-government authorities and elected representatives of Union porishad. Local people showed very positive attitude towards the proposed road project. They expressed their opinion that the road is very essential for their survival as there is no smooth road communication in the project site. They believe that the construction of the proposed road will play an important role in improving communication in that region and that will be improved the overall socio-economic condition of this region. The people in the project area are willing to sacrifice their lands for road construction. They would help the implementing agency spontaneously during pre-construction and construction phase.They also informed that there will be no need outside labor, local people will be worked as labor during construction of the road. The representatives of union parishad and government and non-government authorities also expressed their positive attitudes about the proposed road construction.They expressed their opinion about road design such as alignment, road opening, road length, bridges and culverts of the proposed road.They also suggested that the road project should not have any adverse impact on fish migration and fish population which is now on the decline due to overfishing. Public disclosure meetings have also been carried out for disclosing the impact of the Project and the Environmental Management Plan (EMP).

Impact Assessment

Significant environmental and social impacts caused by the project interventions as well as the proposed appropriate mitigation measures have been assessed. This ESIA study shows that the construction of the Sachna-Golakpur road has both positive and negative impacts.

Positive Impact

The proposed road will play an important role in the communication of this region and thereby, improve the overall socio-economic condition of the people of this area. Enhancement of communication systems, Employment opportunity, improvement of trade and commerce, poverty alleviation, Enhancement in accessibility in health facilities, Schools and colleges are the major positive impacts after the proposed road construction. After construction of the proposed road people of this area can directly move from Jamalganj to Dharmopasha upazilla. People can easily go from Jamalganj to Dhaka via Sunamganj-Netrokona-Mymensingh-Dhaka road through RHD connection. Therefore, after construction of the road, many rural people who are now lacking in communication facilities could avail this connectivity to travel to different parts of the country easily. The road will also be beneficial to the local people in the vicinity of the road who now completely depend on boats and other modes of locally available motorized and non-motorized vehicles to transport. This road will reduce vehicular operating cost and travel time.

Agricultural products are likely to promote agro-based small scale industries in Sunamganj after the construction of the proposed road. This region has been known for agricultural products, stone and sand business. If the roadway is constructed, it will be easier to transport these products from Jamalganj to other parts of the country. After completion of the road project, surrounding areas like Jamalganj, Sachna Bazar, Dharmapasha may be converted into industrial areas. Since the proposed road will connect the national highways, the agricultural and other products of the area could be transported to Dhaka and other cities and it will help to increase the economic growth for people of this region. Employment opportunities, excess to health facilities and literacy rate will be increased significantly after enhancement of communication systems. Therefore, the life style of the people will be improved remarkably and therefore socio-economic condition of the area will be enhanced after the project implementation.

The most of the beneficial impacts are in high significance, regional and long term in nature.

Negative Impact

The ESIA study shows that there might be some adverse impacts for the proposed Sachna-Golakpur road construction. As the proposed road will be constructed in haor area, the most negative impacts on environmental components are related to water resources. The proposed road will be constructed parallel to the Surma River with flush flood, siltation and bank erosion are the major phenomena of this haor region. Road embankment along the haors creates obstruction to natural flow of water and also creates loss of biodiversity. Therefore, water resources problems such as flush flood, wave action, flood level, siltation, bank erosion, road opening for drainage of water and loss of biodiversity would be negatively impacted. The road location, alignment and structure of the road are also taken in important consideration. The significance of these negative environmental impacts is mostly due to design and construction-related impacts including road location, alignment, structure, dimension and road opening etc. It is to be noted that the resultant potential impacts can be offset through proven

mitigation measures during the design and adoption of good engineering practices in construction and operation.

The other major impacts on the environmental components would be that for construction of the proposed road around 83 hectares of land would be acquired which mostly belongs to private owners. Due to construction work and movement of heavy vehicle, air and water contamination and noise generation would be deteriorated at the construction site. Land use pattern in this area will be changed temporary during the construction of labor sheds, contractor's office and material stockyard. Traffic, excavation and filling operations may create some safety hazards for the local population as well as for the construction workers.

Fish habitat and fish production are likely to be declined due to modification of the land for construction of the road during and after the proposed road construction. Fish migration and fish diversity would be impacted as there is connectivity between rivers and haors as well as adequate road opening for free passage of water is required.

EMP Measures

The EMP has been prepared to ensure the implementation and monitoring of the mitigation measures by this ESIA study. The following EMP has been made for establishment of the proposed Sachna-Golakpur Road link to minimize the adverse impacts.

- Acquisition of land should be done in proper way and exact compensation rate should be provided.
- Suggested road alignment should be followed to construct the road. Suggested road openings at indicated locations should be provided with proper engineering design for safe passage of flood water recommended by RRI model study to reduce impediment to drainage.
- Proper traffic safety measures and regulations especially near bazar sides such as Sachna Bazar, Golakpur Bazar and Mominpurpur Bazar should be considered.
- Construction works may deteriorate the water quality of the Rivers and haor/beel. Solid waste from construction site should be well managed. Compliance with DoE standards during and after construction. Manage wastewater discharge and solid waste from establishment after construction.
- During construction appropriate measures by contractor to protect fish habitat. Provide fish friendly structures at bridge.
- Recommend the contractor to employ local people by giving priority to women and vulnerable groups. Ensure equal wages to male and female for equal amount and type of work.
- Implement plantation along the Sachna–Golakpur road sides after the road construction which will recompense the vegetation lost.
- Slope protection works at the road side and bridge site should be provided.
- Improvement of rural and regional roads for better traffic movement. Repair and widening of existing narrow roads.
- Construction workers should be advised to protect natural resources and wild animals.
- Residues from construction materials and exudes from construction machineries into the water and soil should be reduced as much as possible by careful handling.
- The project area is high earthquake prone site (zone I). The designs of the project components should conform to Bangladesh National Building Code, 2006.

- In order to minimize the loss of terrestrial habitats within the project area, homestead vegetation and roadside vegetation should be retained or replanted wherever possible.
- A mix of local and exotic timber, fruit bearing, medicinal and fodder species should be used in the initial re-vegetation of the disturbed land. Local indigenous species should be given priority where possible.
- In order to reduce human pressure on remaining biodiversity resources, an extensive awareness campaign for biodiversity conservation aimed at local communities within and around the project area should be implemented.

1 Introduction

1.1 Background

The project area is located in the north-east region of Bangladesh. North-eastern part especially Sunamganj, Sylhet and Netrokona districts are located in one of the depressed part of the country. The proposed Sachna-Golakpur Road will connect two upazila of the Sunamganj district namely Jamalganj and Dharmapasha. There is no smooth road communication system between these upazilas. As a result, the people of Jamalganj upazila have no easy way to travel to Netrokona, Mymensingh, Dhaka and other western parts of the country. In this connection, the Roads and Highways Department (RHD) has initiated to construct a road between Schana bazar to Golakpur Bazar to facilitate smooth communication from Jamalganj to Dharmapasha and other parts of the country. The main aim of the proposed Sachna-Golakpur road project is to establish a direct and shorter roadway connection between Sunamganj and Dhaka. The RHD has selected River Research Institute (RRI) to carry out the Environmental Impact Assessment (EIA) for 'the Proposed New Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj' and 'Topographical, Hydrological and Morphological Study using Mathematical Model' for the same project. It is to be noted here that the proposed Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj' is a Prime Minister's commitment to set up direct roadway connection between Sunamganj (Jamalganj) and Natrokona-Mymensingh-Dhaka, and western part of Bangladesh.

After establishing the proposed road, Sunamganj town will be connected with Netrokona and Mymensingh towns as well as with Dhaka city through RHD Sunamganj-Netrokona-Mymensingh-Dhaka road. Currently, the RHD regional road (R370) terminates at Sachna Bazar of Sunamganj district and Dharmapasha Upazila Head Quarter of the same district. It is essential to construct the missing stretch of the road between Sachna Bazar and Dharmapasha. The people of Jamalganj upazila have no easy way to travel to Netrokona, Mymensingh, Dhaka and other western parts of the country. Similarly, the people of Dharmapasha upazila have no easy access to Sunamganj, Sylhet and other towns located in the north eastern part of Bangladesh. In order to connect these two upazilas, it is essential to construct the proposed Sachna-Golakpur road link. The construction of the proposed new road will facilitate uninterrupted direct road communication between Dharmapasha Upazilla and Sunamganj District via Golakpur, Mominpur, Kaminipur, Kamlabaz, Sachnabazar. It will also connect Netrokona and Sunamganj Districts with different towns of Mymensing and Sylhet divisions. As a result, many rural people who are now lacking in communication facilities could avail this connectivity to travel to different parts of the country easily. The road will also be beneficial to the local people in the vicinity of the road who now completely depend on boats and other modes of locally available motorized and non-motorized vehicles to transport and market their agricultural products beyond local markets. This will reduce vehicular operating cost and travel time. Since the proposed road will connect the national highways, the agricultural and other products of the area could be transported to Dhaka and other cities and it will help increase the economic growth for people of this region. The project will help for employment generation during and after implementation of the project and therefore, overall socioeconomic conditions in the project area will be improved.

The project area is dominated by floodplains with seasonally flooded tectonic depressions known locally as haors and smaller water bodies known as beels. The proposed Sachna-Golakpur road has to be constructed in the low lying haor area surrounded by beels, haors, rivers, khals and human settlements. During monsoon this area goes under water for six months. Sachna Bazar and Jamalganj

upazila head quarter are situated on the right and left bank of the Surma river respectively. Establishment of this Sachna-Golakpur road link is the most challenging task as this proposed road will be run through parallel to the Surma River within environmentally and hydrologically sensitive low lying haor area. Road embankment along the haors creates obstruction to natural flow of water and is subjected to wave actions. The connectivity between the rivers and the haors is a major issue, for fixing the proper road alignment and road structure locations to construct the proposed Sachna-Golakpur road for smooth communication between Sunamganj to Natrokona. Since rainfall on the adjacent Indian state Magalaya largely affects flooding in the study area, the rainfall pattern of the upstream catchment has great influence here. Most of the rivers in this area are originated from nearby hilly area of India. These rivers are extremely flashy and carry both the water and a huge amount of sediment originated mainly from hill as the result of excessive rainfall.

Huge amount of sediment is transported with heavy flow of water during flash flood that eroding the hilly catchment area. In this hilly region, massive erosion takes place during heavy rainfall on the exposed surface of the hill. If the high intensity rainfall is continued for certain period then coarser sediment such as big sized stone, boulders etc. start to erode and move along the rivers. Finally these sediments are deposited on the river bed, khals, canals and agricultural land. Consiquently, sediment transport rates of the rivers increase significantly and hence major flood events make a disproportionate distribution of sediment and changes in channel size, shape and even location. The sediments carried by the rivers are also deposited along the river banks resulting in an increase in the land elevation there compared to the surrounding haor and beel areas.

Flash flood in this region destroys agricultural products of large areas, causing death, damage to property, environmental pollution and damage to roads and bridges. Most of the cases, flood water comes into the haor very early in the monsoon and farmers do not get sufficient time to harvest their standing boro crop. Over the time sediment transportation by rivers gets deposited on the river and channel beds and reduces the conveyance capacity more or less of all of the water resources system within the Haor area. Therefore, sudden heavy rainfall creates heavy pressure on the water resources system and consequently on agriculture, fisheries, ecology and livelihood resources in this area.

In view of the above mentioned facts and to fulfill the legal obligation of the proposed project, a full-scale ESIA is required. River Research Institute (RRI), Faridpur is entrusted with the responsibility of carrying out the ESIA study by the RHD, Sunamganj. In the light of the Terms of Reference (ToR), a contract was signed between RRI and RHD on 3rd May 2016 to carry out the ESIA.

1.2 Study area

The study area belongs to Sunamganj district of the North East Region of Bangladesh. This region comprises an area about 22,000 km^2 which can be further subdivided into six distinct sub regions. The project area belongs to the Baulai sub region (5000 km^2) and the Surma sub region (4500 km^2). 85% of the study area consists of two upazilas namely Jamalganj & Dharmapasha, and 15 % of the study area under Tahirpur and Bishawambarpur Upazilla in Sunamganj. Jamalganj is an upazila located in between 24°50' and 25°04' north latitudes and in between 91°05' and 91°19' east longitudes and its total area is 309.38 km^2 (land area 279.38 km^2 and riverine area 30 km^2). It is bounded by Tahirpur and Bishwambarpur upazilas on the north, Khaliajuri and Derai upazilas on the south, Sunamgaonj Sadar upazila on the east, Mohangonj and Dharmapasha upazilas on the west. Dharmapasha is an upazila located in between 24°47' and 25°12' north latitudes and in between 90°56' and 91°11' east longitudes. It is bounded by Meghalaya State (India) on the north, Mohangonj and Barhatta upazilas on the south,

Tahirpur and Jamalganj upazilas on the east, Kalmakanda and Barhatta upazilas on the west and its total area is 531 km^2 (land area 527 km^2 and riverine area 4 km^2).

Rivers, beels/haors, floodplain, agricultural lands and human settlements are the major physical features of the study area. The Surma and Baulia rivers and some haors like Pkhnar haor, Haliar haor, Shanir etc. re exist in the study area. There are small strips of land of relatively higher elevation along both banks of the Surma river. At present there are human settlements and well grown trees in these lands. During monsoon this area goes under water more than six months. Agricultural practices along with fishing are the main livelihood in this area. Sachna Bazar and Jamalganj upazila head quarter are situated on the right and left bank of the Surma river, respectively. The proposed study area is shown in the following **Figure 1.1**.

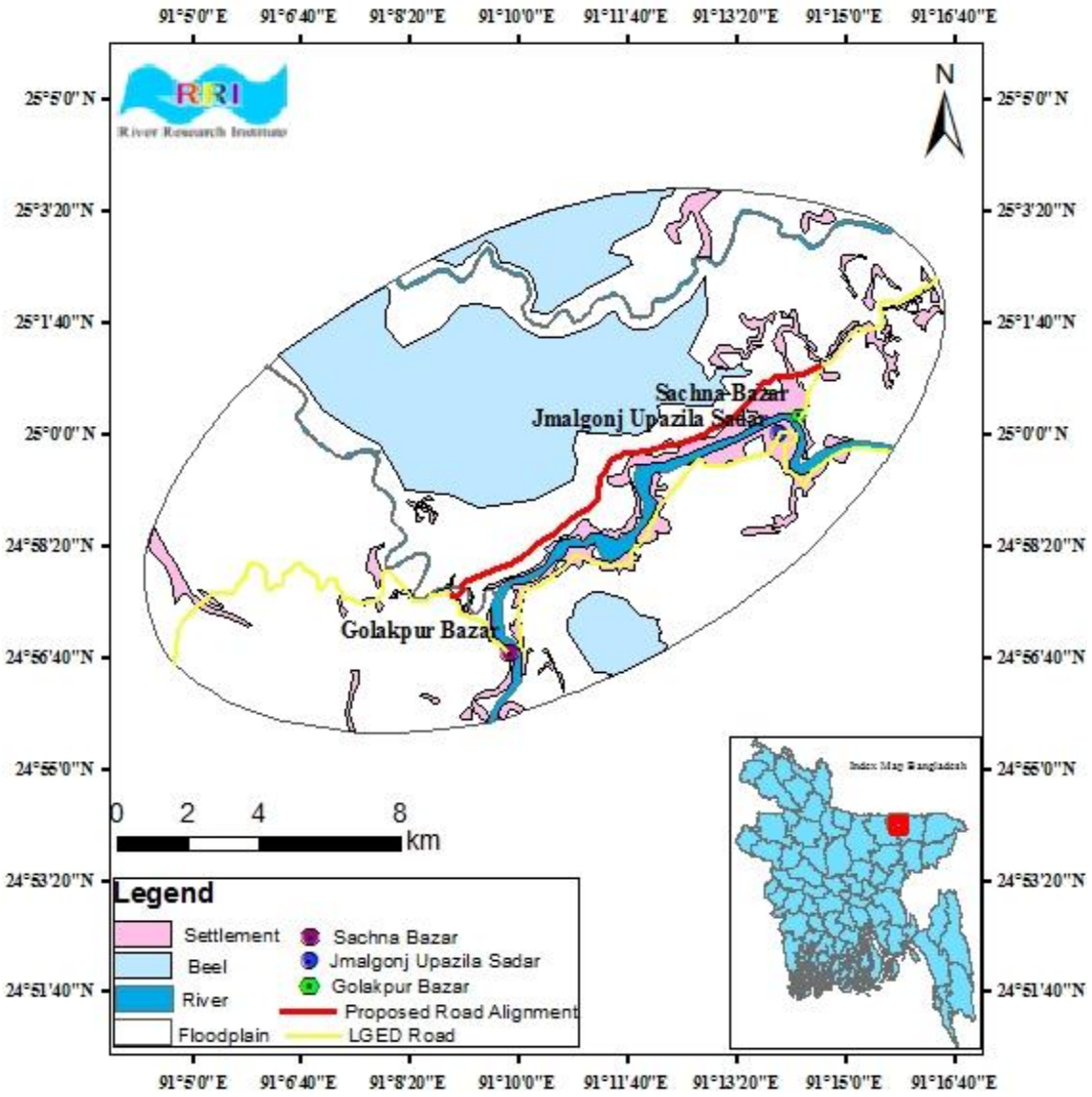


Figure 1.1 ESIA Study area of Sachna-Golakpur Road Project

1.3 Rationale of the EIA

The Department of Environment (DoE) is the authority with the mandate to regulate and enforce environmental management ensuring adequate EIAs of any project. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DoE guidelines. The DoE is set up in the Environment Conservation Rules 1997 where projects are divided into four categories, namely Green, Orange A, Orange B and Red, depending upon their nature and environmental impacts. According to this rules, construction/reconstruction/expansion of flood control embankments, polders, and dykes etc., and construction/reconstruction/expansion of road (regional, national, & international) are fall into the Red category (Appendix A). Therefore, this proposed New Sachna-Golakpur Road project is considered under the Red category of the Environmental Conservation Rules, 1997. This EIA report will be required to obtain the site clearance as well as environmental clearance from DoE.

1.4 Objectives of the study

The main objective of undertaking the Environmental and Social Impact Assessment (ESIA) of the proposed Project New Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj is to provide baseline data/information, to determine the likely potential environmental impacts (beneficial and adverse) associated with the project activities and to provide mitigation measures. The ESIA is identify impacts from the project implementation on physical, biological and socio-economic environment of the project area, and to propose measures to avoid, minimize, mitigate, and compensate such impacts. The specific objectives of the proposed ESIA are:

- Establish baseline data of the proposed project area
- Identify major issues that may arise as a result of the proposed project on physical, biological and socioeconomic environment of the project area
- Recommend practical and site specific environmental mitigation and enhancement measures, and prepare environmental monitoring plan which will be required to obtain the site clearance as well as environmental clearance from DoE.

1.5 Scope of Work

This report has prepared on the basis of a) primary field studies by RRI personnel b) stakeholder meetings resulting from the Public Consultation process undertaken by RRI personnel c) secondary data on physical, biological, ecological, social and other relevant information collected from different organizations.

The detail scope of work is as follows:

i. Establish the environmental and social baseline conditions of the proposed Project New Sachna-Golakpur Road site. The baseline data under following criteria has been generated:

- **Physical environment**
  - Physiography and Landforms
  - Geology
  - Seismicity
  - Climate and Meteorology

- Climate Change

➢ **Environmental quality**
- Water quality
- Air quality
- Noise
- Significant sources of Pollution in the project area and Prospects for their mitigation

➢ **Water Resources**
- Major River Systems
- Surface Water Hydrology
- Flooding and Drainage
- Erosion
- Siltation
- Navigation

➢ **Land Resources and Agricultural environment**
- Agro-ecological regions
- Land use
- Land type
- Soil texture and Organic Matter Content
- Soil Moisture
- Drainage characteristics
- Farming practices
- Crop production constraints
- Cropping pattern by land type
- Crop damage
- Fertilizer and Pesticide
- Irrigated area by crop
- Yield level (Normal and damaged)
- Crop production
- Livestock resources
- Status of livestock and poultry
- Feed and fodder
- Livestock and poultry diseases

➢ **Fisheries resources**
- Constraints and Issues
- Fish habitat and diversity
- Fish Production
- Fishing effort
- Fish migration
- Fish marketing and post-harvest facilities
- Fisher's lifestyle

➢ **Ecological resources**
- Bio-ecological zones
- Environmental Protected Area

- Wildlife
- Flora
- Fauna

➢ **Socioeconomic environment**

- Population
- Land use
- Planned development activities
- Community structure
- Employment and labour market
- Distribution of income, goods and services
- Recreation
- Public health
- Education
- Cultural properties
- Indigenous peoples and traditional tribal lands
- Customs, aspiration and attitudes

ii. The environmental and social impacts of the proposed road intervention have been assessed and

iii. Environmental Management Plan (EMP) has been developed including mitigation measures, enhancement measure, compensation measure and an environmental monitoring plan.

1.6 Limitations

The communication barrier is the major limitation of this study as there is no smooth road communication system in the project site. Moreover, the study site is in under water more than 6 months a year. Inundation of the working site, other wetland problems, hampered data collection during wet season. On the other hand, lack of communication system including roads and vehicles are the constraints during dry season. A great effort was put during field visits, conducting FGD and PRA, and data collection using motor cycles, trawler, even walking for long distances to reach the stakeholders and organize meetings for the ESIA study.

Time limitation to conduct ESIA is another barrier. According to ESIA guidelines for water sector projects, ESIA studies need collection of detailed data and information of the resources for the full hydrological year covering both dry and wet seasons. These data are required for assessing the environmental and hydro-geomorphological consequences due to the given interventions. However, the total period allocated for the ESIA study of the Sachna-Golakpur Road project is only few months. Moreover, selection of an alignment from a number of alternatives of the proposed road has also been investigated. Along with baseline data, hydrological and morphological study results from RRI mathematical model study also used to conduct the ESIA study properly which consumed time.

1.7 Study Team

The following multidisciplinary professionals from RRI are mainly involved to carry out Environmental Impact Assessment (EIA) study of the proposed project:

i. Engr. Pintu Kanungou, Chief Scientific Officer and Team Leader, RRI
ii. Dr. Engr. Fatima Rukshana, Senoir Scientific Officer and Principal Investigator, RRI
iii. Mr. Nayan Chandra Ghosh, Scientific Officer and Investigator, RRI
iv. Mr. Md. Moniruzzaman, Scientific Officer and Investigator, RRI
v. Engr. Abdullah Al Imran, Scientific Officer and Investigator, RRI

1.8 Report format

The ESIA report consists of the following chapters:

Chapter 1:	**Introduction**	: It describes the background of the project, Study area, Rationale of the EIA, objectives of the study, scope of the works and limitation of the study with a list of the EIA study team.
Chapter 2:	**Policy, Legal and Administrative Framework**	: It reviews the national legislative, regulatory and policy framework relevant to the ESIA study.
Chapter 3:	**Approaches and Methods**	: It presents the detailed approach and procedure applied to conduct the ESIA study. The chapter also describes data sources and methodology of data collection, processing and impact assessment.
Chapter 4:	**Description of the Project**	: It provides a simplified description of the Project including objectives and project area, alignment, design of the road and road structures, key activities, implementation arrangements, and other related aspects.
Chapter 5:	**Analysis of Alternatives**	: It discusses various alternatives considered during the feasibility and design stage of the Project, and their environmental and social considerations.
Chapter 6:	**Environmental and Social Baseline of the Project Area**	: It describes the existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the project area.
Chapter 7:	**Public Consultations and Disclosure**	: It provides details of the consultations held with the stakeholders at the project site. Also included in the chapter are the disclosure requirements for the EIA.
Chapter 8:	**Environmental Impacts Assessment and Mitigation Measures**	: It assesses the potential impacts of the proposed interventions on the environmental components. The chapter also proposes appropriate mitigation measures to eliminate, offset, or reduce the potential impacts.
Chapter 9:	**Environmental Management Plan**	: This chapter specifies the implementation arrangements for the mitigation measures identified during the ESIA study and described in the previous chapter. The EMP includes among others mitigation plan, an enhancement plan, a contingency plan and the environmental monitoring plan.
Chapter 10:	**Conclusions and Recommendations**	: It conclude the study with recommendations
	Appendixes	: Relevant documents included in Appendixes.

2 Policy, Legal and Administrative Framework

2.1 Legal Provisions of the Government

Government of Bangladesh has adopted various acts, regulations and guidelines to ensure environmental safeguards in their development investments. These legal documents were reviewed during the preparation of this IEE and EIA. The implementation of this project will be governed by environmental acts, rules, policies, and regulations. The Relevant legal provisions, regulations, and standards for environmental assessment and management are briefly described below.

2.1.1 The National Environment Policy, 1992

The National Environment Policy was adopted by the Government of Bangladesh in 1992, with the aim to maintain ecological balance and overall development through protection and improvement of environment and to protect the country against any natural disaster. The Policy provides the broader framework of sustainable development in the country. It also stated all major undertakings, which will have a bearing on the environment and need an initial environmental examination (IEE) and environmental impact assessment (EIA) before initiation of the project. The Policy delineates the Department of Environment (DoE), as the approving agency for all such IEE/EIAs to be undertaken in the country.

2.1.2 The National Water Policy, 1999

The National Water Policy of 1999 was adopted to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. The policy considers water as being essential for human development, socio-economic development, poverty alleviation and preservation of the natural environment.

Sub-clause (b) of Section 4.5 states that planning and feasibility studies of all projects (relevant to water resources management or development or have interference on water sector) will follow the Guidelines for the Project Assessment (GPA), the Guidelines for Participation of Water Management (GPWM), the Guidelines for Environmental Impact Assessment (EIA), and all other instructions that may be issued from time to time by the Government. Giving importance on the navigation sector, sub-clause (a) of section 4.10 states that if a project may cause disruption to navigation, adequate mitigation measures should be taken.

2.1.3 National Conservation Strategy (NCS) 1992

National Conservation Strategy was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle. However, the final approval of the document is yet to be made by the government.

2.1.4 The Biodiversity Conservation Strategy and Action Plan 2004

The Biodiversity Conservation Strategy and Action Plan 2004 (BCSAP) is a wide ranging and multi-faceted plan, which is also closely related to the statements set out in the National Environment Policy.

The BCSAP has the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development; and
- Improvement in the quality of life of the people.

2.1.5 National Environmental Management Action Plan (NEMAP) 1995

The National Environmental Management Action Plan (NEMAP) is a wide ranging and multifaceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements for the period 1995 to 2005 and set out the framework within which the recommendations of the National Conservation Strategy are to be implemented. NEMAP has the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce rate of environmental degradation;
- Improvement of the natural and built environment;
- Promotion of sustainable development; and
- Improvement in the quality of life of the people.

2.1.6 Bangladesh Climate Change Strategic Action Plan (BCCSAP), 2009

The Bangladesh Climate Change Strategy and Action Plan 2009 is built on the following 6 pillars: Food security, social protection and health to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programs focus on the needs of this group for food security, safe housing, employment and access to basic services including health;

Comprehensive disaster management to further strengthen the country's already proven disaster management system to deal with increasingly frequent and severe natural calamities;

Infrastructure to ensure that existing assets are well maintained and fit-for-purpose and thaturgently needed infrastructure is put in place to deal with the likely impact of climate change;

Research and knowledge management to predict the likely scale and timing of climate change impacts on different sectors of the economy and socio-economic groups, to underpin future investment strategies and

to ensure that Bangladesh is networked with the latest global thinking on science and best practices of climate change management;
Mitigation and low carbon development to ensure low carbon development options and implement these as the country's economy grows over the coming decades and the demand for energy increases; and

Capacity building and institutional strengthening to enhance the capacity of government ministries and agency, civil society and the private sector to meet the challenges of climate change and mainstream them as part of development action.

2.2 Legal Framework

2.2.1 Water Resource Management Legislation

Panishampad Parikalpana Act (Water Resource Planning Act, 1992)

Under this Act, the government is authorized to set up a Water Resource Planning Organization (WARPO), which would prepare a master plan for the development of water resources and through a technical committee, advice all other agencies related to the issue of water resource development use.

The Embankment and Drainage Act 1952

This is an Act to consolidate the laws relating to embankment and drainage and make better provisions for the construction, maintenance, management, removal and control of embankments and watercourses or the better drainage of lands and for their protection from floods, erosion or other damage by water.

According to the Section 4 (1) every embankment, watercourse and embanked tow-path maintained by the Government or the Authority, and all land, earth, pathways, gates, berms and hedges belonging to or forming part of, or standing on, any such embankment or watercourse shall vest in the Government or the Authority, as the case may be.

The section 56 (1) states that, persons will be subject to penalty (500 taka or imprisonment… if he erects, or causes of willfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or willfully permits to be obstructed or diverted, any water course. This section could be applied to the person causing damage to the protective works.

The Ground Water Management Ordinance, 1985 (Ordinance No. Xxvit Of 1985)

This is an Ordinance to manage ground water resources for agricultural production. This act authorizes the Thana Parishad to grant license for installing tubewells in their jurisdiction areas. It may grant the license if the Thana Parishad is satisfied that the installation of the tubewell applied for

a) Will be beneficial to the areas where it is to be installed, or

b) Will not have any adverse effect upon the surrounding areas, or
c) Otherwise feasible.

The Inland Water Transport Authority Ordinance, 1958 (E.P. Ordinance No. Lxxv Of 1958)

This is an ordinance to set up an authority for the development, maintenance and control of inland water transport and certain inland navigable waterways in Bangladesh. The authority is mandated to perform any other function such as, carrying out river conservancy work, including river training for navigation purposes and aiding navigation; drawing up programs on dredging requirements and priorities for the efficient maintenance of existing navigable waterways; and reviving dead or dying rivers, channels, or canals, including developing new channels and canals for navigation.

The Protection and Conservation of Fish Act, 1950 (Bengal Act Xviii Of 1950)

This Act provides power to the government to:

- Make and apply rules in any water or waters for the purposes of protection of fisheries.
- Prohibit or regulate the erection and use of fixed engines; and the construction, temporary or permanent, of weirs, dams, bunds, embankments and other structures.
- Prohibit the destruction of fish by explosives, guns, and bows in inland or coastal areas.
- Prohibit the destruction of fish by means of poisoning, pollution and effluents.
- Prescribe the seasons during which fishing is allowed.
- Prohibit fishing in all waters during spawning periods.
- Specify the officials with authority to detect breaches.

The Protection and Conservation of Fish Rules (1985)

These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that "No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters". Section 6 of the Rules states -"No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters".

The Government Fisheries (Protection) Ordinance, 1959 (Ordinance No. Xxiv Of 1959)

This ordinance provides power to the government to declare any area as "Khas managed fishery" to bring it under the management and control of the government. No person shall fish in such an area without a valid fishing license issued by such authority as may be prescribed under the Act.

2.2.2 Environmental Legislation

Environment Conservation Act (1995, Amended in 2000 & 2002)

The Bangladesh Environment Conservation Act of 1995 (ECA '95) is currently the main legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has repealed the Environment Pollution Control Ordinance of 1977.

The main objectives of ECA '95 are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The Department of Environment (DOE) executes the Act under the leadership of the Director General (DG).

Bangladesh Environment Conservation Act (Amendment 2000)

This amendment of the Act focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Bangladesh Environment Conservation Act (Amendment 2002)

This amendment of the Act elaborates on:
(1) Restriction on polluting automobiles

(2) Restriction on the sale and production of environmentally harmful items like polythene bags
(3) Assistance from law enforcement agencies for environmental actions
(4) Break up of punitive measures and (5) authority to try environmental cases.

The Environment Conservation Rules, 1997

These are the first set of rules, promulgated under the Environment Conservation Act of 1995 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003).

The Environment Conservation Rules of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.

Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for IEE and EIA according to categories of industrial and other development interventions.

The Rules are not explicit for water development projects. Rather, this is covered under the broader heading of "exploration, extraction and distribution of mineral resources" under the 'Red' category projects.

The DoE has issued EIA Guidelines and addresses the IEE and EIA for several sectors and activities. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DoE guidelines.

Environment Court Act, 2000

The Environmental Court Act, 2000 provide for the establishment of environment courts and make rules for protection against environmental pollution. This act also provides the jurisdictions of environment court, penalty for violating court's order, trial procedure in special magistrate's court, power of entry and search, procedure for investigation, procedure and power of environment court, authority of environment court to inspect, appeal procedure and formation of environment appeal court.

Bangladesh Wild Life (Preservation) Order, 1973 (P. 0. No. 23 of 1973) and Act, 1974

The Bangladesh Wild life Preservation (Amendment) Act 1974 provides for the following main effects:

- This Act provides power to the government to declare areas as game reserves, wild life sanctuaries and national parks to protect the country's wild life.

  This Act also provides legal definitions of the protected areas as follows:

"Game reserve" means an area declared by the government as such for the protection of wild life and increase in the population of important species wherein capturing of wild animals shall be unlawful;

"National park" means comparatively large areas of outstanding scenic and natural beauty with the primary objective of protection and preservation of scenery, flora and fauna in the natural state to which access for public recreation and education and research may be allowed;

"Wild life sanctuary" means an area closed to hunting, shooting or trapping of wild animals and declared as such under Article 23 by the government as undisturbed breeding ground primarily for the protection of wild life inclusive of all natural resources, such as vegetation, soil and water.

Under this law hunting, killing, capture, trade and export of wild life and wild life products are regulated. The Act also designates a list of protected species and game animals.

Provided that the government may, for scientific purposes or for aesthetic enjoyment or betterment of scenery, relax all or any of the prohibitions specified.

2.3 Compliance with DoE Guidelines

The primary institution for environmental management is the Department of Environment (DoE) under the Ministry of Environment and Forest (MoEF). The DoE is the authority with the mandate to regulate and enforce environmental management, including control of pollution of water resources and ensuring adequate EIAs. It is the primary institution for environmental management and setting and enforcement of environmental regulations. Its key duties related to the water sector include:

- Pollution control, including: monitoring effluent sources, ensuring mitigation of environmental pollution
- Setting Water Quality Standards (WQS) for particular uses of water and for discharges to water bodies
- Defining Environmental Impact Assessments (EIA) procedures and issuing environmental clearance permits - the latter being legal requirements before proposed projects can proceed to implementation
- Providing advice or taking direct action to prevent degradation of the environment
- Declaring Ecologically Critical Areas (ECAs) where the ecosystem has been degraded to a critical state. ECA status confers protection on land and water resources through a series of environmental regulations

The DoE has issued EIA Guidelines for Industries (this document was released in December 1997) and addresses the IEE and EIA for several industrial sectors and activities. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DoE guidelines. Figure 2.1 shows the application procedure for obtaining site/environmental clearance. Environmental clearance from the DoE is required under the Environment Conservation Act of 1995. Section 12 of the Act stipulates that ‘no industrial unit or project shall be established or undertaken without obtaining Environmental Clearance

from the Director General in the manner prescribed by the Rules.' The procedure for obtaining the Environmental Clearance from the DoE is set out in the Environment Conservation Rules 1997. The Rules divide projects into four categories, namely Green, Orange A, Orange B, and Red, depending upon their nature, and hence perceived environmental impacts. A schedule attached to the Rules defines the categories into which various types of projects fall. The Rules also set out differing requirements to be fulfilled in applying for an Environment Clearance under each of the four categories of project, identifying the level of environmental impact assessment required in each case. The process of obtaining clearance from the DoE is presented in Figure 2.1. According to the Environment Conservation Rules, construction/reconstruction/expansion of flood control embankments, polders, and dykes etc., and construction/reconstruction/expansion of road (regional, national, & international) are fall into the Red category. Therefore, according to the DOE, this proposed project is considered under the Red category of the Environmental Conservation Rules, 1997.

In order to obtain an Environmental Clearance Certificate for the project from the DoE, the following documents/ materials are to be submitted with the application:

- Feasibility Report for the Project (where applicable)
- Environmental Impact Assessment (EIA) Report
- Environmental Management Plan (EMP)
- No Objection Certificate from relevant Local Authority (where applicable)
- Other necessary information, (where applicable)

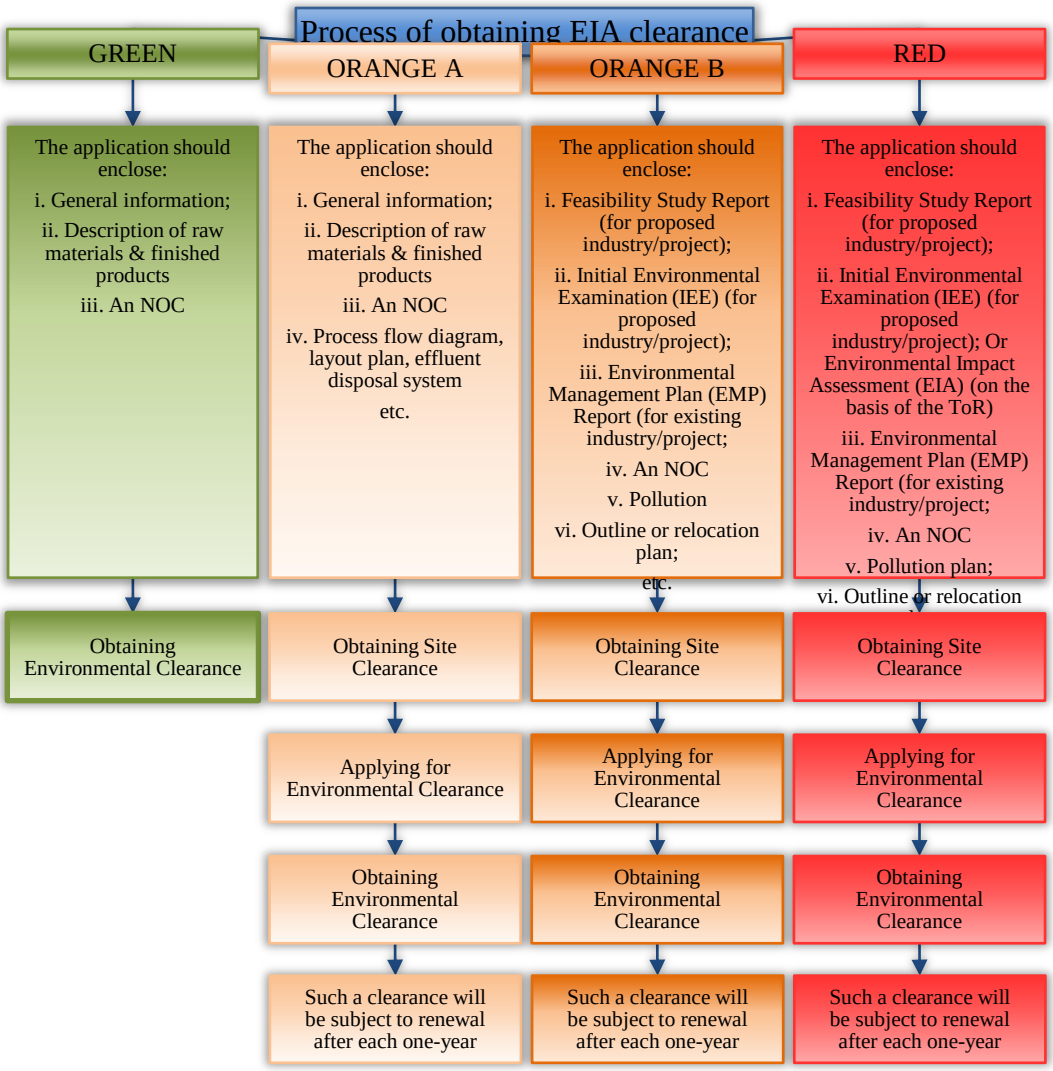


Figure 2.1: Steps Involved in Environmental clearance following DoE Guideline

2.4 Environmental Quality Standards

Environmental quality standards for air quality, noise, odor, sewage discharge, industrial effluents, and industrial project emissions for Bangladesh are furnished in the following tables.

Table 2.1: Bangladesh Standards for Ambient Air Quality

(All values are in micrograms per cubic meters)

Sl No.	Area	Suspended Particulate Matters (SPM)	Sulfur Dioxide (SO_2)	Carbon Dioxide (CO_2)	Oxides Nitrogen (NO_x)
Ka	Industrial and mixed	500	120	5000	100
Kha	Commercial and mixed	400	100	5000	100
Ga	Residential and rural	200	80	2000	80
Gha	Sensitive	100	30	1000	30

Source: Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Page 3123. Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note:
Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions

Any industrial unit not located at a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.

Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

Table 2.2: Bangladesh Standards for Noise

Sl No.	Area Category	Standard Values (all values in dBA)	
		Day	Night
Ka	Silent Zone	45	30
Kha	Residential Area	50	40
Ga	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
Gha	Commercial area	70	60
Uma	Industrial area	75	70

Source: Schedule 4, Rule-12, Environment Conservation Rules, 1997 (Page 3127, Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note:
Day time is reckoned as the time between 6 a.m. to 9 p.m.
Night time is reckoned as the time between 9 pm to 6 am

Silent zones are areas up to a radius of 100 meter around hospitals, educational institutes or special establishments declared or to be declared as such by the Government. Use of vehicular horn, other signals and loudspeakers is prohibited in silent zones.

Table 2.3: Bangladesh Standards for Odor

Parameters	Unit	Values
Acetaldehyde	PPM	0.5-5.0
Ammonia	PPM	1.0-5.0
Hydrogen Sulfide	PPM	0.02-0.2
Methyl Disulfide	PPM	0.009-0.1
Methyl Mercaptan	PPM	0.02-0.2
Methyl Sulfide	PPM	0.01-0.2
Styrene	PPM	0.4-2.0
Trimethylamine	PPM	0.005-0.07

Source: Schedule-8, Rule-12, Environment Conservation Rules, 1997. (Page 3130, Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note:
Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters):
Q = 0.108 xHe2 cm
Where Q - gas emission rate (Nm3/hour)
He - effective height of the outlet (m)
Cm - above mentioned standard (ppm)

Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Table 2.4: Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/L	40
Nitrate	mg/L	06-Sep
Phosphate	mg/L	25
Suspended Solid (SS)	mg/L	100
Temperature	°C	30
Coliforms	Number/100ml	1000

Source: Schedule-8, RuIe-I3, Environment Conservation Rules, 1997. (Page 3131, Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note:

1. These standards are applicable for discharge into surface and inland water bodies.
2. Chlorination is to be done before Final discharge.

Table 2.5: Bangladesh Standards for Industrial Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
1	Ammonical nitrogen (as elementary N)	mg/L	50	75	75
2	Ammonia (as free ammonia)	mg/L	5	5	15
3	Arsenic (as As)	mg/L	0.2	0.05	0.2
4	BODs at 20₀C	mg/L	50	250	100
5	Boron	mg/L	2	2	2
6	Cadmium (as Cd)	mg/L	0.05	0.5	0.5
7	Chloride	mg/L	600	600	600
8	Chromium (as total Cr)	mg/L	0.5	1	1
9	COD	mg/L	200	400	400
10	Chromium (as hexavalent Cr)	mg/L	0.1	1	1
11	Copper (as Cu)	mg/L	0.5	3	3
12	Dissolved oxygen (DO)	mg/L	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	Umhoms/cm	1200	1200	1200
14	Total dissolved solids	mg/L	2100	2100	2100
15	Flouride (as F)	mg/L	2	15	10
16	Sulfide (as S)	mg/L	1	2	2
17	Iron (as Fe)	mg/L	2	2	2
18	Total kjeldahl nitrogen (as N)	mg/L	100	100	100
19	Lead (as Pb)	mg/L	0.1	1	0.1
20	Manganese (as Mn)	mg/L	5	5	5
21	Mercury (as Hg)	mg/L	0.01	0.01	0.01
22	Nickel (as Ni)	mg/L	1	2	1
23	Nitrate (as elementary N)	mg/L	10	Not yet set	10
24	Oil and grease	mg/L	10	20	10
25	Phenolic compounds (as CeHsOH)	mg/L	1	5	1
26	Dissolved phosphorus (as P)	mg/L	8	8	15
27	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission			

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
28	pH	mg/L	6-9	6-9	6-9
29	Selenium (as Se)	mg/L	005	0.05	0.05
30	Zinc (as Zn)	mg/L	5	10	10
31	Total dissolved solids	mg/L	2100	2100	2100
32	Temperature	OC (Summer) OC (Winter)	40 45	40 45	40 45
33	Suspended solids	mg/L	150	500	200
34	Cyanide	mg/L	0.1	2.0	0.2

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3132-3134, Bangladesh Gazette, 28 August 1997) (Translation from original Bengali)

Note:

These standards will be applicable for all industries other than those which are specified under 'industrial sector specific standards'.

These standards will have to be compiled from the moment of trial production in case of industries and from the moment of the very beginning in case of projects.

These standards will have to be met at any point of time and any sampling. In case of need for ambient environment condition, these standards may be made stringent.

Inland surface water will include drains, ponds, tanks, water bodies, ditches, canals, rivers, streams and estuaries.

Public sewer means leading to fully fledged joint treatment facility comprising primary and secondary treatment.

Land for irrigation means organized irrigation of selected crops on adequate land determined on the basis of quantum and characteristics of waste water.

Table 2.6: Bangladesh Standards for Industrial Project Emissions

Sl. No.	Parameters	Values in (mg/Nm^3)
1	Particulates	
	(ka) Power station of capacity of 200 MW or more	150
	(kha) Power station of capacity less than 200 MW	350
2	Chlorine	150
3	Hydrochloric acid vapor and mist	350
4	Total fluoride (as F)	25

Sl. No.	Parameters	Values in (mg/Nm^3)
5	Sulfuric acid mist	50
6	Lead particulates	50
7	Mercury particulates	10
8	Sulfur dioxide	Kg/ton acid
	(ka) Sulfuric acid production (DCDA * process)	4
	(kha) Sulfuric acid production (SCSA * process)	100
	(*DCDA: Double conversion, double absorption, SCSA; Single conversion single absorption) Lowest height of stack for sulfur dioxide dispersion:	
	(ka) Coal based power plant	
	500 MW or more	275m
	200 MW - 500 MW	220m
	Less than 200 MW	14(Q)03
	(kha) Boiler	
	Steam per hour- upto 15 tons	11m
	Steam per hour - more than 15 tons	14(Q)03
	($Q=S0_2$ emission in kg/hour)	
9	Oxides of nitrogen	3 kg/ton acid
	(ka) Nitric acid production	50 ppm
	(kha) Gas based power stations	50 ppm
	500 MW or more	40 ppm
	200 - 500 MW	30 ppm
	Less than 200 MW	200 ppm
	(Ga) Metallurgical oven	
10	Kiln soot and dust	Mg/Nm-1
	(ka) Blast furnace	500
	(kha) Brick kiln	1000
	(Ga) Coke oven	500
	(Gha) Limekiln	250

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3135-3136, Bangladesh Gazette, 28 August 1997) (Authentic translation from original Bengali).

2.5 Compliance with Donor Agencies Social Safeguard Policies

2.5.1 Asian Development Bank's Social Safeguard Policies

Asian Development Bank (ADB) has had environment assessment requirements for more than 20 years and owns safeguard policy framework which is currently taken to consist of three operational policies, namely the Environment Policy (2002), the Policy on Indigenous Peoples (1998), and the Policy on Involuntary Resettlement (1995), together with their respective operations manual sections and guidelines.

ADB's safeguard policies are central to achieving sustained development and poverty reduction. The objective of these policies is to avoid, minimize or mitigate adverse environmental impacts, social costs to third parties or marginalization of vulnerable groups that may result from development projects. Safeguard policies prescribe; "do no harm" requirements that must be met for all ADB projects. Regarding the resettlement plan of a project, ADB provides that 'A satisfactory resettlement plan must include all 11 essential elements. The safeguard policies are at the front line of ADB's accountability mechanism and compliance review process, since these policies, if properly implemented, help ensure that third parties do not incur material damages, either directly or through environmental media, and thus have no basis for complaint.

All three safeguard policies involve a structured process of impact assessment, planning and mitigation to address the adverse effects of projects and programs throughout the project cycle. The safeguard policies require that: (i) impacts are identified and assessed early in the project cycle; (ii) adverse impacts are avoided, minimized, or mitigated; and (iii) affected people are consulted.

2.5.2 Compliance with World Bank Environmental Assessment (EA) Process

The World Bank introduced the Operational Directive on Environmental Assessment (OD4.00, Annex A) in October 1989. This comprehensive and detailed new policy mandated an environmental assessment for all projects that may have significant impacts on the environment. After two years of the Bank experience with environmental assessments, the operational directive was revised to broaden its scope and applicability. Recognizing that the projects aimed at achieving environmental objectives could sometimes have negative and unanticipated effects, the new revised guideline OD.4.01 was introduced which incorporates a new system of classifying projects according to the nature and extent of their environmental impact. The Bank uses the following three categories to signal the appropriate level of EA for any given project.

Category A: If the project is likely to have significant adverse impacts that are sensitive, diverse or unprecedented, or that affect an area broader than the sites or facilities subject to the physical area. EA for Category A projects examines a project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" condition) and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For Category A projects, the borrower is responsible for preparing an EIA report that includes an environmental management plan and a monitoring plan.

Category B: A proposed project falls under Category B if its potential adverse environmental impact on human populations or environmentally important areas including wetlands, forests, grasslands, and other natural habitats- are less adverse than that of Category A projects. The scope of EA for Category B projects may vary from project to project, but it is narrower than that of Category A.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impact. Beyond screening, no EA action is required for Category C projects.

As for social assessment, the Social Assessment Policies and Guidelines of the World Bank (G.P. 10.05: Social Analysis through Social Assessment) puts forward the overall objectives and prerequisites of social assessment. It also discusses the basic steps in the assessment process. In the context of possible resettlement of people who might be evicted from their own land or from public land (used in authorized or unauthorized manners), the World Bank Operational Directive No. 4.30 (on Involuntary Resettlement) provides necessary guidelines. These guidelines would assist in indicating the need for resettlement within the scope of the SIA and also help in preparing the Resettlement Framework and Resettlement Action Plan through subsequent studies.

2.6 GoB Laws on Land Acquisition

The principle legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance II of 1982 with amendments up to 1994) and other land laws and administrative manuals relevant to land administration in Bangladesh. According to the Ordinance, whenever it appears to the Government of Bangladesh that any property in any locality is needed or is likely to be needed for any public purpose or in the public interest, the Government can acquire the land provided that no property used by the public for the purpose of religious worship, graveyard and cremation ground. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 50% premium on the assessed value (other than crops) due to compulsory acquisition. The 1994 amendment made provisions for payment of crop compensation to tenant cultivators. Given that people devalue land during title transfer to minimize tax payment, compensation for land paid by DC including premium largely remains less than the actual market price.

2.7 Administrative Framework

Roads and Highway Department (RHD) is responsible for implementing this project. The organization has long experience in implementing such projects with its own institutional resources. There are planning, design, implementation and Operation & Maintenance (O&M) sections to implement this kind of projects. It has also project evaluation section, which monitors and evaluates the implementation status of projects.

3 Approaches and Methods

3.1 Background

The ESIA of the 'Proposed Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj' has been conducted following the ESIA Guidelines of the Department of Environment (DoE), in accordance with the ECR (1997), EIA Guidelines (1997) of the GOB and Guidelines for Environmental assessment of Water Management Projects (WARPO, 2005). Primary and secondary data and information have been used in the EIA of the project. Discussions were held with the stakeholders concerned including directly affected people, government officials, community representatives, and a wide range of potential beneficiaries of the project. The main purpose of this approach was to obtain a fair impression of the people of the project and its environmental impacts. Even though constrained by time, this study has been carried out with high care and using technically sound extensive effort and through brainstorming with the personnel concerned.

A multi-disciplinary team has been formed having specializations in respective disciplines pertinent to conduct ESIA study of the Sachna-Golakpur Road project. Ideas, objectives and potential outcomes of the proposed road project were shared among the team members through brainstorming sessions. Conceiving the ideas and objectives of the project activities, the ESIA team several times visited the study areas to identify the given alignment and corresponding proposed road location and physically observed the status of the resources of the study area to prepare baseline scenario. The study team has established baseline condition i.e. physical, biological and socio-economic environment of the project area during field visits which will be required to recommend practical and site specific environmental mitigation and prepare and implement environmental monitoring plan during and after the project implementation. Field data collection has been done in different ways; i) consultation with Government and non-Government officials and elected representatives, ii) Questionnaire survey, iii) Focus group discussion and iv) In-situ water test and soil samples collection for lab analysis.

During field visit, the team equipped with GPS, digital cameras, laptop and in-situ testing apparatuses for facilitating the collection of primary data and related project information. The study team has talked about the proposed project and collected necessary data from the government official concerned regarding management of water bodies and road construction authorities and other government officials including Water Development Board (BWDB), Roads and Highways Department (RHD), Agricultural Extension Department (DAE), District Livestock Office (DLO), World Fish (WF), District Fisheries Office (DFO) and Upazila Project Implementation Office (PIO) and Local Government Engineering Division (LGDE) in Sunamganj district including Jamangonj and Dharmapasha upazilla who may be impacted after the proposed road construction. The study team has also talked about the proposed project to elected representatives such as Chairman of Sachna Bazar Union parishad, Vice-chairman of Jamalganj upazilla and Chairman of Uttair Sukhair Rajapur Union. Questionnaire survey and Focus group discussion have been held at Sachna bazar, Golakpur Bazar, Shamim Nagar, Mannanghat, Mominpur Bazar etc. Surma River water and ground water quality test has been done in-situ at different places within the project site. Soil samples were collected from

different places at project site for chemical/ physical analysis at the laboratory. The study team also visited different haors nearby project site like Pakhnar Haor, Haliar Haor and Shanir Haor etc. It is observed from the field visit that the proposed road is highly demanding by the stakeholders to facilitate smooth inter-districts communication system. Field maps were prepared based on satellite images and map obtained from the RRI 'THM Model study' team showing road alignment and road location.

3.2 The Overall ESIA Process

The guideline for Environmental Assessment of Water Management Projects, developed by the Flood Plan Co-ordination Organization (FPCO) in 1992 and updated by the Water Resources Planning Organization (WARPO) in 2005 was followed for conducting the Environmental and Social Impact Assessment (ESIA) study of the 'Proposed New Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj'.

The overall process followed for conducting the ESIA study is shown in Figure 3.1.

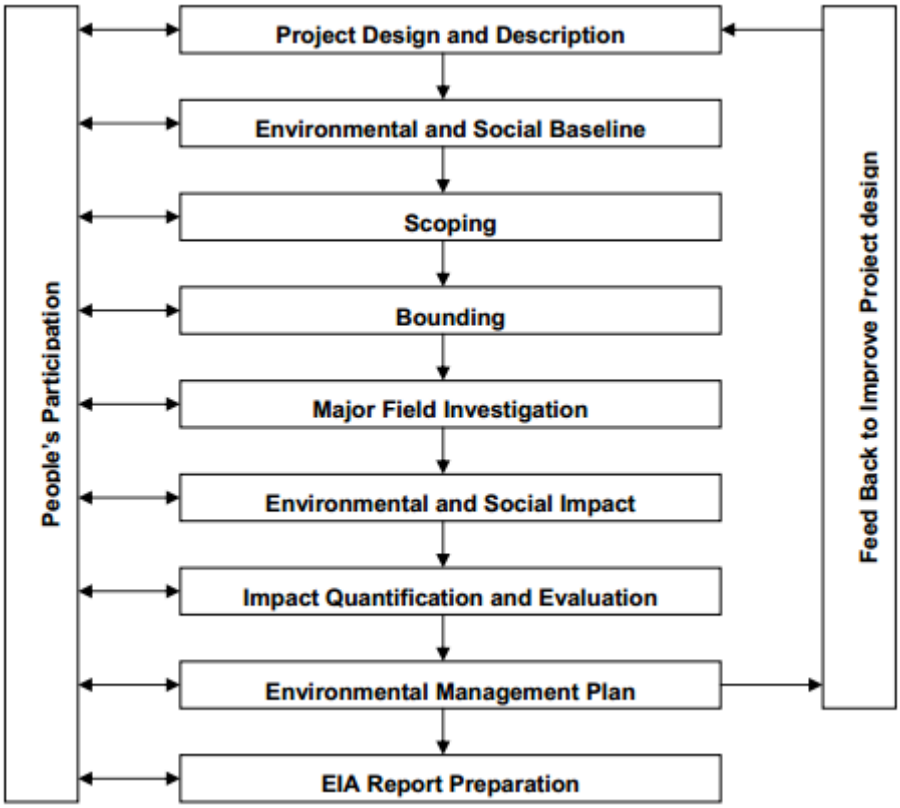


Figure 3.1: The overall process for conducting the ESIA

The step-wise detailed EIA process followed for the EIA study is briefly described below.

3.2.1 Project Design and Description

The study area is located in the low-lying haor area of the Sunamganj district. It comprises the Surma, Baulai, Rakti rivres and their levees and surrounding floodplains. The proposed Sachna-Golakpur Road will connect between Jamalganj and Dharmapasha upazilla in Sunumgonj district. Road alignment and road structure locations have been identified by the RRI 'THM Model study' team. Out of three possible alignment alternatives, the team suggested one suitable alignment with supporting hydrological and morphological analytical data to construct the proposed Sachna-Golakpur Road road link. Details of project design, description and alternatives are furnished in Chapter 4.

The members of ESIA Team and Morphology team interpreted and discussed the project intervention information to assess the environmental and social impacts of the proposed interventions.

3.2.2 Environmental and Social Baseline

The Environmental and Social baseline condition of the project area has been drawn from the information collected from secondary and primary data sources through literature review, field investigations and consultations with different stakeholders. The baseline condition has been established in terms of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socioeconomic conditions including identification of problems in respect of the proposed project sites and adjoining areas.

Initially a reconnaissance field visit was conducted in the project area to identify the project location and its functional objectives to prepare an Initial Environmental Examination (IEE). Subsequent to this, a multidisciplinary ESIA study team was formed to conduct a full Environmental and Social Impact Assessment. The information has been collected from both primary and secondary sources to prepare the baseline condition of the ESIA study. Rapid Rural Appraisals (RRAs), Participatory Rural Appraisals (PRAs), Focused Group Discussions (FGDs) and interviews with key informants were conducted to collect data and information on the environmental and social aspects of the Project area. The RRAs, PRAs and FGDs have covered communities like teachers, traders, farmers, day laborers, servicemen, small traders, fisherman, boatmen and public representatives of local government institutions. During the visit, photographs and geographical coordinates (Longitude/ Latitudes) of different environmentally important locations have been collected using GPS. All qualitative and quantitative data and information, gathered from different surveys and secondary sources have been used appropriately in the preparation of the environmental and socioeconomic baseline of the project and presented in this report.

3.2.3 Scoping

A structured scoping process was followed for identifying the Important Environmental and Social Components (IESCs) which are likely to be impacted by the proposed Sachna-Golakpur road interventions. This was achieved in two stages. In the first stage, the individual professional of the ESIA team member prepared a preliminary list of the components pertaining to his/her discipline which could be impacted by the project. The second stage included village scoping sessions where obtained opinion of the stakeholders on their perception about the environmental and social components which could be impacted by the project interventions. With the help of the professional judgments of the multidisciplinary ESIA team as well as the opinions of the stakeholders, the preliminary list of the important environmental and social components was finalized.

3.2.4 Bounding

Through a bounding process, the area likely to be impacted both inside and outside of the project boundary was selected. River catchment boundaries, ecological boundaries, social & administrative boundaries and also temporal bounds referring time and duration of the proposed project activities were considered for this ESIA.

The project influence area (PIA) for this EIA has been established considering the maximum length of proposed all road alignments. The maximum proposed road length is 17.7 km which has taken the major axis of the oval shaped actual project area. However, the project influencing area has been extended to 50% of the actual area from the project boundary to analyze the land use and identify environmental sensitive areas that may be affected due to secondary impacts. Recent satellite imageries were used based on of the project areas for above purposes.

3.2.5 Major Field Investigation

During the study of ESIA, a number of field visits were made by the multidisciplinary study team members. Consultations have been made with the people of the project area, local government authorities and officials concerned of Bangladesh Water Development Board (BWDB), Roads and Highways Department (RHD), Agricultural Extension Department (DAE), District Livestock Office (DLO), World Fish (WF), District Fisheries Office (DFO) and Upazila Project Implementation Office (PIO). The team members also made professional observation during their field visits. The team observed the conditions of different communities and natural happenings, and collected data on most important and effective environmental components. Intensive consultation with the local people carried out in each case for securing people's participation.

3.2.6 Impact Assessment and Possible Computation

Possible impacts of the proposed road interventions on each of the IESCs were assessed under the future-with-project (FWIP) and future-without-project (FWOP) conditions. Differences between the two conditions

were considered as the impact of the proposed interventions on the IESCs. At this stage opinion of the local people, obtained at the major field investigation stage has also been duly considered.

3.2.7 Impact Quantification, Evaluation and Mitigation Measures

The assessment of effects and identification of residual impacts takes account of any incorporated mitigation measures adopted due to any potential impact of Project activities, and will be largely dependent on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change. Potential impacts can be both negative (adverse) and positive (beneficial).
The criteria for determining significance are generally specific for each environmental and social aspect but generally the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity used for the Project are summarized below.

The assessment of magnitude has been undertaken in two steps. Firstly, the key issues associated with the Project are categorized as beneficial or adverse. Secondly, potential impacts have been categorized as major, moderate, minor or negligible based on consideration of the parameters such as: Duration of the potential impact; Spatial extent of the potential impact; Reversibility; Likelihood; and Legal standards and established professional criteria.

Impacts of the proposed interventions on the IESCs, assessed in the previous stage, were quantified to the extent possible. Scores was assigned for negative impacts by minus (-) sign and for positive impacts by plus (+) sign. As suggested in the ESIA Guidelines a scale of 1 to 5 has used for both negative and positive impacts considering magnitude, extent, and sustainability of beneficial impacts and reversibility of negative impacts.

The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in **Table 3.1**.

Table 3.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 35 years)	Medium Term Lifespan of the project (5 to 15 years)	Less than project lifespan	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few	Baseline remains constant

	return to baseline		months	
Legal standards and established professional criteria	Breaches national standards and/ or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

The sensitivity of a receptor has been determined based on review of the population (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 3.2**.

Table 3.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low / Negligible	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the potential impact significance matrix shown in **Table 3.3**.

Table 3.3: Assessment of Potential Impact Significance

Magnitude of Potential impact	Sensitivity of Receptors			
	Very High	**High**	**Medium**	**Low / Negligible**
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible

Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Subsequent to the impact assessment discussed above, appropriate mitigation measures have been proposed to avoid, offset, mitigate/reduce, or compensate for the identified impacts. Generally, impacts having moderate to critical consequence significance per the Table 3.3 require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance can be left alone not needing any mitigation measures.

Generally, preference is given to the avoidance of the impact with the help of options available for nature, siting, timing, method/procedure, or scale of any project activity. If avoidance is not possible, appropriate mitigation and control measures are proposed to reduce the consequence significance of the predicted impact. Finally, if impact reduction is not possible, compensatory measures are proposed.

3.2.8 Environmental Management Plan

Negative impacts, assessed in the previous stage, was picked up and mitigation measures be suggested for minimizing their affects. Likewise, positive impacts also assessed in the previous stage, was picked up and enhancement measures be suggested for increasing their benefits. Compensation measures were suggested for negative impacts which could not be mitigated. An environmental monitoring plan was prepared for detecting changes taking place in the environmental and social components due to implementation of the proposed project.

Finally, an environmental management plan (EMP) for the proposed project was prepared comprising the mitigation/ enhancement measures with environmental monitoring plan, reporting and documentation protocols.

3.2.9 ESIA Report

At the end of the study, the present ESIA report on the ‘Proposed Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj’ has been prepared incorporating all the findings of the ESIA study.

4 Description of the Project

4.1 Introduction

The project area belongs to Sunamganj district in Bangladesh. The aim of the proposed Sachna-Golakpur Road project is to facilitate direct roadway communication between Sunamganj and Natrokona-Mymensingh-Dhaka, and western part of the country. The proposed Road will be linked between Jamalganj and Dharmapasha upazilla under Sunumgonj district. Currently these two upazillas are very isolated area due to lack of access to national road network systems (RHD road link). Therefore, people of the project area are facing severe road communication difficulties and have usually depends on waterway communication. Moreover, the LGED roads are not suitable for all the year round and also are not suitable for heavy transportation. As a result, the people of Jamalganj upazila have no easy way to travel to Netrokona, Mymensingh, Dhaka and other western parts of the country. In this connection, RHD has initiated to build up a road between Schana bazar to Golakpur Bazar to facilitate smooth communication from Jamalganj to Dharmapasha and other parts of the country. The RHD has appointed RRI to conduct the Numerical model study and EIA study of the proposed Project. It is mentioned here that our Prime Minister has assured to construct a direct roadway connection between Sunamganj (Jamalganj) and Natrokona-Mymensingh-Dhaka, and western part of the country for faciliting smooth road communication systems.

Sunamganj district is famous for its natural resources especially fish, egg and other agricultural products. These agricultural products are likely to promote agro-based small scale industries in Sunamganj after the construction of the proposed road. This district has been also known for the stone and sand business. It has been supplying river sand, natural sand, crushed stone, gravel and shingle. Moreover, thousands of businessmen are involved in this sector. If the roadway is constructed, it will be easier to transport these products from Jamalganj to other parts of the country. This roadway will connect Jamalganj upazila headquarter to the district town and rest of the country. After completion of the road project, surrounding areas like Jamalganj, Sachna Bazar and Dharmapasha may be converted into industrial areas. Improvement of communication systems, Employment opportunities, excess to health facilities and literacy rate will be increased significantly after the project implementation. Therefore, the life style of the people will be developed remarkably and thereby socio-economic condition of the area will be improved in this area.

4.2 Objective of the Project

The main objective of the proposed Sachna-Golakpur road project is to establish a direct and shorter roadway connection between Sunamganj and Dhaka. If this road is constructed, uninterrupted movement of heavy vehicles will be possible and it will improve overall roadway transport facilities of Sunamganj district.

4.3 Project area

The project area belongs to Sunamganj district in the Northeast Region of Bangladesh (**Figure 4.1**). Sunamganj District with an area of 3669.58 sq km, is bounded by Khasia and Jaintia hills (India) on the

north, Habiganj and Kishoreganj districts on the south, Sylhet district on the east, Netrokona and greater Mymensingh districts on the west. There are many haors and beels in Sunamganj district. The Surma is the major river in the study area and there is distinct connectivity between river and haor. The study area starts at Suchna Union of Jamalganj Upazilla (Latitude 25o1.56' N, Longitude 90o15.15' E) and ends at Golakkpur Bazar under Uttar Sukhair Rajapur Union of Dharmapasha Upazilla (Latitude 24o 57.75' N, Longitude 90o57.8"E) of Sunamganj district.

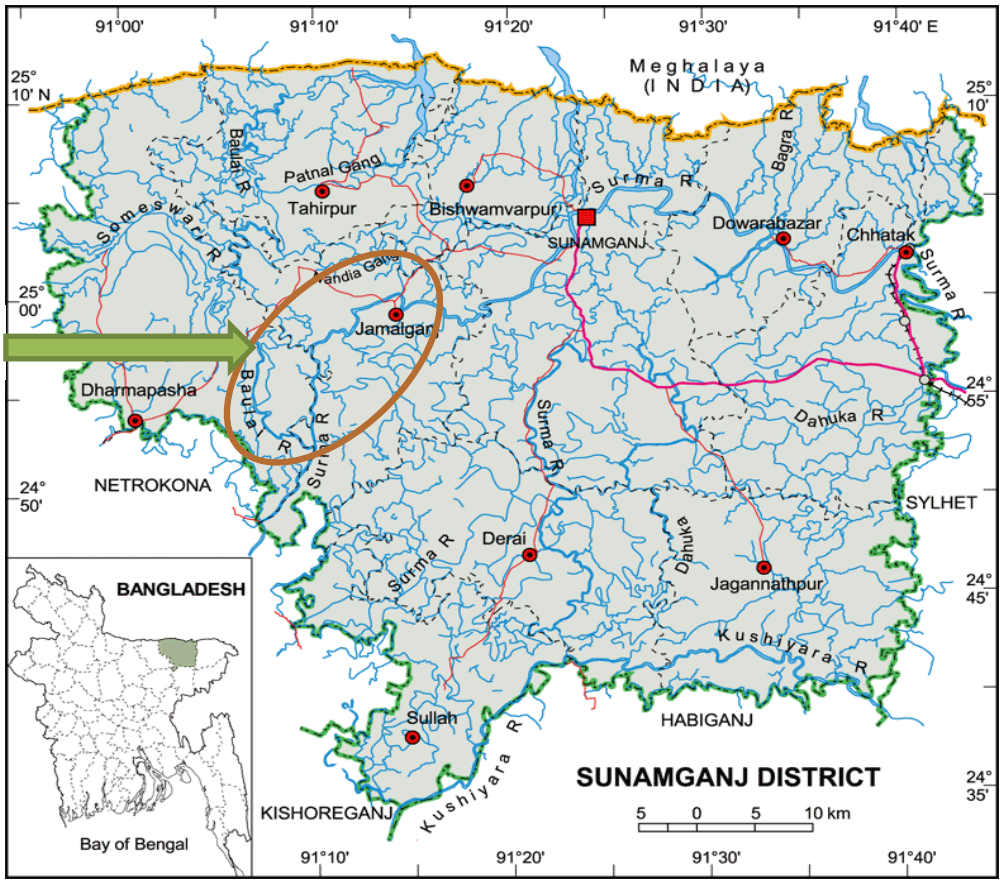


Figure 4.1: Location of the proposed Project

The proposed Sachna-Golakpur road has to be constructed in the low-lying haor area surrounded by beels, haors, rivers, khals and human settlements. During monsoon the study area goes under water. The rivers, haors, human settlements, floodplains, beels, river confluences, oxbow lakes, meander scars and agricultural lands are the dominant physical features at and around the study area. The Rakti and the Baulai rivers meet the Surma river in the study area. Sachna Bazar and Jamalganj upazila head quarter are situated on the right and left bank of the Surma river respectively. Both Sachna Bazar and Jamalganj are important growth centres. At present they are separated by the river as there is no bridge over the Surma river. As a result, people have to cross the river by boat. The physical features at and around the study area are shown in **Figure4.2**.

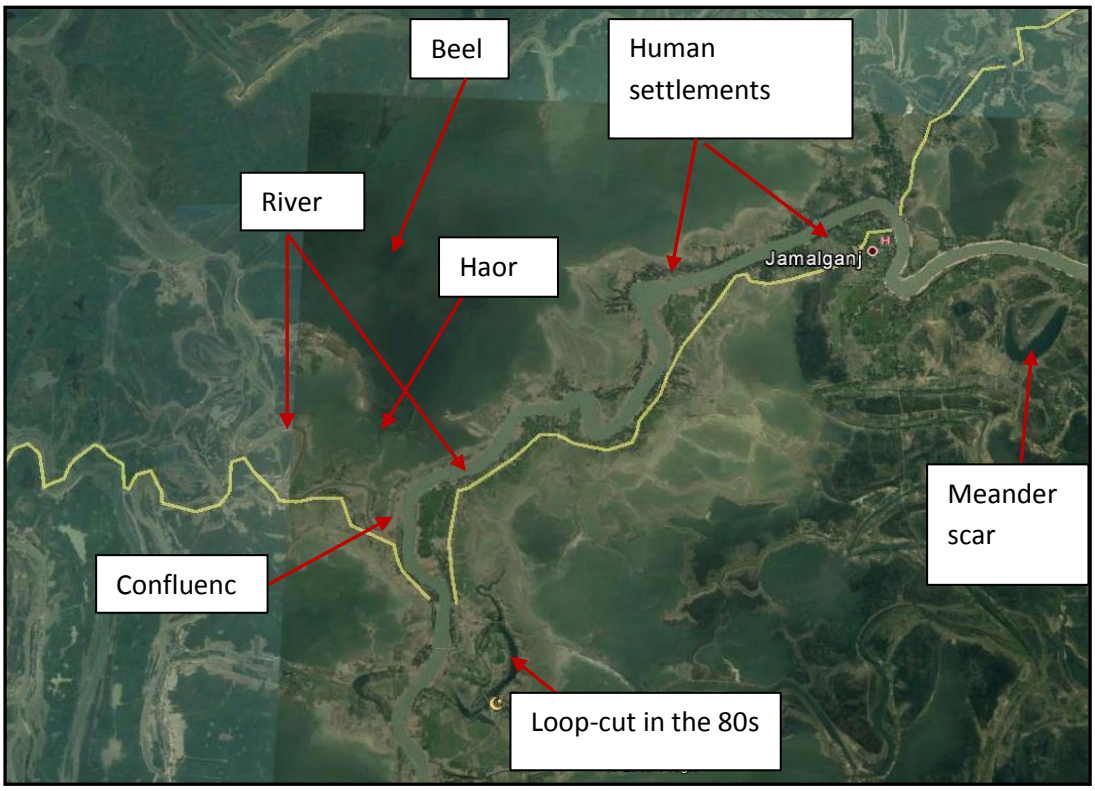


Figure: 4.2 Physical features at and around the project area

4.4 Existing Road Network

The proposed Sachna-Golakpur Road will connect between Jamalganj and Dharmapasha upazilla under Sunumgonj district.. Sachna Bazar and Jamalganj upazila head quarter are situated on the right and left bank of the Surma river respectively. Both Sachna Bazar and Jamalganj are important growth centres. At present they are separated by the river and there is no bridge over the river. As a result, people have to cross the river by boat.

According to the officials of the Road Division, RHD, Sunamganj no likely alignment of the proposed Sachna-Golakpur road link is selected so far. However, a likely road alignment from Sachna Bazar to Dharmapasha is shown in RHD road network map of Sunamganj Division (**Figure 4.3**). It appears from the map that RHD has been contemplating to construct the proposed road link along the north side of the Surma (Nawa) river. There could be a number of alternative road alignments with their advantages and disadvantages. Suitable road alignment will be the one that is less expensive to construct and has minimal environmental impacts. The LGED road map of Sunamganj district is shown in **Figure 4.4**. It is evident from the figure that there is no RHD road network linking Jamajgonj with western part of the country in general. The proposed road link will help establish this roadway communication. At present Sachna Bazar which is situated near the Jamalganj Upazila Head Quarter is connected with Sunamganj district town by RHD regional road. However, Jamalganj Upazila Head Quarter remains disconnected with Sachna Bazar due to lack of a bridge over the Surma river. The Sunamganj-Netrokona-Mymensingh road from Sunamganj town terminates at Sachna Bazar. Sunamganj town is connected with Sylhet town and

Raniganj by regional highways (R280 and R241 respectively). Sunamganj is also connected with Dwarabazar, Chhatak, Bishambarpur, Takerghat and Tahirpur by zila roads. Some parts of these roads are under construction. Dharmapasha is connected with Madhayanagar by zila road. Therefore, establishment of road link between Sachna Bazar and Dharmapasha Upazila Head Quarter will facilitate smooth roadway communication in the region. At present there are only LGED roads with river gaps for roadway communication. These roads are not suitable for movement of heavy traffic. Construction of some parts of these roads is not yet completed and at many stretches of these roads improvement works are needed. These LGED roads are serving important purposes in roadway communication in the project area in absence of any RHD road link. Existing LGED road network will be improved further if two bridges over the Surma river and necessary bridges over the Baulai river are constructed.

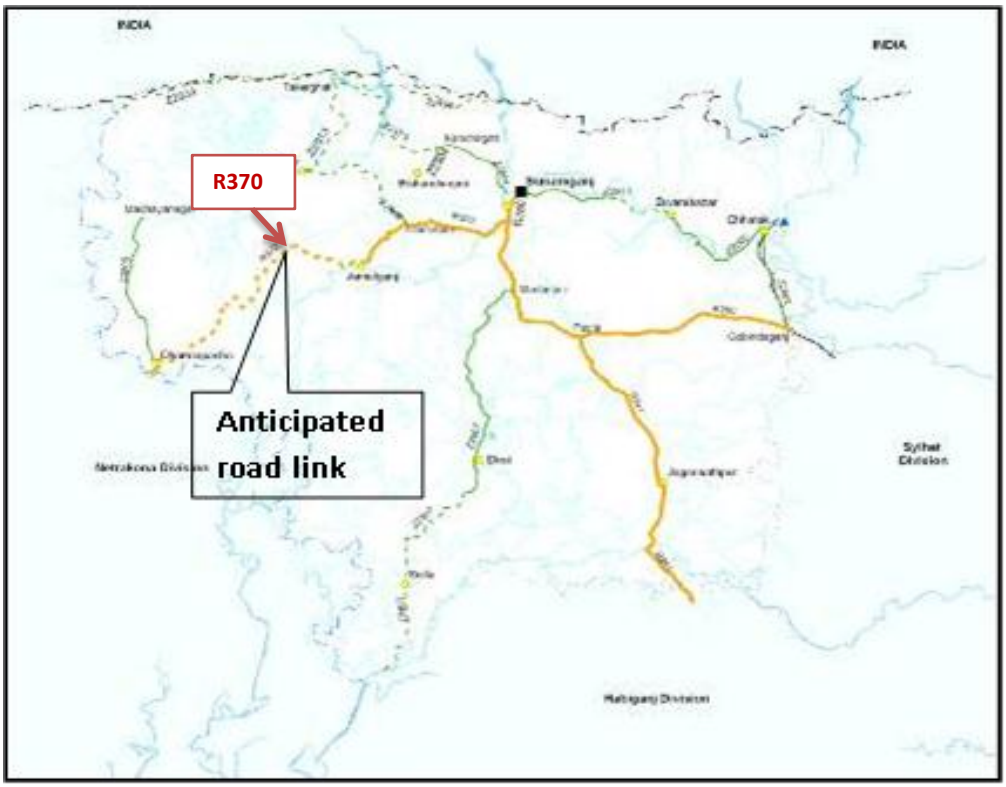


Figure 4.3: RHD road network under Road Division, Sunamganj

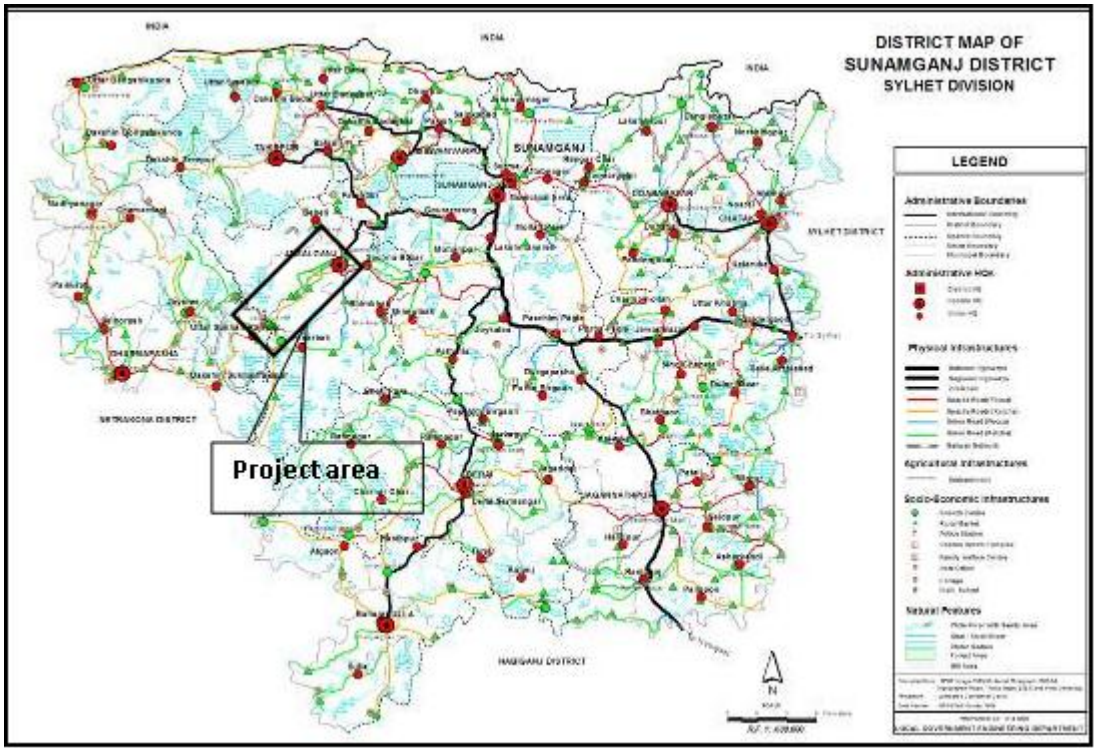


Figure 4.4: Existing road communication network at and around the study area

4.5 Alignment of the proposed road

Preffered three alternative road alignment options for the proposed Sachna-Golakpur road have been designed considering relevant factors. The road alignment is selected out of three alternative locations based on numerical model investigation results, field data analysis, and the judgment of community and relevant organizations (Chapter 5). The starting point of the proposed road link on the Sachna Bazar side is at about 1.7km northeast of the Sachna Ghat along the existing RHD road. The position of this starting point is 322778.62E, 2768014N in UTM co-ordinate system whereas the end point of this road link on the Golakpur side is 313144.67E, 2761803.5N in same co-ordinate system. The total length of the proposed road link under is 12.2km.

Figure 4.5: Proposed road alignment at Right side of the Surma River

Figure: 4.6: Probable starting point of the proposed road link from Sachna Bazar side

4.6 Hydrological and Hydraulic Design of Road and Road Structures

4.6.1 Formation Level of the Road

The design water level of the road varies from 8.52mPWD to 8.55mPWD from Golakpur end to Sachna Bazar end. The required freeboard considering wave runup is 1.06m. Therefore, the formation level of the road varies from 9.58mPWD to 9.61mPWD.

4.6.2 Hydrological and Hydraulic Design Parameters of the Road Structures

The hydrological and hydraulic design parameters of the road structures obtained from the mathematical model study are given in **Table 4.1**.

Table 4.1: Hydrologic and hydraulic design parameters of the road structures (bridges)

Road Structure description	Chainage (km)	Length (m)	Design discharge (m3/s)	Design water level (mPWD)	Maximum velocity (m/s)	Pier Scour level (mPWD)	Abutment scour level (mPWD)
Bridge-1	0.305	50	103	8.55	0.76	-2.59	-3.86
Bridge-2	0.725	50	88	8.55	0.56	-3.57	-3.26
Bridge-3	0.911	50	85	8.55	0.40	-4.50	-0.92
Bridge-4	6.092	31	26	8.54	0.63	-2.09	-2.70
Bridge-5	6.586	37.5	56	8.54	0.60	-4.25	-6.51
Bridge-6	9.554	28	33	8.54	0.76	-3.20	-3.87
Bridge-7	10.01	43.5	82	8.53	0.78	-4.95	-6.15
Bridge-8	10.65	93	245	8.53	0.97	-6.45	-7.50
Bridge-9	11.30	81	191	8.53	1.20	-6.78	-7.11
Bridge-10	11.722	75	168	8.53	0.88	-6.38	-1.16

Note: Chainages are from the starting point of the proposed road link at Sachna Bazar end

4.6.3 Navigational Clearances

The rivers and drainage routes that the proposed road crosses do not fall under BIWTA navigational route classification. From June to November the study area remains under water and waterway communication becomes the only means for the people to go from one place to another and to transport goods. Generally people use motor driven boats for this purpose. Based on the information obtained from the local people regarding navigation condition a vertical clearance of 1.2m has been proposed for Bridge-1 to Bridge-9

whereas the same for Bridge-10 (over the Baulai river) has been suggested as 1.5m. The suggested navigation clearances are above reported design water level.

4.7 Design Life

The proposed road and structure (bridges) is designed for a life of 50 years.

4.8 Earthquake

The road location is characterized by High earthquake prone site and falls under Zone-I. Seismic coefficient of this zone is 0.08g.

4.9 Land Acquisition Cost

Among three alternative alignments, option-1 is selected basaed on reconnaissance survey and numerical model investigation result for the proposed road (Chapter 5). For option-1, the length of the proposed Sachna-Golakpur road will be 12.2km. For this road construction about 83 hectare of land will be required which mostly belongs to private owners. This proposed road corridor is mainly floodplain used for agricultural and fishing. The prevailing rates of land and cost of compensation have to be established in discussion with the Land Acquisition Department of District Commissioner after finalization of land acquisition plan during detailed design stage.

4.10 Activities during pre-construction, construction and post-construction phases

The activities to construct the proposed road intervention will be done in three phases namely pre-construction, construction and post-construction. Works under these three categories are following:

Pre-construction phase

- Survey and design data collection for construction of the road work and bridges
- Hydraulic design of the road / bridges
- Mobilization of construction materials and equipment by heavy vehicles.
- Construction of labour shed/stock yard.
- Distribute land acquisition money before the construction works
- Storage of construction materials at stockyard.
- Installment of water and sanitation facilities
- Installment of Garbage disposal system
- Discussion with local stakeholders about the project and interventions
- Display of billboard at construction site for public awareness.

Construction phase

- Earth work for construction of the proposed road and bridges
- Earth work by manual labor in construction of road/bridges

- Compaction of soil for construction of road
- Piling and R.C.C works along with cutting, bending and binding of rods as per specification to construct bridges
- River Training Works (RTWs) /Protective Works
- Road Embankment Slope Protection Works
- Plantation of Timber/Fruit plant along the both sides of the road.
- Close monitoring of construction work by the RHD officials.
- Selection of the suitable route for the proposed road and location and number of structures;
- Hydraulic design of the road / bridges;

Post-construction phases

- Any adverse impacts on erosion, deposition, flooding, navigation in the upstream or downstream of the proposed route and bridges due to construction by RHD
- Morphological changes in the vicinity of the route / bridge and RTW by RHD
- Operation and Maintenance by RHD.
- Implementation of EMP and monitoring by RHD.

5 Analyses of Alternatives

5.1 With and Without Project Scenarios

With Project Scenarios

The proposed road will play an important role in the communication systems of north-east reagion of Bangladesh. After construction of the proposed Sachna-Golakpur road link, there will be a direct roadway communication between Sunamganj (Jamalganj) to Natrokona-Mymensingh-Dhaka. The people travelling from Sunamganj to Dhaka and from northern and north-western regions to Sunamganj will get benefit in terms of reduced travel time and cost after construction of the proposed road. The proposed road link will fill up a missing part of the Sunamganj-Netrakona regional highway (R370). Now, there is a LGED road link between Jamalganj head quarter and Mannanghat Bazar along the left bank of the Surma river. Communication system will be much easier as there will be no need of going to Sunamganj via Sylhet, and hence, distance between Dhaka and Sunamganj will be reduced. The communication between Sunamganj and other towns and cities of the country will also bealso easier. Moreover, the proposed road will be constructed in the low lying area that gets flooded during monsoon. There are also many beels and haors on both sides of the Surma river. Villages are connected with one another and with nearby bazars by village roads in the project site. However, during monsoon these roads go under water and village people have to depend solely on boat to maintain communication among them. After the construction of the proposed road local people will be used all weather road and will reduce travel problem. Therefore, people might be get avail to travel in regional and national Roadway commutation through this proposed road.

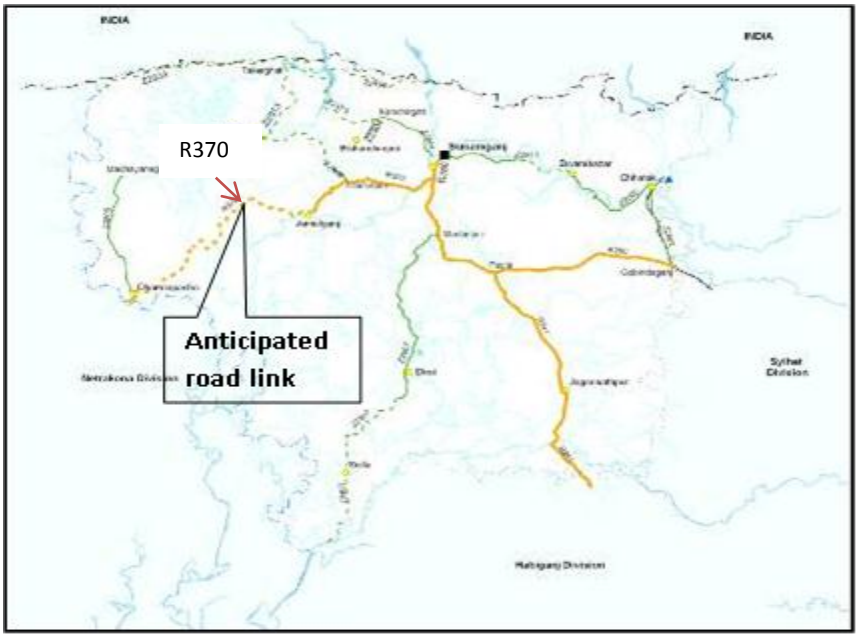


Figure 5.1: RHD road network under Road Division, Sunamganj

Sunamganj district is famous for fish and agricultural products. This district is also known for the stone and sand business.There is more than a thousand businessmen are involved in this business, where about

fifty thousand workers are directly dependent on this sector. If the roadway is constructed, it will be easier to transport these products from Jamalganj to other parts of the country. After completion of the road project, surrounding areas like Jamalganj, Sachna Bazar, Dharmapasha may be converted into industrial areas. Improvement of communication systems, Employment opportunities, excess to health facilities and literacy rate will be improved significantly after the project implementation. Therefore, after construction of Sachna-Golakpur road, the life style of the people will be developed remarkably and poverty alleviation likely to occur there. Socio-economic condition of the people will be improved consequently in this region.

Without project condition:

- Pace of floodplain development will be slow and disturbance to natural environment will be less.
- People in the study area will lack in communication facilities. The exsisting waterway communication may be hampered due to siltation in the rivers and haors.
- Over all soci-economic development in the study area will be hampered due to lack of marketing facilities, all weather smooth communication facilities, schooling facilities and employment generation facilities.
- People will exploit natural resources more and more to feed themselves as a result pressure on natural resources will be continue to increase.

5.2 Alternatives for Proposed Road Link

The project area lies in a very complex hydrological and environmental setting. Establishment of Sachna-Golakpur road link is a challenging task for materialization of the Sunamganj-Netrokona-Mymensing-Dhaka road communication. Improper planning and design of the road and road structures including alignment will not only be a safety concern but also be a threat for the delicate environmental quality of the project area.

5.2.1 Road Alignment

Road alignment is the position or the layout of the center line of the road on the ground. The horizontal alignment includes the straightway, the horizontal deviations and curves. Changes in gradients and vertical curves are covered under vertical alignment of the roads. The continuous line of a highway is formed longitudinally by its alignment in the horizontal and vertical planes. In combination with the cross-sectional element, the highway is then in three dimensions becomes functional and operative.

5.2.2 Factors Controlling Road Alignment Selection

The following factors have been identified in selection of options for the proposed Sachna-Golakpur road link.

- The proposed road is part of Sunamganj-Netrokona-Mymensingh regional highway. It will be an all-weather road that will allow for movement of large vehicles. In this type of road relatively

short curves, at or near the minimum radius for the design speed should be used in conjunction with straights or very large radius curves.

- The length of the road connecting Sachna and Golakpur should not be much to reduce cost of construction.
- The construction of the proposed road is envisaged for development of the Jamalganj and Dharmapasha upazilas. Therefore, the road should not be much away from the existing growth centers, bazars, group of villages and places of religious and social importance.
- The road is for both motorized and non-motorized vehicles as well for pedestrian. Therefore, the road may have mild bends.
- Since the proposed road link is part of a highway, the radius of horizontal curve should not be less than 250 m (for design speed of 65km/h).
- The alignment of the proposed road should be selected so that longitudinal slopes are not steeper than ruling gradient.
- The alignment of the proposed road should be decided such that minimum sight distance is available for drivers of the vehicles.
- The alignment of the proposed road should be selected in such a way so that marshy land, ponds, wells, graveyards, historical monumental and religious sites etc may be avoided.
- The alignment should encounter minimum number of drainage routes in order to reduce the number of cross drainage works.
- While crossing river, the sites should provide all the requirements needed for a good bridge construction. The alignment of the road should cross the river at 90^{o} to avoid construction of skew bridge.
- The road alignment should be through such areas that provide good formation bed.
- The road alignment should be such that excessive cutting and filling could be avoided.
- Environmental issues like air pollution, noise pollution, loss of biodiversity and habitat should be given due consideration.
- The road alignment should be selected to meet the public demand of that area.

5.2.3 Issues and Constraints

Based on field investigations, stakeholder consultations and review of relevant reports the following issues and constraints associated with the construction of the proposed Sachna-Golakpur road link have been identified.

The key issues are:

- Existing hydrological and flow regime in the project area
- Connectivity between the rivers and their floodplains
- Effects of human interventions in the river and floodplain on river behaviour
- Present bank erosion situation and likely future trend in bank erosion
- Road embankment slope stability against wave actions
- Surface water and flooding
- Existing land uses; and
- Ecosystems and biodiversity of the haors

The key constraints are:

- Soil quality of the project area for construction of road and bridge
- Encroachment into wetlands
- Access from local villages, businesses and local roads
- River gaps
- High magnitude of flash flood discharge
- Suitability of locally available materials for construction, and
- Transportation of construction materials to the construction site

5.2.4 Alignment Options for the proposed Road

The existing RHD road from the Sunamganj town terminates at Sachna Bazar that lies on the right bank (north bank) of the Surma river. From Suchna Bazar the river flows towards southwest direction upto Surma-Baulai confluence. Therefrom, the river turns towards south. Golakpur is situated on the west bank of the river. Therefore, Sachna can be connected to Golakpur with road both along the right and left bank of the Surma River. A road alignment is shown in RHD road network map that connects the existing RHD road near Sachna Bazar with existing Mynensingh-Netrokona highway much away (to the west) from Golakpur. This road alignment runs much away (to the north) from the Surma river.

In consideration of factors controlling road alignment selection and related issues and constraints three alignment options have been developed for assessment by 'Topographical, Morphological and Hydrological study using mathematical model' study team. The selected three options have been discussed below.

Option-1

The proposed road alignment under Option-1 is shown in **Figure 5.1.**

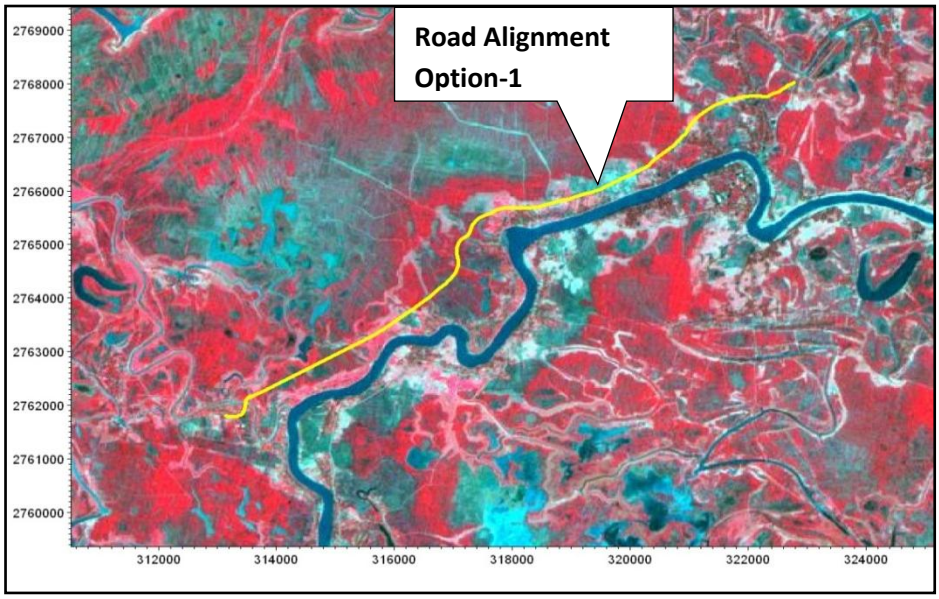


Figure 5.2 Sachna-Golakpur road alignment Option-1

The starting point of the proposed road link on the Sachna side is at about 1.7km northeast of the Sachna Ghat along the existing road. The position of this starting point is 322778.62E, 2768014N in UTM co-ordinate system whereas the end point of this road link on the Golakpur side is 313144.67E, 2761803.5N in same co-ordinate system. The total length of the proposed road link under Option-1 is 12.2km. From Sachna Bazar to Shadarkandi the road alignment passes along the northern edge of the natural levee somewhat away from the small villages near the bank margin. There is no instance of levee breach along this river stretch but there is bank erosion potential to some extent although this river stretch is more or less straight. The overall setback distance between the existing LGED road and the river bank margin is not much and as a result at some locations the existence of this road is in danger due to bank erosion. Therefore, the road alignment along this river stretch under Option-1 is selected safely away from the river bank (right bank) and on the relatively higher elevation land compared to that of the large expanse of low land to the north that goes under water regularly during monsoon.

From Shadarkandi to Maminpur the road alignment runs much away from the river. The river has formed a U-shaped bend here of which left bank is the outer bank. The existing LGED road here is 200m or more distance away from the right bank of the river. The elevation of land on which the road alignment passes here is relatively higher than that of the low-lying area to the northeast of the road. The road alignment along this river stretch is chosen to avoid large curve of the road and also to reduce the length of the same.

From Maminpur to Baulai river crossing a more or less straight alignment has been chosen in southwest direction. This alignment passes along the northern edge of the levee from Maminpur to Uttar Laxmipur. Thereform, after traversing a short distance, the road alignment passes through the relatively low elevation land upto Baulai river crossing. The natural levee along this river stretch is not much wide and there are scattered homesteads along this narrow strip of relatively high elevation land. There is of course LGED road along this narrow strip of land. However, it will not be wise to align a highway through this land because of unsafe setback distance between the road and the river bank margin. The proposed road alignment crosses the Baulai river at 90^{O} and then connects to the existing road.

Option-2

The starting point of the proposed road link on the Sachna side under Option-2 is the same of that under Option-1. From the starting point to the entrance point to Sachna Bazar the road alignment follows the existing RHD road alignment. However, therefrom the road alignment is shifted towards the southeast direction upto a point wherefrom it is possible to align the road towards the Surma river and to construct a bridge over the Surma river at a suitable location. It is done in order to avoid the road alignment through Sachna Bazar and Jamalganj Upazila Head Quarter. From the west end of the proposed bridge over the Surma river under Option-2 the road alignment is directed towards the west to the existing LGED road. The existing LGED road from Jamalganj Upazila Head Quarter to Mannan Ghat follows an alignment along the left bank of the Surma river almost parallel to the river. There is wide natural levee of the Surma river along its left bank in the study area as it is along the right bank. The existing LGED road runs through or along the southern edge of this levee. It is, therefore, decided to use this road alignment as part of the proposed road alignment under Option-2 with some deviations as the existing road alignment is dangerously close to the river bank at some locations. It is to be noted here that the existing LGED road is not suitable for heavy vehicles and may go under water during an extreme flood event. The road structures

are also not suitable of heavy vehicles. The proposed road alignment under Option-2 is shown in **Figure 5.2.**

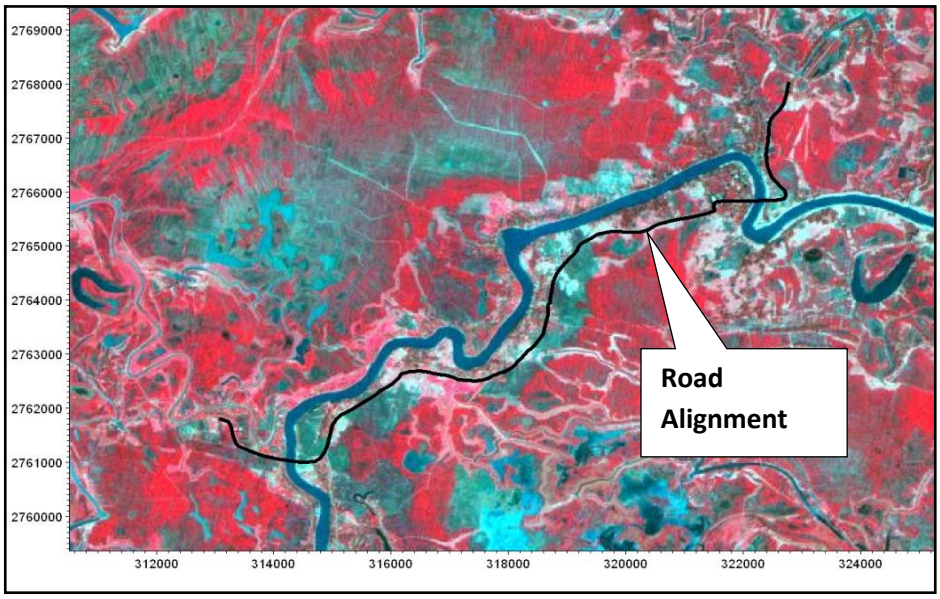


Figure 5.3: Sachna-Golakpur road alignment Option-2

At about 1km upstream of Golakpur Bazar the proposed road alignment is directed towards the west from the existing LGED road to the Surma river. With a bridge over the Surma river the proposed road alignment is then directed towards the northwest to the existing road. The total length of this road alignment from starting point to end point is about 15km.

Option-3

The proposed road alignment under Option-3 is shown in **Figure 5.3**. This alignment option is selected in line with an alignment shown in RHD road network map.

The starting point of the proposed road link on the Sachna side under Option-3 is the same of that under Option-1 and Option-2. From the starting point the alignment runs towards the southwest direction following a more or less straight way over a length of about 12.8km. Along this stretch the road passes through wetland and crosses a number of small rivers that are visible only during dry season. Therefrom, the road alignment follows a curved way directing towards southwest to southeast to southwest before meeting the existing road. The road crosses the Baulai river at 90^{o} along this curved way. The total length of the road under this option is about 17.7km.

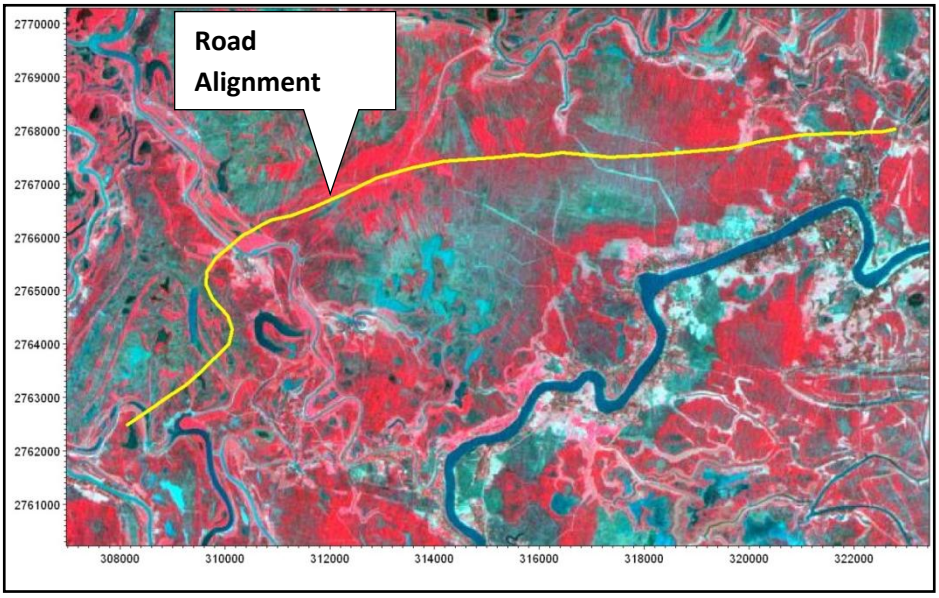


Figure 5.4: Sachna-Golakpur road alignment Option-3

5.2.5 Community and Organization Concerns

During the EIA study a number of field visits were made by the study team members. Consultations have been made with the people of the project area, local government authorities and officials concerned of BWDB, RHD, DAE, DLO, WF, DFO and PIO. Among other issues of the proposed road project they also expressed their concerns about road alignment. Since common people of the project area see possibility of connecting Sachna to Golakpur with road along both banks of the Surma river, their opinion as to suitable road alignment has been influenced by their interest. People who live on the left bank of the river think that the proposed should be aligned along the left bank of the river. Many of them are of the opinion that the existing LGED road may be upgraded to this end. On the other hand, people who live on the right bank of the river want that the proposed road should be aligned along the right bank of the river. The public demand for the proposed road is, however, very high. Nobody wants that the road should be much away from his locality. The difference in opinion between the inhabitants of both banks of the river as to preferred road alignment is affected by the fact that at present there is no bridge over the Surma river in the project area or within an easily accessible distance from their localities. Very positive community attitude towards the proposed road project is reflected by the fact that the people in the project area are willing to sacrifice their lands for road construction. At present they have no easy access to national road network.

Like common people, local government authorities particularly union parishad chairmen and members also want that the proposed road should be aligned through the areas that fall under their jurisdiction or nearby the same. According to the incumbent chairman of the Sachna Bazar Union Parishad the proposed road should be aligned along the right bank of the river. He pointed out that the road could be constructed along the right bank of the Surma river with minimum number of road structures as haor water mainly drains into Baulai river system. He also mentioned that there is a BWDB sluice gate across the Baulai river at Insanpur through which water may be drained out. He further added that the haor soil is not suitable for

road construction and there is no need for hiring non-local construction laborers as local laborers are able to perform the tasks. The incumbent chairman of the Uttar Sukhair Rajapur Union is of the opinion that the proposed road should be provided with sufficient number of bridges and culverts to protect it from flash flooding from the sudden onrush of water from the Meghalaya Hills. He also mentioned about very positive attitude of the people under his jurisdiction towards the road project as the road will improve the roadway communication facility remarkably.

The vice chairman of Jamalganj Upazila did not directly express his any choice for the alignment of the proposed road. However, his comments on various aspects of the proposed road indicate that he has perceived the road alignment to be along the right bank of the Surma river. He proposed some sluice gates along the proposed road in lieu of bridges or culverts to protect the crops from damage by flood water. He opined that the bridges and culverts should be designed to withstand scour from large flash floods as was happened in 2004. He further added that the bridges and culverts should be provided across the existing channels or drainage routes in order to avoid conflict with the interest of the local people. In this regard he emphasized the need for taking into account the opinions of the people in project implementation.
The concerns of the BWDB, LGED, PIO, DLO, DAE and WF as to feasible road alignment and proposed road project have been summarized below:

- LGED has a proposed road plan from Sachna to Golakpur via Kaminipur.
- The proposed road should be well protected against onrush of the water from flash flood and wave action
- The road project should not have any adverse impact on fish population which is now on the decline due to overfishing
- The proposed road should at a safe distance from the river
- The soil of the haor basin is not suitable for construction of roads and bridges. At some places the soil contains too much organic matter
- The road should have sufficient opening for safe passage of water from flash floods;
- The road project should not be in conflict with FCD projects of BWDB; and
- Bridges and culverts of the proposed road should be designed considering fish passage requirements

5.2.6 Assessment of Alternative Alignment Options

The assessment of the alternative road alignment options is needed to identify preferred alignment. In this regard it is important to identify the key issues and constraints associated with each of the alignment options. The assessment has to be made against relevant project objectives that are to be met. The overall project objective is to establish easy and smooth road communication between the resourceful northeastern part of the country and western part of the same. At present there is no smooth RHD road communication facility between Sunamganj district and adjoining Netrokona district. The saucer shaped and deeply flooded Sylhet basin is a major physical barrier for establishing smooth road communication between these two districts. There are a number of challenges to be addressed for establishing the proposed road link between Sachna and Golakpur. The challenges involve poor quality of soil in the haor area as a whole and at the haor centers in particular for construction of roads and bridges, complex hydrological setting of the project area, avulsive behavior of the river, tectonic subsidence, deposition of sediments in rivers and

haors, deterioration of haor ecosystem due to human activities etc. On the other hand, establishment of the proposed road link will bring immense benefits to the people of the region in terms of easier access to national road network, reduced dependence on waterway communication for transporting agricultural products to distant markets, towns and cities, commercial and industrial development, employment generation, schooling facilities in rural area etc. The alternative road alignment options have been assessed against relevant project objectives and need statement. Community and agency concerns have also been taken into account in screening process.

Out of three alternative alignments, option-1 (Right side of the Surma with 12.2km total length) is the best alignment for the proposed Sachna-Golakpur road considering all issues, constrains, objectives, baseline data analysis and numerical model investigation.

6 Environmental and Social Baseline of the Project Area

This section describes the environmental conditions including Physical, Biological and Socio-Economic Environment of the project site. The ESIA study team has established baseline condition including physical, biological and socio-economic environment of the project area which is required to recommend practical and site specific environmental mitigation and prepare and implement environmental monitoring plan during and after the project implementation. The ESIA study team have visited project site several times. Field visits has been done in different ways; i) Consultation with Government and non-Government officials and elected representatives, ii) Questionnaire survey iii) Focus group discussion and iv) In-situ water test and soil samples collection for laboratory analysis.

During field visits, the ESIA study team has talked about the proposed project and collected necessary data from the government official concerned regarding management of water bodies and road construction authorities and other government officials including RHD, BWDB, LGED, DAE, DLO, WF, PIO and DFO in Sunamganj district including Jamangonj and Dharma pasha upazilla. The study team has also talked about the proposed project to elected representatives such as Chairman of Sachna Bazar Union porishad, Vice-chairman of Jamalganj upazilla and Chairman of Uttair Sukhair Rajapur Union. Questionnaire survey and Focus group discussion have been held at Sachna bazar, Golakpur Bazar, Shamim Nagar, Mannanghat, Mominpur Bazar etc. Surma River water, haor water and ground water quality test has been done in-situ at different places within the project site. Soil samples were collected from different places at the project site for chemical/ physical analysis at the RRI laboratory. The study team also visited different haors/beel in and around project site like Pagnar Haor, Haliar Haor, Shanir Haor, Tanguar Haor, Khankiajuri Beel, Busk beel, Aila Beel, Firagang Beel, Dhoroni Beel and Joldhara etc.

Therefore, the information provided in this section is based on (i) Primary field studies by RRI personnel (ii) Stakeholder meetings resulting from the Public Consultation process undertaken by RRI personnel (iii) Collected Secondary data on physical, biological, ecological, social and other relevant information.

The project influence area (PIA) for this EIA has been established considering the maximum length of proposed all road alignments. The maximum proposed road length is 17.7 km which has taken the major axis of the oval shaped actual project area. To cover the sufficient receiving of environmental condition in accordance with the impacts of the Project, 50% of area added with actual project area as the PIA.

6.1 Physical Environment

Physical Environment of the study area have been assessed in terms of physiography and landforms, geology, seismicity, Climate and Meteorology, river systems, drainage system, soil type, agro-ecological settings, environmental pollution etc.

6.1.1 Physiography and Landforms

The physiographic unit of the study area is under Sylhet basin. It forms a prominent low-lying area containing numerous large, semi-natural wetlands like haors, baors, water fall etc. It is a lager, gentle, depressional feature, bounded by the Old Brahmaputra floodplain in the west, the Meghalaya Plateau foothills in the north, Sylhet High Plain in the east and the Mehgna estuarine floodplain on the south.

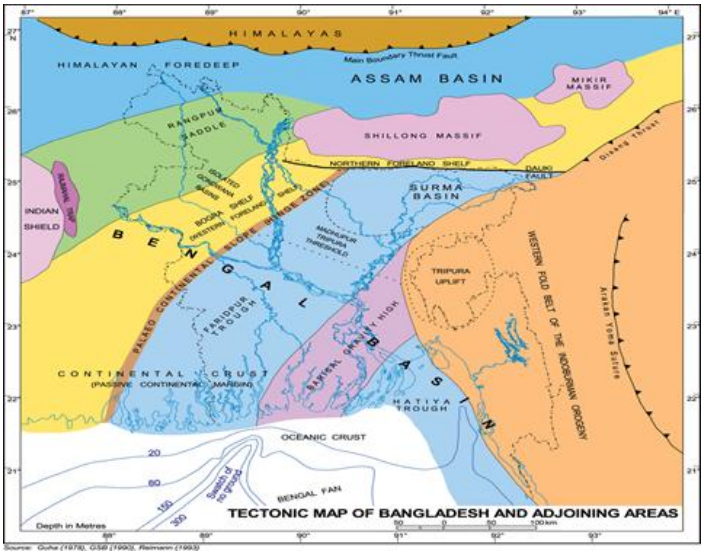
Its greatest length, both E-W and N-S, is just over 113 km. Numerous beels, large swamps and haors cover this saucer-shaped area of about 7250 sq km. The slope of the Brahmaputra floodplain is about 12cm/km. In north-south direction the length of the Sylhet basin is about 80km. The Sylhet city is about 20 m higher than the floor of the Sylhet basin. The Old Surma River is flowing 5.5 m above than the land level of the Bauli River. The trend of land levels in Bangladesh is sloping from north to south, but different characteristics are observed in north east region. The surface profile shows that the land slopes in the Sylhet basin are in reverse direction. This phenomenon is well supported to the higher subsidence rate in the northern part of the basin. The bottom of the Sylhet basin is elongated in the north south direction, with a deeper bottom and very steep slopes at the northern edge. The slopes of both east and west edges are milder and vary from 15 to 30 cm/km with a flat bottom several kilometers wide. The rivers entering into the basin from the east and the west and flowing over the side slopes in the east-west direction, turn towards the south while they flow over the flat bottom of the basin. On the contrary, the slope of the basin bottom is in the reverse direction.

The sinking of this large area into its present saucer-shape seems to be intimately connected with the uplift of Madhupur Tract. The region appears to be sinking at a rate of approximately 2cm per year (Rashid, 1991) and has sunk 9 - 12 m over the last several hundred years (Morgan and McIntire, 1959). This area is still undergoing persistent subsidence. In addition to the hills located along the southern spur of the Shillong Massif, a number of hillocks, locally known as Tila, form minor but morphologically distinct, ranges around Sylhet in northeastern Bangladesh. These elevations, as for instance Kailas Tila, Dupi Tila and the tilas at Beanibazar, east of Sylhet, are generally built up of Plio-Pleistocene clastic sediments and reach maximum elevations of about 60m above MSL. It is regularly flooded during the monsoon.

6.1.2 Geology

Bangladesh is divided into two major tectonic units: i) Stable Pre-Cambrian Platform in the northwest and ii) Geosynclinal basin in the southeast. A third unit, a narrow northeast-southwest trending zone called the hinge zone separates the above two units almost through the middle of the country. This hinge zone is currently known as palaeo continental slope. Stable Pre-Cambrian Platform refers to the stable shelf of the Bengal Basin. It is the part of the basin that lies on the west and northwest of the line joining Calcutta and Mymensingh. This line is frequently referred to Calcutta-Mymensingh gravity high, which represents the hinge zone of the basin or the basin ward extension of the stable shelf. In Bangladesh part of the Bengal Basin, the stable shelf can be divided into three major zones. They are Dinajpur slope, Rangpur Saddle and Bogra slope. It is composed of continental crust overlain by Cretaceous (144 to 66 million years ago) to recent sediment. However, in isolated basins on the stable shelf, there is Permo-Carboniferous (360 million years to 245 million years ago) sediments with considerable amount of coal. The thickness of sedimentary column on the stable shelf of Bengal Basin varies from less than 200m to 8,000m. A large part of the basin is covered by Sylhet limestone of Eocene age (58 million years to 37 million years ago).

The Sylhet Trough, which underlies most of the northeast region, is a sub-basin of the Bengal Basin and consists of 13-20 km thickness of alluvial and deltaic sediments underlain by much older gneiss and granitic rocks.



Map 6.1: Tectonic map of Bangladesh and adjoining area

Sylhet Trough is situated on the southern side of the Shillong Massif and corresponds to the vast low lands of Surma Valley with numerous swamps (haors) where absolute elevation marks even below the sea level. It is a sub-basin of the Bengal Foredeep in the north-eastern part of Bangladesh and is characterized by a very pronounced, vast, closed negative gravity anomaly up to 84 mgl (Milligal). Shillong Massif forms the northern boundary of Sylhet Trough while the great Dauki Fault separates the trough from the Massif. The Trough is bounded on the east and southeast by the sub-meridional trending folded belt of Assam and Tripura as the frontal deformation zone of Indo-Burman Ranges. Indian Platform bounds the trough from the west while it is open in the southwest to the main part of Bengal Basin. It is an oval shaped trough about 130 km long and 60 km wide. Sub-meridional trending anticlinal folds of Chittagong-Tripura Folded Belt gradually plunge northward to the Sylhet Trough. In cross-section the Sylhet Trough is sharply asymmetrical with comparatively gentle southern and steep faulted northern slope. Dauki Fault with 5 km wide fault zone forms the contact between Shillong Massif and Sylhet Trough. The evolution of Sylhet Trough includes (i) a passive continental margin (Pre-Oligocene) to (ii) a foreland basin linked to the Indo-Burman Ranges (Oligocene and Miolene) to (iii) a foreland basin linked to south-directed over thrusting of Shillong Plateau (Pliocene-Holocene). The anticlinal folds of Habiganj, Rashidpur, Bibiana, Maulvi Bazar, Katalkandi, Fenchuganj, Harargaj, Patharia, Beani Bazar (Mama Bhagna) and Kailas Tila, which occupy the southern rim of Sylhet Trough have sub-meridional trend in contrast to sub- latitudinal trending Chhatak, Jalalabad, Sylhet, DupiTila and Jatinga structures. These two structural trends form a syntaxial pattern at the north-eastern tip of Sylhet Trough. The Neogene sediments have excellent development in Sylhet Trough while the Paleogenes are at greater depths.

6.1.3 Seismicity

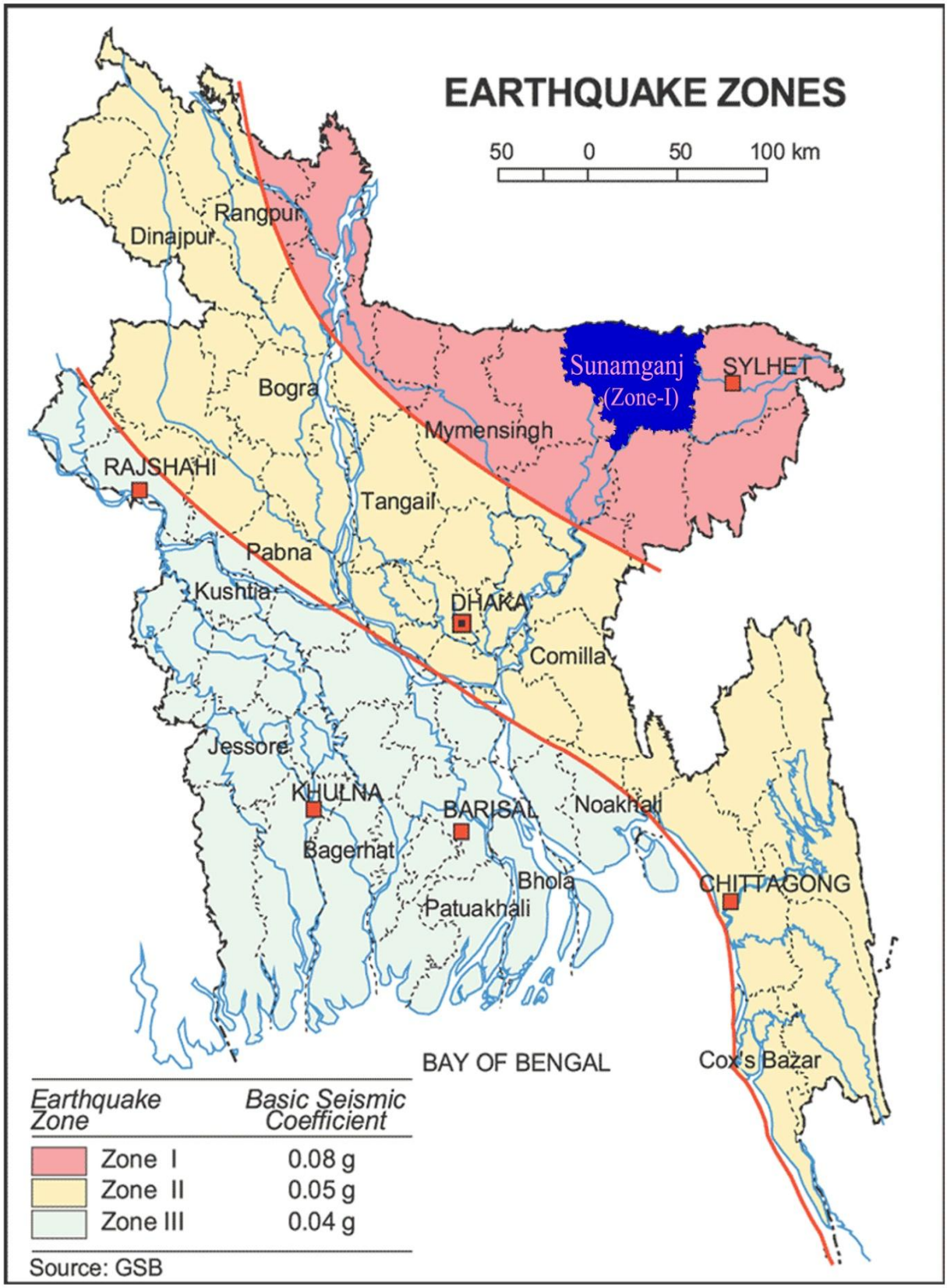
Geographical location of Bangladesh has made it ideal suited for natural disasters like earthquake, cyclones etc. Tectonic framework of Bangladesh and adjoining areas indicate that Bangladesh is suited adjacent to the plate margins of India and Eurasia where devastating earthquakes have occurred in the past. Depending on the geological structure, Bangladesh has been divided into three generalized seismic zones: zone-I, zone-II and zone-III (**Table 6.1** and Map

6.1). The basic seismic co-efficient of these three zones are 0.08, 0.05 and 0.04, respectively. There are also different geological faults in and around the country, as shown in **Map 6.2**.

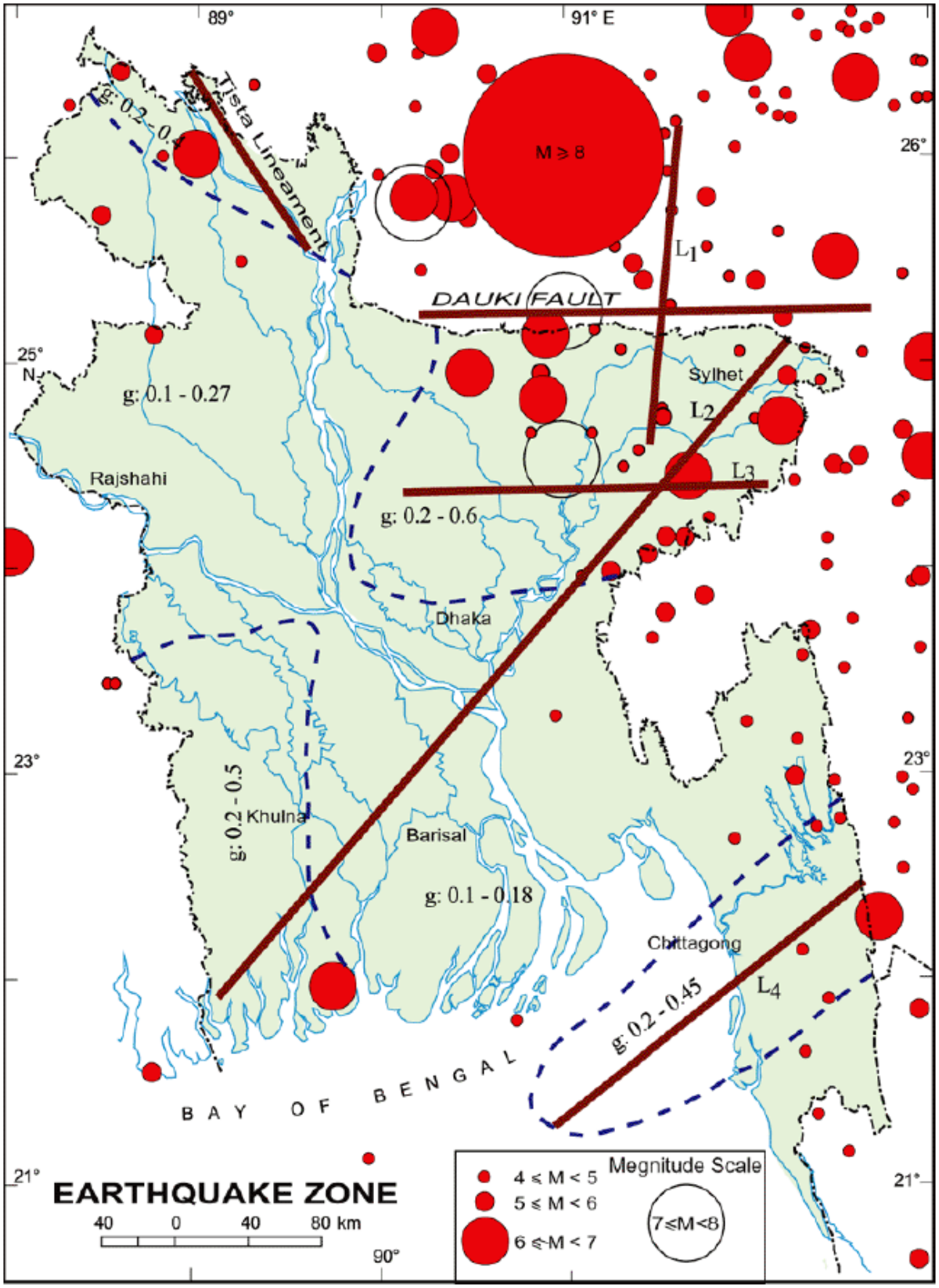
Table 6.1: Seismic zones of Bangladesh

Zoning	Area Mercalli Scale
I	North and eastern regions of Bangladesh (seismically most active)
II	Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla Noakhali and western part of Chittagong Folded belt
III	Khulna division S-W Bangladesh (seismically less active)

The study area falls under Zone-I, which is characterized by High earthquake prone site and has a basic seismic coefficient of 0.08g (**Table 6.1** and **Map 6.1**) and there is also fault line near the study area (**Map 6.2**). According to it, the maximum magnitude of earthquake is within the range of $6 \leq M < 7$ on the Richter scale in and around of the study area. During seismic or earthquake delineation, ground condition has not been taken into account in Bangladesh. Hence special precaution is needed in considering the risk from earthquakes to any water structure in floodplain formations.



Map 6.2: Earthquake zoning map with seismic coefficients



Map 6.3: Fault Lines of Bangladesh (Source: GSB)

6.1.3 Climate and Meteorology

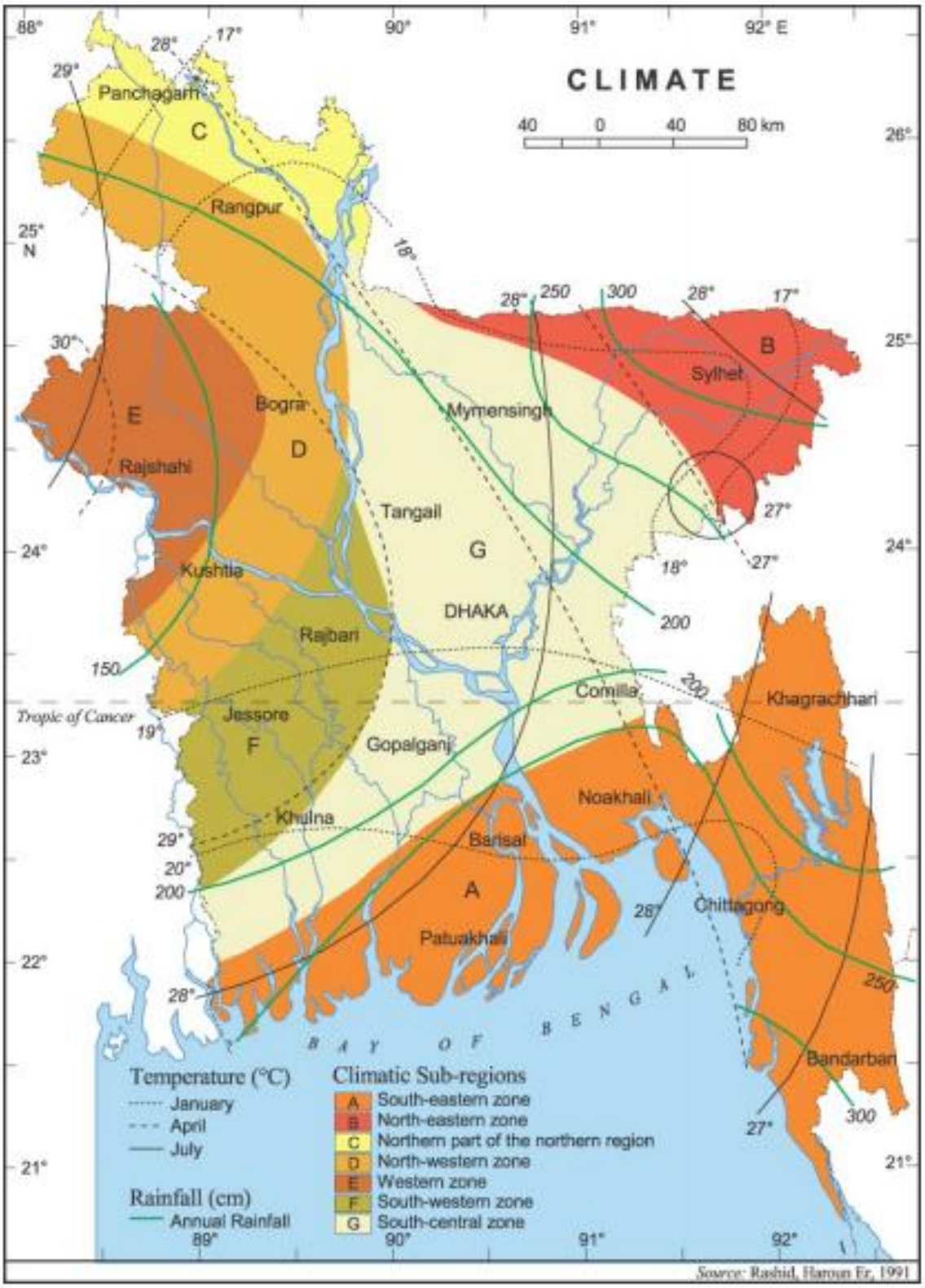
The northeast region of Bangladesh is located entirely to the north of the Tropic of Cancer, and hence its climate is characterized by the sub-tropical monsoon. The sub-tropical monsoon results intense regional and orographic rains caused by the interface of the mist air masses incoming from the Indian Ocean through the Bay of Bengal with a predominant northeastern direction and the steep and high hills located at the foothills in the states of Assam, Meghalaya and Tripura in India.
The hydro-meteorological seasons of the northeast region are generally classified into:

- Pre-monsoon season extending from April to May
- Monsoon season from June through September
- Post-Monsoon season from October to November and
- Dry season from December through March

The climate of the study area is subtropical monsoonal with an average annual rainfall of approximately 4,000 mm. Over 80% of the rain falls during the monsoon season from June to October. Climate is dominated by distinctive geographical characteristics of the region which ultimately plays a major role in determining the spatial and temporal distribution of rainfall, evapotranspiration and hydrology of surface and groundwater.

According to Climatic sub-regions of Bangladesh (**Map 6.3**), the project area is located in the north-eastern (B). The average annual rainfall in the study area is 4000mm. It rains in this area throughout the year. From June to October the rainfall is very high. Winter rainfall is very low. The temperature varies in summer from 40^{o}C to 30^{o}C whereas the same in winter are 18^{o}C and 10^{o}C respectively. The yearly average humidity is 79% where maximum 88% in July and minimum 65% in February. Annual average sunshine is 6.4 hour/day where maximum is 8.4 hr/day in February and minimum 3.6 hr/day in July. In the project site annual mean wind speed is 7.3 km/hour. Monthly average wind speed varies from 2.1 km/hour to 8.8 km/hour. However, extreme wind speed recorded 168 km/hour. Average annual evapotranspiration is 1550 mm/year (Minimum 103 mm in December and maximum 162mm in March)

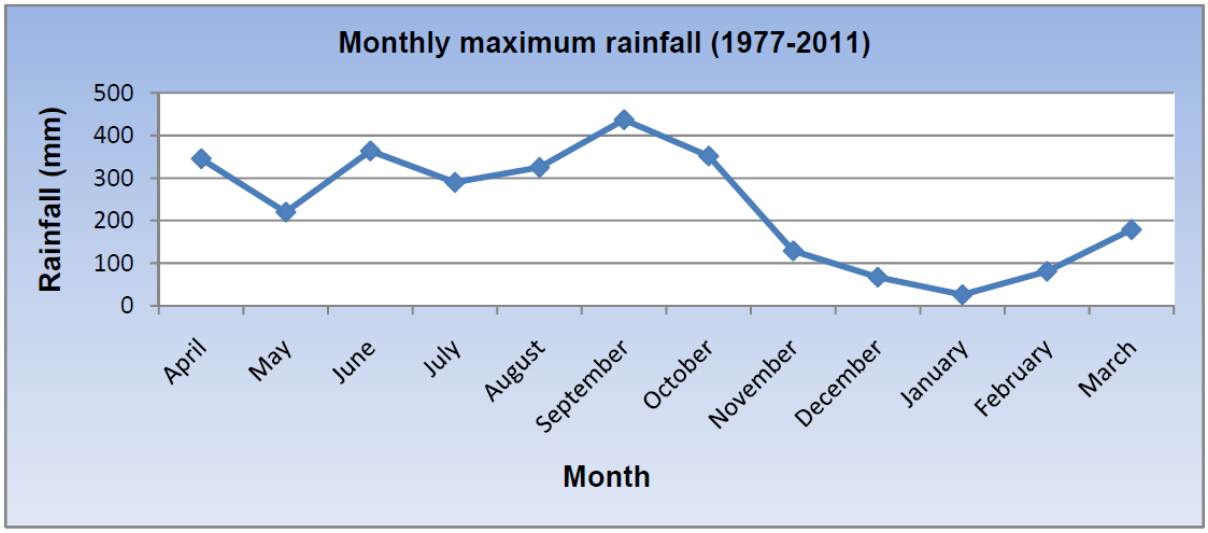
Information of different meteorological parameters i.e. rainfall, temperature, relative humidity, wind speed, evaporation and sun shine hours have been collected from National Water Resources Database (NWRD) of the Bangladesh Meteorological Department (BMD) at Sylhet station and CEGIS report on EIA study of Kalni Bridge. To complete understanding on the meteorological system of the study area, meteorological parameters are described in the following sections.



Map 6.4: Climatic sub-regions of Bangladesh

Rainfall:

The monthly maximum rainfalls (1977-2011) have shown in **Figure 6.1.** These data were collected from the BMD station of Sylhet (1977-2011) showed in CEGIS report on EIA study of Kalni Bridge. The Figure has shown significant rainfall occurred during the months of April to November. On the other hand, very low rainfall occurred during the month of December to March. The maximum rainfall ever recorded in the study area is 420 mm in the month of September. The mean annual rainfall is about 4005mm, which is a very high side compared to the national average of 2300mm. Annual rainfall, however, have shown considerable variability from year to year. The rainfall also varies considerably within a year. Over 80% of the rain falls during the monsoon season from June to October. The average annual rainfall in Jamalganj upazila is 4000m.

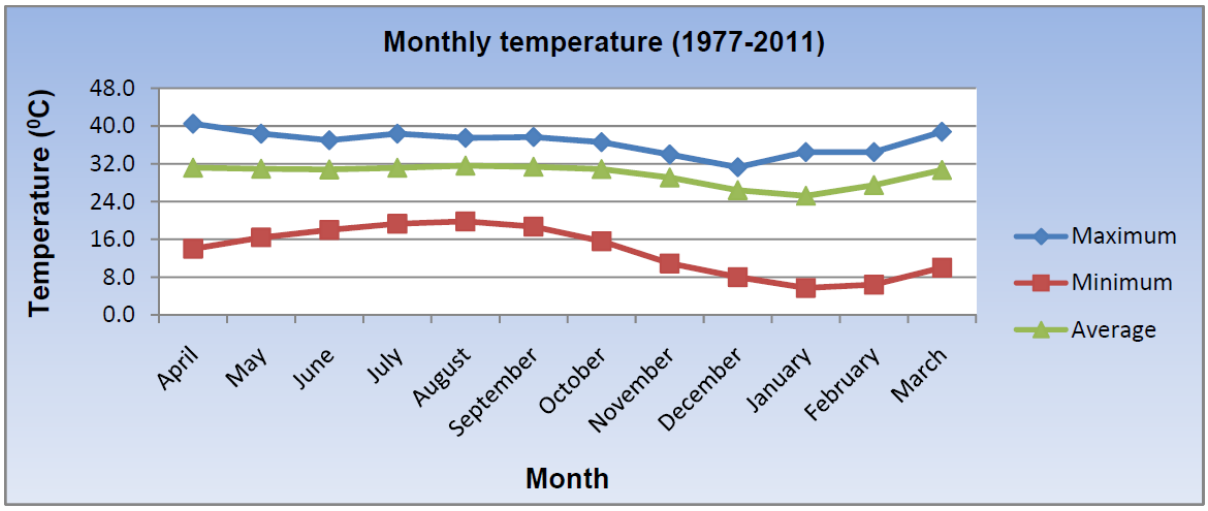


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.1: Monthly variation of maximum rainfall in the study area.

Temperature:

The monthly variation of maximum, average and minimum temperature for last 35 years (1977-2011) has shown in **Figure 6.2**. The Data have shown that the monthly maximum temperature varies from 32.0°C to 40.1°C whereas the monthly minimum temperature varies within the range of 6.2°C to20.6°C. The highest monthly temperature is found as 40.1°C (April) whereas the lowest monthly temperature is 6.2°C (January). The average temperature is steady and is around 32°Cduring the month of March to October. Temperature falls from November to reach minimum value in January and then rises again in February and reached to maximum in March.

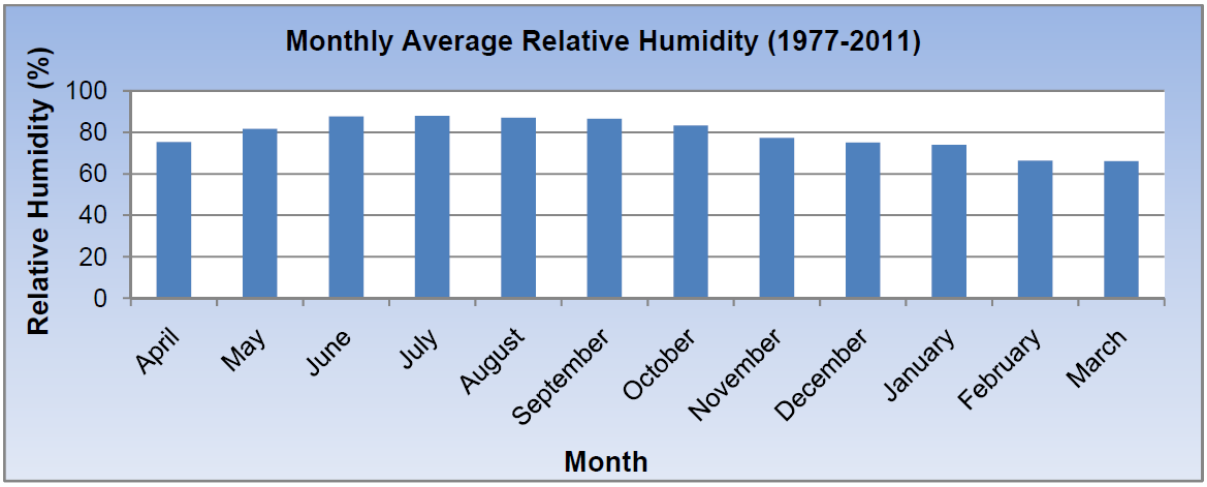


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.2: Monthly variation of maximum, average and minimum temperature in the study area.

Relative Humidity:

Monthly average relative humidity of the study area varies from 63% to 84%. Figure.3 have shown the monthly average relative humidity of the Sylhet station for the last 35 years (1977-2011). It has been clear from the Figure that the study area is considered as humid during the month of May to October (>80%).

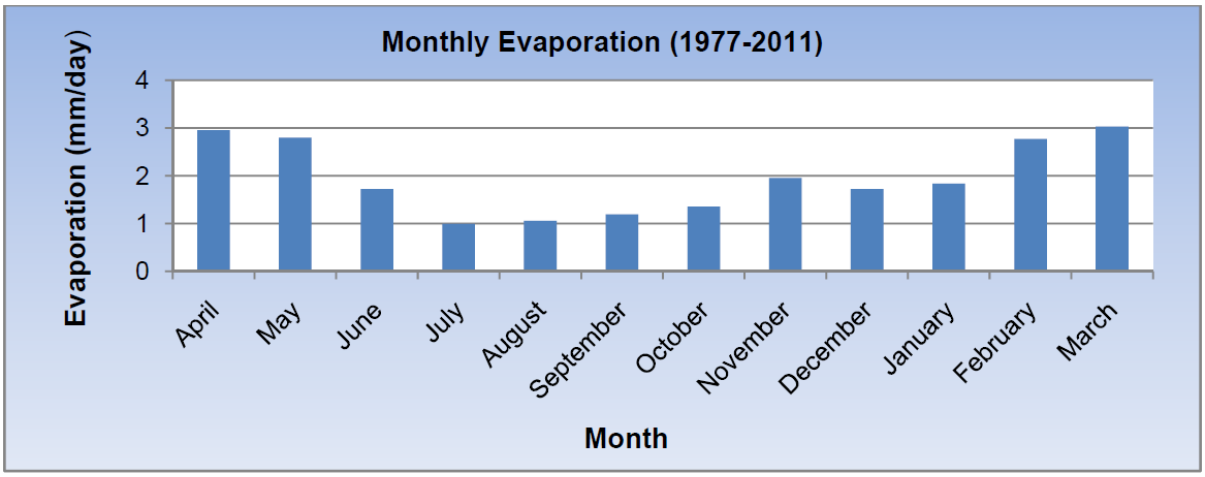


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.3: Monthly variation of average relative humidity in the study area.

Evaporation:

Monthly average evaporation rate of the Sylhet station is shown in **Figure 6.4**, which shows that the evaporation rate of the area is lower as throughout the year the evaporation rate is less than 3mm/day. The evaporation rate of the area varies from 1-3mm/day. Evaporation rate is relatively higher during the month of January to May and lower during June to January. The rate is maximum in March and minimum in July.

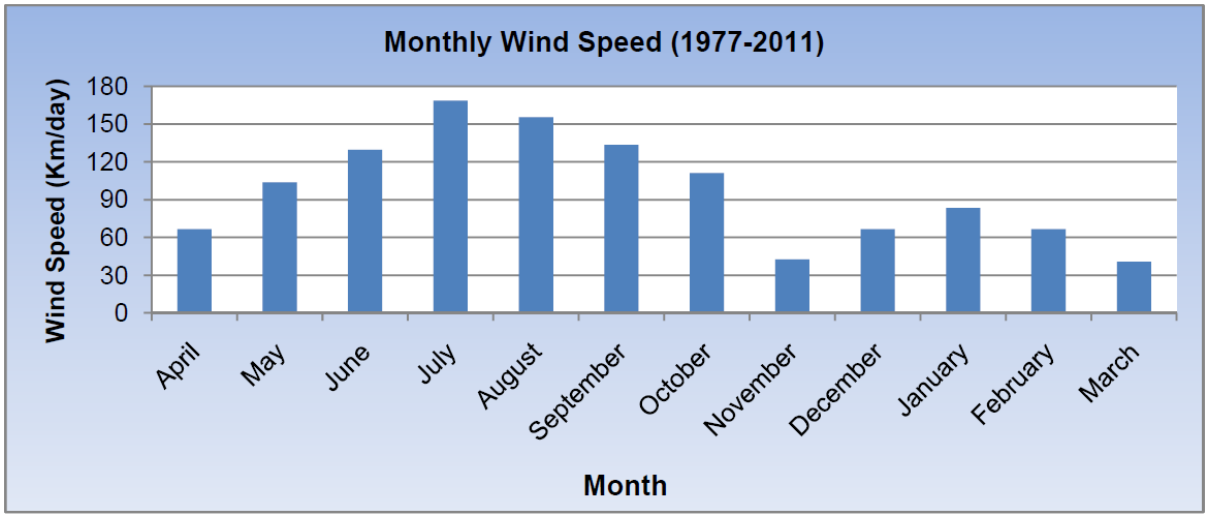


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.4: Monthly variation of average evaporation in the study area.

Wind Speed:

Monthly average wind speed of the study area varies from 42-169km/day. Wind speed is minimum in March (42km/day) and maximum in July (169km/day). Wind speed increases from march to July and then decreases up to November. Then increases up to January and decreases to March. The monthly variation of the wind speed for the last 35 years (1977-2011) is shown in **Figure 6.5**.

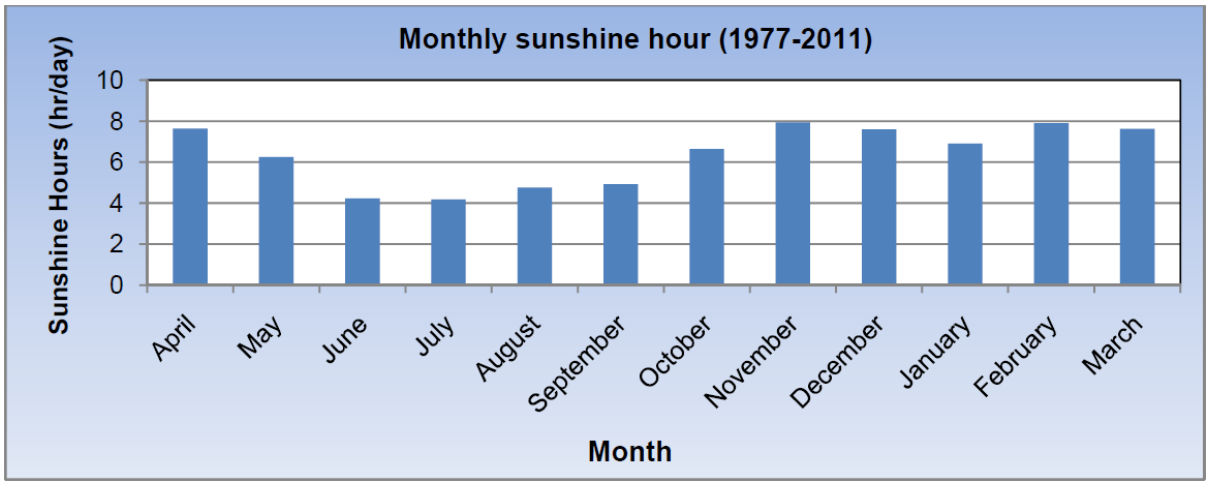


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.5: Monthly variation of average wind speed in the study area.

Sunshine Hour:

Monthly average sunshine hour for the Sylhet station is shown in **Figure 6.6** for the last 35 years (1977-2011). According to the Figure, the average sunshine hour varies from 4.1-7.9hour/day with its maximum value in November and minimum value in July. Sunshine hour is larger during October to May and lower during June to September. The data were collected from the BMD station at Sylhet and showed in CEGIS report on EIA study of Kalni Bridge.

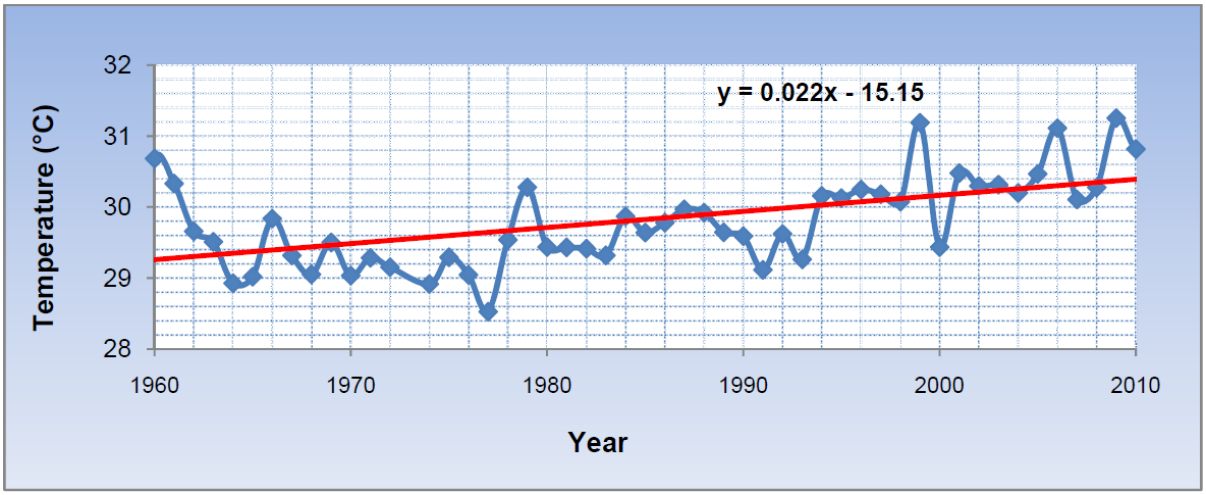


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.6: Monthly variation of average Sunshine hour in the study area.

6.1.4 Climate Change

In the northeast region, the climate is sub-tropical monsoonal. The sub-tropical monsoon climate tends to have more sharply defined seasons than the tropical climate. Rainfall is the most distinctive component of climate in the haor region. Climate is dominated by distinctive geographical characteristics of the region which ultimately plays a major role in determining the spatial and temporal distribution of rainfall, evapotranspiration and hydrology of surface and groundwater. In order to assess the change in climatic factors, trend of annual variations of the aforementioned meteorological parameters were analyzed.

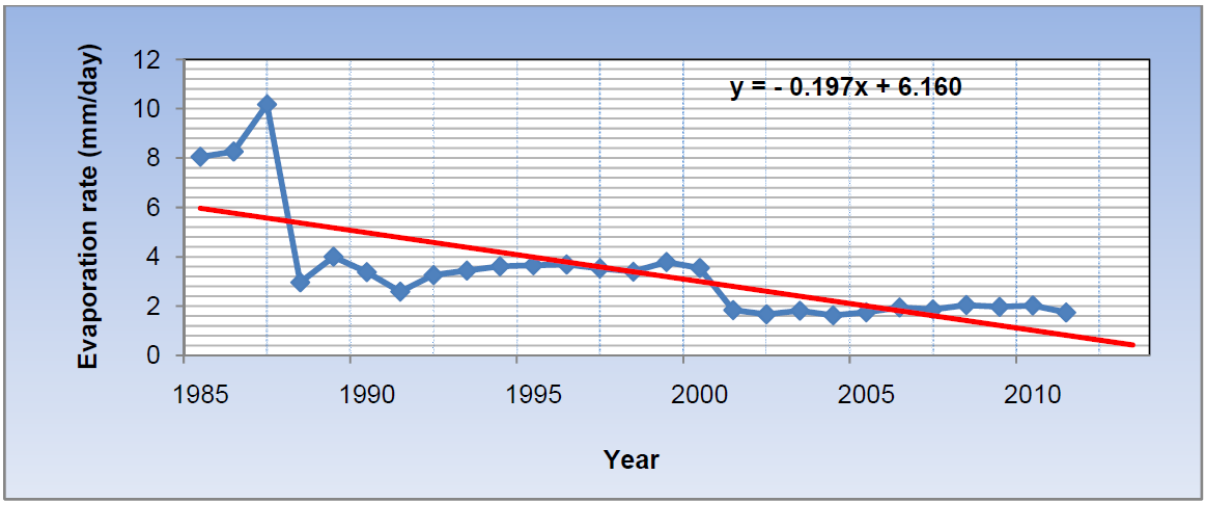


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.7: Annual variation of mean temperature in the study area (1960-2010).

The major impact caused by climate change is the rise in temperature. As per analyses made in the study, the average temperature is found to be gradually increasing in the area. In last 50 years, the mean annual temperature has experienced a rise of about 0.022°C per year (**Figure 6.7**). The variation of mean annual temperature recorded at Sylhet station is shown in **Figure 6.7**.

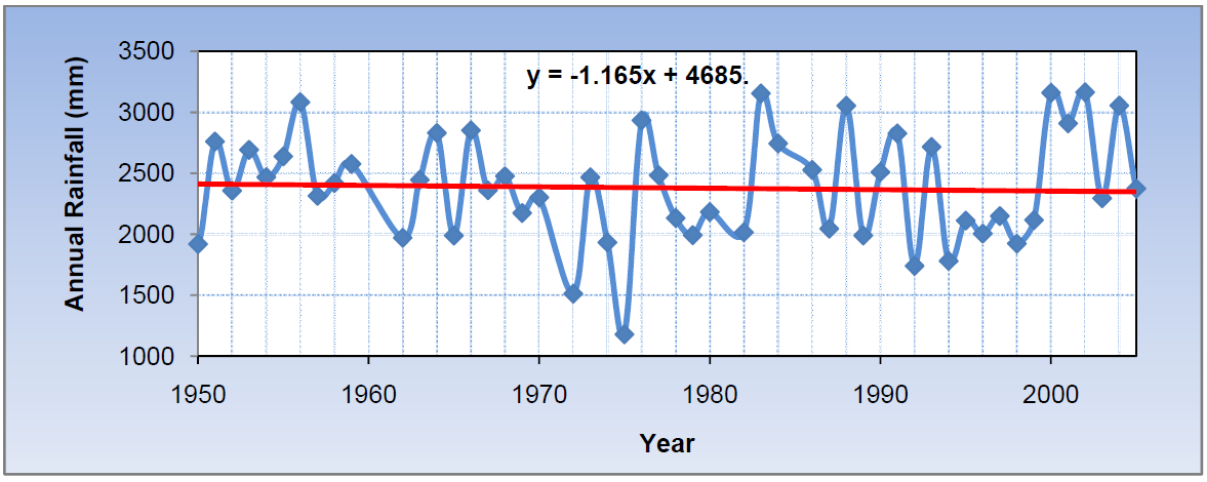
The hot season commences early in April and continues till August. The maximum temperature observed is about 32.0°C to 40.1°C during May to July and the minimum temperature recorded in January is about 6.2°C to 20.6°C. The highest rainfall is observed during monsoon.



Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.8: Annual variation of evaporation rate in the study area (1985-2010).

The increase in mean annual temperature affects the rate of evaporation and thus rainfall intensities. The evaporation rates recorded at Sylhet station shows a decreasing trend (decreasing by 0.197 mm/day each year in last 25 years). The **Figure 6.8** has shown the decreasing trend in Evaporation rate. During this period, spring season has been shortened and monsoon has been shifting towards May. These days, monsoon starts from the month of May and lasts up to mid -October. Due to such timing, water scarcity is often observed in the Boro season. This phenomenon affects the cropping patterns as well as the biodiversity and ecosystem of the study area. Now-a-days, farmers initiated hybrid cropping, which eventually improved their socio-economic status.

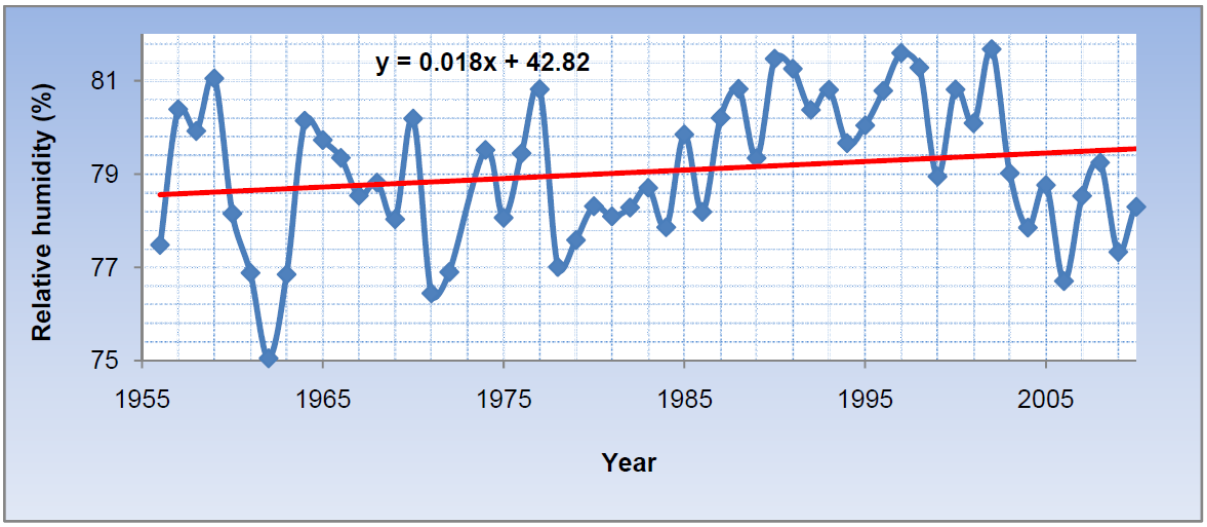


Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.9: Annual variation of rainfall in the study area (1950-2005).

The rainfall intensities and patterns have also been changed and extreme consequence of it is affecting the study area. In the last 60 years the annual rainfall of the study area decreased by 1.165mm per year at Sylhet. The annual variation of the rainfall in the study area is shown in **Figure 6.9**.

Along with the other factors, average humidity also experienced a slight change. The average annual relative humidity increased 0.018% per year in last 55 years at Sylhet region. The variation of average annual relative humidity of the study area is shown in **Figure 6.10**.



Source: CEGIS report on EIA study of Kalni Bridge, 2014

Figure 6.10: Annual variation of relative humidity in the study area (1955-2010).

6.2 Environmental Quality

Baseline data for environmental quality monitoring has gathered on noise quality, air quality, water quality and soil quality in the project area. The values of the aforementioned environmental parameters are collected and analyzed considering both primary and secondary information from different sources.

6.2.1 Noise

The study area is in low-lying Haor areas. Many haors like Shanir haor, Pagnar haor, Haliar Haor etc. are located in the project site. The noise level of the Shanir haor collected from the EIA study of the haor management plan has been given the following **Table 6.2**.

Table 6.2: Daytime noise levels of the study area

Location	Maximum Noise Level (dBA)
Shanir Haor	59.5

Source: EIA Report on 'Haor Flood Management and Livelihood Improvement Project', 2016

Table 6.3 shows the standard values for noise in Bangladesh. Noise levels exceeding 80dB is usually considered as noise pollution in Bangladesh. The noise level in shanir Haor is 59.5. The observed noise levels are found higher than the permissible limits for daytime at Shaniar Haor.

Table 6.3: Standards of noise levels for different zones of Bangladesh

Zone Class	Limits in dB	
	Daytime (6am-9pm)	Nighttime (9pm-6am)
Silent zone	45	35
Residential zone	50	40
Mixed	60	50
Commercial zone	70	60
Industrial zone	75	70

6.2.2 Air Quality

Air quality of the project area is quite good. The data of air Quality has been collected from the EIA study of the haor management plan, 2016. Many haors like Shanir haor, Pagnar haor, Haliar Haor etc. are located in the project site. The air quality of the Shanir haor is given below in the following Table.

Table 6.4: Air quality of the study area

Sl. No.	Location	Unit	SPM	PM_{10}	CO	O_3	NO	NO_2	NO_X	SO_2
1.	Shaniar Haor	$\mu g/m^3$	82.3	46.1	2477	25.30	271	196	467	1.2
2.	DoE Urban Standards 2005	$\mu g/m^3$	200	150	40000	235	NSY	200	-	365
3.	WHO Guidelines	$\mu g/m^3$	50	25	30000	-	-	40	-	20

Source: EIA Report of 'Haor Flood Management and Livelihood Improvement Project', 2016

6.2.3 Water Quality

Water quality monitoring is very important in the study area as most of the people residing adjacent to the Surma River uses the river water for their domestic purposes along with irrigation, and uses ground water for their drinking purposes.

Figure 6.11: People uses Surma River water for domestic purposes and for irrigation purposes

The water quality parameters were tested in-situ by portable multi-parameter meter in three locations; Sachna Bazar, Mominpur and Golakpur Bazar of right bank of Surma River; tube well of Shamimnagar and Mominpur; and haor water of Shamimnagar. The in-situ water quality parameters Temperature, pH, Dissolved Oxygen (DO), Electrical Conductivity (EC), Total Dissolve Solid (TDS), Resistivity, Salinity, Phosphate (PO_4^-), Sulphate (SO_4^-) and Nitrate (NO_3^-) are given below along with the DoE standard of water quality.

Figure 6.12: RRI personnel testing water quality parameters using HACH 30 QD Multiparameter at Sachna Bazar location of Surma River

Table 6.5: In-situ water quality test parameters of Surma River

Location	Easting	Northing	Temp. (°C)	pH	DO (mg/l)	EC (µS/cm)	TDS (mg/l)	Resistivity (kΩ-cm)	Salinity (%)	PO_4^- (mg/l)	SO_4^- (mg/l)	NO_3^- (mg/l)
Sachna Bazar	321794	2766723	23.7	7.83	6.17	112.9	55.3	8.86	0.05	0.25	8.00	0.3
Mominpur Bazar	316996	2763492	24.9	7.67	6.54	113.3	52.6	8.98	0.05	0.11	9.00	0.2
Golakpur Bazar	314760	2759990	24.9	7.68	6.41	102	48.1	9.8	0.05	0.15	8.00	0.23
DoE Standard (ECR, 1997)	Irrigation		20-30	6.5-8.5	>5.0	-	-	-	-	6	400	10
	Fishing		20-30	6.5-8.5	>5.0	-	-	-	-	6	400	10

Source: RRI field Investigation, 2016

Table 6.6: In-situ water quality test results of a tube-well near Mominpur Bazar

Location	**Easting**	**Northing**	**pH**	**EC (µS/cm)**	**TDS (mg/l)**	**Resistivity (kΩ-cm)**	**Salinity (%)**	**PO_4 (mg/l)**	**SO_4 (mg/l)**	**NO_3 (mg/l)**
Mominpur Bazar	316772	2763564	7.54	687	335	1.46	0..33	0.26	Not Found	0.45
Shamim Nagar	322333	2768076	7.78	511	248	1.96	0.25	-	-	-
DoE Standard (ECR, 1997)	Drinking		6.5-8.5	-	1000	-	-	6	400	10

Source: RRI field Investigation, 2016

Table 6.7: In-situ water quality test parameters of Haor water at Shamimnagar village

Location	Easting	Northing	Temp. (°C)	pH	DO (mg/l)	EC (µS/ cm)	TDS (mg/l)	Resistivity (kΩ-cm)	Salinity (%)
Shamim Nagar	322333	2768076		7.66	5.88	59.2	27.8	16.88	0.03
DoE Standard (ECR, 1997)	Irrigation		20-30	6.5-8.5	>5.0	-	-	-	-
	Fishing		20-30	6.5-8.5	>5.0	-	-	-	-

Source: RRI field Investigation, 2016

It is observed after analyzing **Table 6.4**, **Table 6.5** and **Table 6.6**, the water quality parameters are within Standard value provided by DoE (ECR, 1997) in the study area.

6.2.3 Significant Sources of Pollution in the Project Area and Prospects for Their mitigation

One of the important sources of pollution is the population of river bank as all of their human wastes fall into the Surma River. As the land elevation along both banks of the river is relatively higher, people build their homesteads on this land and cultivate crops in an extensive amount. These crops use fertilizer and pesticides which ultimately get washed out and enter into the river during monsoon. From the people's opinion it is known that due to heavy siltation the land is very fertile and they don't use excessive amount of fertilizer and pesticides. So this kind of chemical pollution is not that much threatening. As there is a large sand business in the bank of the river, this may cause some pollution due to high amount of transportation in the river. If the proposed road link is established, the river transportation will be decreased and the environment of the river will be improved.

6.3 Water Resources

The water resources system of the study area meets the demand of the surrounding ecosystem and provides livelihood for a significant amount of people. It is the source of water supply, and plays an indispensable role in assimilating and diluting waste, attenuating and regulating drainage, recharge into the aquifer, and maintaining the environment for aquatic habitats.

6.3.1 Major River Systems

Major river systems inside the northeast region include:

- Surma-Baulai-Ghorautra river system which starts as the northern branch of the Barak river at Amalshid and collects inflows from the Meghalaya hills and Kangsha system.
- Kushiara-Kalni-Dhaleswari river system, which starts as the southern branch of the Barak river at Amalshid and collects inflows from the Tripura Hills, local runoff, and spills from the Surma river.
- Kangsha river system, which includes inflows from the Susang Hills and locally generated runoff from the northwest corner of the region.
- Old Brahmaputra river, which now only carries spills from the Brahmaputra river and local runoff.

- Upper Meghna river, which commences 5 km upstream of Bhairab Bazar at the junction of the Ghorautra and Dhaleswari river systems, to form the outlet of the northeast region;

The Surma sub region covers the areas of Sylhet district and the eastern half of the Sunamganj district. This area is fed by the waters of the Surma River and its tributaries. All these rivers originate from the Khasi and the Jaintia hills in India. This sub region has several haors. The tributaries of the Surma River are flashy and reason for flash floods in early summer. These rivers are extremely flashy that is characterized by sudden and wide variation in flow as a result of excessive rainfall. When heavy rainfall is occurred in the hilly region of India, water quickly moves towards the haor area of Bangladesh through a number of rivers and khals. This floodwater not only carries the water but also carry a huge amount of sediments originated mainly from hills. Over the time this sediments get deposited on the river bed, banks and channel beds and reduce the conveyance capacity more or less of all of the rivers and channels and water storage capacity of the water bodies in the low lying area. As a result, when flash flood due to sudden heavy rainfall creates pressure on the water resources system, water easily overtops and creates breaching at several locations on the submersible embankments and eventually water quickly enters into the haor. Most of the cases, flood water comes into the haor very early in the monsoon and farmers do not get sufficient time to harvest their standing boro crop.

The main source of inflow to the region is from the Barak River which enters Bangladesh at Amalshid. At the border, the Barak bifurcates to form the Surma and Kushiara rivers, the two main rivers of the eastern part of the region. Between them, these two rivers receive most of the flashy river flows which enter the region from the Meghalaya Plateau and Tripura Hills. The largest of these rivers includes the Sarigowain, Lubhachara, Manu, Kowhai and Sonaibardhal. Inflows from these tributaries cause considerable spilling from the Surma and Kushiara during the monsoon. Spill flows follow a wide flood plain on the Kushiyara right bank, eventually joining the Kalni and Dhaleswari rivers before reaching the upper Meghna.

In the west of the region, the Kangsha, Someswari and Mogra rivers drain a large part of the area. These rivers join the Dhanu and Baulai rivers, which in turn capture additional flash flood flows emerging from the hilly catchments across the border before entering the central depression. The floodplain which constitutes the depression carries enormous volumes of water under minimal hydraulic gradient; in the monsoon the longitudinal gradient in the depression is almost horizontal, falling less than 1 cm per km, but conveying flows of more than 5000 m3/s. The entire region drains through a single outlet at Bhairab Bazar on the upper Meghna.

At Amalshid, the bifurcation location of the Barak River, large part of the Surma River is dried up and as a result about 85 percent flow of the Barak passes through the Kushiyara. The length of the Kushiyara River from Amalshid to Markuli is about 180 km. It's important water level measuring stations are at Amalshid, Sheola, Fenchuganj and Markuli. Stones and sylhet-sands are carried out in different parts of the country through this river. The flood danger level of this river is 13.5 mPWD at Sheola and 15.85 mPWD at Amalshid. This river is a class III navigation route fixed by the BIWTA. The average width of the KushiyaraRiver is 250m and in the rainy season the mean depth of the river reaches upto 10m. It has sinuous pattern with surface water slope 6 cm/km. It is a perennial river and has no tidal effect. Its flow is minimum during February-April and is about 25.02 m^3/s (March, SW 173-Sheola). On the other hand, the maximum flow occurs during July-September and is about 2960 m^3/s (August, SW 173-Sheola).

It flows down in the southwest direction from Sunamganj town. At Markuli, the Kushiara River joins the old course of Surma River and becomes the Kalni River. The Kushiyara River, is also a branch of the Barak River that arrives from the Manipur State of India. The rivers and the khals in the low lying project area drain into the old course of Surma and the Kushiyara-Kalni. The Kushiara and its tributaries are silt carrying, flashy and eroding rivers.

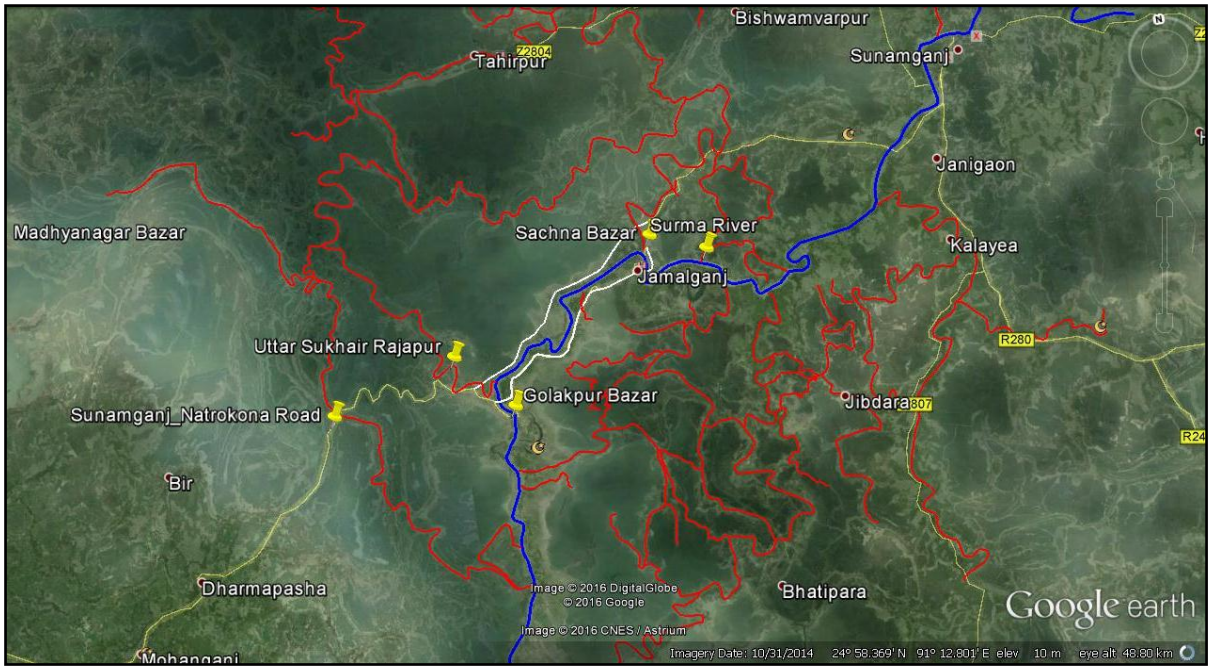


Figure 6.13: Complex River, channel and khal network at and around the project area

The Surma is a major river in the project area. The Surma is a branch of the Barak River that arrives from the Manipur State of India. At Amalshid, its entry point in Bangladesh, the Barak bifurcates. The right hand branch called the Surma River follows the international border of Bangladesh and India. In Kanaighatupazila of Sylhet district it fully enters into Bangladesh territory and flows towards. The Surma is a perennial river with many tributaries and distributaries. In the downstream part the river is navigable year round. During flood season water enters into the floodplain. The total length of the river within Bangladesh territory is about 249km. The width varies from 86m to 275m. The river is sinuous in pattern and water surface slope is 3cm/km.

Besides the Surma river, the other two important rivers are the Rakti and Baulai rivers. Rakti river is a tributary of the Surma river. This river originates from the Khasi Hills of the Indian state of Meghalaya. The Rakti has rwo distributaries from its right bank called the Muharram river and the Patni river. The Baulai river arrives from Tanguar haor and receives the flow of the two distributaries of the Rakti river. It then combines with the old course of Someswari river on its right bank and then with the Surma river. The Baulai is a flashy and eroding river. The average width of the river is somewhat less than 100m.

Source: RRI field investigation, 2016

Figure 6.14: Surma (left) and Baulai (right) river in the study area

6.3.2 Flooding and Drainage:

Sunamganj district is situated in haor area consisting of medium lowland, lowland and very lowland. The Haor Basin is a particularly vulnerable region of Bangladesh (IFAD 2011, WB 2010). Usually haor areas are flooded for 6 months of the year from May to October. During this time the project area becomes a vast stretch of turbulent water. Boats are used during the flood season as a means of communication because roads get completely submerged. During the dry season, most of the water drains out, leaving one or more shallow beels which become mostly overgrown with aquatic vegetation. These beels can completely dry out by the end of the dry season.

Flush floods are more likely occur in the project site. Most of the rivers in these areas are originated from nearby hilly area of India. These rivers are extremely flashy that is characterized by sudden and wide variation in flow as a result of excessive rainfall. When heavy rainfall occurred in the hilly region of India, water quickly moves towards the haor area of Bangladesh through a number of rivers and khals generating flush flood. Most of the cases, flood water comes into the haor very early in the monsoon and farmers do not get sufficient time to harvest their standing boro crop. During flush flood, flow of water carries sediments, which are eroded from the hilly catchment area. During heavy rainfall in the hilly region, massive erosion takes place on the exposed surface of the hill. When the high intensity rainfall is continued for certain period, coarser sediment starting to erode and move along the rivers. Finally these sediments are deposited on the river bed, khals, canals and agricultural land. During flash flood, sediment transport rates of the rivers increase significantly and hence major flood events make a disproportionate distribution of sediment and changes in channel size, shape and even location.

Drainage pattern throughout the study area follow the land gradient, sloping from north to south and from either side of the study area towards the Surma (Nawa River) Baulai channel. Consequently, distributary channels from the Surma river all behave as spill channels, diverting water out of the Surma system into the central basin lowlands. In the downstream of the study area, Someswari river, Kangsha river and Dhanu river drains in a south and easterly direction into the Baulai river system. The gradient of these tributary streams all flatten out appreciably as they approach the low-lying central basin lands. The streams connect with the Baulai river through a complex maze of distributary channels.

6.3.3 Erosion

Erosion is one of the major problems recognized by the people in the study area. Erosion engulfed local people's land, homes and has become an environmental and social hazard. Every year, both the left bank and right bank of Surma River significantly erodes at the study area. However, comparison of satellite images of last two decades indicates that the rate of bank erosion is rather slow. It is found from the FAP study (FAP 6) that during 1952-89 substantial bends migration (left bank erosion) occurred at Jamalganj upazila head quarter. Left bank migration also took place in the river stretch from Jamalgaonj upazila head quarter to Noagaon Bazat to the east. The average annual rate of bank erosion over this period is, however, 5m. During the same period two consecutive bends in the immediate downstream of the Jamalganj upazila head quarter also experienced down valley migration. In the downstream of the Surma-Baulai confluence there are evidence of at least 7(seven) loop-cuts upto Mitamain. It is, therefore, clear that erosion does occur in the study area but at a slow rate. Natural changes in flow and sediment yield as well as human interventions into the river and floodplain may accelerate the process of bank erosion.

Source: RRI field investigation, 2016

Figure 6.15: Bank erosion at the study area in the Surma River

6.3.4 Siltation

Siltation is a common issue in this haor area. The most of the rivers are very flashy in this region and the origins of the rivers are adjacent to hilly area of India. During heavy rainfall in the hilly region of India, water quickly moves towards the haor area of Bangladesh through a number of rivers and khals. This floodwater not only carries the water but also carry a huge amount of sediment. This sediment gets deposited over time on the river and canal beds and reduces the conveyance capacity more or less all of the water resources system within the haor area. During heavy rainfall in the hilly region, massive erosion is taken place on the exposed surface of the hill. If the high intensity rainfall is continued for certain period then coarser sediment such as big sized stone, boulders etc. start to erode and move along the rivers. Finally these sediments are deposited on the river bed, khals, canals and agricultural land. During flash flood, sediment transport rates of the rivers increase significantly and hence major flood events make a disproportionate distribution of sediment and changes in channel size, shape and even location. The sediments carried by the rivers are also deposited along the river banks resulting in an increase in the land elevation there compared to the surrounding haor and beel areas. These elevated lands are inhabited by people. Therefore, patches of small villages almost all

along the rivers and channels are visible in the project area. These village areas are densely vegetated with well grown trees.

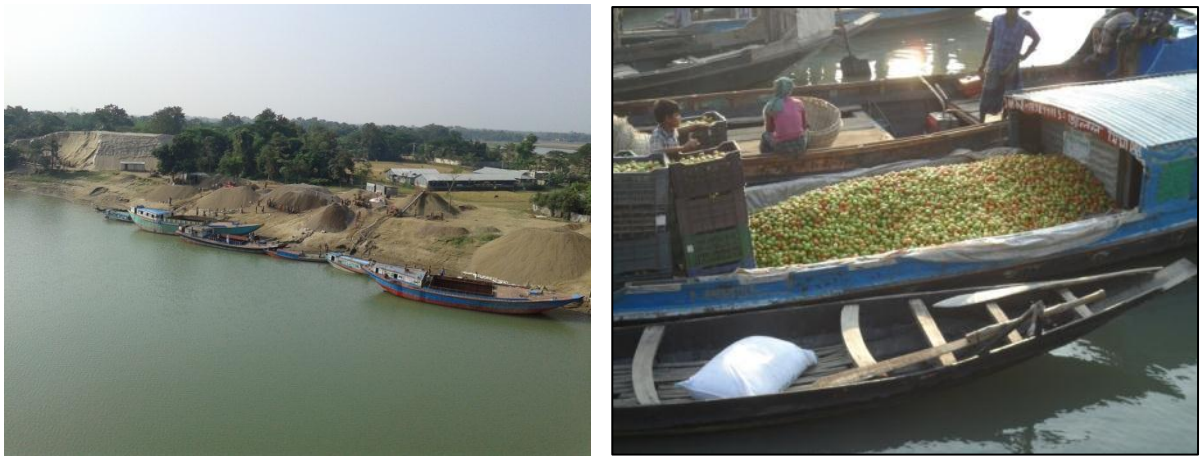
Siltation is more likely a key problem in the study area. The Surma and Baulia River is silted up from upstream along with high flow. Sedimentation has been taking place in the river both upstream and downstream over the years and cumulative effect in fact reduces the depth significantly. The conveyance capacity of the river has decreased due to high siltation rate. The level of water is changing with its seasonality. When the river has low flow, sediment is deposited. Thus, depth of the river is decreasing and the carrying capacity is reducing.

6.3.5 Navigation

Surma River is an important route for navigation. It flows by the side of the Sunamganj district town, Jamalganj upazila head quarter, Sachna Bazar and Golakpur Bazar. Thus, the river provides an important waterway link for these important places and growth centers. As there is no all weather road links between Jamalganj and Dharmapasha upazilas, this river is the only way of communication. Along with Dharmapasha upazilla, large portion of population of Jamalganj upazila use this river to go to Jamalganj upazila head quarter and Sunamganj town and to other important places to the south of the project area. There is a large market place for sand business in Jamalganj upazilla. The sand is transported to all over the Bangladesh through the Surma River.

Source: RRI field investigation, 2016

Figure 6.16: People crossing the Surma river from Sachna Bazar to Jamalganj for travelling short and long distance



Source: RRI field investigation, 2016

Figure 6.17: Transportation of sand at Jamalganj (left) and vegetables at Monnan Ghat (right) via boats along the Surma river route

6.4 Land Resources and Agricultural Environmental

6.4.1 Agro-ecological regions

Agro-ecological region or zone has unique combination of physiographic, soil, hydrological and agro-climatic characteristics. According to the Land Resources Appraisal of Bangladesh for agricultural development, Bangladesh has been subdivided into 30 agro-ecological regions and 88 sub-regions (**Map 6.4**). Thirty agro-ecological regions zones, 88 sub-regions and 535 units have been identified by adding successive layers of information on the physical environment which are relevant for land use and assessing agricultural potential. These layers are: (i) Physiography (land forms and parent materials); (ii) Soils and their characteristics; (iii) Depth and duration of seasonal flooding; (iv) Length of the rainfed Kharif and Rabi growing periods; (v) Length of the pre-Kharif period of unreliable rainfall; (vi) Length of the cool winter period and frequency of occurrence of extremely low (below 0.4^0C) winter temperature; (vii) Frequency of occurrence of extremely high (> 40^0C) summer temperature (FAO/UNDP, 1988). Agro-ecological regions and sub-regions are very broad units. Fertility status of these regions varies considerably (BARC, 2005).

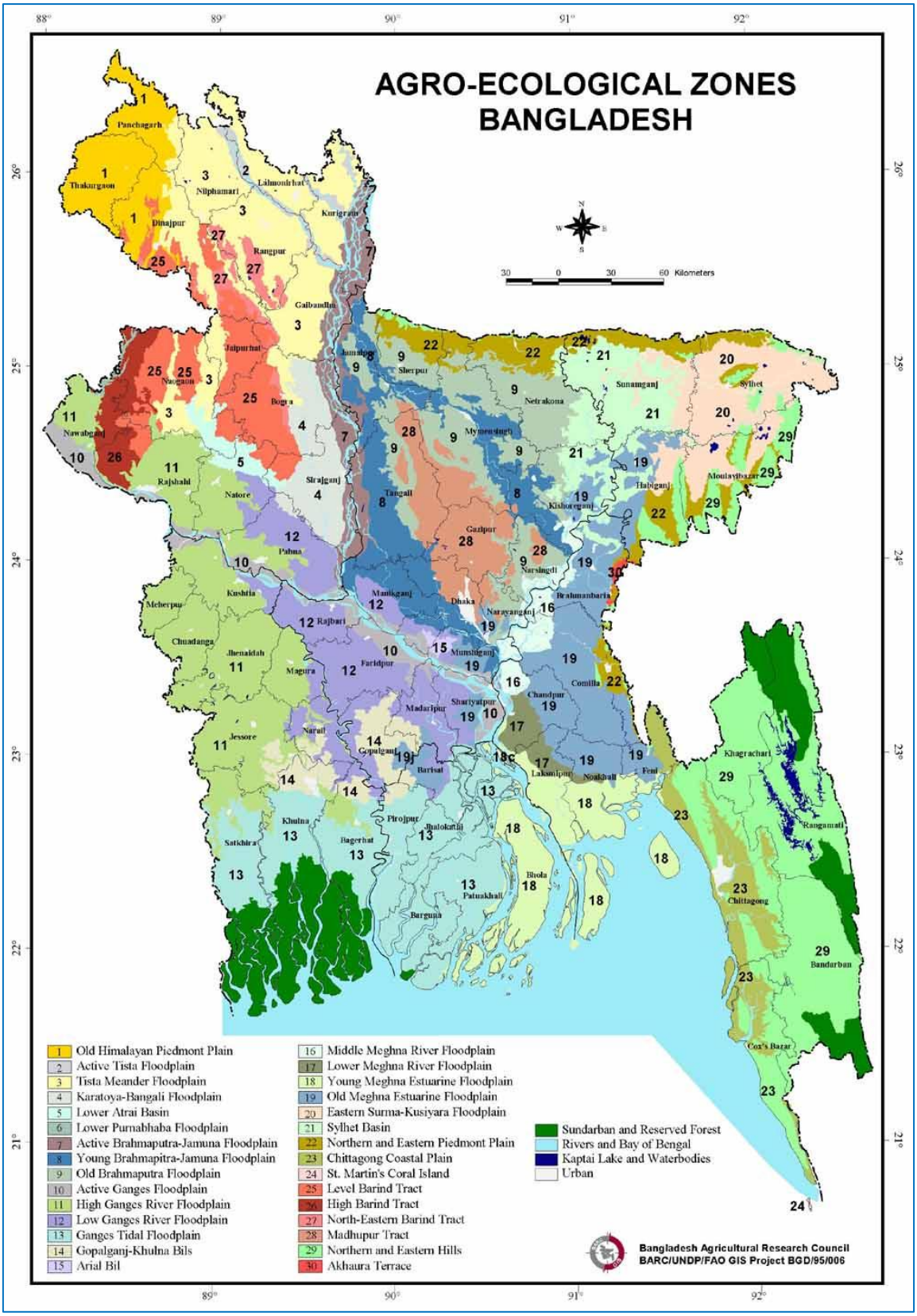
The project area is located in the agro-ecological zone of Sylhet Basin (4573 sq. km) (AEZ-21). The region occupies the lower, western side of the Surma-Kushiyara floodplain. Relief is locally irregular near rivers. The soils of the area are grey silty clay loams and clay loam on the higher parts that dry out seasonally and grey clays in the wet basins. Peat occupies some wet basin centers. The soils have a moderate content of organic matter and soil reaction is mainly acidic. The fertility level is medium to high. About 74% of the top soil texture of the haor region is clay to clay loam, 21% loam and the rest are silty loam, sandy loam and sand.

Table 6.8: Some Physiochemical properties of soils of AEZ-21

Major Land Type	Soil pH	Soil OM	Nutrients Stats								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium Low Land (19%)	4.8-6.0	L-M	L	L-M	L-M	M-Opt	M-Opt	M-Opt	M-Opt	Opt	Opt
Low Land (43%)	4.8-6.0	M	L	L-M	L-M	M-Opt	M-Opt	M-Opt	M-Opt	Opt	Opt
Very Low Land (32%)	4.8-6.0	M	L	L-M	L-M	M-Opt	M-Opt	M-Opt	M-Opt	Opt	Opt

OM=Organic matter; VL=Very low; L-Low; M=Medium; Opt=Optimum; H=High; VH=Very high

Source: Fertilizer Recommendation Guide-2005, BARC.



Map 6.5: Agro-ecological zones of Bangladesh

6.4.2 Land use

In the study area there are cultivable lands, human settlements, some uncultivable lands and water bodies. Besides there are a number of hats, bazars and growth centers. As the study area is in haor area, the commercial and industrial establishments are insignificant. The study area belongs to deeply flooded area (flood depth>1.8m) and cropping pattern is fallow-fallow-boro. The agricultural land is mainly vegetation type. Agriculture is the main output of the region. Cropping patterns are determined by the seasonal floods with rice and vegetables are the major important crops. Detailed of land use of the study area is presented in the **Table 6.9**.

Source: RRI Field Investigation in December, 2016

Figure 6.18: Land uses pattern in the study area

Table 6.9: Present land use status of the project area

Land Use	Area (ha)	Percent of total area
Total Area	21610	100
Net Cultivable Area (NCA)	16316	75
Settlements	1483	7
Water bodies (river, beel)	3811	18

Source: RRI estimation from Satellite Image and Upazila Agricultural Offices, 2016

6.4.3 Land type

Land type classifications are based on depth of inundation during monsoon season due to normal flooding on agriculture land. According to SRDI (1988), five land types have been classified in terms of depth of flooding. The study area is dominated by very low land (67%) which is followed by medium low land (24%) and low land (09%) of the Net Cultivable Area (NCA). Detailed distribution of land type of the study area is presented in **Table 6.10**.

Table 6.10: Distribution of land type in the study area

Land type	Characteristics	Area (ha) of NCA	% of NCA
Medium Low Land	Land which normally is flooded lesser than 180 cm during the flood season.	3916	24
Low Land	Land which normally is flooded from 180 cm to 275cm deep of water during the flood season.	1426	09
Very Low Land	Land which normally is flooded deeper than 275 cm during flood season.	10974	67
	Total	**16316**	**100**

Source: RRI estimation from field information, Secondary data from Upazila Agricultural Offices and Satellite Images.

6.4.4 Soil texture and Organic Matter Content

Soil texture is the relative proportions of sand, silt and clay. It is very important for agriculture crop production. The soil texture is dominated by Silt in entire study area.

Soil organic matter is the fraction of the soil that consists of decomposition of plant or animal tissue. It is very important parameter which determines agricultural production. Most of productive agricultural soils contain 3 to 6% organic matter.

Soil texture and organic matter in soil has shown in the following Table. Usually Haor soil content more organic matter than the river bank soil.

Table 6.11: Soil texture and Organic Matter Content in the study area

Location	Collection place	Soil Texture (%)			Organic matter content (%)
		Sand	Silt	Clay	
Golakpur Bazar	River bank	14	80	6	6.60
Mominpur Bazar	River bank	9	85	6	3.40
Sachna Bazar	River bank	10	83	7	4.97
Shamim Nagar	Haor	15	75	10	8.07

Source: RRI field Investigation and sample tested at RRI laboratory, 2016

6.4.5 Soil Moisture

The available soil moisture is very important for the cultivation of different crops. The soils having capacity of high level of available soil moisture are highly suitable for cultivation of Rabi crops under rain fed condition. According to SRDI (1988), the available soil moisture has been classified into four categories. In the study area three categories of available soil moisture have been identified. Maximum area is covered under high level of available soil moisture (67%). Detailed distribution available soil moisture of the study area is presented in **Table-6.12.**

Table-6.12: Detailed distribution of available soil moisture in the project area

Available Moisture	Characteristics	Area (ha) of NCA	% of NCA
Low	Plant extractable soil moisture remained in the field level less than one month.	3916	24
Medium	Plant extractable soil moisture remained in the field level from one to two months.	1426	09
High	Plant extractable soil moisture remained in the field level more than two months.	10974	67
	Total	**16316**	**100**

Source: RRI estimation from field information, Secondary data from Upazila Agricultural Offices and Satellite Images.

6.4.6 Drainage characteristics

Drainage plays a vital role in the management of soil in the study area. As per the SRDI (1988), the drainage characteristics have been divided into six classes from the agriculture point of view. Maximum area in study area is under very poorly drained (67%) which is followed by well drained (24%) and poorly drained (09%). Detailed drainage characteristics of the study area are presented in **Table 6.13**.

Table 6.13: Detailed drainage characteristics of the study area

Drainage classes	Drainage Characteristics	Area (ha) of NCA	% of NCA
Well Drained	Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep.	3916	24
Poorly Drained	The soil remains under water from 15 days to 7/8 months. Water is drained from the soil slowly. In most cases, the land remains wet/water logged for a considerable period of time after the rainy season.	1426	09
Very Poorly Drained	The land remains submerged under water for more than 8 months and remains wet throughout the year.	10974	67

Drainage classes	Drainage Characteristics	Area (ha) of NCA	% of NCA
	Total	**16316**	**100**

Source: RRI estimation from field information and Secondary data from Upazila Agricultural Offices.

6.4.7 Farming practices

The both banks of Surma River in the project area are agriculturally rich land. The main vegetable in the both bank of Surma River usually cultivate Tomato and Chili the most. The mid low land and low land usually produce rice, especially BR 28 and 29. Farmers generally use surface water for irrigation.

Agricultural crops are grown according to cropping seasons. Kharif and Rabi seasons are two distinct cropping seasons in a year. The Kharif season starts from March and ends in October while the Rabi season starts from November and ends in February. Based on crop adaptability and crop culture, the Kharif season has been further sub-divided into Kharif-1 (March-June) and Kharif-II (July-October) season. The Rabi season starts from November and ends in February. During this season, crops are favored with high solar radiation, low humidity and temperature, but lack of adequate soil moisture depresses the crop yield because of very low or evens no rainfall throughout the season. Wide ranges of crops can be grown in this season. Major crops grown in this season of the study area are HYV Boro, Tomato, chili, Mustard and Cucumber. However, there are occasional overlaps such that the Kharif-II season crops (Aman rice) are harvested in the Rabi season and Rabi season crop (HYV Boro) is harvested in the Kharif-I season.

Figure 6.19: Major crops in Rabi Season in the study area

6.4.8 Crop production constraints

The main constraints of the study area are siltation of river and drainage canals, drainage congestion, over rainfall etc. According to local people, the natural calamities such as flash flood, hailstorm, cyclone and drought, pest and disease infestation etc. are also affecting normal crop production to some extent. The main obstacle of agricultural production according to DAE, Sunamganj are as follows:

- Flash Flood
- Heavy Rainfall
- Fallow Land
- Low Ground Water Level and Rock Layer
- Siltation
- River Bank Erosion
- Hailstorm and Thunderstorm
- Lake of Human Resources in Field Level
- Labor Problem in Boro Cutting Season
- Lake of Technological Devices in DAE offices

6.4.9 Cropping pattern by land type

The dominant cropping pattern in medium low land is Fallow-Summer Vegetables-Winter Vegetables which are occupied by 24% of the NCA. Fallow-Fallow-Rabi Crops which is occupied by about 05% of the NCA in low land. In the very lowland, Fallow-Fallow-Boro is being practiced about 58% of the NCA. Detailed cropping pattern is presented in **Table 6.14.**
In Kharif-I season; mainly remains fallow. In Kharif-II season, T. Aman is grown in about 13% of the NCA. In Boro /Rabi season, Boro is grown in about 67% of the NCA. Rabi crops such as Mustard, Tomato and Chili are occupied about 5% of the NCA respectively.

Table 6.14: Existing major cropping pattern by land type

Land type	Kharif-I (March-June)	Khartif-II (July-Oct)	Rabi (Nov-Feb)	Area (Ha) of NCA	% of NCA
Medium Low Land	T Aman	Summer Vegetables	Winter Vegetables	3916	24
			Sub Total	**3916**	**24**
Low Land	Fallow	Fallow	Rabi Crops	806	05
	T Aman	Summer Vegetables	Winter Vegetables	620	04
			Sub Total	**1426**	**09**
Very Low Land	Fallow	Fallow	Boro	9424	58
	T Aman	Fallow	Boro	1550	09
			Sub Total	**10974**	**67**
			Total	**16316**	**100**
			Cropping Intensity (%)	**133**	

Source: Secondary data from Upazila Agricultural Offices and RRI field survey, 2016

6.4.10 Crop damage

Crop damage/ production loss along with area has been collected from the field in consultation with stakeholders, farmers, and officials of DAE. The main causes of crop damage are flash flood, drainage congestion, heavy rainfall, drought as well as different natural calamities in the haor regions. Flash flood and hail storm are common threat which causes crop damage in the study area. The siltation of the river and khals is caused rise of bed which directly influence for drainage congestion. The infestation of pest and diseases are also responsible for crop damage.

Annual crop damage along with area in the project area has been evaluated. Crop production loss has been calculated using the formula: *Crop production loss = Total cropped area ×damage free yield - (damaged area ×damaged yield+ damaged free area × damage free yield)*. Total 2421 metric tons of rice has been lost in 1614 ha land of the project area.

In 2016, HYV Boro and T. Aman were damaged about 11% and 03% respectively. The area of Sachna Bazar, Jamalganj and North Sukhair Razapur were affected by heavy rainfall and drainage congestion during broadcasting period of Aman. Detailed crop damage is presented in **Table 6.15**.

Table 6.15: Crop wise damage in the study area

Crop name	Location	% of damage area	Timing	Causes of damage
HYV Boro	Sachna Bazar, Jamalganj and North SukhairRazapur	11	March-April	Flash Flood, Hail storm & pest infestation
T. Aman	Sachna Bazar, Jamalganj and North SukhairRazapur	03	July-August	Flash Flood, Heavy rainfall & drainage congestion

Source: Secondary data from Upazila Agricultural Office, Jamalganj and RRI field survey, 2016

6.4. 11 Seeds

Seeds are very important input to get a good agricultural production. A mature fertilized plant ovule, consisting of an embryo and its food store surrounded by a protective seed coat is termed as seed. It means, a ripened plant ovule containing an embryo. A propagation part of a plant, as a tuber or spore is also considered as seed. The role of seeds is very important for growing crops. Selection of seeds has to be made carefully. More than 85% germination rate, free from disease infestation and high yield potential need to be considered. The seed rate (kg/ha) varies crop to crop. The rice seeds are usually supplied by BADC, but hybrid vegetables are mostly supplied by private companies in the study area. The seed rate used (Kg/ha) in the project area presented in **Table 6.16**.

Table 6.16: Seed and Labor used in the project area

Crop Name	Seed Used (Kg/ha)	Labor(Number/ha)
Boro	35 kg/ha	82
Groundnut	110 kg/ha	44
Chili	100 kg/ha	52
Potato	1.75 t/ha	40
Tomato	0.4 kg/ha	54
Mustard	10 kg/ha	32

Source: Secondary data from the Upazila Agricultural Offices, Jamalganj, 2016.

6.4. 12 Labor

Mostly manual labor is used for cultivation in the study area as mechanized cultivation is very rare in the Haor region. So, agricultural labor is considered as one of the essential inputs for crop production in the study area. The labor requirement is vary throughout the year. There is some labor problem during rice cutting season as people from other places comes in this place in a laser amount. The number of labor requirement varies from crop to crop. Labor used for different crops is also presented in **Table 6.16**.

6.4.13 Fertilizer and Pesticide

Fertilizer application rate is lower in the study area compared to the other part of the country because of the heavy siltation in rainy season and the extensive presence of organic matter in soil in this haor region. The rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability. The major fertilizers used in the project area are Urea, TSP and MP. Major insects as reported by the farmers are Stem borer, Ear cutting Caterpillar, Gall midge, pulse beetle and Aphids. Local farmer reported that they are using different types of pesticides such as Basudin, Furadan, Bavistin, Theovit, Know in WP and Virtako etc. to prevent pest infestation in rice and Rabi crops cultivation. Detailed fertilizer and pesticides used is presented in **Table 6.17**.

Table 6.17: Fertilizer and pesticides application of the study area

Crop Name	Fertilizer (Kg/Ha)				Pesticides		
	Urea	TSP	MP	Gypsum	No. of Appli	Liq. (ml/ha)	Gran. (Kg/ha)
Boro	150	75	60	-	4	320	6 kg
Groundnut	75	-	-	-	-	-	-
Chilli	540	380	190	-	3	100	2 kg
Potato	190	370	190	-	4	200	2 kg
Tomato	540	380	190	-	5	250	4 kg
Mustard	80	60	40	-	2	50	1 kg

Source: Secondary data from the Upazila Agricultural Office, Jamalganj, 2016.

6.4.14 Irrigated area by crop

Irrigation used in dry season to grow rice and vegetables. Irrigation coverage of the project area is about 86% of the total NCA during the dry season. Irrigation is mainly provided to HYV Boro crops. The source of irrigation water is surface water (Surma River). Irrigation water is lifted with the help of Low Lift Pumps (LLPs) to grow vegetables and rice. Detailed irrigated area is presented in **Table 6.18**.

Figure 6.20: Irrigation water is lifted from Surma River using LLPs to irrigate the crop field

Table 6.18: Irrigation area by crop

Crop name	Irrigation (Surface water)		
	Irrigated area	% of area	Charge (Tk./ha)
Boro	12067*	86	6500/-
Groundnut	40	100	3500/-
Chili	806	100	5500/-
potato	275	100	5500/-
Tomato	1056	100	5500/-
Mustard	32	30	3500/-

Source: RRI estimation from field information

* Supplementary irrigation.

6.4.15 Yield level (Normal and damaged)

The crop yield rate was estimated from the information collected from DAE offices and consultation with the beneficiaries/ farmers at field level. The yield of rice is estimated as cleaned rice. The average yield value of different crops of the project area is presented in the following Table.

Table 6.19: Crop Yield level by different crops

Crop Name	Yield (ton/ha)	
	Normal	Damaged
HYV Boro	3.8*	2.3*
Groundnut	1.6	0.8
Chili	37	14.0
Potato	20.0	10.0
Tomato	22.5	8.4
Mustard	1.5	0.7

Sources: RRI estimation based on field information and ***DAE office, Jamalganj***

**Indicates cleaned rice*

6.4.16 Crop production

The major agricultural production comes from the rice crops. In the study area, the annual total rice production is about 106,564 metric tons after loss of 6,061 metric tons. The total production of rice is about 50897 metric tons. The total production of non-rice crops (such as Tomato, Chili Groundnut, Potato and Mustard) is about 55,667 metric tons. Detailed crop production and crop production loss is presented in the following Table.

Table 6.20: Existing crop production of the study area

Crop name	Crop area (ha)	Damage free area		Damaged area		Total production (ton)	Production lost (ton)
		Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
Boro	14031	12417	3.8	1614	2.3	50897	2421
Total Rice	**14031**	**12417**	**-**	**1614**	**-**	**50897**	**2421**
Groundnut	40	36	1.6	4	0.8	61	3
Chili	806	725	37	81	14	27959	1863
potato	275	248	20	27	10	5230	270
Tomato	1056	950	22.5	106	8.4	22265	1495
Mustard	107	96	1.5	11	0.7	152	9
Total Non Rice	**2447**	**2055**	**-**	**229**	**-**	**55667**	**3640**
Total	**16316**	**14472**	**-**	**1843**	**-**	**106564**	**6061**
Cropping Intensity (%)						**133**	

Source: RRI estimation from field information and DAE office, Jamalganj.

Farmers receive about Tk 3,389,300,000 as annual return from different crops. Among the agricultural crops grown in the study areas, highest annual return of about 46% is coming from Rice. About 0.1% annual returns from Mustard and Groundnut each, 38% from Chili, 3% from Potato and 15% from Tomato of the total annual income. Detail of annual incomes of the agricultural crops of the study areas is shown in the following Table.

Table 6.21: Annual gross return from agricultural crop

Crop Name	Production (ton)	Rate (tk/ton)	Return (tk)	% of return
Rice	50,897	32,000	1,551,232,000	46
Groundnut	61	55000	3,190,000	0.1
Chili	27959	50000	1,304,800,000	38
Potato	5230	20000	99,200,000	3
Tomato	22265	25000	519,250,000	15
Mustard	152	60000	8,580,000	0.1
Total			**3,389,300,000**	**100**

Source: RRI estimation from field information.

6.4.17 Livestock Resources

A large number of populations of the study area earn their livelihood through work associated with raising cattle and poultry. The use of cow dung as manure and fuel, and animal power for transportation, a ready source of capital and meat, milk and eggs for human consumption make up the demand of the local area. Livestock resources also play an important role in the sustenance of landless people. Most of the people are rearing cows/ bullocks, goats, chickens and ducks in their household.

Figure 6.21: Livestock resources in the study area

6.4.18 Status of livestock and poultry

According to local people and livestock offices, most of the houses rear cows, ducks and chickens in their houses. There are also many duck farms in the study area as ducks nurturing is very suitable in the haor region. Detailed status of livestock and poultry has presented in the following Table.

Table 6.22: Status of Livestock/Poultry in the study area

Livestock	% of Household	Number of Livestock/Poultry
Cattle (Bull, Ox, Cow, Calf)	80	47775
Buffalo	0.05	68
Duck	85	156557
Goat	25	3178
Sheep	30	1929
Horse	0.05	48

Livestock	% of Household	Number of Livestock/Poultry
Pig	0.01	36
Chicken	80	118912
Pigeon	2	984

Source: Based on field information and Upazila Livestock Offices.

6.4.19 Feed and fodder

The owners of the livestock population are facing problems in respect of availability of fodder and feeds during rainy season` due to standing crop and non-availability of grazing land. Rice straw is the main fodder. Oil cake, rice husk etc. are the other common fodders in this project area. Shortage of grazing land due to water logged is barrier to grazing cow in the land throughout the year aggravates the feed and fodder problem to the animal population. Poultry population at family level survives by scavenging and generally no feed supplements are provided. All feeds and fodder are insufficient of poor paddy cultivation due to waterlogged and drainage congestion. However, at times kitchen waste becomes feed to the poultry.

6.4.20 Livestock and poultry diseases

Productions of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreak of disease is causing a considerable economic loss in livestockfarming. Every year livestock population is affected by different diseases like Fever, Footand Mouth Disease (FMD), Anthrax, Diarrhea, Black leg and Pest Des Petits Ruminants(PPR). Major poultry diseases are Rani khet (Newcastle), Paralysis, Fowl Pox and Fowl cholera. During monsoon season, the soggy condition of the animal shelter promotes various kinds of diseases to the bullock and cows. Moreover the unhygienic condition of the courtyard during this season increases the diseases of poultry birds. More of there is vulnerable period in between July to October (rainy season) months for spreading diseases to livestock and poultry population. However, some diseases are found round the year.

6.5 Fisheries Resources

Fisheries resources play an important role in improving the socio economic status of the people of Bangladesh. The role of fisheries in the national economy is very important. According to the government statistics about 60% of the national protein in our food comes from fish. Of the total national income, the Fisheries sector alone contributes 4% to the national export income; the contribution of fisheries sector is third. About 1.2 million people are engaged full time and another 10.2 million are engaged in part time in this sector for their livelihoods. (Source: Statistical year book of Fisheries, 2012) Bangladesh is one of the world's most important inland fishing nations.

The study area of Sachna-Golakpur Road project is also an important source of fisheries. Open water fish habitat of this project area includes main rivers – Surma River, seasonal floodplain, inundated paddy fields and haor/beel. The Haors/beel of the project area provide the winter shelter for the mother fishery, and in the early monsoon these mother fisheries produce millions of fries for the entire downstream fishing communities. The diversity of wetland habitats, seasonal inundation and fluctuation of water regime and connectivity of the haor with the Rivers, canal, khals, beels system make the haor suitable for capture fisheries production of this area. Free flow of water at the early monsoon from River to the haor facilitates migration of fish from the river to the haor. Varied depth

classes of the haor basin provide habitats for young fish grow larger, adults to grow maturity and the brood fish to spawn at various suitable habitats. Inundated floodplains during wet season become highly suitable for grazing of riverine and Beel fish. Nutrient influxes occur from both river and floodplain ends. As a result, phytoplankton and zooplankton grow and fishes use those as primary food.

Source: RRI field survey, 2016

Figure 6.22: Capture fish from haor (left) and from Surma river (right) in the study area

6.5.1 Constraints and Issues

There is a gradual decline in the production trend of capture fisheries over decade due to indiscriminate fishing, shrinkage of fish habitat, reducing depth of river etc. Most of the riverine and beel habitat fishes use floodplain as feeding and breeding ground. During full flood monsoon season the most of the study area goes under water and form a suitable water system for fish habitation and subsistence fishing.

Silting up of beels and canals reduces the depth as well as water volume negatively impacting fish production. The exploitation pressure is very high in the haor areas. No care is taken as to the future of fish stock. Fishermen use sometimes nets with too small mesh gear to catch as much fish as possible gradual bringing many species to extinction. There is no effective enforcement of the fish conservation act. There is also decline in the natural production of fry and fingerlings in open waters during the decades due to indiscriminate fishing of brood stocks and spawn.

In the study area, not only the fish stock and yields of captured fish declined, but access to the traditionally common property has profoundly changed. In the past, fishermen and particularly subsistence fishermen were free to fish in the beels and in the floodplains. At present, the right to fish in government beels or govt. water bodies like deepest part of haors is frequently obtained through the auctioning of leases by the Deputy Commissioner (DC), although under the new Fish Legislation this practice is not allowed. The leaseholders are usually rural elite or businessmen who allow fishermen to fish in their leased water bodies. This change in the access regime also has profound effects on water management conflicts centering on the beel, as leaseholders are influential members of the society. Hence they often determine the drainage and resulting water levels in beels. Heavy drought also

creates a major problem for fisheries. Floodplain / beel area are being reduced, ultimately reduce the shelter, feeding and rearing grounds of fish and hampered their life cycle for migration. As a result, some species are threatened or endangered. Ultimately the productions are being decreased. Further, in the study area, water is found in lower parts of the haor where can only save the mother fish/ brood fish but some ill motive peoples are being harvesting the brood fish.

Major fisheries problems and issues so far identified during baseline survey are as follows-

- Indiscriminate fishing by dewatering beel and over exploitation of fishes by using huge number of small mesh sized fishing gear
- Lack of communication systems for trading fish
- Siltation of internal khals are causing loss of year round river khal connectivity;
- lack of quality fish seed and feed for the improved aquaculture practices;
- insufficient trained fish farmer, etc
- Decreasing trend of fish production due to habitat loss, improper fisheries management;
- Morphological changes of Surma river caused loss of the year round river-beel connectivity;
- Reduction of beel fish habitat area due to conversion of beel into crop fields
- Reduction of fish spawning, nursing and grazing grounds

6.5.2 Fish habitat and diversity

Fish habitat is primarily classified under two categories such as capture fishery and culture fishery. River, beel and floodplain are considered under capture fish habitat. In the study area the most of the fish production is coming from capture fisheries and culture fish are very limited. Fish habitat of the study area is classified into river, floodplain and beel. Different types of fish habitat in the study area are shown in **Figure 6.24**. A wide range of fishes are captured in the study area round the year. Fish species diversity in Sunamganj including order, family, English and local name are shown in **Table 6.23**.

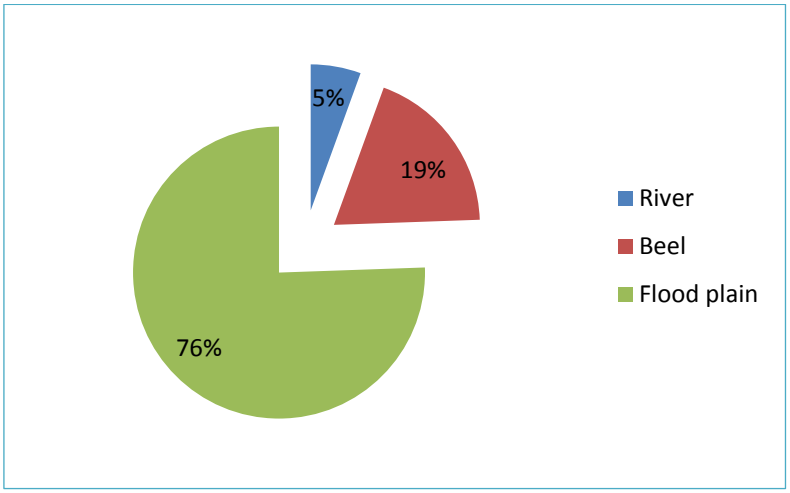


Figure 6.23: Classification of fish habitat in the study area

Table 6.23: Fish species diversity in the study area

Sl. No.	Order	Family	Species	English Name	Local Name
1	*Rajiformes*	*Dasyatidae*	*Himantura Bleekeri*	Bleeker's Whipray	Shapla Pata
2	*Pleuronectiformes*	*Bothidae*	*Pseudorhombus Arsius*	Large Tooth Flounder	Kathal Pata
3	*Syngnathiformes*	*Syngnathidae*	*Microphis Deocata*	Deocata Pipefish	Kota Kumirer Khil
4	*Anguilliformes*	*Anguillidae*	*Anguilla Bengalensis*	Indian Mottled Eel	Bamos
5		*Ophichthidae*	*Pisodonophil Boro*	Rice-Paddy Eel	Hizra
6	*Synbranchiformes*	*Sybranchidae*	*Monopterus Cuchia*	Cuchia	Kuche
7	*Tetraodontiformes*	*Tetraodontidae*	*Tetraodon Cutcutia*	Ocellated Pufferfish	Potka
8	*Cyprinodontiformes*	*Beloniidae*	*Xenentodon Cancila*	Fresh Water Garfish	Kakila
9		*Hemiramphidae*	*Hyporamphus Limbatus*	Congaturi Halfbeak	Ekthota
10		*Aplocheilidae*	*Aplocheilus Panchax*	Blue Panchax	Teen Chokha
11		*Oryziidae*	*Oryzias Melastigma*	Ricefish	Teen Chokha/ Kanpona
12	*Cypriniformes*	*Cyprinidae*	*Securicula Gora*	Gora Chela	Ghora Chela
13			*Salmostoma Phulo*	Finescaled Razorbelly Minnow	Fulchela
14			*Salmostoma Bacalia*	Large Razorbelly Minnow	Narkali Chela
15			*Esomus Danricus*	Flying Barb	Darkina
16			*Parluciosoma Daniconius*	Slender Rasbora	Darkina
17			*Adpidoparia Morar*	Aspidoparia	Morari
18			*Barilius Tileo*	Tileo Baril	Pathor Chata
19			*Barilius Bendelisis*	Hamilton's Barila	Koksa
20			*Danio Devario*	Sind Danio	Chap Chela
21			*Brachydanio Rerio*	Zebra Danio	Anju
22			*Amblypharyngodon Mola*	Mola Carplet	Mola
23			*Osteobrama*	Cotio	Dhela

Sl. No.	Order	Family	Species	English Name	Local Name
			Cotio		
24			*Labeo Gonius*	Kuria Labeo	Ghonia
25			*Labeo Calbasu*	Kalbasu	Kalibaush
26			*Labeo Rohita*	Rohu	Rui
27			*Labeo Angra*	Angra Labeo	Agun Chokha
28			*Labeo Pangusia*	Pangusia Labeo	Ghora Mukh
29			*Labeo Dyocheilus*	Brahmaputra Labeo	Ghora Mach
30			*Labeo Bata*	Bata Labeo	Bata
31			*Labeo Boggut*	Boggut Labeo	Ghoria
32			*Cirrhinus Cirrhosus*	Mrigal Carp	Mrigal
33			*Cirrhinus Reba*	Reba Carp	Raik
34			*Puntius Sarana*	Olive Barb	Deshi Sarpunti
35			*Barbonymus Gonionotus*	Silver Barb	Thai Sarpunti
36			*Puntius Guganio*	Glass Barb	Mola Punti
37			*Puntius Phutunio*	Dwarf Barb	Phutani Punti
38			*Puntius Conchonius*	Rosy Barb	Bagha Punti
39			*Puntius Ticto*	Ticto Barb	Tit Punti
40			*Puntius Gelius*	Golden Barb	Gili Punti
41			*Puntius Sophore*	Pool Barb	Jat Punti
42			*Puntius Terio*	One Spot Barb	Teri Punti
43			*Oreichthys Cosuatis*	Cosuatis Barb	Kosua Punti
44			*Tor Tor*	Tor Mahseer	Mohashol
45			*Catla Catla*	Catla	Katla
46			*Crossocheilus Latius*	Gangetic Latia	Kalabata
47			*Garra Gotyla*	Goytala	Ghar Poia
48			*Hypophthalmic hthys Molitrix*	Silver Carp	Silver Carp
49			*Hypophthalmic hthys Nobilis*	Bighead Carp	Bighead Carp
50			*Ctenopharyngo don Idella*	Grass Carp	Grass Carp
51			*Cyprinus Carpio Var. Communis*	Common Carp	Carpu
52			*Cyprinus Carpio*	Common Carp	Carpu
53			*Cyprinus Carpio Var.*	Mirror Carp	Mirror Carp

Sl. No.	Order	Family	Species	English Name	Local Name
			Specularis		
54			*Mylopharyngodon Piceus*	Black Carp	Black Carp
55		*Balitoridae*	*Nemachilus Botia*	Mottled Loach	Gutum
56			*Nemachilus Zonalternans*	River Loach	Gutum
57		*Cobitidae*	*Pangio Pangia*	Indian Coolie-Loach	Panga
58			*Somileptes Gongota*	Gongota Loach	Pahari Gutum
59			*Botia Dario*	Bengal Loach	Rani
60			*Botia Dayi*	Hora Loach	Betangi
61			*Lepidocephalus Guntea*	Guntea Loach	Gutum
62			*Lepidocephalichthys Annandalei*	Annandalei Loach	Gutum
63	*Sliuriformes*	*Clariidae*	*Clarias Batrachus*	Walking Catfish	Magur
64			*Clarias Gariepinus*	North African Catfish	African Magur
65		*Siluridae*	*Wallago Attu*	Wallago	Boal
66			*Ompok Bimaculatus*	Butter Catfish	Boali Pabda
67			*Ompok Pabda*	Pabdah Catfish	Madhu Pabda
68			*Ompok Pabo*	Pabo Catfish	Pabda
69		*Heteropneustidae*	*Heteropneustes Fossilis*	Stinging Catfish	Shing
70		*Olyridae*	*Olyra Longicaudata*	Long Tail Catfish	Bot Shingi
71		*Chacidae*	*Chaca Chaca*	Squarehead	Gangane
72		*Pangasiidae*	*Pangasius Pangasius*	Pungas	Pangus
73			*Pangasianodon Hypophthalmus*	Sutchi Catfish	Thai Pangas
74		*Schilbeidae*	*Silonia Silondia*	Silond Catfish	Shilon
76			*Ailia Coila*	Gangetic Ailia	Kajuli
77			*Pseudeutropius Atherinoides*	Indian Potasi	Batasi
78			*Eutropiichthys Vacha*	Batchwa Bacha	Bacha
79			*Eutropiichthys Murius*	Indus Garua	Muri Bacha
80			*Clupisoma Garua*	Garua Bacha	Ghaura
81		*Amblycipitidae*	*Amblyceps Mangois*	Indian Torrent Catfish	Kanoch
82		*Bagridae*	*Rita Rita*	Rita	Rita

Sl. No.	Order	Family	Species	English Name	Local Name
83			*Rama Chandramara*	Asian Cory	Bichi Guinga
84			*Aorichthys Aor*	Long-Whiskered Catfish	Ayer
85			*Aorichthys Seenghala*	Tengara	Ayer
86			*Hemibagrus Menoda*	Menoda Catfish	Ghagor
87			*Mystus Cavasius*	Gangetic Mystus	Gulsha
88			*Mystus Bleekeri*	Day's Mystus	Gulsha
89			*Mystus Tengara*	Tengara Mystus	Bojuri Tengra
90			*Mystus Vittatus*	Asian Striped Catfish	Rani Tengra
91			*Mystus Armatus*	Kerala Mystus	Tengra
92		*Sisoridae*	*Glyptothorax Telchitta*	Sylhet Hara	Teli
93			*Gogangra Viridescens*	Huddah Nangra	Gang Tengra
94			*Gagata Chenia*	Indian Gagata	Gang Tengra
95			*Bagarius Yarrellii*	Dwarf Goonch	Bagha Ayer
96		*Erethistidae*	*Erethistes Jerdoni*	Sylhet Hara	Kutakanti
97			*Erethistes Hara*	Koshi Hara	Harkata
98	*Osteoglossiformes*	*Nototeridae*	*Chitala Chitala*	Clown Knifefish	Chital
99			*Notopterus Notopterus*	Bronze Featherback	Foli
100	*Clupeiformes*	*Engraulidae*	*Setipinna Phasa*	Gangetic Hairfin Anchovy	Phasa
101		*Clupeidae*	*Gudusia Chapra*	Indian River Shad	Chapila
102			*Tenualosa Ilisha*	Hilsa Shad	Ilish
103			*Corica Soborna*	Ganges River Sprat	Kachki
104			*Gonialosa Manmina*	Ganges River Gizzard Shad	Goni Chapila
105	*Perciformes*	*Channidae*	*Channa Striatus*	Striped Snaked	Shol
106			*Channa Marulius*	Great Snakehead	Gazar
107			*Channa Punctatus*	Spotted Snakehead	Taki
108			*Channa Orientalis*	Walking Snakehead	Taki
109		*Mastacembelidae*	*Macrognathus Aral*	One-Stripe Spinyeel	Tara Baim
110			*Mastacembelus Armatus*	Zig-Zag Eel	Shal Baim

Sl. No.	Order	Family	Species	English Name	Local Name
111			*Macrognathus Pancalus*	Barred Spinyeel	Guchi Baim
112		*Mugilidae*	*Rhinomugil Corsula*	Corsula Mullet	Khorshola
113		*Belontiidae*	*Colisa Chuna*	Honey Gourami	Chuna Khalisha
114			*Colisa Fasciata*	Banded Gourami	Khalisha
115			*Colisa Lalia*	Dwarf Gourami	Lal Khalisha
116			*Ctenops Nobilis*	Frail Gourami	Naptey Khalisha
117		*Anabantidae*	*Anabas Testudineus*	Climbing Perch	Koi
118		*Gobiidae*	*Brachygobius Nunus*	Bumblebee Goby	Nuna bele
119			*Glossogobius Giuris*	Tank Goby	Bele
120			*Gobiopterus Chuno*	Gobius Chuno	Chuno
121		*Nandidae*	*Nandus Nandus*	Gangetic Leaffish	Bheda
122		*Pristolepidae*	*Badis Badis*	Badis	Naptey Koi
123		*Cichlidae*	*Oreochromis Niloticus*	Nile Tilapia	Nilotica
124		*Sciaenidae*	*Johnius Coitor*	Coitor Croaker	Koytor Poa
125		*Ambassidae*	*Chanda Nama*	Elongate Glass-Perchlet	Lomba Chanda
126			*Parambassis Lala*	Highfin Glassy Perchlet	Lal Chanda
127			*Parambassis Ranga*	Indian Glassy Fish	Gol Chanda

Source: RRI field survey, 2016 and World Fish Center, Sunamganj

Source: RRI field survey, 2016

Figure 6.24: Fish species diversity in the study area

Major source of fish is haor/beels followed by rivers and a little portion comes from ponds. According to the World Fish Center (2010), the major species from these three different sources has shown the following **Table 6.24** and fish habitat status of the study area in **Table 6.25**:

Table 6.24: Major fish species from different sources

Type of source	Species		High demand
	Small fish	Big fish	
River	*Ghulsha* (small *Tengra*), *Kajoli, Ritha, Ghaura*	*Ruhi, Boal, Shol, Mohashol, Bacha, Kalibaush, Bata*	*Ruhi, Kajoli, Bacha*
Haor/*beel*	*Tangra, Meni, Puti, Icha* (small prawn), *Taki, Bujuri*	*Shing, Magur, Shol, Gojar, Boal*	*Pabda, Koi, Meni, Tangra, Shing, Magur*
Pond	Tilapia	*Pangas, Ruhi*, Mrigel, Bighead	*Pangas*

Source: The World Fish Center, Bangladesh and South Asia Office, 2010

Table 6.0.25: Fish habitat status of the study area

Sl. No.	Fisheries Category	Habitat Types	Area (Ha)
1	Capture	River	865.4
		Beel	2945.5
		Floodplain	11780.0
		Sub-total	15591
2	Culture	Fish pond	0
		Sub-total	0
		Grand total	15591

Source: RRI estimation using field data and Satellite image

6.5.3 Species of conservation significance

Fish species variety those are locally unavailable for last 10 years or have become rare as reported by the local people and World Fish Center are given in the following **Table 6.26:**

Table 6.26: List of species of conservation significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Labio rohita	Rui		√
Catla catla	Catla		√
Cirrhinus mrigala	Mrigel		√
Rasbora deniconius	Darkina		√
Labeo nandinus	Nanid	√	
Rita rita	Rita	√	
Batia dario	Rani	√	
Ailia coila	Kajali	√	
Heteropneustes fossilis	Shing	√	
Clarius batrachus	Magur	√	

Source: RRI estimation from field survey and The World Fish Center, Sunamganj

6.5.4 Fish Production

Sunamganj is in surplus in overall fish production. However, the total fish traded comprises both local production and outside fish coming from other districts. In one hand, it exports fish captured from haor, beel and river to few major areas of the country and on the other hand, it imports culture fishes from outside. Fish is captured round the year from rivers and *haors*/beels in the district. A large number of active populations are involved in fishery making it a dynamic sector and a lot of fishes goes outside from Sunamganj to other districts including Dhaka and also abroad through processing companies. The overall scenario of Fish production is shown in **Table 6.27**.

Table 6.27: Overall scenario of Fish production in Sunamganj district

Sl. No.	Fisheries Resources	Number	Area in Hectare	Production 2014 (tons)	Production 2015 (tons)	Target 2016 (tons)	Production per Hectare (tons)
1	Government Pond	203	59.660	120.00	118.00	120.00	1.980
2	Private Pond	16826	2300.54	6954.00	7131.80	7320.00	3.100
3	Commercial Fishery	73	207.990	784.00	795.00	810.00	3.820
4	Government Beel	976	20968.00	22435.00	22800.00	23800.00	1.090
5	Private Beel	0	0	0	-	-	-
6	Haor	82	56149.90	22182.00	23550.00	24200.00	0.420
7	Flood Land	142	53161.56	17500.00	17900.00	19000.00	0.340
8	Fishery in Pan	0	0	0	0	0	-
9	Fishery in Cage	225	0.80	12.820	16.700	17.00	20.88
10	Cannel	133	683.130	472.00	474.00	475.00	0.690
11	River	111	5754.910	3085.00	3100.500	31200.00	0.540
12	Others	294	636.80	850.250	870.00	900.00	1.370
	Total	19065	139922.44	74395.070	76756.00	79862.00	-
13	Government Fishery Hatchery	1	10.12	0.172	0.172	0.180	-
14	Private Fishery Hatchery	5	8.85	1.800	1.580	1.800	-
15	Private Nursery	294	78.75	309.00	311.00	316.50	4.010
Grand Total		19365	140020.82	74706.042	77072.750	80179.980	-

Source: District Fisheries Office, Sunamganj, 2016

Fish production of the study area is mainly derived from capture habitat which includes river, beel and floodplain. Estimated total annual fish production of the study area is about 8160.15 tons. The bulk of the inland fish production is coming from capture fisheries.

Table 6.28: Fish production from different habitats in the study area

Sl. No.	Fisheries Category	Habitat Types	Total production (Ton)
1	Capture	River	482.67
		Beel	3210.60
		Floodplain	4466.88
		Sub-total	8160.15
2	Culture	Fish pond	-
		Sub-total	
		Grand total	8160.15

Source: RRI estimation according to District Fisheries Office, Sunamganj.

6.5.5 Fishing effort

Seasons

In the project area fish are catching all the year round in the Surma River. However, organized Catch and Open Catch two distinct seasons are identified in the haor/beel. Organized Catch usually starts in Mid-November when the water starts drying up and the dykes surrounding the water bodies appear and continues till end of March of the following year. The Open Catch season starts when the new water of monsoon comes in May-June and continues rest of the year until the Organized Catch starts.

Open Catch

Most fishermen capture fish individually during open capture period till Ashin of Bangla year (mid-September) with small boats or without any boats using variety of nets. Afterwards, the leaseholders put restriction (locally called *shashon*) on fishing. When the restriction is imposed, fishermen can still capture fish in some water bodies through a payment to the leaseholders until the Organized Catch starts.

Organized Catch

During Organized Catch, all the group members start fishing with big fishing gears in their respective *beel*s. All the family members of the fishermen group join together during this period. The individual leaseholders also deploy local and outside fishermen groups to harvest for them where the former gets 75% of the harvest. Type of capture also varies in two different seasons. Big fishes are more captured during Organized Catch compared to Open Catch. Total amount of capture fish during Open Catch is only one third of Organized Catch as identified through the fish flow in local wholesale markets.

Figure 6.25 Fish capture at Haor using Triangular trap (left) and at the Surma River using Drag Net (right) in the study area

Fishing Gears

A large number of fishing net/gears are used in fishing in the study area. Some common fishing gears are (a) Current jal, which is used to Boal, Baim, Goinna, Tengra, Punti, etc., (b) Ber jal which is used to catch Boal, Goinna, Rui, Catla, Punti, Chanda, Gura Chingri, etc.; (c) Urainna jal which is used to catch tengra, gulsha, baila, bata, chingri, etc., (d). Tana jal which is used to catch baila, tengra, gura chingri, etc.(e) Thela jal which is used to catch Gura Chingri, Punti, Tengra, Baila etc. About 10% of fishers have fishing boat and 90% have fishing net. Traditional fishing gears of the study area are Urainna jal, Thela Jal, Lining (Borshi) etc. Fishing gear diversity in the study area has shown in the following **Table 6.29** and **Figure 6.27**.

Table 6.29: Fishing gears diversity in the study area

Sl. No.	Type of Gears	English Name	Local Name	Remarks
1	Fishing Trap	Box Trap	Kuti Chai/Echa Chai	
2		Box Trap	Icha Chai	
3		Box Trap	Banjali/ Tin Muikha, Trap Bair	
4		Box Trap	Sat Muikkha	
5		Box Trap	Mochna Chai	
6		Busket Trap	Bang Chai/ Ghuni Chai	
7		Box Trap	Duri/ Echar Duri	
8		Box Trap	Balish Chai/ Koiya Chai	
9		Conical Trap	Gui/ Kun	
10		Conical Trap	Ronga	
11		Conical Trap	Baim Ronga	
12		Tubular Trap	Tubular Kuichcha Chai	
13		Box Trap	Box Shaped Kuichcha Chai	
14	Fish Aggregating Device (FAD) or Open Trap	Bush Trap	Dal or Katha	
15		Barrage Trap	Deaoa Jal	
16		Fence	Chai Ban or Pati Ban	
17		Light Trap	Light Trap	

Sl. No.	Type of Gears	English Name	Local Name	Remarks
18		Triangular Trap	Hogra	
19		Tubular Trap	Chonga	
20		Ditch	Gata/ Doba/ Gara	
21		FAD	Vira of Ghuitta for catching Icha	
22		Bell Shaped Trap	Polo	
23		Triangular Trap	Naia Ocha	
24		Triangular Trap	Kura Ocha	
25	Hook	Hook for Handling	Boal Hook/ Pocha Hook	
26		Long Line	Tanga Hook	
27		Floating Hook	Daitta Borshi	
28		Long Line	Laar Borshi	
29		Hook for Handling	Chip Borshi	
30		Floating Hook	Khili Daitta	
31	Wounding Gears	Spear	Thuri Cocha or Caicha Cocha	
32		Spear	Cocha or Chol	
33		Spear	Aittor	
34		Spear	Ghas Coach or Jogorr	
35		Spear	Cuchiar Kali	
36		Hook	Ring	
37	Other Fishing Instruments	Hand	Hand	
38		Push Net	Push Net/ Thela Jal	
39		Push Net	Push Net/ Ochu Jal	
40		Surrounding Net	Seine Net/ Kona Jal	
41		Surrounding Net	Seine Net/ Gon Jal	
42		Surrounding Net	Seine Net/ Gorgori Jal	
43		Hand Lift Net	Lift Net/ Dharma Jal	
44		Fixed Lift Net	Lift Net/ Veshal Jal	
45		Lift Net	Lift Net/ Chata Jal	
46		Gill Net	Gill Net/ Current Jal	
47		Gill Net	Gill Net/ Koi Jal	
48		Gill Net	Gill Net/ Chela Jal	
49		Gill Net	Gill Net/ Bata Jal	
50		Gill Net	Gill Net/ Suti Jal	
51		Cast Net	Cast Net/ Jhaki Jal	
52		Cast Net	Cast Net/ Bachuri Jal	
53		Cast Net	Cast Net/ Utar Jal	
54		Lantern Net	Lantern Net/ Chabi Jal	
55		Drag/Dredge Net	Drag Net/ Tana Jal	
56		Drag/Dredge Net	Drag Net/ Ichar Jal	
57		Drag/Dredge Net	Drag Net/ Para Jal	
58		Fixed Set Bag Net	Set Bag Net/ Bhar Jal	
59		Fixed Set Bag Net	Set Bag Net/ **Gor Jal**	
60		Fixed Set Bag Net	Set Bag Net/ Bandor Jal	
61		Fixed Set Bag Net	Set Bag Net/ Basta Jal	
62		Fixed Set Bag Net	Set Bag Net/ Dera Jal	
63		Skimming Net	Skimming Net/ Lewa Jal	

Source: The World Fish Center, Sunamganj

Figure 6.26: Fishing gears diversity in the study area

6.5.6 Fish migration

The project area covers rivers, seasonal floodplain, and haor/beel. The Surma and Baulia rivers are main route as longitudinal fish migration in the study area. The Haors/beel of the project area provide the winter shelter for the mother fishery, and in the early monsoon these mother fisheries produce millions of fries for the entire downstream fishing communities. Connectivity of the haor with the Rivers, canal, khals, beels system are the way to fish migration of this area. Many fish species migrate horizontally to the rivers, and other water bodies of the area as part of their life cycle. Overall fish migration situation is moderate in the study area. Feeding and sheltering migration of riverine fishes occur through different connected *khals* of the study area.

6.5.7 Fish marketing and post-harvest facilities

Due to lack of the communication systems in the study area, fish marketing and postharvest facilities are poor. Local fishermen sell bulk of their catch either directly to the local fish markets such as Sachna Bazar and Golakpur Bazar, Mominpur Bazar etc. or to fish traders or buyers (Bapari) coming from Sunamganj. There is no specific fish markets (arats) present in study area. No structured fish landing centers are found in the area. No ice factories are observed in the scheme area. Fishermen sell their catch fish as early as possible to nearby fish markets or to the fish traders. No good fish storage facility is available. Fish seeds for culture fishery are collected from the fish hatcheries and nurseries which are situated apart from the study area. Fish feeds are also collected from the fish feed dealers of Sunamganj.

6.5.8 Fisher's lifestyle

Income level of traditional fishermen is decreasing due to decline of fish population, degradation of habitat condition etc. There are mainly three types of fishermen in the study area. River fishermen who mainly capture fish from Surma river. This type of fisherman fishes in groups of around 20-30 by using Mohajal or Berjal and motorized boat provided by local large traders. This type of fishing is

expensive because the net and the boat they use cost 1.5 to 2 lac taka which is provided by the traders. Another type of fisherman, who take fishing as the secondary occupation which capture fish but not as a main occupation and capture on an irregular basis. They do not have regular access to any water bodies and fish in nearby areas with small nets and less fish habitat where the restriction is low. The third type of fisherman is Haor/*beel* fishermen, whose major occupation is fishing. The fisherman who own any beel/haor and received lease formally and others who do not own any beel but fish in others' water bodies.

6.6 Ecological Resources

The study area is located in the northeast part of the country which has important ecosystems. The study area consists of human settlement, haors, beels and river systems. Haor refers to a large natural depression where there are perennial water bodies (i.e., beels) that become part of a contiguous wetland during monsoon and remain disconnected by vast crop lands during the dry season. Due to its alternative wet and dry nature, the ecosystem offers two major livelihood options: fishing in the wet season (June-October) and cropping in the dry season (December-April). The haor is fed by small rivers draining the adjacent land and also by the rivers during flood season. During the subsequent dry season, the water evaporates or drains away through the southern outflow to leave a diverse system of dry season water bodies. This seasonal variability of flow and water level in the haor area helps support a unique wetland eco-system. Both rivers and haors are made up of a complex of habitats whose diversity supports exceptionally rich fish faunas. Haors and beels are connected to the rivers and natural river functioning depends on the diversity in form of these various habitats and the inter-connectivity between them, with uninterrupted flows along the main channels and the seasonal invasion of the haor and its water bodies. Brief ecological description is presented below.

6.6.1 Bio-ecological zones

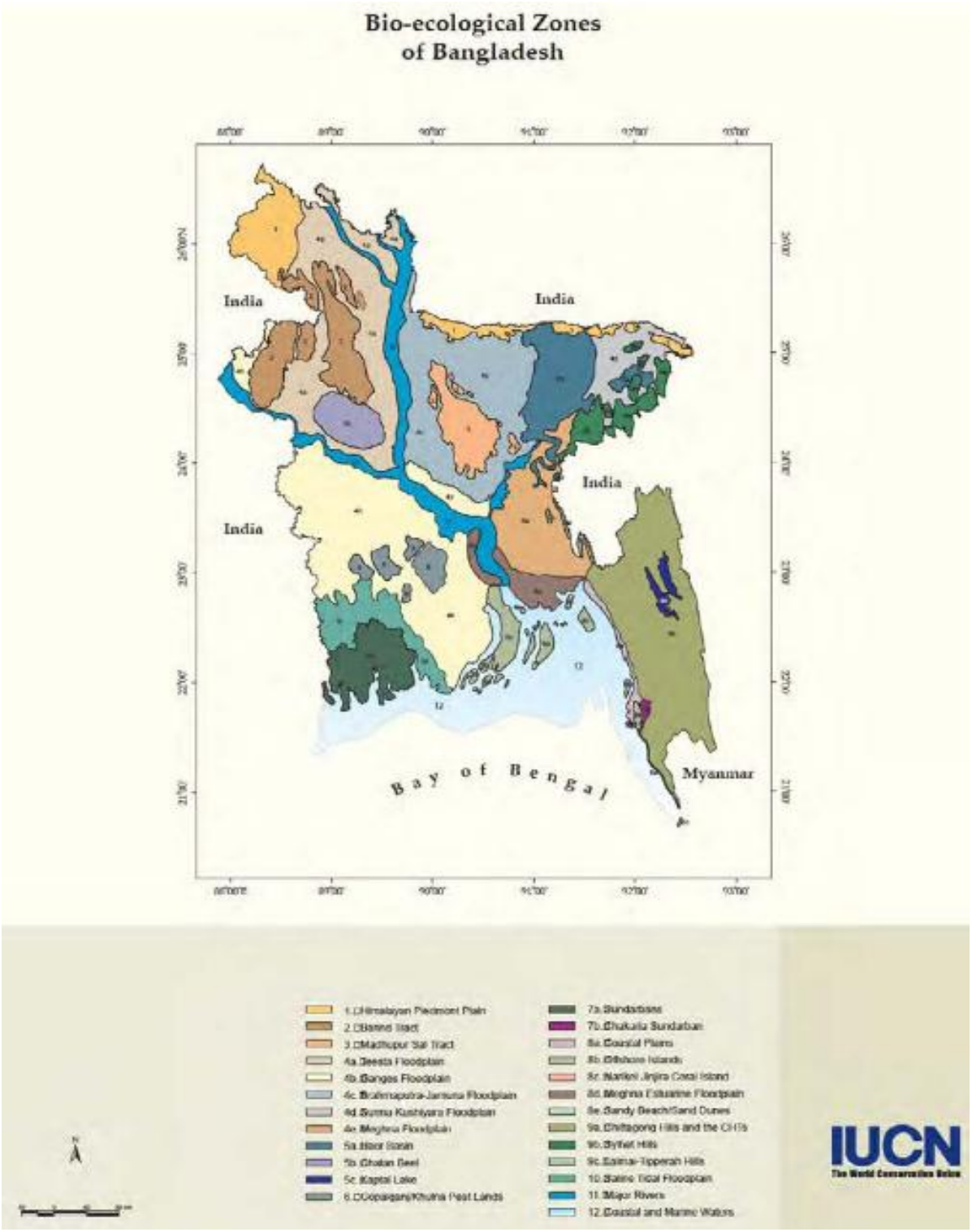
According to the ecosystem features, species diversity, IUCN Bangladesh identified 25 Bioecological Zones in Bangladesh (Nishat *at el*, 2002). They are Himalayan Piedmont Plain, Barind Tract, Madhupur Sal Tract, Teesta floodplain, Ganges Flood plain, Brahmaputra-Jamuna floodplain, Surma-Kushiara floodplain, Meghna floodplain, Haor basin, Chalan Beel, Kaptai Lake, Gopalgonj-Khulna Peat Land, Sundarbans, Chakaria Sundarbans, The coastal plains, Offshore islands, Narikel Jinjira coral island, Narikel Jinjira coral island, Sandy beach/Sand dunes, Chittagong Hills and the CHT, Sylhet hills, The LalmaiTipperah hills, The saline tidal floodplain, Major Rivers, Coastal Marine Water.

These bio-ecological zones can be classified as major ecosystems of the country. Map 5.4 shows the bio-ecological zone of Bangladesh. According to the map, the study area encompasses one of these bio-ecological zones, namely the Haor basin. A brief description of the Haor basin (5a) is presented below.

Haor Basin

The Haor basin is an internationally important wetland ecosystem, which is situated in Sunamganj, Habiganj, Sylhet, Kishoreganj, Moulvibazar and Netrokona districts. It is a mosaic of wetland habitats, including numerous rivers, streams and irrigation canals, large areas of seasonally flooded cultivated plains, and hundreds of *haors* and *beels.* This zone

contains about 400 *haors* and beels, varying in size from a few hectares to several thousand hectares. Some of the most important *haors* and *beels* are: the Meda beel, Tanguar haor, Aila beel, Dekhar haor, Kuri beel, Erali beel, Dubriar haor, Hakaluki haor, Kawadighi haor and Hail haor. These *haors* and *beels* support major subsistence and commercial fisheries while the seasonally flooded lake margins support major rice-growing activities, and the abundant aquatic vegetation provides rich grazing for domestic livestock and an alternative source of fuel and ferti1izers for the local people. The wetlands are also home to a wide variety of resident and migratory waterfowl, including perhaps as many as 100,000 to 150,000 ducks, and provide a refuge to many other species of wildlife, which are becoming increasingly rare elsewhere in Bangladesh. Keeping in mind all these ecological benefits, the Tanguar haor, which is located in this zone, has been declared a Ramsar site. The Bangladesh Government has also declared this *haor* an Ecologically Critical Area (ECA) (GoB-IUCN, 1992).



Map 5.4: Bio-Ecological zones of Bangladesh

The Haor basin is the only region in Bangladesh where remnant patches of freshwater swamp and reed lands still exist. The Hijal *(Barringtonia acutangula)*, Koroj *(Pongamia pin nata)*, Bhui dumur *(Ficus heterophyllus)*, Nol *(Arundo donax)*, Khagra *(Phragmites karka)*, Ban golap *(Rosa involucrata)* and Barun *(Crataeva nurvala)* are the main plant species found in the swamp forests. All of them are flood-tolerant species and can survive in

submerged conditions for extended periods of time. However, among these, hijal, tamal and koroj trees are of the greatest value to the people and the environment (GoB-IUCN, 1992). About 150 species of waterfowl have been recorded in this zone; but over 70 of these are now rare and several have not been reported for many years. However, the most common species include: the little grebe *(Tachybaptus ruficollis),* Little cormorant *(Phalpcrocorax niger),* a variety of herons and egrets, Asian openbill *(Anastomus oscitans),* Lesser adjutant *(Leptoptilos javanicus),* Black-headed ibis *(Threskiornis mclanocephalus),* several ducks notably the Lesser whistling-duck *(Dendrocygna javanica),* Cotton pygmy-goose *(Nettapus coromandelianus)* and Northern pintail *(Anas acuta),* White-breasted waterhen *(Amaurornis phoenicurus),* Water cock *(Gallicrex cinerea),* Purple swamp hen *(Porphyria porphyria),* Common coot *(Fulica atra),* Pheasant-tailed jacana *(Hydrophasianus chirurgus),* Bronzedwinged jacana *(Metopidius indicus)* and a wide variety of shorebirds, gulls and terns. Besides, mammalian species associated with these wetlands include the Ganges river dolphin *(Platanista gangetica),* which is still common in the large rivers, the Fishing cat *(Prionailurus viverrinus)* and three species of otter: the Common otter *(Lutra lutra),* Smoothcoated otter *(L. perspicillata)* and Clawless otter *(Aonyx cinerea)* (GoB-IUCN, 1992).

6.6.2 Environmental Protected Area

Based on the Bangladesh Wildlife (Conservation and Security) Act, 2012, some specific areas of environmental importance are declared as environmental protected areas (EPA) in the name of sanctuaries, national parks, community conservation areas, safari parks, eco-parks, botanical gardens notified under the provisions of sections 13, 17, 18 and 19 under Chapter IV and special biodiversity conservation area established under the provisions of section 22 under Chapter V and traditional heritage and kunjaban are declared under section 23 for some specific purpose of environmental protection. There is no such EPA in and around the HFMLIP area. Moreover, based on the Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 some specific areas of ecologically important are declared as ecologically critical area (ECA) for conservation of ecological condition of that area restricting certain activities detrimental to the environment.

There is no ecologically critical area (ECA) in the study area. The Tanguar Haor ECA is situated at northern boarder in Sunamganj district. Tanguar haor whose total area is approximately 160 kilometers including all geographic features and land use is located in the Northeastern part of Sunamganj district, it shares a border of approximately 17 kilometers with Nongstoin, India in its north. It is located beside Dharmapasha and Tahirpur. It is approximately 20km away from the study area.

6.6.3 Terrestrial fauna (Wildlife)

No endangered species are present in the study areas. Common mongoose (Herpestes edwardsi), Jackle (Canis aureus), Jungle cat (Felis chaus), common house rat (Rattus rattus), house mouse (Mus musculus) are the major mammals. Indian flying bat (Pteropus giganteus) colonize in some dense homestead forest. Among the reptiles, Bengal Grey Lizard (Veranus bengalensis), Garden Lizard (Calotes versicolor), dark bellied marsh snake (Xenocrophis cerasogaster) are known to occur in the area. The common lizards found within the scheme area include garden lizard (Calotes versicolor) and house lizard (Hemidactylus frenatus). Among other species that once were common but now are only occasionally seen in are the Asiatic soft-shell Turtle (Chitra indica). Amphibian species favor wetland areas and the marginal dried areas. Some species like Common toad (Bufo melenostictus), Jerdon's

bull frog (Hoplobatrachus crassus), Maculated tree frog (Polypedates maculatus), Ornate microhylid (Microhyla ornata), Balloon frog (Uperodon globulosus) prefer the cool, damp habitat of the bamboo grooves.

In the study area, birds can be divided into two major groups; birds observed in floodplains and wetland, and birds observed in dry land habitat such as homestead, open woodland, scrub and grass land. Birds of prey survive well in the area. The area is also place for the migratory birds. Every winter many of migratory birds come around the area and make their temporary habitat. Major birds are found in the project area are shown in **Table 6.30**.

Table 6.30: Major Birds Available around the Project Site

English Name	Scientific Name
Duck	*Anas poecilorhyncha*
Kingfisher	*Alcedo Hercules*
Wagtail	*Motacilla Alba*
Egret	*Egretta Garzetta*
Stork	*Myctria Leucocephala*
Crow	*Corvus splendens*
Dove	*Streptopelia sp*
Titra	*Farnolinus*
Crane	*Grus grus*
Cheer	*Catreus wallichii*
sparrow	*Passer Domesticus*

Source: RRI Field investigation and consultations with local people

6.6.4 Terrestrial Flora (Vegetation)

In the study area there are cultivable lands, human settlements, some uncultivable lands and water bodies. There is no significant urban or industrial development. Few numbers of small commercial centers are situated there. The agricultural land is mainly vegetation type. Agriculture is the main output of the region. Cropping patterns are determined by the seasonal floods with rice as the most important crop. Chili, Tomato, Cucumber, Radish and other vegetables are also grown.

Human settlements with dense vegetation along with some well grown trees are exists in the study area. The tree species are common species characteristic of the district and include eucalyptus, plum, rain tree, koroi, neem, akasmoni, debdaru, acacia, mango, jackfruit etc.

Major terrestrial flora of this area can be divided according to following categories:

- **The upland settlement vegetation**

Upland is flood free and homesteads are situated on this type of land. Usually bank of Surma cover this types of vegetation. Homestead platform is only host land of big trees like Rain Tree *(Albizia lebbeck),* Narikel *(Cocos nucifera),* Kola *(Musa sp.),* Neem *(Azadirachta indica),* Mera *(Trewia nudiflora)* koroi, akasmoni, debdaru, acacia, mango, jackfruit etc. These types of vegetation are well grown along the Surma river with the settlement due to density of human habitat structures.

Figure 6.27: Vegetation cover along the Surma River in the study area

- **Settlement Ridges vegetation**

Ridges are dominated by tall grasses e.g. *Crotolaria* sp, *Saccharum spontaneum* etc. This type of habitat is very important for wildlife. Somewhere homeowners cultivate this land for vegetable growing. These lands are inundated in peak monsoon. Ridge vegetation is valuable for their contribution to fuel wood and thatching supply as well as protects settlement from wave action in wet season.

- **The undulating Kanda vegetation**

Kanda is a land that forms undulation and a slightly higher than agricultural land. This type of land remains fallow or use as cattle grazing or crop thrashing in dry season. Kandas are abounded by mixed grass species. Kanda is good habitat for insects and as well as some birds. Dholkolmi *(Ipomoea fistulosa)* is another dominant species grown on some kandas.

- **Crop fields vegetation**

Cropland is major land type in all over the haor area including the study area. This land is mainly used for boro cultivation. Cropland supports various avifauna and reptiles.

Figure 6.28: Crop field vegetation in the study area

6.7 Socio-Economic Environment

The processes of development of infrastructures including road are bound to create their impacts on the socio-economic aspects of the local people, particularly in the peripheral of the project area. Therefore, the studies on the socio-economic impacts of the proposed Sachna-Golakpur road on the local population no doubt deserve attention.

Socio-economic impact assessment (SEIA) is a useful method to help understand the potential limit of impacts of a proposed change. It can be used to assess impacts of a wide range of types of change, from a proposal to build a new freeway to a proposal to change access to a natural resource such as a forest or the ocean. This understanding can help design impact mitigation strategies to minimize negative and maximize positive impacts of any change.

In order to study the socio-economic aspects of people, the required data was collected from various primary (e.g. field survey, site visits, public consultation, professional judgment etc.) and secondary (e.g. government and private sector agencies) sources.

In order to assess the impacts of the proposed Project on people living in the vicinity of the proposed Sachna-Golakpur project area, detailed survey was conducted and existing socio-economic conditions and salient features of the area were duly observed. During the detailed site visit, relevant government agencies/departments were also consulted for the collection of the relevant data. Information on socio-cultural resources and economic development were collected through field survey and secondary sources.

6.7.1 Location

The study area mainly consists of Jamalganj and Dharmapasha upazilla under Sunamganj district. The proposed Sachna-Golakpur road will directly connect these two upazillaz. The people of Jamalganj upazila cann't travel directly to Netrokona, Mymensingh, Dhaka and other western parts of the country. On the other hand, the people of Dharmapasha upazila have also no easy access to Sunamganj, Sylhet and other towns located in the north eastern part of Bangladesh. In order to connect these upazilas it is essential to construct the proposed Sachna-Golakpur road link.

Jamalganj is an upazila located in between 24°50' and 25°04' north latitudes and in between 91°05' and 91°19' east longitudes and its total area is 309.38 km^2 (land area 279.38 km^2 and riverine area 30 km^2). It is bounded by Tahirpur and Bishwambarpur upazilas on the north, Khaliajuri and Derai upazilas on the south, Sunamgaonj Sadar upazila on the east, Mohangonj and Dharmapasha upazilas on the west. Jamalganj Thana was formed in 1940 and it was turned into an upazila in 1984. There are 5 unions, 97 mouzas, and 192 villages in this upazila. On the other hand, Dharmapasha is an upazila located in between 24°47' and 25°12' north latitudes and in between 90°56' and 91°11' east longitudes. It is bounded by Meghalaya State (India) on the north, Mohangonj and Barhatta upazilas on the south, Tahirpur and Jamalganj upazilas on the east, Kalmakanda and Barhatta upazilas on the west and its total area is 531 km^2 (land area 527 km^2 and riverine area 4 km^2). Dharmapasha Thana was formed in 1942 and it was turned into an upazila in 1983. There are 10 unions, 174 mouzas, and 324 villages in this upazila. different haors/beel nearby project site like Pagnar Haor, Haliar Haor, Shanir Haor, Tanguar Haor, Khankiajuri Beel, Busk beel, Chhatidhara Beel, Aila Beel, Firagang Beel, Dhoroni Beel and Joldhara etc.

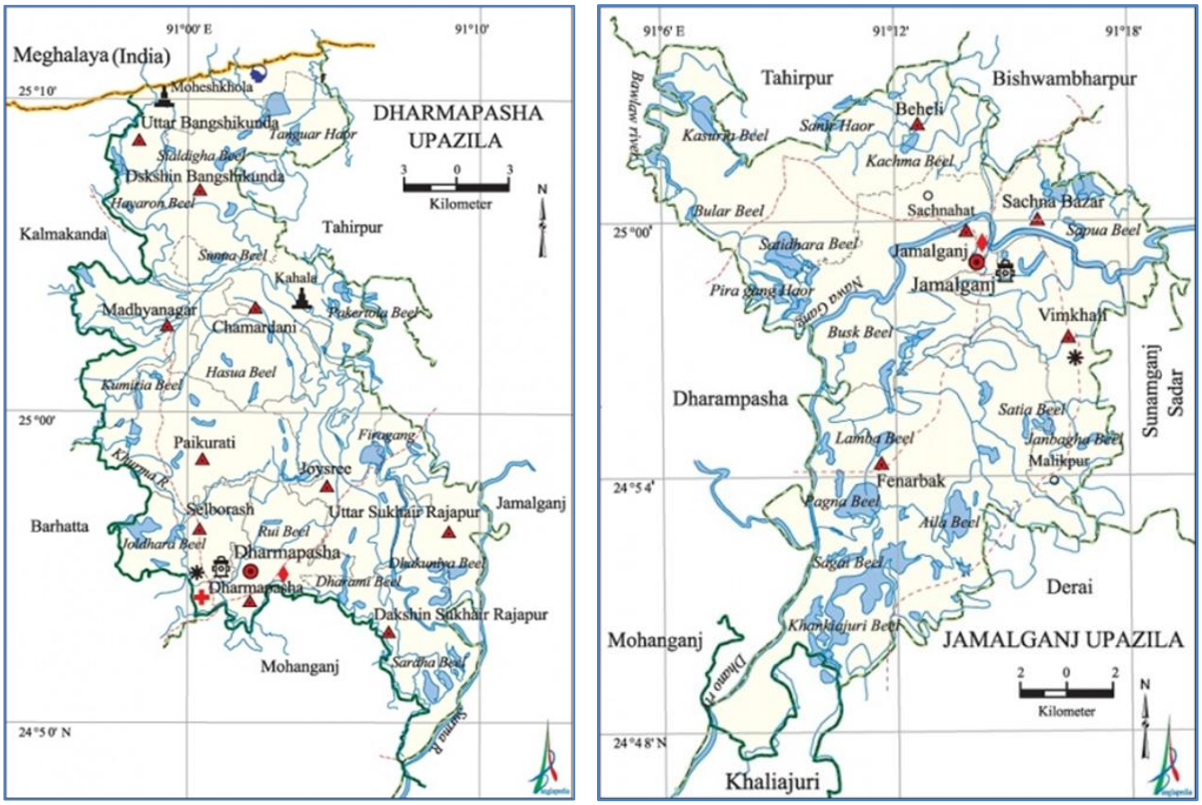


Figure 6.29: Map showing Jamalganj (right) and Dharmopasha (left) Upazila

The study area comprises of nine unions of Jamalgonj, Dharmapasha, Bishwambarpur and Tahirpur upazilla. 85% of the study area consists of two upazilas namely Jamalganj and Dharmapasha and 15% covers Bishwambarpur and Tahirpur. The following table shows proportional distribution of study area in percentile in terms of per union.

Table 6.31: Location of the study area including upazilla, union, area and % of union within project site

District	Upazila	Unions	Total area of each Union (Ha)	Area of each Union within project area (Ha)	% of each Union within project area
Sunamganj	Jamalganj	Sachna Bazar Union	3023.0	1239.4	40
		Jamalganj Sadar Union	5037.9	4080.7	80
		Behli Union	8008.7	6006.6	75
	Dharmapasha	Sukhair Rajapur North Union	7200.2	4680.1	65
		Joysree Union	5700.0	2280.0	40
		Sukhair rajapur South Union	4899.9	734.9	15

District	Upazila	Unions	Total area of each Union (Ha)	Area of each Union within project area (Ha)	% of each Union within project area
	Bishwambarpur	Fatehpur Union	4367.8	1528.7	35
	Tahirpur	Tahirpur Union	5245.5	786.8	15
		South Sreepur Union	5592.4	279.6	5

Source: RRI estimation from Population and Housing Census, BBS, 2011and Satellite image.

6.7.2 Demography and household

According to the source of Bangladesh Population and Housing Census, Bangladesh Bureau of Statistics 2011, the total population of Jamalganj upazila is 167,260 while total population is 223,202 in Dharmapasha upazila. Union wise demographic scenario including total area, household, population and density are presented in the following **Table 6.32**.

Table 6.32: The demographic scenario including total area is presented in in the study area.

Administrative Unit	Area in Acres	Total Households	Total Population	Population Density [sq.km]
Sachna Bazar Union	7470	4437	26049	862
Jamalganj Sadar Union	12449	9295	51604	1024
Beheli Union	19790	3565	19320	241
SukhairRajapur North Union	17792	3265	17421	242
Joysree	14085	3920	20525	360
Sukhair Rajapur South Union	12108	1784	9563	195
Fatehpur Union	10793	4897	27737	635
Tahirpur Union	12962	3456	18977	362
South Sreepur Union	13819	3670	20738	371
Total				

Source: Population and Housing Census, BBS, 2011

6.7.3 Housing Tenancy

In the study area, almost all of the people are dwelling in their own household. Maximum rented housing tenancy is found in Jamalganj Union because this union has greater urban area than other areas. Shukhair Rajapur North Union has minimum rented housing tenancy. Rent free housing tenancy is almost similar in Jamalganj Union and Sachna Bazar Union. Maximum rent free housing tenancy is found in Behli Union indicating heighst Socioeconomic environmental vulnerability in the study area.

Table 6.33: Tenancy status of residence in the project area

Administrative Unit	Percentage of Tenancy of House		
	Owned	Rented	Rent free
Sachna Bazar Union	95.8	2.0	2.2
Jamalganj Sadar Union	92.7	4.5	2.8
Beheli Union	96.6	0.2	5.3
SukhairRajapur North Union	94.4	0.8	4.8
Joysree	96.4	0.2	3.4
Sukhair Rajapur South Union	93.1	0.0	6.9
Fatehpur Union	96.6	0.4	3.1
Tahirpur Union	92.8	2.8	4.4
South Sreepur Union	96.1	0.1	3.8

Source: Population and Housing Census, BBS, 2011

Figure 6.30: House in the Haor (left) and house beside Surma river (right) in the study area

6.7.4 Household Size

According to the household and population census 2011 by BBS about 13.9% to 21.7% households comprise of 8 more than members. Findings reveal that the average size of the household in the study area ranges from 5.2 to 5.9 members. In the study area, it is found that the highest concentration is in Sachna Bazar Union (5.9) and the lowest concentration is in Joysree Union (5.2). Generally big household size is considered as curse with small number of earning member. If most of the household members are able to contribute to household income, they are considered as benevolent.

Table 6.34: Distribution of household members by Upazila and Unions

Administrative Unit	Percentage of households comprising of								Average Size of Household
	1 Person	2 Persons	3 Persons	4 Persons	5 Persons	6 Persons	7 Persons	8+ Persons	
Sachna Bazar Union	1.5	5.7	9.9	14.7	17.6	15.7	13.1	21.7	5.9

Jamalganj Sadar Union	1.9	5.8	11.8	15.8	18.4	16.6	11.9	17.9	5.5
Beheli Union	2.8	6.6	12.0	17.5	17.5	15.0	11.4	17.3	5.4
SukhairRajapur North Union	2.4	6.4	11.9	17.1	18.6	16.8	11.3	15.5	5.3
Joysree	1.5	7.4	13.6	17.2	18.2	16.8	11.2	13.9	5.2
Sukhair Rajapur South Union	1.8	6.5	118	18.5	18.5	15.1	11.6	16.2	5.3
Fatehpur Union	1.9	5.7	10.7	15.8	18.3	16.2	12.4	19.0	5.7
Tahirpur Union	2.1	5.8	12.0	17.6	20.1	15.9	11.7	14.7	5.3
South Sreepur Union	1.9	6.3	10.9	16.1	17.7	17.3	12.0	17.8	5.5

Source: Population and Housing Census, BBS, 2011

6.7.5 Age Structure

Analysis of age structure shows that about 43% of total population are children (age ranges up to 14 years), 50% of total population are youth (age ranges from 15 to 59 years) and the rest 6.5% of total people belong to old category (age ranges above 60 years). The following **Table 6.35** delineates that people of all ranges are more or less equally distributed across the study area.

Table 6.35: Percentage of population in age group in the study area by Upazila & Unions

Administrative Unit	Percentage of population in the age group									
	0-4	5-9	10-14	15-19	20-24	25-29	30-49	50-59	60-64	65+
Sachna Bazar Unoin	14.5	15.5	12.6	8.3	8.4	8.2	20.1	5.3	2.6	4.4
Jamalganj Sadar Union	14.2	15.9	12.7	8.4	8.2	8.0	20.6	5.2	2.6	4.3
Beheli Union	14.2	15.7	11.1	8.1	7.9	8.5	21.4	55	2.8	4.9
Sukhair Rajapur North Union	14.5	16.8	12.3	7.6	7.6	8.1	20.2	5.3	2.7	4.9
Joysree Union	15.5	16.2	10.7	7.0	8.1	8.1	21.0	5.7	2.8	4.8
Sukhair Rajapur South Union	15.9	17.8	10.8	7.1	7.3	8.1	20.6	5.6	2.5	4.3
Fatehpur Union	14.9	15.4	11.6	7.9	8.4	8.2	20.8	5.5	2.7	4.5
Tahirpur Union	14.6	13.9	11.3	8.5	8.5	8.7	21.6	5.8	2.6	4.5
South Sreepur Union	15.5	15.4	11.1	7.1	8.0	8.8	21.5	5.5	2.5	4.6

Source: Population and Housing Census, BBS, 2011

6.7.6 Gender Ratio

In the study area it is found that the number of male and female population is almost equal. The gender ratio ranges from 100 to 105. The following table shows the detail of gender ratio in the study area.

Table 6.36: Gender ratio in the study area

Administrative Unit	**Population**		**Gender Ratio**
	Male	Female	
Sachna Bazar	13222	12827	103
Jamalganj Sadar Union	9295	9282	103

Beheli Union	9681	9639	100
Sukhair Rajapur North Union	8886	8535	104
Joysree Union	10362	10163	102
Sukhair Rajapur South Union	4889	4674	105
Fatehpur Union	13877	13860	100
Tahirpur Union	9726	9251	105
South Sreepur Union	10751	9987	108

Source: Population and Housing Census, BBS, 2011

6.7.7 Dependency Ratio

Dependency ratio refers to ratio of dependent population (population aged up to 14 years and above 50 years) to the working age population (population aged between 15 to 59 years). Categorical distribution of population by Upazila and union is shown in the following Table:

Table 6.37: Categorical distribution of population in the study area by Union

Administrative Unit	0-14 Children (%)	15-59 Active Workforces (%)	60+ Old (%)
Sachna Bazar	42.6	50.3	7.1
Jamalganj Sadar Union	42.8	50.4	6.9
Beheli Union	41.0	51.4	7.7
Sukhair Rajapur North Union	43.6	48.8	7.6
Joysree Union	42.4	49.9	7.6
Sukhair Rajapur South Union	44.5	48.7	6.8
Fatehpur Union	41.9	50.8	7.2
Tahirpur Union	39.8	53.7	7.1
South Sreepur Union	42.0	50.9	7.1

Source: Population and Housing Census, BBS, 2011

6.7.8 Community structure

Distribution of Population by Religion, Residence and Community is presented in the following table.

Table 6.38: Distribution of Population by Religion, Residence and Community in the study area by Union

Administrative Unit	Total	Muslim	Hindu	Christian	Buddhist	Others
Sachna Bazar Union	26049	23316	2733	0	0	0
Jamalganj Union	51604	45713	5875	0	5	11
Beheli Union	19320	12461	6854	0	0	5
ShukhairRajapur North Union	17421	15076	2344	0	0	1
Joysree Union	20525	17251	3274	0	0	0
Shukhair Rajapur South	9563	8588	975	0	0	0

Union						
Fatehpur Union	27737	18664	9066	0	0	7
Tahirpur Union	18977	15210	3767	0	0	0
South Sreepur Union	20738	18046	2686	0	0	6

Source: Population and Housing Census, BBS, 2011

6.7.9 Literacy and Education

Education is an important indicator of socio-economic development. It is well established that the distribution of personal incomes in society is trongly related to the amount of education people have had. Generally speaking more schooling means higher lifetime incomes. These outcomes emerge over the long term. It is not people's income while in school that is affected, nor their income in their first job, but their income over the course of their working life. Thus, any noticeable effects of the current quality of schooling on the distribution of skills and income will become apparent some years in the future, when those now in school become a significant part of the labour force.

Information on Literacy and Education based on Population and Housing Census, BBS, 2011 of Jamalganj and DaharmapashaUpazila is described below:

6.7.10 Literacy in Jamalganj Upazila

Literacy denotes to the ability of writing a letter in any language. According to Population and Housing Census, BBS, 2011 in JamalganjUpazila, it is found that 32.5% of the population aged 7 years and over is literate.

Literacy rates by gender of three consecutive censuses are shown in the following table:

Table 6.39: Literacy rate in JamalganjUpazila by genderin three consecutive censuses

Item	1991	2001	2011
Both Gender	20.1	29.6	32.5
Male	26.1	33.9	34.6
Femle	13.7	25.2	30.2

Source: Population and Housing Census, BBS, 2011

Literacy rate is also shown in a Bar-Diagram below:

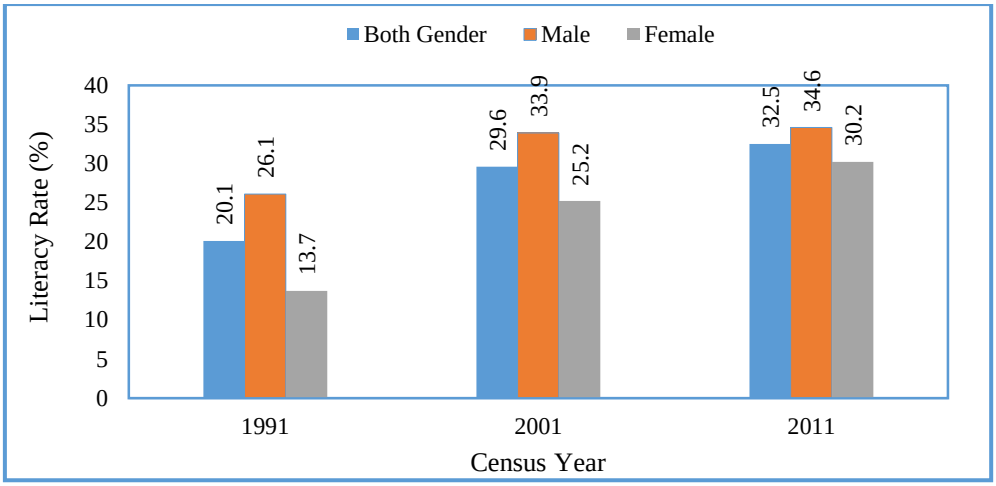


Figure 6.31: Literacy rate in Jamalganj Upazila in three consecutive censuses

Table 6.39 shows that, the literacy rate of the JamalganjUpazila in 2011 is 32.5% for both gender and 34.6% for male and 30.2% for female. It shows an increase of 2.9, 0.7 and 5.0percent point in 2011 over 2001 for both sex, male and female respectively.

6.7.11 Education in Jamalganj Upazila

School attendance of boys and girls aged between 3-29 years is presented in the following table:

Table 6.40: School Attendance rate in JamalganjUpazila by gender

Item	3-5 Years	6-10 Years	11-14 Years	15-19 Years	20-24 Years	25-29 Years
Both Gender	5.56	64.14	58.12	23.46	3.84	0.70
Male	5.05	62.33	53.15	21.86	3.96	0.97
Femle	6.11	66.03	63.57	25.29	3.73	0.48

Source: Population and Housing Census, BBS, 2011

There exist gender differences in school attendance rates in various age groups which can be observed from the **Table 6.40.** The female attendance rate are in the age groups 3-5, 6-10, 11-14 and 15-19 year is higher than their male counterparts. On the other hand, male attendance rate in the age groups 20-24 and 25-29 years is higher than female. The highest school attendance rate is 66.03% which is found for female in the age group 6-10 years.

6.7.12 Literacy in Dharmapasha Upazila

In Dharmapashaupazila, it is found that 29.2% populations aged 7 years and over are literate. Literacy rates by gender of three consecutive censuses are shown below:

Table 6.41: Literacy rate in Dharmapasha Upazila by gender in three consecutive censuses

Item	1991	2001	2011
Both Gender	10.8	26.4	29.2
Male	25.7	29.6	30.6
Female	15.6	23.0	27.7

Source: Population and Housing Census, BBS, 2011

Literacy rate is also shown in a Bar-Diagram below:

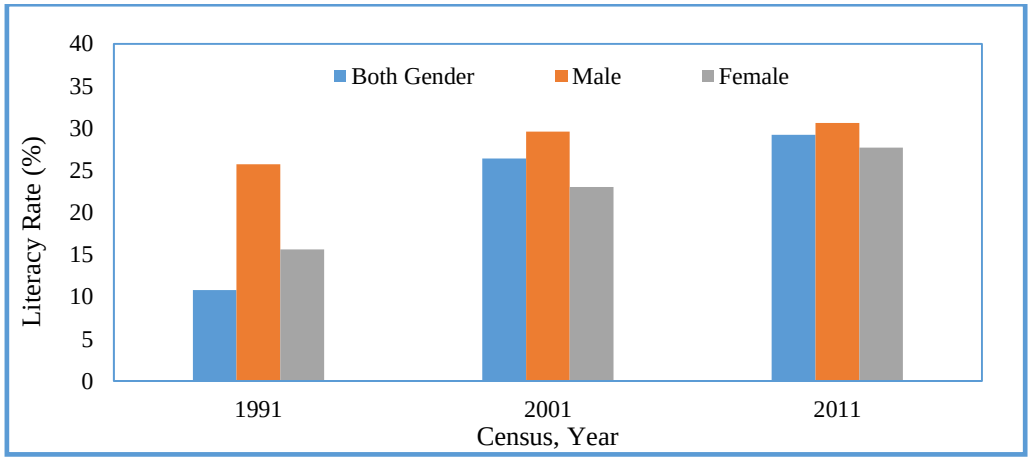


Figure 6.32: Literacy rate in DharmapashaUpazila in three consecutive censuses

6.7.13 Education in Dharmapasha Upazila

School attendance of boys and girls aged between 3-29 years is presented in the following table:

Table 6.42: School Attendance rate in Dharmapasha Upazila by gender

Item	3-5 Years	6-10 Years	11-14 Years	15-19 Years	20-24 Years	25-29 Years
Both Gender	3.46	61.61	46.83	22.63	3.17	0.50
Male	3.46	59.86	39.98	21.34	4.20	0.88
Female	3.46	63.44	57.49	24.08	2.38	0.27

Source: Population and Housing Census, BBS, 2011

The following two tables show the detail education scenario in the study area.

Table 6.43: School attending scenario of population aged 3-14 in the study area

	Population Aged 3-5 Years				Population Aged 6-10 Years				Population Aged 11-14 Years			
Administrative Unit	Attending School		Not Attending School		Attending School		Not Attending School		Attending School		Not Attending School	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
JamalganjUpzila	460	520	8650	7991	8377	8478	5062	4361	3996	4354	3522	2495

Sachna Bazar Union	85	94	1267	1164	1516	1492	553	502	782	811	487	312
Jamalganj Union	155	174	2597	2402	2537	2545	1708	1539	1356	1473	1061	732
Dharmapasha Upazila	1843	1839	6794	5797	313	230	7131	9451	61	27	7836	9839
ShukhairRajapur North Union	36	46	882	832	949	965	560	488	409	407	419	280

Source: Population and Housing Census, BBS, 2011

Table 6.44: School attending scenario of population aged 15-29 in the study area

	Population Aged 3-5 Years				Population Aged 6-10 Years				Population Aged 11-14 Years			
Administrative Unit	Attending School		Not Attending School		Attending School		Not Attending School		Attending School		Not Attending School	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
JamalganjUpzila	1578	1609	5641	4754	246	272	5969	7018	59	36	6012	7424
Sachna Bazar Union	241	335	860	723	45	48	1016	1086	16	7	956	1165
Jamalganj Union	658	55	1705	1440	100	117	1754	2239	21	14	1877	2222
DharmapashaUpazila	1843	1839	6794	5797	313	230	7131	9451	61	27	7836	9839
ShukhairRajapur North Union	120	102	626	482	12	5	588	711	2	1	633	775

Source: Population and Housing Census, BBS, 2011

6.7.14 Employment and labor market

According to BBS population and housing census 20011 in the study area the number of employed person ranges from 16% to 20%, of total population, about 14% to 18% are engaged in household work (mostly women), about 6% to 9% of total population are not working (it includes children and physically handicapped population) and about 0.08% to 0.23% of total population are looking for work.

Table 6.45: Distribution of population aged 7 years and above not attending school by activity study in the study area.

Administrative Unit	**Activity Status**							
	Employed Work		Looking for Job		Household		Do not work	
	Male	Female	Male	Female	Male	Female	Male	Female
JamalganjUpzila	24023	1769	274	110	619	23943	5845	7186
Jamalganj Union	8205	589	65	33	191	8173	1992	2535
Sachna Bazar Union	3654	412	59	9	43	3470	712	892
DharmapashaUpazila	38189	1750	564	143	856	37548	7556	9204
ShukhairRajapur North Union	3291	150	12	2	58	3113	476	564

Source: Population and Housing Census, BBS, 2011

Agriculture was reported by the local people is the mainstay of their mode of livelihood. About 18% to 28% of the total population in the study area engaged in agriculture. The engagement in industrial sector is negligible (0.01% to 0.95%) in the study area. However, no industries are found in the study area. A small section of total population is engaged in the field of service (0.86% to 5.0%) in harnessing their livelihood.

Table 6.46: Population aged 7 Years and above not attending school but employed

Administrative Unit	Population Aged 7 Years and Above Not Attending School but Employed			Field of Employment					
				Agriculture		Industry		Service	
	Both Sex	Male	Female	Male	Female	Male	Female	Male	Female
JamalganjUpazila	25792	24023	1769	21492	878	733	151	1798	740
Sachna Bazar Union	4066	3654	412	3416	108	153	11	85	293
Jamalganj Union	8794	8205	589	6951	360	233	14	1021	215
Dharmapasha Upazila	39939	38189	1750	35566	1191	369	88	2254	471
ShukhairRajapur NorthUnion	3441	3291	150	3176	113	2	0	113	37

Source: Population and Housing Census, BBS, 2011

Field findings showed that there is no shortage of agricultural or non-agricultural labor in the study area but now young are tending to go to foreign countries in search of better opportunities. About 10 years ago there was sufficient temporary labour coming to the study area. Now a days it become decreasing because less temporary labours are coming. The wage rate varies between 200 tk. to 250 tk. /day. A few migrated laborers are tending to stay here round the year and finally return to their household at the end of the year with all their income. Women's participation in agricultural sector is negligible.

6.7.15 Public health

Public health, as defined by C. E. A. Winslow, a leading figure in the history of public health, is the science and art of preventing disease, prolonging life, and promoting health and efficiency through organized community efforts for the sanitation of the environment, the control of community infections, the education of the individual in personal health, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance or improvement of health. Today the American Public Health Association (APHA) states that public health is the practice of preventing disease and promoting good health within groups of people, from small communities to entire countries. APHA further states it includes health professionals from many fields working together with the common purpose of protecting the health of a population.

6.7.15.1 Health Scenario in Jamalganj Upazila

6.7.15.1.1 Source of drinking water in Jamalganj Upazila

Most of the households in these haor areas are using tube-well water (groundwater) for drinking purpose. About 50% of the households are dependent on surrounding river/haor/pond water for domestic use. According to BBS population and housing census 2011 in Jamalganj Upazila, 96.3% of general household get the facility of drinking water from tube-well, 0.3% from tap and the remaining 3.4% household get water from other sources. Table 5.17 has shown the detail.

6.7.15.1.2 Sanitation in Jamalganj Upazila

In the Jamalganj Upazila, 28.5% of general household have sanitary latrine, 61.6% non-sanitary latrine and 9.9% have no toilet facility (BBS population and housing census 2011). **Table 6.47** has shown the detail.

6.7.15.2 Health Scenario in Dharmapasha Upazila

6.7.15.2.1 Source of drinking water in Dharmapasha Upazila

In Dharampasha Upazila, 91.1% of general household get the facility of drinking water from tube-well, 0.1% from tap and the remaining 8.8% household get water from other sources. **Table 6.47** has shown the detail.

Table 6.47: Distribution of general household by source of drinking water in the study area

Administrative Unit	Percentage of Source of Drinking Water			Percentage of Electricity Connection
	Tap	Tube well	Others	
JamalganjUpzila	0.3	96.3	3.4	26.9
Jamalganj Union	0.1	94.5	5.4	31.3
Sachna Bazar Union	0.4	95.6	4.0	29.6
DharmapashaUpazila	0.1	91.1	8.8	13.5
ShukhairRajapur North Union	0.0	97.9	2.1	17.1

Source: Population and Housing Census, BBS, 2011

6.7.15.2.2 Sanitation in Dharmapasha Upazila

In the Dharmapasha Upazila, 17.6% of general household have sanitary latrine, 66.3% non-sanitary latrine and the remaining 12.5% have no toilet facility (BBS population and housing census 2011). **Table 6.48** has shown the detail.

Table 6.48: Types of toilet structure and toilet facility

Administrative Unit	Type of toilet Structure (%)				Toilet Facility (%)			
	Pucca	Semi-Pucca	Kancha	Jhupri	Sanitary (WithWater Seal)	Sanitary (NoWater Seal)	Non-Sanitary	None
JamalganjU pzila	2.2	8.6	87.1	2.2	3.5	25.0	61.6	9.9
Jamalganj Union	3.2	11.2	84.2	1.4	4.3	23.6	66.9	5.1
Sachna Bazar Union	4.1	12.7	51.5	1.7	2.8	31.6	59.4	6.2
DharmapashaUpazila	0.7	3.6	88.6	7.1	3.6	17.6	66.3	12.5
ShukhairRajapur North Union	0.2	2.9	94.7	2.2	1.9	27.4	62.8	7.8

Source: Population and Housing Census, BBS, 2011

6.7.15.3 Health disabilities

Table 6.49: Type and percentage of health disabilities in the study area

Administrative Unit	Total Population	Percentage of Type of Disability						
		All	Speech	Vision	Hearing	Physical	Mental	Autistic
JamalganjUpzila	167260	2.0	0.3	0.5	0.3	0.7	0.2	0.1
Jamalganj Union	51604	1.9	0.3	0.4	0.2	0.7	0.1	0.1
Sachna Bazar Union	26049	2.1	0.3	0.5	0.2	0.8	0.2	0.1
Dharmapasha Upazila	223202	1.3	0.2	0.3	0.1	0.5	0.2	0.1
Shukhair Rajapur North Union	17421	1.9	0.2	0.4	0.3	0.7	0.2	0.1

Source: Population and Housing Census, BBS, 2011

The above table and field investigation revealed that that health disability of the population in the study area is not noticeable.

6.7.16 Access to Electricity

All the unions of the Jamalganj upazila have brought under the Rural Electrification Program. However, a total of 26.9% of the general households reported to have electricity connection in the entire Upazila in 2011 as against 4.9% in 2001 (BBS population and housing census 2011).

The Dharmapasha upazila have brought under the Rural Electrification Program. However, a total of 13.5% of the general household reported to have electricity connection in the entire Upazila in 2011 as against 4.0% in 2011.

The following **Table 6.50** describes the picture of electricity connection in the study area

Table 6.50: Percentage of access to electricity in the study area

Administrative Unit	Percentage of Electricity Connection
JamalganjUpzila	26.9
Jamalganj Union	31.3
Sachna Bazar Union	29.6
DharmapashaUpazila	13.5
ShukhairRajapur North Union	17.1

Source: Population and Housing Census, BBS, 2011

6.7.17 Household income and expenditure

Household income and expenditure is an important indicator to evaluate the socio-economic condition of people. In the study area it is found the most of the income and expenditure are varying from 5,000 tk./month to 20,000 tk. /month. It is observed from the field findings that most of the income comes mainly from agriculture (65%) and fishing (25%), selling labour (5%) and 5% constitute other which include service (Govt. and non govt.), remittance etc. On the other hand, most of the expenditure is for household consumption (59%) and housing (35%).

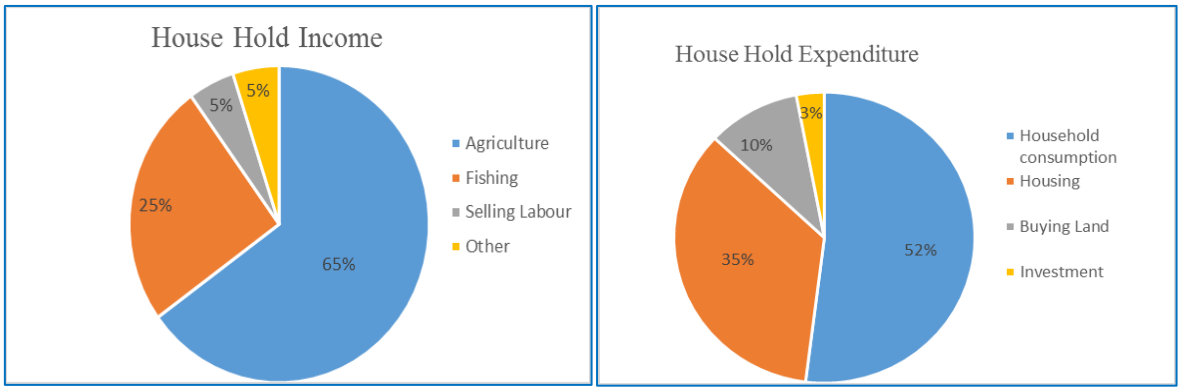


Figure 6.33: Distribution of House hold income and expenditure

6.7.18 Indigenous peoples and traditional tribal lands

According to BBS population and housing census 2011there are no indigenous peoples and traditional tribal lands in the study area.

7 Public Consultations and Disclosure

7.1 Introduction

The Government of Bangladesh (GoB) and international donors (e.g. World Bank, Asian Development Bank, JICA etc.) have placed great importance on involving primary and secondary stakeholders for determining the environmental and social impacts associated with project implementation. In order to gather local knowledge for baseline conditions, understand perceptions of the community regarding impact significance, and propose meaningful mitigation measures, participation of stakeholders is an integral part of the EIA process.

According to the EIA Guidelines of the DoE, the public consultation meeting is mandatory for the Environmental Impact Assessment (EIA) study of any development project especially which is under RED Category projects. Public participation through consultations in the National Water Sector project is also mandated according to the Guidelines for the Environmental Assessment of Water Management projects (WARPO, 2005). It is a part of the EIA process aimed at involving the project stakeholders into the project development and implementation process. During the consultation process the proposed project interventions were discussed while the results of the impact assessment were shared during the disclosure sessions. In the consultation process, the stakeholders got involved with the study consultants in reforming/developing the project interventions considering the local needs and aspirations in line with the problems and solutions suggested by them. Information about the proposed interventions and findings of the EIA and the EMP were shared with the project stakeholders for obtaining their perceptions, views and feedbacks on the probable changes likely to happen within the project area.

7.2 Objectives

The overall objective of the public consultation is to explore the prospect of the proposed Sachna-Golakpur road project under Sunamganj road division, Sunamganj in terms of environmental and socio-economic benefits and drawbacks. The specific objectives are the following:

Specific objectives

- To familiarize the stakeholders/government agencies with technical, environmental, social, and economic issues of the proposed new Sachna-Golakpur road under Sunamganj road division for better understanding;
- To observe the proposed alignments of the road;
- To see the present status and existing road network of the project area;
- To explore the problems currently faced due to lack of proposed road;
- To know about the expected benefits if the road link is implemented;
- To understand the present status of the river systems including Surma and Baulia rivers;
- To explore the necessity of culverts and bridges on the proposed road;
- To outline impacts (positive/negative) on the environmental and social components and overall livelihood system of the study area;
- To promote public awareness on the proposed project, especially among the potentially impacted

communities/individuals;

- To ask the communities/individuals about the proposed course of action and the project alternatives;
- To solicit the views of affected communities/individuals on environmental and social problems;
- To gather inputs from the affected communities/individuals for crucial decisions regarding mitigation of the identified environmental and social issues;
- To foster cooperation among officers, communities, and the stakeholders to achieve a cordial working relationship for smooth implementation of the project;
- To identify the environmental issues relating to project components;
- To secure people's inputs with respect to project design, selection of mitigation measures, and monitoring strategies, and incorporating suggestions made during consultations into project design; and
- To assess the views of the beneficiary community and their willingness to participate in the project planning and decision making.

7.3 Approach and methodology

Participatory approach has followed for identifying the participants as well as conducting public consultation and disclosure meetings. A multi-disciplinary team has been formed having specializations in respective disciplines pertinent to conduct public consultations as to Sachna-Golakpur Road project. During field visit, the team equipped with GPS, digital cameras, laptop and in-situ testing apparatuses for facilitating the collection of primary data and related project information. The team several times visited the study areas to identify the given alignment and corresponding proposed road location and physically observed of the status of the resources of the study area to prepare baseline scenario. Baseline condition including physical, biological and socio-economic environment of the project area have been identified by the study team during field visit. The base line of the project site will be required to recommend practical and site specific environmental mitigation and prepare and implement environmental monitoring plan during and after the project implementation. Different techniques has been followed during field visit such as; i) consultation with Government and non-Government officials and elected representatives, ii) Questionnaire survey, iii) Focus group discussion and iv) In-situ water test and soil samples collection for lab analysis.

The consultation process so far has solicited inputs from a range of stakeholders, including government officials, experts, and researchers, including elected representatives, residents at the project locations, and project affected persons who may be impacted after the proposed road construction. Initially, the consultants talked with the RHD, LGED, DAE, DLO, DFO, BWDB and other related authorities of the respective areas in order to obtaining their views and suggestions on the project. Key stakeholders were identified through consultation with local people and local government officials. The venue, date and time of those meetings were fixed in consultation with the key persons of the respective venues. The consultant used necessary checklists for facilitating the public consultation and disclosure meetings to maintain uniformity and relevance in discussion and recording the opinions and views of the participants properly.

A checklist was prepared covering the issues like overall briefing of the project including problem of the area with the potential solutions, proposed interventions, probable impacts of selected interventions etc.

During public consultation meeting (PCM), all relevant issues within socio-economic, agricultural, hydrological, fisheries and ecological aspects were discussed in detail. Principal investigator of the multi-disciplinary consultant team facilitated the consultation meeting where the other members of the team were attended and assisted as necessary. The principal investigator displayed maps and other relevant documents of the study area and explained the initial baseline condition and proposed interventions. The other team members explained all relevant points and issues in order to enable the participants to comprehend the proposed interventions/activities properly and to respond, accordingly. The stakeholders' perceived views over the impacts on important environmental and social components (IESCs) along with perceived benefits, risks, threats and demand from the project were identified. The consultants paid the utmost care in recording opinions and views of the participants relevant to the EIA Report.

7.4 Public consultation and disclosure meetings

During the consultation process solicited inputs from a range of stakeholders, including government officials, experts, and researchers, including elected representatives, residents at the project locations, and project affected persons included who may be impacted after the proposed road construction. Focus group discussions (FGD) were carried out during in the public consultation process. In order to conduct the FGD and consultation meetings, checklists have been prepared covering the aspects including an overview of the proposed project and seeking information on the problems of the area with their potential solutions, the local needs and demands have been discussed by giving equal opportunity to all participants including male and female attending in the meeting. During consultation meeting all relevant issues within the water resources, land resources, socio-economic resources, and disaster aspects have been discussed in detail.

7.3.1 Location of public consultation meeting

Public consultation meetings have been held at Sachna bazar, Golakpur Bazar, Kaminipur, Shamim Nagar, Mannanghat, Mominpur Bazar, Kalipur, Uttar Kamlabaj, PaschimTalipur and Kokraporshi. Some photos of Public consultation have been shown in **Figure 7.1.**

PCM at Sachna Bazar

FGD at Mominpur Bazar.

PCM at Kaminipur

FGD at Shamimnagar.

PCM at Golakpur

FGD at Golakpur

PCM at Kokraporshi

FGD at Kokraporshi.

Figure 7.1: PCM and FGD at different Places in the study area

7.3.2 Participants list

A list of the participants attended in different meetings is attributed in the following Table 6.1 with their addresses.

Table 7.1: Name of the Participants including age, religion, date and address who are attended at different meetings and FGD during consultation process

Sl. No.	Name	Age (Years)	Religion	Address	Date
1	Khursid Mia	50	Islam	Uttar Kamlabaj	23/12/2016
2	Chama Akter	16	"	"	"
3	AmbiaKhatun	45	"	"	"
4	NargisAkter	18	"	"	"
5	Md. Hossain Ali	40	"	"	"
6	Nabi Hossain	22	"	"	"
7	Diponkkor Roy	38	Hinduism	Sachnabazar	"
8	Anik Das	18	"	"	"
9	Safiqul Islam	32	Islam	"	"
10	Abdul Motalib	60	Islam	Mominpur Bazar	"
11	Abdul Kadir	48	"	"	"
12	Md. Badsha Mia	28	"	"	"
13	Hanif Mia	70	"	"	"
14	SamsulHaque	30	"	"	"
15	Md. Safiqul Islam	28	"	"	"
16	FazlulHaque	45	"	"	"
17	Raham Ali	70	"	"	"
18	AbdusSattar	45	"	"	"
19	Ashik Mia	40	"	"	"
20	Lal Mia	32	"	"	"
21	Mozaffar Mia	48	"	"	"
22	Sagar Mia	28	"	"	"
23	Abid Ali	40	"	"	"
24	Sagar Mia	28	"	"	"
25	Shameem	39	"	"	"
26	Md. Amir Hosain	45	"	"	"
27	Md. Rubel	22	"	"	"
28	Maram Ali	55	"	"	"
29	Sukkur Ali	65	"	"	"
30	Khurshid	68	"	"	"
31	SamchulAlam	40	"	"	"
32	MojammelHaque	20	"	"	"
33	Oahid Ali	72	"	"	"
34	Sahjalal	27	"	PaschimTalipur	"
35	Nayantara	26	"	Kokraporshi	24/12/2016

Sl. No.	Name	Age (Years)	Religion	Address	Date
36	Nabi Hossain Kazi	37	"	"	"
37	Iqbal Hossain	34	"	"	"
38	Md. Mubarak	30	"	"	"
39	Md. Jamir Hossain	32	"	"	"
40	Sabar Ali	46	"	"	"
41	AbulKalam	45	"	"	"
42	Mahmud Ali	35	"	"	"
43	Johora Begum	45	"	"	"
44	Fulbanu Begum	60	"	"	"
45	Subarba	15	"	"	"
46	Marjina	25	"	"	"
47	Ambia Begum	55	"	"	"
48	Nurjahan	55	"	"	"
49	Israel Ali	50	"	Shamimnagar	"
50	Jamal Hossain Sowdagar	35	"	"	"
51	Khador Banu	45	"	"	"
52	Rahima Khatun	45	"	"	"
53	Kulsum	35	"	"	"
54	Sakina	60	"	"	"
55	Rabeya	60	"	"	"
56	Jobeda	30	"	"	"
57	Jahura	32	"	"	"
58	Shaheda	35	"	"	"
59	Monowara	30	"	"	"
60	Chanchal Hossain	26	"	Kalipur	"
61	Bulbul Ahmed	23	"	"	"

7.3.3 Findings

The proposed Sachna-Golakpur road is very high demanding by the local people as there is no smooth roadway communication facility between Jamalganj and Dharmapasha upazilas. They believe that the construction of the proposed road will play an important role in improving communication in that region and it will enhance the overall socio-economic condition of the region. Among other issues of the proposed road project they also expressed their concerns about road alignment. Since common people of the project area see possibility of connecting Sachna to Golakpur with road along both banks of the Surma River, their opinion as to suitable road alignment has been influenced by their interest. People who live on the left bank of the river think that the proposed should be aligned along the left bank of the river. Many of them are of the opinion that the existing LGED road may be upgraded to this end. On the other hand, people who live on the right bank of the river want that the proposed road should be aligned along the right bank of the river. The public demand for the proposed road is, however, very high. Nobody wants that the road should be much away from his locality. The difference in opinion between the inhabitants of both banks of the river as to preferred road alignment is affected by the fact that at present there is no bridge over the Surma River in the project area or within an easily accessible distance from

their localities. Very positive community attitude towards the proposed road project is reflected by the fact that the people in the project area are willing to sacrifice their lands for road construction. At present they have no easy access to national road network.

The overall findings of the public consultation meeting are given in the following:

- 100% of people in the project site want the proposed Sachna-Golakpur road.
- Tree plantation in both sides of the proposed road. It will be a worthy place for bird.
- Children will get better education as some parents do not send their children to school due to high risk of life during flash flood.
- Education rate and quality of life will be increased after the road construction.
- There will be industrialization on both sides of the road which will decrease the poverty rate.
- Right now they work for only 6 months in year. If the road constructed, they will go to other places to find jobs easily in rainy season.
- The road will be beneficial in every aspect.
- They could shift their houses near roadside.
- Easy communication with Dharmapasha, eventually with Netrokona will improve their life style.
- Urbanization will take place.
- Present dependence on waterway communication will decrease and travel time from one place another would be also decrease.
- Fish production will not be affected after the proposed road construction.
- If the road alignment runs through their homesteads, they want compensation from the government to shift to other places.

7.3.4 Organization Concerns

During the ESIA study a number of field visits were made by the study team members. Consultations have been made with the local government authorities and officials concerned of Bangladesh Water Development Board (BWDB), Roads and Highways Department (RHD), Agricultural Extension Department (DAE), District Livestock Office (DLO), World Fish (WF), District Fisheries Office (DFO), Upazila Engineer, Upazila Livestock Office, Upazilla Agricultural Extension Department and Upazila Project Implementation Office (PIO). The consultants have also talked about the proposed project to elected representatives such as Chairman of Sachna Bazar Union porishad, Vice-chairman of Jamalganj upazilla and Chairman of Uttair Sukhair Rajapur Union.

Local government authorities' particularly union parishad chairmen and members also want that the proposed road should be aligned through the areas that fall under their jurisdiction or nearby the same. According to the incumbent chairman of the Sachna Bazar Union Parishad the proposed road should be aligned along the right bank of the river. He pointed out that the road could be constructed along the right bank of the Surma river with minimum number of road structures as haor water mainly drains into Baulai river system. He also mentioned that there is a BWDB sluice gate across the Baulai river at Insanpur through which water may be drained out. He further added that the haor soil is not suitable for road construction and there is no need for hiring non-local construction laborers as local laborers are able to perform the tasks. He also expressed that there will be no harm to fish, livestock and agriculture resources due to the proposed road construction. He noted that land acquisition should be with acceptable price and

the price may vary from 1 lakh taka per decimal (closer to Sachna Bazar) to 50,000 taka per 30 decimals (haor area). He informed that there will be no need for the outside labor; local people will work as labor. The incumbent chairman of the Uttar Sukhair Rajapur Union has opinioned that the proposed road should be provided with sufficient number of bridges and culverts to protect it from flash flooding from the sudden onrush of water from the Meghalaya Hills. He also mentioned about very positive attitude of the people under his jurisdiction towards the road project as the road will improve the roadway communication facility remarkably.

The vice chairman of Jamalganj Upazila did not directly express his any choice for the alignment of the proposed road. However, his comments on various aspects of the proposed road indicate that he has perceived the road alignment to be along the right bank of the Surma River. He proposed some sluice gates along the proposed road in lieu of bridges or culverts to protect the crops from damage by flood water. He opined that the bridges and culverts should be designed to withstand scour from large flash floods as was happened in 2004. He further added that the bridges and culverts should be provided across the existing channels or drainage routes in order to avoid conflict with the interest of the local people. In this regard he emphasized the need for taking into account the opinions of the people in project implementation.

Figure 7.2: Consultation with the incumbent chairman of the Sachna Bazar Union Parishad and the vice chairman of Jamalganj Upazila.

Figure 7.3: Consultation with the incumbent chairman of the Uttar Sukhair Rajapur Union.

The concerns of the BWDB, LGED, PIO, DLO, DAE and WF as to feasible road alignment and proposed road project have been summarized below:

- There will be no need for the outside labor, local people will work as labor during construction of the road
- LGED has a proposed road plan from Sachna to Golakpur via Kaminipur;
- The proposed road to be aligned along the right bank of the Surma River. If the road could be constructed along the right bank of the Surma river, minimum number of road opening will be required as haor water mainly drains into Baulai river system.
- The proposed road should be well protected against onrush of the water from flash flood and wave action;
- The road project should not have any adverse impact on fish population which is now on the decline due to overfishing;
- The proposed road should at a safe distance from the river;
- The soil of the haor basin is not suitable for construction of roads and bridges. At some places the soil contains too much organic matter;
- The road should have sufficient opening for safe passage of water from flash floods;
- The road project should not be in conflict with FCD projects of BWDB; and
- Bridges and culverts of the proposed road should be designed considering fish passage requirements.

Study team consulting with RHD personnel

Study team consulting with LGED personnel

Study team consulting with Executive Engineer, BWDB.

Study team consulting with Sub-divisional Engineer, BWDB.

Study team consulting with DFO personnel.

Study team consulting with WF personnel.

Study team consulting with DLO personnel

Study team consulting with DAE personnel

Study team consulting with Upazilla Engineer of Jamalganj Upazilla.

Study team consulting with Upazilla PIO of Jamalganj Upazilla.

Figure 7.4: Study team consulting with different Office personnel

Table 7.2: Name of the Official personnel consulted during field visit with addresses

Sl no.	Consulted Persons	Address
1.	Mr. Shafiqul Islam	Executive Engineer, RHD, Road Division Sunamganj.
2.	Mr. Debashish Biswash	Sub Divisional Engineer RHD, Road Division Sunamganj.
3.	Md. Afsar Uddin	Executive Engineer Bangladesh Water Development Board (BWDB) Sunamganj.
4.	Mr. Ranjan Kumar Das	Sub Divisional Engineer Bangladesh Water Development Board (BWDB) Sunamganj.
5.	Md. Rabiullah	Sub Assistant Engineer Local Government Engineering Department (LGED) Sunamganj.
6.	Md. Gias Uddin	District Survey officer District Fisheries Office Sunamganj.
7.	Md. Mizanur Rahman	Technical Specialist, World Fish, Sunamganj.
8.	Mr. Azharul Islam	District Livestock Officer

Sl no.	Consulted Persons	Address
		District Livestock Office Sunamganj.
9.	Md. Jahedul Haque	Deputy Director District Agriculture Extension Office Sunamganj.
10.	Md. Abdus Sattar	Upazilla Engineer Local Government Engineering Department (LGED) Jamalganj, Upazila.
12.	Dr. Safayet Ahmed Siddiquei	Upazila Agriculture Officer Jamalganj Upazila.
13.	Md. Mosarraf Hossain	Upazila Project Implementation Officer (PIO) Jamalganj Upazila.
14.	Md. Abdul Latif	Upazila Livesock Assistant UpazilaLivesock Office, Jamalganj Upazila
15.	Mr. Rasid Ahmed	Incubent Upazila Vice Chairman, Jamalganj Upazila
15.	Mr. Rezaul Karim Shamim	Incumbent chairman Sachna union Parishad
16.	Farhad Ahmed	Incumbent Chairman, Sukhair Rajapur Uttar Union Parishad

8 Environmental Impacts Assessment and Mitigation Measures

The impacts will be both beneficial and adverse. The implementation of any project interventions may have either positive or negative impacts on some environmental and socio-economic components or may have no impacts on some other environmental components. The Sachna-Golakpur road project has both beneficial and adverse impact including direct and indirect impact on the environmental and socio-economic components.

Mitigation refers to the measures that are designed to cope with adverse consequences and to enhance the positive impacts on the environment as a result of the project implementation. Mitigation measures are recommended actions that reduce, avoid or offset the potential adverse environmental consequences of the project activities. The mitigation measures are of curative, preventive and compensatory types. All the measures have been described in this chapter considering three phases namely Pre-construction, Construction and Post-construction. Rapid Environmental Assessment Checklist for this project was prepared to screen the project for environmental impacts and categorization of the project (Appendix 2).

The possible impacts of the proposed project intervention on each of the important environmental component) IEC have assessed under future with project condition (FWOP) and the future without project condition (FWIP). The difference between the two conditions has taken as the impact of the proposed intervention of the IEC. Qualitative and quantitative field assessment has been converted to values indicating magnitude of environmental changes using the scale from 0 to 5 (+5 for maximum positive and -5 for maximum negative).

The following tables describe the impacts with mitigation measures of IEC during pre-construction, construction and post construction phases for the proposed Sachna-Golakpur road works.

Table 8.1: Environmental Impacts and Mitigation Measures during Pre-Construction Phase/Design phase of the Sachna-Golakpur road project

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
Land acquisition and resettlement impacts required due to the project components	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• About 83 ha land need to be acquired. • The acquire land is low lying floodplain mainly involved with the agricultural practices along with fishing .	• About 83 ha land will be modified for construction of road. • Resettlement impacts will be very low as the vast expanse of land of project site is low lying haor or beel area that is very thinly populated.	Permanent	-3	• Appropriate compensation should be provided for Land acquisition and resettlement • Expedite payment of any remaining compensation • These impacts will be addressed through the EMP.
Air quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Air quality is quite satisfactory. • No severe air pollution has been found.	• Dust generation during vehicle movement and construction material transportatio by heavy vehicles. • This impact will be low as the vast expanse of land of project site is low lying haor or beel area that is very thinly populated.	Temporary	-2	• Construction materials (sand/soil) to be covered with thick polythene while transporting • Water to be sprinkled as and where needed
Noise	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur	• Sound is within tolerable limit • No significant source of noise is found.	• Noise may be generated during mobilization of vehicles and construction materials.	Temporary	-2	• Noise levels from vehicles, equipment and machinery to comply with national noise standards.

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
	South Union Fatehpur Union Tahirpur Union South Sreepur Union					
Seismic considerations in design of structures	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• The project site is characterized by High earthquake prone under Zone-I. • The basic seismic coefficient is 0.08g and there is also fault line near the project site.	• The possibility of earthquake, negatively impacted	Permanent	-4	• The designs of the project components will conform to Bangladesh National Building Code, 2006.
Identification of sources of materials	Jamalganj Upazilla Sunamgang Kishoreganj Dhaka Sylhet Dharmapasha Upazilla	• The project site is a remote area and there is unavailability of construction materials	• Difficulty of Construction	Temporary	+1	• The contractor, at the detailed design stage, shall (i) identify all potential material sources (ii) propose quarry sites and sources permitted by government and (iii) verify suitability of all material sources.
Social conflict between owners of land and contractor	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• haor or beel area/ Crop land	• Damage of crop land/ catch fish	Temporary	-2	• Compensate the land owner as per the current value

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
Drinking water availability and water arrangement	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Sufficient Tube-well water for drinking purposes	• Reduced drinking water availability at work place • Water-borne disease may spread out	Temporary	-1	• Prior to the initiation of construction activities, the contractor will be responsible for arrangement of water in every workplace at suitable and easily accessible places for the whole construction period.
Sanitation	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• No sanitation facilities near the work place	• Environmental degradation and health hazards	Temporary	-1	• Required sanitation facilities should be established.
Electricity facility	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• At the project site electricity facility is available.	• Laborers cannot avail modern amenities of life	Temporary	+1	• Electricity connection should be established near the labour shed.
Environmental clearance (EC)	N/A	N/A	N/A	N/A	N/A	• EIA document have to submit to DoE as part of environmental clearance requirement. • The EC is to be obtained prior to commencement of civil works.

Table 8.2: Environmental Impacts and Mitigation Measures during Construction Phase of the Sachna-Golakpur road project

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
Air Quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Air quality is quite good	• Fugitive dust generation during construction work. • The impact will be low as the project site is very thinly populated.	Temporary	-2	• Water to be sprinkled as and where needed
Noise and vibration	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Noise and vibration level are quite good • No significant source of noise has found.	• Noise generation due to contraction work • The impact will be low as the project site is very thinly populated.	Temporary	-2	• Noise levels from vehicles, equipment and machinery to comply with national noise standards.
Connectivity between rivers and haors	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union	• The project area consists of floodplains, levees, haors and rivers • There is distinct connection	• Natural flow regime will be changed • Fish habitat and fish migration will be negatively affected	Permanent	-4	• Provide appropriate road openings for flow of water between river and haor

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
	Fatehpur Union Tahirpur Union South Sreepur Union	between rivers and floodplain • The exsisting connectivity is important for maintaining riverine and floodplain ecosystem				
Flood level	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Monsoon flooding inundates the study area regularly • Design flood level along the road varies froom 8.52m PWD to 8.55 PWD	• The proposed interventions will cause slightly increase in the flood level	Permanent	-5	• Formation level of the road level should be kept considering a free board above design flood level
Road opening for safe passage of flood water.	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	• Monsoon flooding inundates the study area regularly • Early flooding causes damage to crops.	• During rising period of flood water enters into floodplains and during recession period rivers drain the floodplains. This flow system may be hampered.		-5	• Adequate number of road openings should be provided at appropriate locations with proper engineering design for safe passage of flood water • Construction of sufficient number of bridges as

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
						recommended by RRI THM model study to reduce impediment to drainage. • Road structure should be constructed taking into account their hydrologic and hydrologic design parametars.
Strengthening and improving of existing road and structures	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Most of the existing roads and bridges are not in good condition now.	• Social and community disturbances by flooding	Permanent	-1	• Damaged culverts and small roads should be reconstructed with proper engineering design to allow smooth water flow between river and haor/beel.
Bank/slope protection activities	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)		• Creates non-hazardous solid waste	Permanent	-1	• Some generated waste like concrete wastes, sand, bricks, and cement during construction would be collected and dumped on a preselected temporary dumping yard • No dumping of such waste nearby water

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
						bodies • These wastes can be used to raise the level of the construction site or connecting roads.
Water quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• River, Haor and Tube-well water quality is satisfactory	• Construction work of the proposed road will deteriorate the water quality of the river and haor	Temporary	-1	• Control solid waste from construction site • Compliance with DoE standards during and after construction • Manage wastewater discharge and solid waste from establishment after construction
Reduce terrestrial vegetation	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)		• Damage to trees and clearance of vegetation at project location • This impact will be low as the project site is in low-lying haor area.	Temporary	-1	• Minimize vegetation loss as much as possible • Implement plantation along the Sachna – Golakpur road sides after the road construction
Aquatic habitat quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South		• Deteriorate aquatic habitat quality for incautious spillage of concrete materials into river and haor	Temporary	-1	• Care should be taken to minimize spillage of concrete materials into the river water

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
	Union Fatehpur Union Tahirpur Union South Sreepur Union					
Destruction of birds, animals etc.	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	• Different types of birds are available in the project site hoar/beel area).	• Hunting reduces birds, as different types of birds are available in the project site.	Temporary	-1	• Construction workers should be advised to protect natural resources and wild animals. • Hunting is strictly prohibited in the project site.
Material handling at site	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	-	• Workers may be injured during material handling at project site	Temporary	-1	• All workers employed for mixing asphaltic material, cement, concrete, etc. will be provided with protective foot wear and goggles.
Safety measures During construction	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	-	• During construction safety measures will be required to protect the workers.	Temporary	-1	• All relevant provisions of the Bangladesh Labor Act, 2006 and Bangladesh National Building Code, 2006 will be adhered to, with regards to provision of adequate safety measures during construction.
First aid	Sachna Bazar Union Jamalganj Union Sukhair Rajapur	-	• Workers may be injured at project site	Temporary	-1	• At every workplace, a readily available first aid unit, including an

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
	North Union (Golakpur)					adequate supply of sterilized dressing material and appliances, will be provided as per the factory rules. • Suitable transport will be provided to facilitate transfer of injured or ill persons to the nearest hospital.
Hygiene in the construction camps and site	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	• Hygiene at the project site is quite satisfactory	• Negative impact on health of workers in the project	Temporary	-2	• All temporary accommodations will be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing. Safe drinking water in sufficient quantity for the work force will be provided at the construction site as well as at the construction camps. • Adequate toilets, separate for women and men, shall be provided at the construction sites, with septic tanks.

IEC	Location	Baseline condition	Impacts	Duration/ Extent	Magnitude of impact	Mitigation Measures
						Garbage bins will be provided in the camps and regularly emptied, and the garbage disposed of in a hygienic manner. • Adequate health care will be provided for the work force.
Employment generation	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	Normal employment situation at the project area	• Additional employment will be generated during construction work	Temporary	+3	• Recommend the contractor to employ local people by giving priority to women and vulnerable groups • Ensure equal wages to male and female for equal amount and type of work • Promote use of local materials, particularly consumables items.

Table 8.3: Environmental Impacts and Mitigation Measures after Construction of the Sachna-Golakpur road project

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
Regional hydrology and Flooding	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• The project area gets inundated every year during monsoon flood • The velocity of flow over the floodplain is generally low. • Occurrence of a high discharge from the Meghalaya Hills during rising stage, the flow velocity over the north floodplain and the Surma river increases. • During falling stage of the Surma river flood, the north floodplain drains into the Baulai and the Rakti rivers that drain into the Surma river. • The flow velocity at the outfall of the Baulai and the Rakti rivers increases substantially • Flow velocity of the	• The proposed Sachna-Golakpur road alignment will be constructed parallel to the Surma river that causes obstruction to natural flow of water. • The road across the floodplain causes blockage of floodplain flow and flow velocity through the road structures is much higher than that over the floodplain.	Will remain in Same condition alike baseline scenario.	• The study area gets flooded during monsoon and causes damage to crops and properties • During flash-flood flow occurs over the road and destroy crops and properties • During flash flood, even the proposed road may get damaged if this issue properly addressed.	-4	• Adequate opening for free flow of flood water. • Provide sufficient number of bridges as recommended by RRI THM model study to reduce impediment to drainage flow. • Road alignment and formation level of the road should be as per suggestions given from RRI model study • During extreme event proper monitoring

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
		Surma river in the downstream of the outfalls increases. • Occurrence of a flash flood from the Meghalaya Hills causes further increase in the flow velocity at the outfalls and in the Surma river downstream.					should be done by RHD and local community
Drainage congestion	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Drainage congestion exists in the project areas and is mainly due to monsoon flooding. • During flash flood, the capacity of the Baulai river is not enough to convey all flood water to the Surma river. As a result, substantial flood water enters into the Surma river in the form of floodplain flow.	• Monsoon flooding will inundate these areas regularly. The proposed road may aggravate drainage congestion.	Will remain in Same condition alike baseline scenario.	• Monsoon flooding inundated these areas regularly. Proposed road would create more drainage congestion.	-3	• Use the recommended locations, number and size of the bridge recommended by RRI THM model study • The model study suggested that three bridges are needed at the Sachna end of the proposed road to allow for entrance of Surma river flood flow into the floodplain and

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
							seven bridges are needed at and upstream of the Surma-Baulai confluence to allow for safe and natural passage of flash flood flow from the Meghalaya Hills during recession period of the Surma river flood.
Erosion	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	Erosion is a common phenomenon. Erosion usually takes places at the bend locations of the Surma river	Implementation of the proposed work may impact erosion slightly.	Will remain in Same condition alike baseline scenario.	Erosion causes damage of crops and lands.	-1	Erosion protection measures may be under taken where necessary through close monitoring of the developments.
Sedimentation	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North	Sedimentation has been taking place in the rivers and floodplains.	Sedimentation May to some extent in the floodplain	Will remain in Same condition	Implementation of the proposed work may have adverse impact	-2	Dredging at the silted up location of the project site.

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
	Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	Sedimentation also occurs from upstream with water in the floodplain during moonsoon	increase.	alike baseline scenario.	on sedimentation at the north side of the road.		
Fish habitat	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	The fish habitat is quite good.	Land filling for construction of road would reduce seasonal floodplain. After road construction people may fill up floodplains near the road to build houses Markets etc.	Will remain in Same condition alike baseline scenario.	• Occupation of floodplains for road construction and development purposes will reduce floodplain fish habitat	-1	• Adequate opening for free flow of water and fish migration. • Use the recommended locations, number and size of the bridges • Limiting floodplain development
Fish migration, Fish species Fish diversity	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union	Fish migration, fish species and fish diversity condition is quite good.	The proposed road construction, would be interruption for fish migration or movement of larger and small	Will remain in Same condition alike baseline scenario.	The proposed road construction, would interruption of fish migration or movement for larger and	-2	• Adequate opening for fish migration. • Use the recommended locations, number and size of the bridge

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
	Fatehpur Union Tahirpur Union South Sreepur Union		fish species.		small fish species.		• Provision of fish paths
Land use pattern	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	Mainly for human settlement, agriculture and aquaculture	• Industial and commercial use of land may be increased. • Number of human settlements may increased and land use for agriculture may decrase	If the project is not implemented, there would be no change of land use practices.		+3	Proper land use planning
Loss of fish production	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• About 83 ha land will be modified for construction of the proposed road. • This land is low lying floodplain mainly involve with the agricultural practices along with fishing	• The floodplain fish production would be declined due to modification of land for construction of the road	If the project is not implemented, there would be possibility to loss of fish production due to constraint of fisheries manageme	• Expected decrease in fish production would be decreased about 8% in FIWP over FWOP	-1	These impacts will be addressed through the EMP.

IEC	Location	Baseline condition	Future with project condition (FWOP)	future without project condition (FWIP)	Impacts	Magnitude of impact	Mitigation Measure
				nt fisheries resources management.			
Loss of crop production	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• About 83 ha land will be modified for construction of the proposed road. • This land is low lying floodplain mainly involved with the agricultural practices along with fishing • The total production of rice is about 50897 metric tons and non-rice crops about 55,667 metric tons annually in the project area.	• The production of crops mainly rice and vegetables that would be declined due to modification of land for construction of the road.	If the project is not implemented, there would be no change of land use practices.	• Expected decrease in crop production would be decreased about 10% in FIWP over FWOP	-2	• Tree plantation along the both sides of the Sachna-Golakpur road.

9 Environmental Management Plan

Environmental Management Plan (EMP) for the construction of Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj comprises of enhancement plan for increasing the benefits of the positive impacts and mitigation plan for minimizing the effect of the negative impacts. All the measures under the EMP have been described in this chapter considering three phases. These phases are Pre-construction, Construction and Post-construction. The EMP also includes an environmental monitoring plan for keeping track of changes taking place in the environmental and social components to check if the intended benefits are derived from the project. There is also EMP Implementation Monitoring Plan for Post-construction Phase.

Different measures that have been proposed for the augmentation of beneficial impacts and minimization of the adverse impacts of the proposed road works are described in this chapter.

9.1 Augmentation measure / Plans for Enhancement

9.1.1 Employment opportunities to increase in incomes and to combat poverty

One of the major direct beneficial impacts of the proposed project during the construction stage is creation of employment opportunities. The opportunities will be direct by working in the construction work and indirect by providing services to the construction crew. The amount of money that is earned in wages will directly support undertaking of various economic activities and enterprise development. This impact is direct, of high significance, regional and short-term in nature.

Benefit augmentation measure: The following measures will be implemented:

- Recommend the contractor to employ local people by giving priority to women and vulnerable groups
- Ensure equal wages to male and female for equal amount and type of work
- Promote use of local materials, particularly consumables items.

The proposed Sachna-Golakpur Road is likely to improve regional connectivity. The proposed road will facilitate direct communication between Jamalganj and Dharmopasha upazilla and Sunamganj town will be connected with Netrokona and Mymensingh towns as well as with Dhaka city through RHD Sunamganj-Netrokona-Mymensingh-Dhaka road. It would result in increased commercial activities. Therefore, people in this area are likely to have access to more job opportunities. People sell their products like egg, fish other things to the markets. Moreover, people from Jamalganj or Dharmopasha are likely to go Sunamganj or Dhaka to work with high wages because of smooth roadway communication system. In this way after construction of the proposed road income of the people will reduce which poverty in this area. This impact is direct, of high significance, regional and long term in nature.

9.1.2 Skill Enhancement during construction period

Employment in the construction work is likely to enhance skills of workers, and a large number of people will get practical or hands-on training. This will enhance their technical skills, which could get them good job in future. The skill and knowledge acquired from the Project during construction will enhance employment opportunities. Such trained human resource can earn livelihoods from similar project in future. This impact is indirect but of high significance, regional, and long-term in nature.

Benefit augmentation measures: Workers will be encouraged to develop skills while working with contractors through hands-on training.

9.1.3 Enterprise Development and Business Promotion during construction

Different types of commercial activities will come into operation during the construction period in order to meet the demand of workers. Since they will have good purchasing power, they will regularly demand for different types of food, beverage and other daily necessary items. To meet these demands, many local and outside people may operate a number of small shops and restaurants around the construction camp. Similarly, construction work will demand construction materials like aggregate, cement etc. This will increase market for national industries. The impact is indirect, of medium significance, local, and short term in nature.

Benefit augmentation measures: Use of local consumable and construction materials will be given priority.

9.1.4 Enhancement of Transportation and Communication System after construction of the road

After construction of the proposed road link between Sachna Bazar and Golakpur Bazar, there will be a direct roadway communication system between Sunamganj (Jamalganj) and Natrokona-Mymensingh-Dhaka. The people travelling from Sunamganj to Dhaka and from northern and north-western regions to Sunamganj will get benefit in terms of reduced travel time and cost if the proposed road link between Sachna Bazar and Golakpur Bazar is established. Roadway commutation will be much easier as there will be no need of going to Sunamganj via Sylhet, and hence, distance between Dhaka and Sunamganj will be reduced by 59 km if this road is constructed. The communication between Sunamganj and other towns and cities of the country will also be easier.

The project area is situated on the bank of the Surma is low lying haor region. The scattered villages are connected with one another and with nearby bazars by village unpaved roads. These roads are accessible only in the dry season and hired motorcycle is the main mode of transport in Sachna, Shamimnagar, Mominpur, Monnanghat, etc. riding on a motorcycle on these unpaved rough crisscross roads especially for female and children. However, during monsoon these roads go under water and village people have to depend solely on boat to maintain communication among them. If the proposed road is constructed, villagers' will get benefit to use the road in the monsoon and in dry season too, which will ensure all weather communication system communication.

These impacts will be direct, of high significance, regional and long-term.

9.1.5 Enhancement of trade and commerce activities after the construction of road

Sunamganj is naturally resourceful with fish, egg and other agricultural products. These agricultural products are likely to promote agro-based small scale industries in Sunamganj with the proposed road project. This district has been also known for the stone and sand business (river's sand). It has been supplying river sand, natural sand, crushed stone, gravel and shingle. Beside this, there are more than a thousand businessmen are involved in this business, where about fifty thousand workers are directly dependent on this sector. If the roadway is constructed, it will be easier to transport these products from Jamalganj to other parts of the country. This roadway will connect Jamalganj Upazilla headquarter to the district towns and rest of the country. In this way, Trade and Commerce will be increased and therefore, the socio-economic condition of the people will be improved.

These impacts will be indirect, of high significance, regional and long-term.

9.1.6 Enhancement in accessibility in health facilities, Schools and colleges

The proposed Sachna-Golakpur road will enhance the medical facilities to a large extant of population in the project area. At people of the project area need to reach at least Jamalganj and Dharmapasha upazila head quertarsto get better medical assistance as there is no improved facility. It has been known from the people of the project area that, if one gets ill in an odd time such as night in monsoon they can only depend on fate. Sometimes in a worst condition, due to the long time spending in a really rough road to reach medical centers kills the patient on the road. People mainly depend on quack doctor and untrained physician followed by a few paramedic physicians. The main transportation in the area is motor-cycle and rickshaw. Due to the ticklish transportation system, trained physicians are hardly interested to go there and give treatment. The proposed new road will facilitate smooth communication between Jamalganj and Dharmapasha upazilas which will eventually smoothen communication from Sunamganj to Netrokona districts. As a result, the people of the project area could avail better health care facilities due to reduced time to reach nearby medical centers. Improved communication system will encourage establishment of many new medical centers in the project area.

Along with medical facilities, it will also boost up the education rate of the children of the project area. As the existing roads flooded during monsoon, students cannot make effort to take education for a long time of a year. Some parents expressed their fear to let their children to go school during monsoon and flash flood season as there are enormous risks of injury or even death for their children in these seasons. So they stop sending their children to school for education. In some case, due to poverty, they stop education of children. There are only primary education facilities followed by a few secondary education facilities in the study area. Students need to reach Jamalganj and Dharmapasha upazila to get higher secondary or college education. Due to bad road communication system, teachers of these schools often make transfer to a town school. The new road will reduce risks in communication to schools, attract better teachers to stay there, decrease poverty situation, construct new high school and college in the project area and hence increase the education rate and eventually improve the quality of a life in the project area.

These medical and education facilities will further increase the living standard of the project area. These impacts will be indirect, of high significance, regional and long-term.

The proponent is committed to implement the following benefits augmentation measures, as discussed above:

9.2 Environmental management plan for Mitigation of the proposed Sachna –Golakpur road

The EMP includes negative impacts of the proposed interventions which have been assessed in the environmental and social impact assessment stages as furnished in the previous chapter. Measures to minimize and/ or avoid the negative impacts are suggested, and enhancement and compensation measures also include in the following tables (**Table 9.1** to **Table 9.3**). The EMP is developed for pre-construction, construction and post construction stages together with a monitoring plan.

Table 9.1: Environmental Management Plan (EMP) including Monitoring at Pre-Construction Phase/Design phase

IEC	Location	Impacts	Magnitude of impacts	Mitigation/ Enhancement/ Compensation Measures	Magnitude with EMP	Monitoring	Responsible Agency
Air quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Dust generation during vehicle movement and from rotation of construction materials movement by vehicles. • This impact will be low as the project area is thinly populated.	-2	• Covering construction material (sand/soil) with thick polythene while transporting • Water sprinkling where needed	0	RHD/ Contractor	Contractors
Noise and vibration	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Noise may be generated during mobilization of vehicles and construction materials. This impact will be low as the project area is thinly populated.	-2	• Noise levels from vehicles, equipment and machinery to comply with national noise standards	0	RHD	Contractors
Land resources	-	• There would be no impact on land resources at pre-construction stage.	0	• There would be no mitigation measure in this phase.	-	-	-
Impacts on	-	• There would be no impact on fisheries	0	• There would be no	-	-	-

IEC	Location	Impacts	Magnitude of impacts	Mitigation/ Enhancement/ Compensation Measures	Magnitude with EMP	Monitoring	Responsible Agency
fisheries		at pre-construction stage		mitigation measure in this phase.			
Seismic considerations in design of structures	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• The project area is high earthquake prone site (zone) and has a basis seismic coefficient of 0.08g.	-4	• The designs of the project components will conform to Bangladesh National Building Code, 2006.	0	RHD	RHD, Contractor
Identification of sources of materials	Jamalganj Upazilla Sunamgang Kishoreganj Dhaka Sylhet Dharmapasha Upazilla	• Lack of easily accessible sources of materials	-2	• The contractor, at the detailed design stage, shall identify all potential material sources, propose quarry sites and sources permitted by government and verify suitability of all material sources.	0	RHD	Contractor/ RHD
Drinking water availability and water	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union	• Drinking water shortage may occur	-2	• Prior to the initiation of construction activities, the contractor will be responsible for arrangement of water	+1	RHD	Contractor/

IEC	Location	Impacts	Magnitude of impacts	Mitigation/ Enhancement/ Compensation Measures	Magnitude with EMP	Monitoring	Responsible Agency
arrangement	Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union			in every workplace at suitable and easily accessible places for the whole construction period. • Sufficient supply of cold potable water will be provided and maintained at the construction camps.			
Design and layout - Construction camps and/or hot mix plants, storage areas, and disposal areas	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Pollution from construction materials	-1	• The construction camps, hot mix plants, storage areas, and disposal areas will be located away from river/ beels and other water bodies. At these locations, the contractor will work out layouts adhering to the air and water standards prescribed by DoE.	+1	RHD	Contractor and RHD

Table 9.2: Environmental Management Plan (EMP) including monitoring during Construction Phase

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
Air Quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Fugitive dust generation during construction work.	-2	• Water to be sprinkled as and where needed	-1	Monitor air quality	RHD and Contractor
Noise and vibration	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Noise generation due to construction work	-2	• Noise levels from vehicles, equipment and machinery to comply with national noise standards.	0	RHD	Contractor
Land acquisition and resettlement impacts	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Land acquisition and resettlement impacts required due to the project components • Resettlement	-3	• Minimize land acquisition and resettlement • Appropriate compensation should be provided for Land	+1	Monitor proper compensation and resettlement	RHD/DC office

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
		impact will be low as the vast expanse of land of project site is low lying haor or beel that is very thinly populated.		acquisition and resettlement			
Connectivity between rivers and haors	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Natural flow regime will be changed • Fish habitat and fish migration will be negatively affected	-4	• Provide appropriate road openings for flow of water between river and haor • Provide 10 bridges along the proposed road for passage of water according to THM model study	-1	RHD and Contractor	RHD
Flood level	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• The proposed interventions will cause slightly increase in the flood level.	-5	• Formation level of the road level should be kept considering a free board above design flood level	-1	RHD	RHD

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
	(Golakpur)						
Road opening for safe passage of flood water.	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• During rising period of flood water enters into floodplains and during recession period rivers drain the floodplains. This flow system may be hampered.	-5	• Adequate number of road openings should be provided at appropriate locations with proper engineering design for safe passage of flood water • Construction of sufficient number of bridges as recommended by RRI THM model study to reduce impediment to drainage. • Road structure should be constructed taking into account their hydrologic and hydrologic design parametars.	-2	RHD	RHD
Fish habitat	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur	• Occupation of floodplains for road construction and development purposes will reduce floodplain fish habitat	-2	• Adequate opening for free flow of water and fish migration. • Use the recommended locations, number and size of the bridges • Limiting floodplain development	+1	RHD and DoF	RHD

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
	Union						
Employment opportunity	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Facilitate new employment during construction	+2	• Recommend the contractor to employ local people by giving priority to women and vulnerable groups • Ensure equal wages to male and female for equal amount and type of work • Promote use of local materials, particularly consumables items.	+3		
Bank/slope protection activities	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Creating non-hazardous solid waste	-2	• Some generated waste like concrete wastes, sand, bricks, and cement during construction would be collected and dumped on a preselected temporary dumping yard • No dumping of such waste nearby water bodies • These wastes can be used to raise the level of the construction site or connecting roads.	+1		
Water quality	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Construction works will deteriorate the water quality of	-1	• Control solid waste from construction site • Compliance with DoE standards during and after	+1	Monitor and control waste water discharge	RHD and Contractor

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
		the rives and haor/beel.		construction • Manage wastewater discharge and solid waste from establishment after construction			
Reduce terrestrial vegetation	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Damage to trees and clearance of vegetation at project location • This impact will be low as the project site is in low -lying haor area.	-1	• Minimize vegetation loss as much as possible • Implement plantation along the Sachna – Golakpur road sides after the road construction	+1	RHD	RHD and Contractor
Aquatic habitat quality	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Deteriorate aquatic habitat quality for incautious spillage of concrete materials into river water	-1	• Care should be taken to tominimize spillage of concrete materials into the river water	0	RHD	RHD and Contractor
Destruction of birds, animals etc.	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union Sachna	• During construction hunting reduces	-1	• Construction workers should be advised to protect natural resources	0	RHD	Contractor

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
	Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	birds, as different types of birds are available in the project site (hoar/ beel area).		and wild animals. • Hunting is strictly prohibited in the project site.			
Material handling at site	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Workers may be injured during material handling at project site	-2	• All workers employed for mixing asphaltic material, cement, concrete, etc. will be provided with protective foot wear and goggles.	+1	Contractor	RHD and Contractor
First aid	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Workers may be injured at project site	-1	• At every workplace, a readily available first aid unit, including an adequate supply of sterilized dressing material and appliances, will be provided as per the factory rules. Suitable transport will be provided to facilitate transfer of injured or ill persons to the nearest hospital.	0	RHD and contractor	RHD and contractor
Hygiene in the construction camps and site	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union	• Reduce hygienic condition at project site	-2	• All temporary accommodations will be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking, and washing.	+2	RHD	Contractor

IEC	Location	Impacts	Magnitude of Impact	Mitigation/ Enhancement Compensation/ Measures	Magnitude with EMP	Monitoring	Responsible Agency
				• Safe drinking water in sufficient quantity for the work force will be provided at the construction site. • Adequate toilets, separate for women and men, shall be provided at the construction sites, with septic tanks. • Garbage bins will be provided in the camps and regularly emptied, and the garbage disposed of in a hygienic manner.			

Table 9.3: Environmental Management Plan (EMP) After Construction and during operation

IEC	Location	Impact	Magnitude of impact	Mitigation/ Enhancement Measures	Magnitude with EMP	Monitoring	Responsible Agency
Regional hydrology and Flooding	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	The study area flooded regularly during monsoon and causes damage to crops and properties	-4	• Adequate opening for free flow of flood water. • Provide sufficient number of bridges as recommended by RRI THM model study to reduce impediment to drainage flow.	+1	Safety of road bridge and culvert will be monitored during extreme flood	RHD and Local community
Drainage congestion	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	Monsoon flooding inundated these areas regularly. Proposed road would create more drainage congestion.	-3	• Use the recommended locations, number and size of the bridges recommended by RRI THM model study	-1	-	RHD and Contractor
Erosion	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	Erosion is a common phenomenon. Implementation of the proposed work impact erosion slightly.	-1	• Erosion protection measures may be under taken where necessary through close monitoring of the developments.	0	Safety of road and bridges will be monitored during extreme flood to reduce erosion	RHD and local people.
Sedimentation	Sachna Bazar Union Jamalganj Union	Implementation of the proposed work	-2	Dredging at the silted up location	-1	RHD	RHD

IEC	Location	Impact	Magnitude of impact	Mitigation/ Enhancement Measures	Magnitude with EMP	Monitoring	Responsible Agency
	Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	may have adverse impact on sedimentation at the north side of the road.		of the project site.			
Fish habitat	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	Occupation of floodplains for road construction and development purposes will reduce floodplain fish habitat	-2	• Adequate opening for free flow of water and fish migration. • Use the recommended locations, number and size of the bridges • Limiting floodplain development	-1	RHD, DOF	RHD, DOF
Fish migration, Fish species Fish diversity	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	The proposed road construction, would reduce seasonal floodplain which would reduce fish migration, species and diversity	-2	• Adequate opening for fish migration. • Use the recommended locations, number and size of the bridge • Limiting floodplain development	0	RHD, DoF	RHD, DoF
Loss of crop	Sachna Bazar Union	• The production	-2	• Tree plantation	-1	Contractor,	RHD

IEC	Location	Impact	Magnitude of impact	Mitigation/ Enhancement Measures	Magnitude with EMP	Monitoring	Responsible Agency
production	Jamalganj Union Sukhair Rajapur North Union	of crops mainly rice and vegetables that would be declined due to Modification of land for construction of the road. • Expected decrease in about 10% in FIWP over FWOP		along the both sides of the Sachna-Golakpur road.		RHD	
Service Accessibility to Health	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Expected to increase accessibility to Health due improvement of the communication system	+3	• Improve rural/local roads for better access to improve healthcare services and better movement ambulance.	+4	RHD LGED	RHD
Service accessibility to Tourist/ Recreation	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South	• Provide better accessibility to the tourist spots in the region especially the most magnificent	+2	• Improvement of rural and regional roads for better traffic movement • Repair and widen existing narrow road • Provide tourist	+3	RHD BPC	RHD BPC

IEC	Location	Impact	Magnitude of impact	Mitigation/ Enhancement Measures	Magnitude with EMP	Monitoring	Responsible Agency
	Union Fatehpur Union Tahirpur Union South Sreepur Union	'Tanguar haor' through road sign and tourist facilities.		facilities			
Education/ literacy	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Literacy rate will be increased	+4	• Provide better and safer walking / travel routes for the students.	+5	RHD	RHD
Transport and road communication	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Facilitate direct roadway communication between Sunamganj (Jamalganj) to Natrokona-Mymensingh-Dhaka. • Smoothen communication within villages for Hat, bazar etc.	+4	• Improvement of rural and regional roads for better traffic movement • Repair and widen existing narrow road	+5	RHD	RHD,LGED and Contractor
Employment opportunity	Sachna Bazar Union Jamalganj Union Behli Union	• Create new employment	+4	• Employment in new industries and business in the	+5	-	-

IEC	Location	Impact	Magnitude of impact	Mitigation/ Enhancement Measures	Magnitude with EMP	Monitoring	Responsible Agency
	Sukhair Rajapur North Union Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union			project site • Employment in city or adjacent areas such as Sunamganj, Kishorgaj etc. due to smooth communication and higher wages			
Industrial activities	Sachna Bazar Union Jamalganj Union Sukhair Rajapur North Union (Golakpur)	• Generate new agro-based industries	+2	• Ensuring compliance with the DoE • Proper road /river/ haor connectivity • Industries should be discourage within haor areas	+3	RHD	RHD and Contractor
Travel Safety	Sachna Bazar Union Jamalganj Union Behli Union Sukhair Rajapur North Union (Golakpur) Joysree Union Sukhair rajapur South Union Fatehpur Union Tahirpur Union South Sreepur Union	• Reduce travel safety	-1	• Facilitate travel safety • Proper traffic safety measures and regulations especially near bazar sides such as Sachna Bazar, Golakpur Bazar and Mominpurpur Bazar.	+2	Complience of contractor with agreement regarding road safety measures	RHD and Contractor

Table 9.4: EMP Implementation Monitoring Plan at Post-construction Phase

IEC	Indicator	Method	Location	Frequency	Monitoring Cost (Lac Tk)*	Responsible Agency
Water Resources	Physical condition of the road and bridges	Check safety of road and suggested bridges	Suggested locations by RRI model study	Twice in a year. One in extreme flood and another in dry season	5 lac per year	RHD and local people
	Erosion	Check whether any structure of the road is under threat of river bank erosion or damage of road side slope by parallel current or wave action	Suggested locations by RRI model study	During monsoon	3 lac per year	RHD, BWDB and local people
	Siltation	Rate of siltation of river and haor should be measured by measuring the amount of bed level rise	Suggested locations by RRI model study	Twice in a year	2 lac per year	RHD and BWDB
Agricultural Resources	Crop production	Focus Group Discussion (FGD) and individual discussion with farmers should be followed.	All unions of the project area	At harvest time of each cropping Season.	1lac per year	DAE and RHD
	Fish species diversity	Through surveying the species diversity and composition of the active gear	All unions of the project area	Three times per year	5 lac per year	Consultant and RHD

9.2 Institutional Arrangements

Roads and Highways Department (RHD) is the leading agency for road development under the Ministry of Road Transport and Bridge (MRTB). It is responsible for translating government policies for the road sub-sector into the provision of services. The services it provides include planning, design, construction and maintenance of the Strategic Road Network, and provisions to ensure a reasonable level of service for all road users. The RHD has appointed River Research Institute (RRI) to conduct the mathematical model study and EIA study of the Project 'Topographical, Hydrological and Morphological Study using Mathematical Model for the Proposed New Sachna-Golakpur Road under Sunamganj Road Division, Sunamganj'.

The primary institution for environmental management is the Department of Environment (DoE) under the Ministry of Environment and Forest (MoEF). The DoE is the authority with the mandate to regulate and enforce environmental management, including control of pollution of water resources and ensuring adequate EIAs.

The agencies involved in the implementation of the Project and clearance of environmental assessment document are following:

- Ministry of Road Transport and Bridge (MRTB)
- Ministry of Environment and Forest (MoEF)
- Roads and Highways Department (RHD)
- Department of Environment (DoE)

10 Conclusions and Recommendations

10.1 Conclusions

The project area is dominated by floodplains with seasonally flooded tectonic depressions known as haors and beels. The area is isolated and far from development activities due to lack of communication facilities. The construction of the proposed Sachna-Golakpur Road is very tough work as the road run through the hydrologically complex and environment sensitive low-lying haor/beel area. The proposed Sachna-Golakpur Road will connect Jamalganj and Dharmapasha upazilla directly that will generate direct and shorter roadway communication between Sunamganj (Jamalganj) and Natrokona-Mymensingh-Dhaka, and western part of Bangladesh. Currently, there is no direct road link between Jamalgonj and Dharmapasha upazilla either from RHD or LGED. RHD regional road (R370) terminates at Sachna Bazar of Jamalganj upazilla and Netrokona-Mymensingh-Dhaka road. The proposed road will link the missing part of the RHD regional road (R370). After construction of the proposed road therefore, Sunamganj town will be connected to Netrokona and Mymensingh towns as well as with Dhaka city through RHD Sunamganj-Netrokona-Mymensingh-Dhaka road.

The ESIA study shows that the establishment of the Sachna-Golakpur road link has both positive and negative impacts. Enhancement of communication systems, employment opportunity, improvement of trade and commerce, poverty alleviation, enhancement in accessibility in health facilities and schools & colleges are the major positive impacts after the proposed road construction.

The major positive impacts after construct tion of the proposed Sachna-Golakpur road project are summarized bellow:

- The overall communication system would be improved in this region after constraction of the propsed road. The proposed road will connenct Jamalganj and Dharmopasha upazilla and therefore, Sunamganj town will be linked with Netrokona and Mymensingh towns as well as with Dhaka city through RHD Sunamganj-Netrokona-Mymensingh-Dhaka road.
- After the construction of proposed road, people of this region will get benefit in terms of reduced travel time and cost. Distance between Dhaka and Sunamganj will be reduced by 59 km if this road will construct. The communication between Sunamganj and other towns and cities of the country will also be easier.
- The people of this area would avail to access all weather road after constrauction of the proposed road. At present the people of Jamalganj and Dharmopasha are connected to each other and with nearby bazars by very bad quality village roads in dry season. During monsoon the village roads go under water and village people have to depend solely on boat to maintain communication among them. If the proposed road will be constructed, villagers' will get benefit to use the road in the monsoon and in dry season too, which will ensure all weather communication system communication.
- With improved roadway communication system, people of the project area will be able to have excess to larger marketing facilities for their agro-products.The project area is naturally resourceful with fish, egg and other agricultural products. These agricultural products are likely to promote agro-based small scale industries in Sunamganj with the proposed road project.

- People in this area are likely to excess more job opportunities after construction of the proposed road. People from Jamalganj or Dharmopasha are likely to go Sunamganj or Dhaka to work with high wages because of smooth communication system. In this way after construction of the proposed road income will be increased which combat poverty in this area. In this way, trade and commerce will be increased and therefore, the socio-economic condition of the people will be improved. Therefore, this road would be in turn help to increase income of the people, employment generation, development of trade and commerce and finaly would be increased socio-economic condition of this area.
- The proposed new Sachna-Golakpur road will enhance the medical facilities in the project area. Now- a- days, people of the project area need to reach at least Jamalganj and Dharmapasha upazila to get better medical assistance. Even, if one gets ill in an odd time such as night in monsoon they can only depend on their fate. The proposed new road will facilitate smooth communication between Sunamganj and Netrakona districts through Jamalganj and Dharmapasha upazila. This communication will would be improved the health facilities by decreasing time to reach medical centre as well as new establishment of medical centers in the project area.
- Along with medical facilities, the proposed road would also boost up the education rate and quality of the children of project area. As the existing roads flooded during monsoon, students cannot make effort to take education for a long time of a year. Teachers of these schools also make their move to transfer to a town school due to bad communication. Students need to reach Jamalganj and Dharmapasha upazila to get higher secondary or college education. The new road will reduce risks in communication to schools, attract better teachers to stay there, decrease poverty situation, construct new high school and college in the project area and hence increase the education rate and quality of life in the project area.

The ESIA study shows that there might be some adverse impacts for the proposed Sachna-Golakpur road construction. The major negative impacts of the proposed Sachna-Golakpur road project are outlined bellow:

- The proposed road will be constructed in the low-lying haor/beel area and therefore, the most negative impacts on environmental components are related to water resources. Water resources problems in haor area such as flush flood, wave action, flood level, siltation and bank erosion would be negatively impacted on the proposed road. So, the design related issues such as road location, alignment and structure of the road are taken in important consideration.
- The other major impacts on the environmental components would be that for construction of the proposed road around 83 hectares of land would be acquired which mostly belongs to private owners.
- The land will be modified from low land to high land for the construction of the road that would be incresed loss of biodiversity.
- Due to construction work and movement of heavy vehicle, air and water contamination and noise generation would be deteriorated at the construction site.
- Land use pattern in this area will be changed temporary during the construction of labor sheds, contractor’s office and material stockyard.
- Traffic, excavation and filling operations may create some safety hazards for the local population as well as for the construction workers.

- Fish habitat and fish production are likely to be declined due to modification of the land for construction of the road during and after the proposed road construction.
- Fish migration and fish diversity would be impacted as there is connectivity between rivers and haors as well as adequate road opening for free passage of water is required.

This ESIA shows that the significance of the negative environmental impacts will be mostly due to design and construction-related impacts including road location, alignment, structure, dimension and road opening for drainage etc. It is to be noted that the resultant potential impacts can be offset through proven mitigation measures during the design and adoption of good engineering practices in construction and operation. The ESIA carried out for the project shows that the adverse environmental impacts can be addressed through proper planning, location and design of the components, control of construction activity, and mitigation/enhancement measures. The EMP provides for mitigation of all identified impacts. Further, the proposed project components have been discussed with the stakeholders, and no significant issues requiring redress in terms of environmental safeguards have been identified. This impact is direct, of high significance, regional and long term in nature.

This ESIA study shows that the beneficial impacts far outweigh the adverse one after considering EMP. The ESIA study shows that the most of the beneficial impacts are in high significance, regional and long term in nature. Proposed project has been categorized as Category 'Red' based on Environment Conservation Rules 1997 and an EIA is required to get EC from DoE before project implementation.

10.2 Recommendations

The following recommendation has been made for establishment of the proposed Sachna Golakpur Road link to minimize the adverse impact.

- Acquisition of land should be done in proper way and exact compensation rate should be provided.
- Appropriate road alignment should be followed to construct the road. Provided adequate number of road openings at appropriate locations with proper engineering design for safe passage of water recommended by RRI THM model study to reduce impediment to drainage flow.
- Proper traffic safety measures and regulations especially near bazar sides such as Sachna Bazar, Golakpur Bazar and Mominpurpur Bazar.
- Construction works will be deteriorated the water quality of the rives and haor/beel. Solid waste from construction site should be control. Compliance with DoE standards during and after construction. Manage wastewater discharge and solid waste from establishment after construction.
- During construction appropriate measures by contractor to protect fish habitat. Provide fish friendly structures at bridge/ culverts
- Recommend the contractor to employ local people by giving priority to women and vulnerable groups. Ensure equal wages to male and female for equal amount and type of work
- Implement plantation along the Sachna–Golakpur road sides after the road construction which will recompense the vegetation lost.

- Slope protection works at the road side and bridge site should be provided.
- Improvement of rural and regional roads for better traffic movement. Repair and widen existing narrow roads.
- Construction workers should be advised to protect natural resources and wild animals.
- Residues from construction materials and exudes from construction machineries into the water and soil should be reduced as much as possible by careful handling.
- The project area is high earthquake prone site (zone). The designs of the project components will consider conform to Bangladesh National Building Code, 2006.
- To minimize the loss of terrestrial habitats within the project area, homestead vegetation and roadside vegetation should be retained or replanted wherever possible.
- A mix of local and exotic timber, fruit bearing, medicinal and fodder species should be used in the initial re-vegetation of the disturbed land. Local indigenous species should be given priority where possible.
- To reduce human pressure on remaining biodiversity resources, an extensive awareness campaign for biodiversity conservation aimed at local communities within and around the project area should be implemented.

APPENDIX

Appendix A: List of red category project types identified in the ECR, 1997, DoE

1. Tannery
2. Formaldehyde
3. Urea fertilizer
4. T.S.P. fertilizer
5. Chemical dyes, polish, varnish, enamel
6. Power plant
7. All mining projects (coal, limestone, hard rock, natural gas, mineral oil, etc.)
8. Cement
9. Fuel oil refinery
10. Artificial rubber
11. Paper and pulp
12. Sugar
13. Distillery
14. Fabric dyeing and chemical processing
15. Caustic soda, potash
16. Other alkalis
17. Production of iron and steel
18. Raw materials of medicines and basic drugs
19. Electroplating
20. Photo films, photo papers, and photo chemicals
21. Various products made from petroleum and coal
22. Explosives
23. Acids and their salts (organic or inorganic)
24. Nitrogen compounds (cyanide, cyanamid, etc.)
25. Production of plastic raw materials (PVC, PP/Iron, polyesterin, etc.)
26. Asbestos
27. Fiberglass
28. Pesticides, fungicides and herbicides
29. Phosphorus and its compounds/derivatives
30. Chlorine, fluorine, bromine, iodine, and their compounds/derivatives
31. Industry (excluding nitrogen, oxygen and carbon dioxide)
32. Waste incinerator
33. Other chemicals
34. Ordnance
35. Nuclear power
36. Wine
37. Non-metallic chemicals not listed elsewhere
38. Non-metals not listed elsewhere
39. Industrial estate
40. Basic industrial chemicals
41. Non-iron basic metals

42. Detergent
43. Land-filling by industrial, household, and commercial wastes
44. Sewage treatment plant
45. Life-saving drugs
46. Animal glue
47. Rodenticide
48. Refractories
49. Industrial gas (oxygen, nitrogen, and carbon dioxide)
50. Battery
51. Hospital
52. Ship manufacturing
53. Tobacco (processing/cigarette/*biri*-making)
54. Metallic boat manufacturing
55. Wooden boat manufacturing
56. Refrigerator/air-conditioner/air-cooler manufacturing
57. Tire and tube
58. Board mills, E.C.R. '97 203
59. Carpets
60. Engineering works: capital above Tk 10,000
61. Repairing of motor vehicles: capital above Tk 10,000
62. Water treatment plant
63. Sewerage pipeline laying/relaying/extension
64. Water, power, and gas distribution line laying/relaying/extension
65. Exploration/extraction/distribution of mineral resources
66. Construction/reconstruction/expansion of flood control embankment, polder,dike, etc.
67. Construction/reconstruction/expansion of road (regional, national, and international)
68. Construction/reconstruction/expansion of bridge (length of 100 m and above)
69. Murate of potash (manufacturing)

Appendix B: Rapid Environmental Assessment (REA) checklist

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement.

(ii) This checklist focuses on environmental issues and concerns.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Screening questions	Yes	No	Remarks
A. PROJECT SITING **IS THE PROJECT AREA……..**			
○ Densely populated?		√	
○ Heavy with development activities?		√	
○ **ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?**			
○ Cultural Heritage Site		√	There are no sensitive ecological and cultural sites in the project area.
○ Protected Area		√	There is 'Tanguar Haor' about 20Km to north from the project site.
○ Wetland	√		
○ Buffer Zone of Protected Area		√	
○ Special Area for Protecting Biodiversity		√	
B. POTENTIAL ENVIRONMENTAL IMPACTS **WILL THE PROJECT CAUSE…**			
○ Encroachment on precious ecology resulting in loss or damage to terrestrial or aquatic habitats (e.g.,		√	

	wetlands or sensitive or protected areas)?		
	○ Encroachment on historical/cultural monuments or areas?	√	
	○ Decrease in value of land in the area due to noise and other nuisances such as traffic congestion and degradation of environmental aesthetics?	√	
	○ Dislocation or involuntary resettlement of people?	√	
	○ Disproportionate impacts on the poor, women and children, IPs or other vulnerable groups?	√	
	○ Noise and vibration disturbances?	√	
	○ Short-term ecological disturbances such as soil erosion, water quality deterioration (surface and groundwater), air pollution, noise and vibrations from construction equipment?	√	
	○ Creation of slum communities?	√	
	○ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	√	
	○ Accidental disruption of utilities?	√	
	○ Short-term air quality degradation due to	√	

construction-related operations?		
○ Social conflicts if workers from other regions or countries are hired?		√
○ Large population influx of construction causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√
○ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials likely to create physical, chemical and biological hazards during construction and operation?	√	

Screening questions	Yes	No	Remarks
Climate Change and Disaster Risk Questions **The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.**			
○ Is the Project area subject to hazards such as earthquakes, floods, landslides, bank erosion, cyclone winds, climate changes?	√		The project area is located in seismic zone I, referred to as a high risk zone for earthquakes. To address potential risks, provisions of the national building code, BNBC 2006, and seismic vulnerability should be considered in the specifications for design and construction of project components. The area has experienced to receive flush flood from upstream Meghalaya and bank erosion. Suggested mitigation measures

			should be considered during design and construction of the road.
	○ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?	√	There is no current record or data to suggest that there is salinity intrusion in the project site.
	○ Are there any demographic or socioeconomic Aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√
	○ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		√

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