

# Initial Environmental Examination

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Project Number: 45084  
September 2012

## Bangladesh: Coastal Climate-Resilient Infrastructure Project

Prepared by the Local Government Engineering Department, People's Republic of Bangladesh  
for the Asian Development Bank

## CURRENCY EQUIVALENTS

as of 10 July 2012

Currency unit		Taka (Tk)
Tk.1.00	=	\$0.0122
\$1.00	=	Tk. 81.80

## ABBREVIATIONS

ADB	-	Asian Development Bank
BCCSAP	-	Bangladesh Climate Change Strategy and Action Plan
BWDB	-	Bangladesh Water Development Board
CCA	-	climate change adaptation
CCRIP	-	Coastal Climate-Resilient Infrastructure Project
DOE	-	Department of Environment
DRR	-	disaster risk reduction
EA	-	Environmental Assessment
ECA	-	Environment Conservation Act
ECoP	-	Environmental Codes of Practice
ECR	-	Environment Conservation Rules
EIA	-	Environmental Impact Assessment
EMAP	-	Environment Management Action Plan
EMP	-	Environmental Management Plan
GCM	-	growth centre market
GDP	-	gross domestic product
GRM	-	grievance redress mechanism
IEE	-	Initial Environmental Examination
LCS	-	labor contracting societies
LGED	-	Local Government Engineering Department
MOEF	-	Ministry of Environment and Forest
MOLGRD&C	-	Ministry of Local Government Rural Development & Cooperatives
NGO	-	Non-Government Organization
PIC	-	Project Implementation Consultant
PIU	-	Project Implementation Unit
RRA	-	Rapid Rural Appraisal
SLR	-	sea level rise
UNDP	-	United Nations Development Program

## GLOSSARY

<i>Baor</i>	An oxbow lake or wetland formed in an abandoned arm of a river
<i>Beel</i>	A saucer-shaped depression which generally retains water throughout the year
<i>Haor</i>	A back swamp or bowl-shaped depression located between the natural levees of rivers and may comprises of a number of <i>beels</i>
<i>Khas land</i>	Public lands not registered in the name of any individual or corporate body, regarded by land administration officials as belonging to the state
<i>Union Parishad</i>	Lowest administrative unit in the rural areas
<i>Upazila</i>	Sub-district

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## I. EXECUTIVE SUMMARY

### A. Introduction

1. The project is included in the Government of Bangladesh's Strategic Program for Climate Resilience (SPCR), prepared under the Pilot Program for Climate Resilience (PPCR). Within the framework of SPCR, the project will enhance climate resilience in the 12 rural coastal districts.<sup>1</sup> The main project outputs include (1) improved road connectivity; (2) improved market services; and (3) enhanced climate change adaptation capacity.

2. The Project will upgrade about 130 kilometres (km) of Upazila roads, 174 km of Union roads, 233 km Village roads, 15 km cyclone shelter access tracks, 88 growth centre and rural markets, 186 community markets, 37 boat landing stages, and 25 cyclone shelters. Improving rural roads and associated infrastructure will provide local inhabitants with efficient transport to markets and trading centres and access to social and welfare services.

3. This Initial Environmental Examination (IEE) covers three subprojects: (i) upgrading of the Chater Hat Gc - Banshtola Gc – Joymonirghol (Baddamary) Road, Mongla Upazila, in Bagerhat district, (ii). Upgrading/construction of Botbunia Market in Khulna district, and (iii) Road connecting Kalir Bazar to Chakhar UP and Chowlakati Primary School to Jangalia School, in Barisal district. The subprojects included in the IEE are categorised as category B for environment as per ADB guidelines and 'Orange B' as per Department of Environment, Bangladesh's categorization. ADB categorizes all projects according to the magnitude or scale of their anticipated environmental impact. Projects with limited potential adverse environmental impact require an Initial Environmental Examination (IEE), and are classified as Category B.

4. The scope of the IEE includes:

- (i) a review of the policies and guidelines of ADB and the Government of Bangladesh relevant to environmental safeguards and compliances;
- (ii) an examination of the salient biophysical and socioeconomic conditions of the project area;
- (iii) an identification of the relevant environmental and climatic parameters in the project area through scoping and literature review;
- (iv) an assessment of the magnitude of the potential impacts of the project actions;
- (v) assessment of the potential climate and disaster risks on the project, and suggestion for feasible adaptation and disaster risk reduction measures;
- (vi) identification of mitigation measures and monitoring requirements during implementation; and
- (vii) description of consultation and disclosure requirements.

5. The IEE was conducted following ADB's Safeguard Policy Statement, 2009 and relevant policies and guidelines of the Department of Environment (DOE) of the Government of Bangladesh.

### B. Methodology

6. The period of preparing the IEE was from 16 February 2012 to 15 May 2012, and field

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<sup>1</sup> These districts are: Bagerhat, Barguna, Barisal, Bhola, Gopalganj, Jhalokati, Khulna, Madaripur, Patuakhali, Perojpur, Satkhira, and Shariatpur.

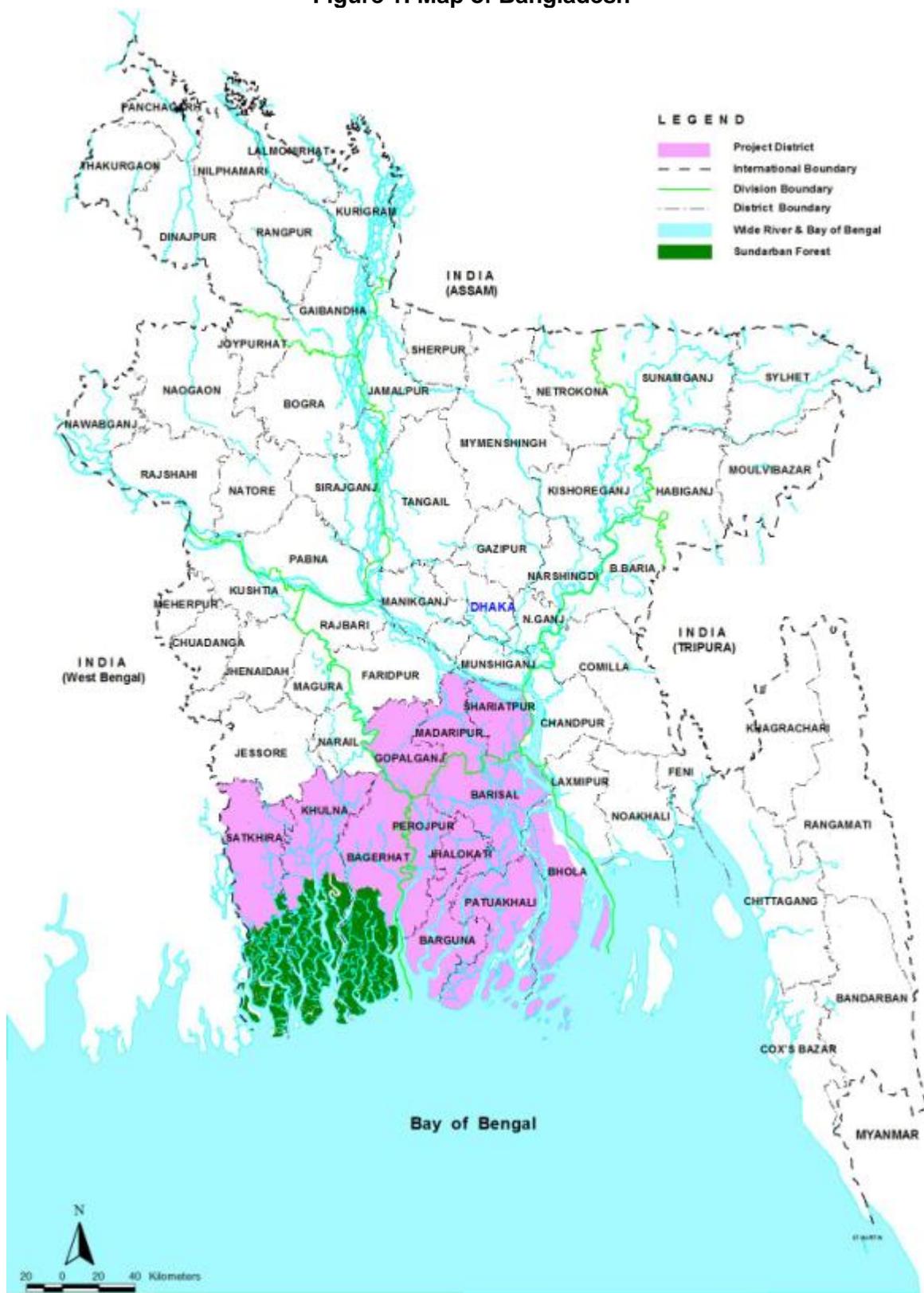
visits for data collection were done in April 2012. The task of preparing the IEE report consisted of the following sequential components:

- (i) Familiarization with and review of various project actions of the LGED projects;
- (ii) Identification and screening of the environmental parameters relevant to the proposed project actions in the CCRIP area through a scoping process;
- (iii) Assessment of the categorization of the sub-project based on magnitude of the potential negative impacts for relevant environmental parameters through the use of rapid environmental assessment checklists Formulation of avoidance/ mitigation measures to address the potential negative impacts, and preparation of an environmental management plan during the period of project implementation;
- (iv) Outlining a set of recommendations/ suggestions for institutional strengthening of the LGED to develop its in-house capability in environmental assessment tasks, especially issues of climate change and disaster risks.

### **C. Conclusion**

7. The potential environmental impacts of the subprojects covered by the IEE are insignificant, and temporary, which will mostly occur only during the construction stage. All the potential environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EMP.

Figure 1: Map of Bangladesh



## II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

8. Bangladesh has a wide range of laws and regulations related to environmental parameters. The most recent and the most important of the environmental laws are the Environment Conservation Act (ECA) of 1995, Environment Conservation Rules (ECR) of 1997 and Environmental Court Act of 2000. The ECR spells out rules and regulations for the enforcement of the ECA. Under the ECR, various development interventions are grouped into three main categories: Green (no environmental assessment required), Orange A (IEE required), Orange B (IEE required) and Red (EIA required) – in accordance with increasing potentials for adverse environmental impacts. The project interventions under the CCRIP fall into Orange category, and thus require the preparation of the IEE report. Both the ECA and the ECR cover a wide range of environmental issues, but they are neither fully comprehensive nor clear, and comprised of adhoc rules. A more recent legislation for enforcement has been the formulation of the Environment Court Act of 2000, which is authorized to try cases related to offences under the ECA/ ECR. The Cabinet has also approved the Environment Court Bill 2010.

9. Since the mid-1980s, there had been a growing awareness and understanding in Bangladesh that the natural resources and the environment of the country are being degraded. The Government of Bangladesh recognizes the importance of environmental sustainability as the basis for long term development in the country. Bangladesh is a signatory to Agenda 21 of the 1992 Earth Summit, and it is committed to implement the international legal instrument in its national policies and programs. A National Conservation Strategy was prepared by the Government in 1991, which formed the basis for the formulation of the National Environment Policy (NEP) in 1992.

10. The Government has so far signed, ratified and acceded to over 25 environment-related international conventions, protocols and treaties. Some of the notable ones are the Ramsar Convention on Wetlands, Montreal Protocol on Ozone Layer Depletion, Agenda 21, United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol, Convention on Biological Diversity, and Convention to Combat Desertification. The close relationship between environment and national development planning is embodied in the National Environment Management Action Plan (NEMAP), completed in 1995 with assistance from the United Nations Development Program (UNDP). As a follow-up of the NEMAP and to concretize its vision, the Government executed a UNDP funded Sustainable Environment Management Program (SEMP) between 1998 and 2004, which emphasized several capacity building components of environmental management.

11. The Government has prepared a National Adaptation Program of Action (NAPA) in 2005 and further revised in 2009, which outlines several climate change adaptation options for the country. A more comprehensive document on climate change, titled 'Bangladesh Climate Change Strategy and Action Plan' (BCCSAP), released in 2008 and further revised in 2009 with 44 programs under six thematic areas. The Government has set up climate change cells in several relevant ministries and line agencies to monitor the activities to mitigate climate change impacts and suggest remedial programs. The Government is planning to set up a climate change department under the MOEF.

## I. DESCRIPTION OF THE PROJECT

### A. Scope of the project

1. The Project will upgrade about 130 kilometres (km) of Upazila roads, 174 km of Union roads, 233 km Village roads, 15 km cyclone shelter access tracks, 88 growth centre and rural markets, 186 community markets, 37 boat landing stages, and 25 cyclone shelters. Improving rural roads and associated infrastructure will provide local inhabitants with efficient transport to markets and trading centres and access to social and welfare services. The project will help reduce poverty in the rural communities it covers. The beneficiaries will be (i) road users, namely bus and truck owners and operators, passengers, and businesses using freight services; (ii) market operators, traders, and market users; and (iii) communities in the areas of influence of subprojects who will have improved access to services and increased employment opportunities. An estimated 3.5 million people will directly benefit from the project. The analysis of subproject roads indicates that the proportion of poor benefiting is 40%-46% for the roads. In addition to the direct and indirect benefits from subprojects, there will be a creation of jobs due to subproject construction. This is estimated at 10,200 person-years, of which at least 2,040 will be for women. The project components have been designed to ensure involvement and benefits for women as well as a reduction of gender inequality. A gender action plan has been prepared integrating action areas, targets and indicators for gender equality and women's benefits within the various components of the project.

### B. Need for the project

2. The road network in the coastal districts covered by the project, under present climate conditions, is seriously damaged during extreme climatic events. The maintenance and damage repair requirements of such road sections will increase with climate change and vehicle operating costs will also rise, unless appropriate improvements are undertaken. For many road sections the cross-drainage systems are inadequate under present climate conditions, with poorly maintained canals and drains not having enough hydraulic capacities to efficiently discharge flows to sluice gated outlets through embankments. Poor drainage causes substantial "water-logging" of adjacent land, adversely affecting land-use, and this situation may worsen under climate change. Similarly, for rural markets, maintenance and damage repair requirements, together with spoilage/wastage of perishable goods will also increase with climate change. As demonstrated by recent cyclone events, the present number and capacities of existing cyclone shelters and livestock refuge facilities are inadequate, even under present extreme climatic events. The risks associated with extreme events will increase with climate change. Many existing cyclone shelters also have vulnerable access roads and power supplies, together with inadequate water supply and sanitation facilities, which often are not usable during the emergency conditions.

3. The rural producers, especially the poor and the small producers, suffer from two sets of constraints that limit their livelihoods: a) poor transport and market infrastructure that limits their access to markets, increases cost of production because of higher input and transportation costs, and lowers commodity price due to remoteness; and b) limited access to demand-driven financial services, especially seasonal agricultural credit and loan for microenterprises, and limited access to good technology and inputs, knowledge and support services such as vaccination services for livestock. Similar rural infrastructure development projects have demonstrated that paved roads and markets improve communication and benefit households income through higher farm prices, increased wages, enhanced investment in agri-business and trade, better access to higher quality inputs, support services, credit and reduced cost of production and transport. Access to child education and primary health care also improves due

to better transport facilities, especially in wet season. During extreme climatic events the poor lose their assets as well as livelihood options. Often after extreme conditions men tend to migrate leaving the families behind. In the coastal areas fisher folk family's poverty is high and many families are headed by widows and single mothers. Therefore, connectivity and mobility for women is equally important as for men for livelihoods. Climate-resilient infrastructure is a priority for recovery and long-term protection and can facilitate mobility for employment, income and livelihoods.

### **C. Location of the project**

4. The Project covers 12 districts of south western Bangladesh. These districts are (i) Satkhira, Khulna, Bagerhat and Perojpur in Khulna Division, (ii) Barisal, Jhalokathi, Patuakhali, Barguna and Bhola in Barisal Division and (iii) Madaripur, Gopalganj and Shariatpur in Dhaka Division.

### **D. Major components of the project**

5. The main outputs of the project are: (1) improved road connectivity; (2) improved market services; and (3) improved climate capacity and protection including increased availability of climate disaster shelters, improved knowledge management and improved facilities of existing climate disaster shelters.

### **E. Description of three Subprojects**

6. The IEE covers following three subprojects, which have been preliminary selected for implementation under the project.

#### **1. Chaterhat GC - Banshtola GC – Joymonirghol (Baddamary) Road, Upazila: Mongla, Dist: Bagerhat**

7. This road connects Growth Center (GC) Chaterhat and Growth Center Banshtola and extends up to the rural market of Joymonirghol (Baddamary). Length of the road is 10.5 km. The entire length of the road is damaged in many places. The road includes 15 drainage structures having a total span of 94.45 meters. The road is operational throughout the year. However, the road remains inundated on average 14 – 22 days in a year. There is 70% motorized traffic (locally available Tomtom) while the rest is non-motorized. There are 150 houses, 70 shops, 1 Union Parishad building, 2 schools and one dilapidated cyclone shelter within 50 meters distance from the road alignment. The length of road passing through the agricultural land is 6.0 km and the rest 0.5 beside non-agricultural land and residential area.

8. The road upgrading will involve improving the roads to appropriate climate-resilient standards and widening and rising of embankments, with suitable slope protection against erosion and wave action. The road crest level will be 800 mm above the normal annual flood level, with an extra height of 200 mm that will be added for the effective sea level rise to the standard 600 mm freeboard. The embankment protection will mainly involve a combination of turf and shrubs, geotechnical measures where there is a high risk of active erosion, and increased cross drainage.

## **2. Botbunia Market, Union Parishad: Tildanga, Upazila: Dacope, District: Khulna**

9. Botbunia GC is located in the Dacope Upazila in Khulna district. It is on the bank of Daki river which is a connection of Sibsa river and Pasur river. This place is about 10 km southwest from Dacope Upazila headquarters. The total market area of land 6.0 acres is on two sides of the Bangladesh Water Development Board (BWDB) embankment. Due to river bank erosion, the market needs to be shifted from its present location. The Union Parishad members, market committee, local people etc. have identified a 3 acre land at *Khas* close to the present location and easily accessible. This land is within the BWDB embankment and is suitable for the market as it will not require any land acquisition also. Tildanga union alone has about 4000 households; about 10,000 people will benefit from this market.

10. The market will include multipurpose sheds, fish shed, meat shed, sanitary latrines, deep tube wells, garbage pits, paved surface, internal roads, drainage facilities. As the market is located in a disaster prone area, the special multipurpose shed will serve as a cyclone shelter during times of disaster. The market will be equipped with adequate water supply facilities sufficient for the entire market area and toilet facilities for normal and emergency requirements during disasters. There will be improvement in the three major areas from market development (1) expansion of trading will occur; (2) income-generating activities of the women will increase. (3) farmers and fishermen will get the right price of their goods and (4) trading activities will enhance if shades are constructed.

## **3. Road connecting Kalir Bazar to Chakhar UP and Chowlakati Primary School to Jangalia School, Upazila – Banaripara, District – Barisal**

11. This road has two parts. One of them is Kalir Bazar to Chakhar Union Parishad (1.37 km). This road starts from the Upazila road that connects Chakhar UP to Mirer Hat. And the ending point is in Kalir Bazar that is located on the bank of Uzirpur River. The other part of the road starts from Chowlakati Primary School and ends at Jangalia High School (2.85 km). The first part of this road has a flexible pavement of bituminous carpeting of length 0.60 km and the remaining portion of 0.77 km is Herring Bone Bond (HBB). The road is damaged in many places. This section of the road includes drainage structures which have a total length of 25.25 meters. The average crest width and average right of way is 3.00 meter and 5.00 meters respectively. The other part of the road also starts from the same Upazila road but near the Azad Market and then it passes by Jangalia Government Primary School (GPS) cum Cyclone Shelter, Jangalia High School and Boro Chowlakati GPS and finally extends up to the Kalir Bazar Chakhar UP road. The entire portion of this road is earthen. The road is operational only six months because during the rainy season it becomes too muddy for any traffic movement. The motorized traffic locally known as Tomtom is common mode of transport along the road. Bicycles also ply along this road. There are 30 houses, 20 shops, 1 primary school, and 1 high school one cyclone shelter cum primary school within 50 meters distance from the road alignment. The length of road passing through the agricultural land is 4.0 km and the rest beside non-agricultural land and residential area. The road remains inundated during high floods.

12. The project activities in this subproject will not cause any significant adverse impact. The road upgrading will involve improving the roads to appropriate climate-resilient standards and widening and rising of embankments, with suitable slope protection against erosion and wave action. The road crest level will be 800 mm above the normal annual flood level, with an extra height of 200 mm that will be added for the effective sea level rise to the standard 600 mm freeboard. The embankment protection will mainly involve a combination of turf and shrubs,

geotechnical measures where there is a high risk of active erosion, and increased cross drainage.

## II. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

### A. Physical Resources

13. The environmental baseline situation in the region including the three subproject areas are well documented in the regional environmental profiles produced by the Water Resource Planning Organization (WARPO), as part of the National Water Management Plan (NWMP).

14. **Hydrology:** Surface water hydrology is characterized by the river networks that are part of the Ganges-Jamuna delta system. The Gorai River, which flows on the northeast side of the project area, has been experiencing lower dry season flows in recent years. This is partly due to upstream abstraction from the Ganges system in India and also because of sedimentation in the mouth of its off take near Kushtia.

15. Groundwater is the main source of potable water in the subproject areas. However shallower aquifers in the coastal areas are saline, so abstraction has to be taken from deep (up to 300m) tube wells, which are relatively costly to construct. Groundwater abstraction north of the coastal area is from the shallower aquifers, but the discovery of natural arsenic in the shallower aquifers is a serious problem.

16. **Geology:** The Khulna and Barisal area consists of late Holocene to Recent Alluvium of the Ganges deltaic plain in north and tidal plain in south. The area is composed of sand, silt and clay in various proportions with small amount of coarse sand, which is classified into seven litho-stratigraphic units from base to top. Stratigraphic cross-sections and panel diagram through this area indicate presence of seven sedimentary cycles, each cycle resembling fining upward sequence. The entire area constitutes complexes of channels of fluvial/ tidal origin, natural levees, bars, swamps and plains like floodplain, deltaic plains, estuarine plains or coastal plains.

17. **Topography, Landforms and Soils:** The subproject areas are located in the Ganges tidal floodplain. The boundary between this unit and the Ganges floodplain is traditional. The tidal landscape has a low ridge and a basin relief crossed by innumerable tidal rivers and creeks. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna. This unit covers most of Satkhira, Khulna, Bagerhat, Pirojpur, Barisal, Patuakhali, Bhola and the entire Jhalokati and Barguna districts but excludes the Sundarbans in the southwest.

18. The river carries fresh water throughout the year in the northeast and east, but saltwater penetrates increasingly further inland towards the west, mainly in the dry season, but for most or the entire monsoon in the southwest. In the northeast, there is moderately deep flooding in the monsoon season, mainly by rainwater ponded on the land when the Ganges distributaries and the lower Meghna are at high flood levels. Elsewhere, there is mainly shallow flooding at high tides, either throughout the year, or only in the monsoon, except in the extensive areas where tidal flooding is prevented by BWDB embankments. Within embankments, there is seasonal flooding with accumulated rainwater. The soils are non-saline throughout the year over substantial areas in the north and the east, but they become saline to varying degrees in the dry season in the southwest.

19. **Climate:** The climate of the project areas can be described as Tropical Monsoon – characterized by warm, humid summers and cool, dry winters. The areas, however, experience noticeable spatial variations in temperature and rainfall. Annual average temperature for Khulna is 35.5° C with a record low of 10° C. Mean temperatures in the southwest range from 18° – 19° C in January to 27.5° – 29° C in July, with April temperature often rising above 40° C in Khulna and Barisal divisions. Annual average temperature for Barisal is 35.1° C with a minimum of 12.1° C. Variations in mean annual rainfall are more pronounced in the CRIIP area than in the eastern parts of the country. The amount of rainfall generally diminishes from east to west. The average annual rainfall varies from 1710 mm in Khulna division to 1955 mm in Barisal division. Nearly 80 percent of the rainfall is concentrated in the months of June to October. The south western districts occasionally experience drought periods in the pre-monsoon months (March-May), which is likely to become more frequent and severe under climate change impacts. Norwesters (pre-monsoon thunderstorms) and tornadoes are other climatic hazards in the project area.

## 1. Biological (Natural Environment)

### a. Aquatic Faunas

20. **Fish and Fisheries:** In general there are five types of fish capturing, which are undertaken. These are:

- (i) River capture fishing- Fish are caught year round within all the main rivers and khals. However, catches tend to peak in May to June, with the mass migration upstream of hilsa (*Tenulosa ilisha*), and in October to November, when the floods subside and fish start returning from the floodplain to the river (ODA 1994). Fish species caught in the rivers tend to consist of the major carps, catfish, hilsa and small shrimp.
- (ii) Major carp spawn capture fishing- There is a high demand for major carp spawn for use in fishpond stocking. This high demand means that the spawn generates high value.
- (iii) Floodplain subsistence capture fishing- During the flood season there is open access fishing across all flooded areas. Subsistence fishing is therefore undertaken by almost all rural households during this period. The capture of fish in this way is often crucial for these households, as it represents the main (and often the only) source of animal protein available to them during the year..

21. **Fisheries:** The fish habitats include ponds, borrow pits, closed channel, and rivers and canals. Capture fisheries are very common in the rivers and canals; and shrimp culture in local ghers are in many cases become the major source of foreign currency. There is controversy about the loss of agricultural productivity of the area due the increased rate of shrimp culture.

22. Improved fish feeds for fishes for use in Ponds/ dighi and in aquaculture are available in the local market. However, the farmers mostly use shell meat, pressed rice and oil cake as fish feed because these are cheaper than the balanced commercial feeds.

23. **Fish Catch in October.** Capture fisheries in the floodplains get higher nourishment during the monsoon due to movement of high amount of biomass energy through run-off to the open as well as in closed water bodies. Consequently fishes grow faster. Fish population in open and closed water bodies also increases during this season. The fresh water fish spawn during May-July period.

24. These promote big catch of capture fisheries during November-December period. Usually captive fisheries are not explored until March-April period because of relatively low market price of fishes and spawns that are released in June-July are allowed time to grow.

25. **Aquatic biology:** The genetic dolphin (*Plastanista gangetica*), known locally as Sisu or Susok, occurs in all the main river systems of Bangladesh, particularly through the monsoon season. The Dolphin is identified as a threatened/ vulnerable species by the IUCN Red Book<sup>2</sup>.

26. Also identified as an endangered species is the Peacock Softshelled Turtle (*Tionyx hyrum*). This turtle is a resident of *beels* and rivers. No information was obtained as to whether the turtle is resident in any of the surface water bodies present within the Project corridor.

27. The fresh water aquatic floras include *hydrilla*, *vallisneria*, bladderwort, water hyacinth, duckweed, water lettuce water lily, water fern, water plantain, *halaincha ipomea* and many species of grasses. The hygrophytes that grow in swampy areas are aroids, ferns, begonias and several grass species. Freshwater wetland plant species e.g. hijal (*baringtonia acutangula*), barun (*crataeva magna*), mandar (*erithrina indica*), pitaly (*trewia nudiflora*), jarul (*lagerstroemia speciosa*), etc. are not very much common in the project site.

## b. Terrestrial Flora

28. **Forest and Plantation:** Trees species in various ecosystems and the aquatic floral species at project site are given below.

- (i) Homesteads and Orchards: betel nut (*areca catechu*), kadam (*anthocephalus chinensis*), coconut (*cocos nucifera*), date palm (*phoenix dactylifera*), sofeda (*achras sapota*), mango (*magnifera indica*), jackfruit (*artocarpus heterophyllus*), fig, pome granade, guava (*psidium guajava*), grapefruit (*citrus grandis*), lemon (*citrus spp.*), blackberries (*eugenia jambolana*), plum, toddy palm, koroï (*albizia sp.*), shisoo (*dalbergia shishu*), shirish, rain tree (*samanea saman*), eucalyptus (*eucalyptus spp.*), bamboo (*bambusa spp.*), babla (*acacia nilotica*), jeol, neem (*azadirachta indica*), jamrul (ejavanica), chalta (*dillenia indica*), bel (*aegle marmelos*), amra (*spondias pinnata*), amloki (*phyllanthus embelica*), segun (*tectona grandis*), etc.
- (ii) Roadside Plantation: date palm (*phoenix dactylifera*), road chambol, koroï (*albizia spp.*), krishnachura (*delonix regia*), rain tree (*samanea saman*), shisoo (*dalbergia shishu*), babla (*acacia nilotica*), akashmoni (*acacia moniliformis*), banian (*ficus bengalensis*), mango (*magnifera indica*), blackberries (*eugenia jambolana*), raj koroï (*samanea saman*), etc.
- (iii) No natural forest exists in project site or in the surrounding areas.

## c. Terrestrial Faunas

29. **Livestock:** The livestock in subproject sites include cow, buffalo, goat, sheep, pig, chicken, duck, geese and pigeon. This component of farming system is used as draft power, milk and meat source and as supplements to family nutrition and income. No classified grassland area virtually exists in the project site. The fellow lands, road, highway and embankment sides and homesteads are used as grazing fields for cattle. General health of cattle is deplorable because of low quality and inadequate nutrition.

<sup>2</sup> IUCN Bangladesh. 2003. Bangladesher Bipanno Bonno Prani, IUCN-The World Conservation Union. 294 p, Dhaka

30. **Livestock in project sites:** Livestock health in the project site appeared to be poor. This was due to shortage of quality green feed during large part of the year, poor living condition and inadequate health care. Animals are mostly confined in the cattle sheds or on homestead platforms for most part of the year. Fallow croplands, roadside slopes and other wastelands are used for grazing the livestock under watch during the dry season.

31. **Wildlife:** The subprojects will not pass through any areas designated as National Parks or Protected Areas. Terrestrial habitat through which the road passes through can be classified as:

- (i) Agricultural Land;
- (ii) Strip Plantation; and
- (iii) Homestead Plantations

32. **Birds:** Crow, doves, pigeon, mynas, weaver bird, magpie robin, house sparrow, storks, herons and egrets, tailor bird, shama, kingfishers (blue lessor pied, white breasted, small fisher), wood packers, bulbul, parakeets, jungle babbler, Indian tree pie, vulture, water hen, owls (spotted owlet, fish owl, hutumpecha), kites (shabaz, koral, tisha, etc.), cormorant, kobo, orioles hawk cuckoo, green pigeon and koel.

33. **Reptiles & Lizards:** Snakes, tree tokey, wall gekko, lizards.

34. **Other Vertebrates:** Toads, rodents (mouse, mole, rates, squirrels), bull frog, green frog.

#### d. Aquatic Faunas

35. **Mammals:** Gangetic dolphin, gharial, otter, shark.

36. **Birds:** Kingfishers, storks, herons, egrets, watermen, snipe, pied wagtail, curlew, green shank, teals, pallas fishing eagle.

37. **Reptiles & Lizards:** Snakes, lizards, monitors tortoises, turtles, green frog, bull frog, tree frog.

38. **Other Vertebrates:** Crabs, snails, mollusc.

#### e. Wildlife Status in Project Site

39. Wildlife species identified and reported from the experience of the survey in the areas that includes the mammals such as jackal, jungle cat, fox and mongoose. In addition, there are reptiles like the water snake, Jat snake (*dendroapis polylepis*), and darash snake (*xenochropis piscator*); amphibians like the common toad and bullfrog, lizards such as monitors (water monitor, black monitor and golden monitor), tree gekko, house lizard and rodents (rat, mouse, squirrel, mole), etc. The survey of wildlife species of a small and densely populated area may not bring out a reliable result. Because, the wildlife species allocate their time spread over a territory where they are used to feed, rest and recreate.

40. The bird species reported from the field survey include crow, mynas, stork, brahmani kite, sparrow, weaver birds, water hen, parakeet, robin, bulbul, black drongo, vulture, hawk cuckoo, black cormorant, owl, snipe, etc. However, comprehensive studies on wildlife were

conducted by the Environmental Specialist during his several field visits and through interrogation of knowledgeable persons in site and local GOB and NGO.

41. **Wetland:** The project areas contains number of rivers, estuaries, mangrove swamps, canals, ponds, shrimp ghers, etc. The farmers generally are interested in draining the wetland during dry period to use for crop cultivation. In absence of large perennial flow many of these wetlands have dried up and lost their wetland features. Moreover sufficient cross drainage works would not impede water movement. Likewise, the flora and fauna of these seasonally flooded areas do not include any endangered or threatened species, and are not likely to be disturbed in their habitats.

## 2. Socio-economic

### a. Agriculture

42. The scope for further intensification of agricultural crops in the project affected sites as well as in the adjacent areas is limited. This is because, the land and water (both surface and underground) is limited. Major crop during the kharif-2 season is rain fed transplanted *aman* paddy (local varieties). Culture fisheries technology locally known as shrimp gher on low land with availability of saline water is popular and brings hard currency from exports.

### b. Crops Grown

43. The crops grown in different cropping seasons and on different land types are given in Table-6. Cultivation of rabi and kharif-I vegetables has gained popularity on highland and made lands in the down town areas of all district town due to availability and access to the local as well as Dhaka City market due to better communication.

**Table: 1: Crops grown in different cropping seasons and on different land types**

Land type	Cropping Season			Annual Perennial
	Kharif-I	Kharif-II	Rabi	
Made-land, Non-flooded	Lemarenthus, long bean, bitter gourd, snake gourd, sweet gourd, ash gourd, cucumber, ribbed gourd, peanut, jute, sesame, sweet potato, aus and egg plant	Lemaranthus, cucumber, long bean sweet gourd, ash gourd, ribbed gourd, snake gourd, fodder, etc.	Maize, millet, potato, sunflower, peanut, radish, chili, coriander, onion, garlic, carrot, tomato, cabbage, cauliflower, egg plant and spinach	Papaya, banana, ginger, turmeric, sugarcane, etc.
Medium Highland, slightly saline	B. aus, Sesame (50- 70%). T. aman	T. aman(local)	Barley, millet, chilli and mung bean	
Medium Lowland,	B. aus & aman T. aman	T. aman	Barley, millet, chilli and mung bean Irrigated boro (<5%)	
Homesteads/ Orchards, Highland	Vegetables (10%)	Vegetables (5%)	Vegetables (10%)	Betel nut, banana, coconut ipil-ipil, jeol bhadi, pome-granade,

Land type	Cropping Season			Annual Perennial
	Kharif-I	Kharif-II	Rabi	
				sofeda, eucalyptus, akshmoni, date plam mango, shisoo, jack fruit, plum, lemon, jarul, mehgani, koroi, babla, debdaru, shirish, etc.

### III. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

#### A. Environmental Impacts

44. The three subprojects will focus on improving/rehabilitating existing rural roads and construction of a market. The potential generic environmental issues in the construction phase include: (i) soil erosion, silt runoff and gully erosion; (ii) drainage blockage/ congestion, water logging and localized flooding; (iii) surface and ground water contamination; (iv) air (dust) and noise pollution; (v) contamination from storage and transportation of construction materials; (vi) hygiene, sanitation and safety of construction workers; and (vii) community disharmony or cultural problems.

45. Specifically the following environmental impacts are observed for the three sub-projects:

#### 1. Chater Hat Gc - Banshtola Gc – Joymonirghol (Baddamary) Road, Upazila: Mongla, Dist: Bagerhat

46. The potential negative impacts include tree removal and (in some cases of narrow stretches of the road) homestead removal on account of road widening needs. New tree plantation – followed by regular caretaking will mitigate the first problem, while compensation for the homesteads and other assets, which have encroached upon the crest and the right-of-way, could be paid to the affected households according to the existing rules and resettlement plans prepared under the Project. Another negative impact will be that unless carefully planned the hydrology of the area is going to be affected creating drainage congestion of the gheras and nearby agricultural areas causing more flood.

47. The positive impacts of this subproject are: (a) prevention of soil erosion (due to bituminizing the pavement and planting trees on embankment slopes); (b) restoration of regional hydrology and drainage through reconstructing/ rehabilitation bridges/ culverts; (c) access to markets and health services; and (d) potential for establishment of new commercial activities at the markets as well as along the improved road.

#### 2. Botbunia Market, Union Parishad: Tildanga, Upazila: Dacope, District: Khulna

48. The soil of this area is silty clay and susceptible to erosion. Due to salinity not many trees are found in the area. There are no archaeological sites near the area. The land is free of any buildings/ structures and there is no need for land acquisition. The typical impacts expected during construction are localized impacts on air quality due to dust generated in earth works and material movement to site, erosion and silt run off, and noise from machinery working at

site. Impacts during operation are impacts on water resources, due to extraction needs and wastewater discharges from market, and solid waste. However, water will be sourced from ground water wells and the design of the market includes facilities for proper solid waste and sanitation facilities and therefore will not impact on the ground water quality.

49. The positive impacts of this subproject are: (1) improvement of water supply and sanitation facilities of the market; (2) removal of drainage conditions from market areas; and (3) enhancement of sales of commodities with subsequent improvement of socio-economic conditions of the beneficiaries.

### **3. Road connecting Kalir Bazar to Chakhar UP and Chowlakati Primary School to Jangalia School, Upazila – Banaripara, District – Barisal**

50. The potential negative impacts include tree removal about 500 numbers and (in some cases of narrow stretches of the road). New tree plantation – followed by regular caretaking will mitigate the first problem, while compensation for the homesteads and other assets, which have encroached upon the crest and the right-of-way, could be paid to the affected households, if any, according to the existing rules. Another negative impact will be that unless carefully planned the hydrology of the area is going to be affected creating drainage congestion of the agricultural areas causing more flood. The positive impacts of this subproject are: (a) prevention of soil erosion (due to bituminizing the pavement and planting trees on embankment slopes); (b) restoration of regional hydrology and drainage through reconstructing/ rehabilitation of bridges/ culverts; (d) access to markets cyclone shelter cum school and health services; and (e) potential for establishment of new commercial activities at the markets as well as along the improved road.

51. The potential short-term adverse impacts of all three subprojects include soil erosion, water pollution, blocked drainage, traffic disruption and accident hazards, and dust and noise pollution. These can be minimized by (i) limiting earthworks to the dry season, (ii) carefully planning drainage diversions, (iii) restoration and rehabilitation of borrow pits, (iv) safely transporting and storing construction materials, (v) spraying water to reduce dust hazards and (vi) prohibiting the use of machinery after sunset to reduce noise pollution.

52. The potential adverse impacts from subproject interventions may include flooding from drainage congestion, the loss of trees, and the loss of agricultural land and other assets from road widening. All potential negative impacts will be minimized by adopting such mitigation measures as (i) tree planting on roadsides to stabilize soil and compensate for tree removal; (ii) providing adequate, and sufficient numbers of, cross-drainage; and (iii) careful road alignment during road widening to minimize farmland and asset loss..

53. In the long run, the subprojects will (i) benefit the environment by planting trees along roadsides, which will also prevent soil erosion from embankment slopes; (ii) improve regional hydrology by reconstruction and rehabilitation of cross-drainage structures, (iii) reduce dust pollution and improve water quality by bituminizing the pavement, (iv) facilitate and improve access to markets for trade and income generation, (v) allow easy movement of motorized and other traffic, and (vi) generally improve the aesthetic quality of the region. In addition, market improvement measures will enhance the environmental quality of GCMs. Community management and ownership of planted trees has been used in other projects, including rural infrastructure-development projects, and the lessons learned in those projects suggest that the approach taken under the Project should be effective.

## **1. Physical**

### **a. Soil erosion and Siltation**

54. Soil erosion is one of the most common environmental impacts of the road projects, unless protective measures are undertaken. The degree of soil stability, erosion and siltation varies according to the soil texture, intensity of rainfall and the slope of the embankments. In sandy soils, the instability is greater than on sticky, clayey soils. Hence, in the subproject areas, measures against soil erosion should take into consideration the nature of the soil texture in specific locations. The risk of erosion will be limited or minimized if the improvement works are done in the dry season. The protective measures through vegetation and compaction on the improved roads will have high positive impact of the proposed road improvement measures.

### **b. Regional hydrology**

55. Roads can contribute to changes in the flow and volume of surface water affecting regional hydrology. Field survey, however, confirmed that the existing roads do not impede local and regional drainage. And the potential for increased flooding is nil. Nevertheless, conditions in the low lying areas have to be dealt with separately and very carefully. The project areas, with the provision of additional cross-drainage will bring positive impacts on the drainage conditions.

### **c. Drainage congestion**

56. The impact issue of drainage congestion and resultant water-logging is essentially related to the above mentioned hydrologic parameters. In the context of the experience vis-à-vis the improved roads, it is likely that the rehabilitated and new culverts or cross-drainage structures will facilitate surface runoff and bring some positive impacts in terms of drainage and water logging. However, it is necessary to emphasize that provision should be given for adequate cross-drainage structures, and discussion should be made with the local people to define the requirement of drainage in the area.

### **d. Water quality**

57. Water quality on roadsides may be affected during the construction phase. Through adoption of simple erosion control measure, such as use of sand bags, rubble, erosion to water ways can be minimized. Even after the roads are carpeted with bitumen, the nature and volume of traffic on them will not be of such magnitude as to cause any significant water pollution problem. Nonetheless, it may be advisable not to locate drinking water intake points close to the road embankments in order to avoid chance of contamination from pollutants.

### **e. Air Pollution**

58. The impact issue of air pollution from road improvements must be weighed against the existing situation on those roads. The bitumen surface of the improved roads will necessarily generate more traffic of motorized vehicles and cause certain amount of air pollution from exhaust emissions. But it will also produce positive impact of lesser dust than the present unpaved earthen roads. Overall, air quality will not deteriorate significantly.

## 2. Natural environment

59. **Fisheries:** Since the proposed subprojects do not involve the construction of new roads, the potential for any adverse impact of fish migration and fish breeding/ spawning is nil. Moreover, the rehabilitation of cross-drainage structures and culverts on Upazila roads including provision of additional drainage capacity, in accordance with the design standard of the LGED, will ensure better fish passage and migration opportunities in the flood plain. Culture fishery in ponds has recently become very popular in the Project area, and the Project works are not expected to affect them adversely.

60. **Tree plantation:** The issue of tree plantation will have a high positive impact from the project actions. Road improvements involving road widening may require removal of some existing trees and vegetation. However, this need not to be viewed as a negative impact because the practice established by LGED of planting and maintaining trees on the improved embankments more than compensates for this and enhances the environment. With proper care and nurturing, the improved roads will have adequate tree plantations along their embankments, which will also help in reducing or preventing soil erosion.

61. **Forest:** The Forest Department is actively involved in social forestry programs involving the rural poor through participatory benefit sharing scheme in the project areas. The Forest Department is engaged in tree plantation along canals, railways and roads in association with the agencies owning those lands. Hence, the road improvements in the project areas will benefit the forestry sector through LGED's continued collaboration and cooperation with social forestry programs of the Forest Department.

## 3. Human Interest Component

62. **Agricultural Land loss:** In the subproject areas, agriculture is the major use of land with a high cropping intensity. Road widening will involve elimination of farmland along the right-of-way. Hence, agriculture land loss in an infrastructure development project could be a significant negative effect. The land acquisition assessment has been carried out which shows that maximum of the land on roadsides is used for agricultural purpose and few for homesteads and other activities. The losses to individual farmers will be small because only narrow strips of land are required. In view of this small amount of potential agricultural land loss, the negative impact of the subprojects will be moderate. The affected persons will be compensated in accordance with the resettlement plan prepared under this project. On the other hand, a positive impact of the road improvement works will be an increase in land values (both farmland and homestead) in the adjoining areas.

### a. Navigation/ boat communication

63. Field investigations did not reveal any conflict between the present route alignment and navigational facilities; however, some bridges and culverts, which are currently damaged, will provide better boat communication facilities after rehabilitation.

### b. Employment opportunities

64. The proposed improvement works are expected to generate significant employment opportunities for the local people during the construction stage. This is in direct conformity with the concept of stakeholder and beneficiary participation, which is central to the design of the Project. Besides, improved roads will increase accessibility of the rural areas, and will thus have

a cascade effect of encouraging commercial activities along the roads and in the connecting growth centre markets, and providing for long-term income-generating opportunities.

**c. Access of goods to markets**

65. Road improvement works would also have a concomitant high positive impact in terms of the accessibility of local goods to the markets through motorized and faster transport. Economic activities, including local trade and commerce, will be stimulated by these transport opportunities, which in turn, will help in rural poverty amelioration - a principal development objective of the project. Even though the economic benefits cannot immediately be fully quantified, the long-run positive impacts are undeniably high.

**d. Traffic**

66. Bitumen surfaced of the improved roads will facilitate increased traffic of both motorized and non-motorized transport modes. The better quality of the roads will also ensure greater vehicle safety and reduce travel discomfort, especially in the rainy season. Negative impacts of increased traffic on improved roads relate to the hazards for pedestrians, slow moving transport modes like cycle rickshaw/ vans, and cattle from neighbouring fields. Appropriate safety measures can adequately deal with this impact.

**e. Cultural features**

67. Cultural features, which include places of worship, burial grounds and historical sites, will be provided with better access through road improvement measures, which may also lead to their better protection and conservation. The project actions are not expected to have any negative impact on cultural features, provided any road realignment, if necessary, is adjusted to avoid encroaching upon such features or structures.

**f. Landscape/ Aesthetics**

68. The road improvement works together with tree plantations on roadsides, will also greatly enhance the visual landscape and aesthetic quality of the entire region.

**g. Growth Center market improvements**

69. Environmental issues related to growth centres market subproject relate to sanitation, safe drinking water, drainage, waste disposal, internal and access road conditions, and status of selling area. The current status of the market infrastructure is very poor and totally inadequate. Sanitation facilities are unhygienic and mostly non-existent. The improvement of physical infrastructure in and around the existing growth centres/ markets will have high positive impact on the general environment.

**4. Climate Change Adaptation Strategies/ Options**

70. The project aims to mainstream climate risk reduction into policy formulation and infrastructure development planning; capacity development to increase understanding of current and emerging climate risks and promote resilient decisions at central and local planning levels; and the demonstration of ways to effectively 'climate-proof' infrastructure with a view to systematically develop and apply climate-resilient building codes and standards. A central element of the project is to examine climate change related risks with local communities and

officials, and to make the experiences gained from the climate-proofing of critical infrastructure work for vulnerability reduction at all levels, using entry points of policy and regulatory revisions as well as climate-resilient development planning. Beside these, adaptation in terms of raising the height and strength and protecting the roads from damages due to climate change is essential from economic and social points of view. Specific affected water-related road infrastructural components are: flood proofing of roads, raising of coastal embankments with concrete top to be used as roads, water management for the road-crossing water-courses, etc. In addition, there would be requirement of repairing and maintenance of existing vulnerable rural infrastructures.

71. Due to Construction of an extensive network of rural road by LGED, the hydrological regime of many low lying areas has changed. In addition to that protecting the land from flooding and river erosion, BWDB has constructed high embankments and polders in and around the LGED built rural infrastructures. Either LGED or BWDB should collect the necessary and relevant hydrological data for designing the resilience structure that can mitigate and adapt climate change situation. Climate Change adaptability should consider more study on the change of hydrological regime that not only affects the hydrology of the wetland but also drainage congestion and creation of local flooding. Hydrological analysis may be required at design stage for constructing climate change resilience road embankment and other rural infrastructure. Care should be taken for the protection of the embankment due to possible rise of water level for climate change. The most vulnerable part is its slope. Protecting the slope by turfing with vegetation like grass is also good and inexpensive option. The other important aspect of embankment is that the soil should be compacted properly

#### **IV. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

72. In the IEE studies of the three proposed subprojects, the IEE teams carried out consultations with local communities and related stakeholders during the field surveys to scope out any public concerns and encourage suggestions for subproject design. The public consultation was carried out from March 2012 to April 2012 as part of the field works. Public Consultation was done using various tools including, formal/ informal discussion with Union Parishad chairpersons and members, Government officials and other stakeholders. During the transect walk, consultations were held with the UP officials and villagers. Also during the reconnaissance survey and site visits, discussions were carried out informally drawing people into dialogue to obtain an overview of likely impacts and concerns of the community. Consultation was held at several locations along the rural roads alignment covering areas where public activity was intense and close to proposed alignment covering owners of houses located close to rural roads. The institutional level consultations were held with representatives of institutions having stakes in implementation of the project. The institutions contacted included fisheries, forest department, local DOE etc.

73. The participants generally appreciated the rural roads and markets upgrading; they realized the overall benefits to the community resulting from project development; they were aware of the increased access, less travel time in commuting after project implementation; and emphasized better management of traffic and necessary noise barriers at educational and health facilities during construction. However, some of the participants had a fear that construction of rural roads with new alignment may alter natural drainage pattern in the area and may cause flooding and water logging in the agriculture fields if adequate cross drainage structures are not provided. The loss of fertile land will deteriorate their income sources. They stressed the safety issues; the women participants raised the issue of their children's safety.

74. Some people were concerned about the land requirements of the project and impact on their agriculture land. They were also of the view that community should be consulted before the road designs are finalized. It was explained to the people there will be minimum land acquisition since the activities would be carried out in the existing land under use by the proposed subprojects. Respondents were of the opinion that trees cutting should be avoided or minimized. Some villagers expected additional plantation should be done. Separate consultation sessions were organized by social team to identify issues pertaining to health specifically for sexually transmitted diseases. The people demanded that locals should be given preference in employment during project implementation.

75. The environmental assessment process under the ADB's Safeguards Policy Statement requires the disclosure of the IEE in an accessible place and language to the public during the completion of the IEE. The LGED will provide by 15 November 2012 a Bengali version of a summary IEE in public places with providing relevant environmental information, including information from the documents as above in a timely manner, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. For illiterate people other suitable communication methods will be used. The LGED will also organize meeting/ seminar in the locality to inform people effectively. This process will be concluded with the EU providing copies of the IEE for display at the district and Upazila level during the same period when the IEE is disclosed on the ADB website.

## **V. GRIEVANCE REDRESS MECHANISM**

76. To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a grievance redress mechanism is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns. The EU of LGED will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It will address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism should not impede access to the country's judicial or administrative remedies. The affected people will be appropriately informed about the mechanism.

77. The project management Office (PMO) and PIOs will make the public aware of the grievance redress mechanism (GRM) through public awareness campaigns. The contact phone number of the respective PIOs and the PMU will serve as a hotline for complaints, and shall be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information brochure will include information on the GRM and shall be widely disseminated throughout the corridor by the safeguards officers in the PMO and PIOs. Grievances can be filed in writing or by phone with any member of the PMO or PIO.

## **VI. ENVIRONMENT MANAGEMENT PLAN**

### **A. Environmental Monitoring**

78. EMP is an important tool to ensure the implementation of mitigation measures for minimizing adverse impacts and maximizing the beneficial impacts. Environmental monitoring generates useful information and improves the quality of implementation of mitigation measures.

The more important short term mitigation measures will include dry season construction work, erosion control from earthworks, careful location of borrow pits, temporary provision for drainage and traffic diversion, sanitation and hygienic provisions for the construction workers, and safe storage/ transportation of construction materials. Long term mitigation measures will include *inter-alia* efficient soil compaction, intensive scheme of roadside tree plantation, ensuring 1:1.5 ratio for the embankment slopes, rehabilitation of borrow pits by the contractors, careful design of cross drainage structures to allow flood water passage and prevent water-logging, minimizing agricultural land loss and prompt compensation for any acquisition, and adequate number of road safety signs and markings at vulnerable or hazardous sections.

79. Field investigations revealed that none of the impact issues will produce high degree of negative environmental effect. The potential short-term negative impacts relate to soil erosion, tree removal, water logging or drainage congestion, air and water pollution, agricultural land loss, navigation and traffic/ road safety. These have to be addressed through five sequential stages of the project cycle, viz., design, contracting, construction, supervision, and operation and maintenance. Most long-term adverse impacts can be mitigated by giving special emphasis on maintenance.

80. The minor negative impacts related to tree removal, agricultural land loss, drainage congestion, pollution and road safety as well as short term (construction phase) effects can be mitigated through appropriate measures, monitoring programs and fulfilment of institutional requirements. Table 9 shows summary of environmental impacts and proposed mitigation measures

**Table 2: Summary of Environmental Impacts and Proposed Mitigation Measures**

Serial No.	Action	Resource Impact	Mitigation	Location	Responsibility		Cost
					Implementation	Monitoring	
<b>Impacts on air quality and noise during construction</b>							
1	Excavating, grading, finishing	Dust, fumes and noise in the vicinity of the worksite. Temporary damage to adjacent land use and exposure to air and noise pollutants	Reduce ambient dust levels by regular spraying of water on exposed earth in construction zone near settlement areas where there is potential for human exposure. Remove construction debris and spoil piles. Impose traffic controls to reduce public exposure, Cover transport vehicles.	Construction zones for rural roads and markets	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction Contract implementation.
2	Use of quarries and borrow pits	Air and noise pollution	Spraying of water in quarrying areas and proper covering of vehicles carrying quarried materials	Quarries and construction sites as well as haulage roads	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction Contract implementation.
3	Construction activity near community areas	Blocks access, disturbs daily life of community and produces noise, dust and congestion	Select haul routes around/ outside community areas. Operate vehicles during restricted hours in village limits. Introduce traffic controls to reduce contact between the public and construction activity. Complete segments passing through populated areas before starting new construction.	Construction office and construction zones for roads and markets	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction Contract implementation.
4	Cement mixing, bitumen mixing and brick crushing	Noxious and objectionable odors and fumes as well as dust	Locate facilities at a sufficient distance from human receptors to eliminate the impact. Conduct activities during daylight hours if there are communities nearby. Water areas where dust accumulates regularly. Locations for facilities approved by the LGED/ Consultant.	Construction zone for roads and markets; brick crushing will allowed only in locations approved by Consultant	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction Contract implementation.
5	Operation of construction equipment, machineries and vehicles	Air pollution from generation of harmful gases	Regular maintenance of all machinery, equipments and vehicles.	Construction zone	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction Contract implementation.
<b>Impacts on Soil Resources during Detailed Design and Pre-construction</b>							
6	Identification of quarries and borrow pit locations and estimates of quantities of materials	Impacts from hauling and degraded roadway surfaces during construction. Hazard due to accident or slope failure during construction	Identify quarry locations, or consider other options, in conjunction with the selected construction contractor. Prepare development plan to estimate quantities and final contours.	Design office	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design Contract.

Serial No.	Action	Resource Impact	Mitigation	Location	Responsibility		Cost
					Implementation	Monitoring	
7	Recommendation of techniques for excavation and earth cutting works	Excess cutting and use of poor techniques resulting in landslides and slope failure	Incorporate environment friendly construction techniques in the detailed design	Design office	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design Contract.
8	Clearing and grubbing before initiating construction works	Degradation of surface water quality. Soil loss from exposure to rain and flowing water, and increased sediment in rivers and streams	Stop land clearing and excavation in rainy periods. Use Log or boulder barriers at the base of slopes subject to erosion. Seed and stabilize slopes and embankments. Include costs for sediment control in the contract bid proposal.	Construction areas	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction contract implementation
9	Identification of disposal sites for construction debris	Improper disposal of construction debris resulting in scarred landscape	Designate specific chainages and suitable locations as disposal sites for safe disposal of construction debris	Along ROW of road within the vicinity of market construction	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction contract implementation
<b>Impacts on Soil Resources during Construction</b>							
10	Cutting and excavation of the road bed	Unstable slopes lead to soil loss	Introduce appropriate/ bioengineering techniques as recommended in detailed design to stabilize soils during construction and for finishing slopes.	All along the road construction zones and market areas	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design contract and construction bid estimate
11	Placement of roads parallel and transverse to canals/ rivers	Damage to roadway due to undercutting of road foundation	Place road embankments above highest water level by 800 mm to make it climate-resilient and use palisade for canal/ river training as given in detailed design and to prevent scouring	All portions of the road construction zones and markets beside canals/ rivers	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design contract and construction bid estimate
12	Disposal of construction debris	Improper disposal of construction debris beside the road alignment and around the market place resulting in scarring of landscape and loss of aesthetic beauty	Prohibition of throwing of construction debris in any sites other than the designated disposal sites identified at the detailed design stage.	Construction zones	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design Contract
13	Operation of equipment storage and repair yards, and fuel depots	Oily waste is improperly disposed of; fuel is spilled and poor housekeeping causes soil and water pollution.	Install secondary containment around fuel tanks and at fueling stations. Prevent oil and fuel spills, control runoff from contaminated areas.	Equipment yards and fueling stations	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of design Contract
14	Closure of equipment yards and camps	Failure to render a site clean and safe at the end of use poses both a sanitary and safety hazard	Remove above-grade structures, clean up construction camp debris and backfill latrines; grade, re-vegetate the area and tree planting under the compensatory forest program.	Construction and labor camps	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in cost of construction contract implementation
<b>Impacts on Soil Resources during Operation</b>							
15	Operation of	Landslides/ rain cuts	Adoption of appropriate engineering and	Specific road	Maintenance by	XEN, LGED	Cost to be

Serial No.	Action	Resource Impact	Mitigation	Location	Responsibility		Cost
					Implementation	Monitoring	
	roadways and market places	and other erosion issues	bioengineering structures and techniques	sections and areas of market	LGED and Market Management Committee (MMC)	and MMC	borne by LGED maintenance fund and Market beneficiaries
<b>Impacts on Water Resources and Water Quality during Detailed Design</b>							
16	Recommendation and design of structures for enabling proper drainage under all weather conditions	Extreme meteorological conditions due to climate change may exceed capacity of structures, erode slopes and destroy pavement, structures	Take into account cost and historical rainfall data to determine size of structures, stability of slopes and height of roadway embankment	Design office	Design contract	PMO, LGED	Included in the cost of design contract
17	Excavation and cutting works	Disposal of excavated materials on nearby streams and rivers causing excess sedimentation, creation of temporary dams (and hence small floods thereafter), disturbances to aquatic ecology.	Use of log barriers or boulder barriers at the base of slopes to hold any excavated material that may fall. No dumping of excavated material or construction rubble into streams and rivers nearby. Reuse of excavated material as far as possible and disposal of unwanted material in proper designated sites.	Construction zone	Supervising Engineer with the Contractor	Environmental Consultant and DOE	Included in the cost of construction contract
18	Construction of road side drainage structures	Insufficient roadside drainage in community areas leads to flooding of adjacent property. Construction of improper drain would damage paddy fields in adjacent areas.	Develop downstream drainage channels to assure continuity of the drainage system. Construct proper lined drain particularly along the section that passes through paddy field at specific locations.	Construction zone	Construction contractor	Environmental Consultant and DOE	Included in the cost of construction contract
19	Operation of roads	Plugging of culverts from debris during heavy downpours; channelization and damage to the roadway.	Maintain culverts and remove debris that interferes with the flow in culverts	Roadway locations	LGED maintenance programs	XEN, LGED	LGED maintenance fund
20	Operation of markets	Dumping of solid waste from markets destroy water quality of adjacent ponds and canals	Proper management of solid waste of markets including arrangement for barrel composting	Markets developed under CCRIP	MMC and LGED maintenance program	XEN, LGED	LGED maintenance fund and contribution from beneficiaries of market
<b>Impacts on trees and vegetation during Pre-construction</b>							
21	Land clearing for	Displacement of trees	Prepare an inventory and remove marketable	Construction	Construction	Environmental	Cost is included

Serial No.	Action	Resource Impact	Mitigation	Location	Responsibility		Cost
					Implementation	Monitoring	
	roadways	and destruction of natural habitat; clearing extends into adjacent forests: loss of habitats	timber prior to construction. Clear only unmarketable trees and brush remaining in the road corridor. All valuable timber shall be handed over to the proper authority; obtain necessary government permits for cutting trees.	ROW of roads and market place designated for development.	contractor	Consultant and DOE, representative from MOEF	in construction contract implementation
22	Land clearing for roadways and development of market area	Displacement of trees and destruction of natural habitat	Provide compensatory plantation (1:5) to replace trees removed. Re-vegetation of slopes above and below road through appropriate bioengineering techniques where necessary. Re-vegetation of road shoulders to help recover some of the vegetated area lost	ROW of roads and market place designated for development	Construction contractor	Environmental Consultant and DOE, representative from MOEF	Cost is included in construction contract implementation
23	Clearing right-of-way	Excessive width causes unnecessary damage to adjacent areas, increases need for rehabilitation and leads to unstable slopes	Maintain minimum construction right-of-way, remove only trees that interfere with construction and limit access to adjacent land. Widening of the standard width of right-of-way to be approved by the PMO, LGED. Prohibit disposal of spoil materials and any other forms of construction debris over the sides of the roadway and adjacent area of market.	Construction ROW for roads and areas for development of markets	Construction contractor	Environmental Consultant and DOE	No cost
24	Operation of Workers camps	Workers fish, hunt and gather firewood; destruction of biological resources	Prohibit fishing, hunting and gathering of firewood among workers. Provide construction camps with food supplies from purchased stores. Provide firewood for warmth from legitimate sources or stockpiled from materials cleared from the roadway construction zone.	Jobsites and labor camps	Construction contractor	Environmental Consultant	Cost included in construction contract implementation
25	Operation of roads and markets	Failure in bioengineering structures installed during construction Poor seedling survival rate or regeneration rate under compensatory tree plantation and re-vegetation activities Carried out in Construction stage	Adoption of alternate bioengineering or engineering measures. Regular watering and monitoring of seedling survival and re-vegetation and taking of appropriate measures Such as fencing, preventing of cattle to eat freshly planted seedlings.	Road ROW and market places	LGED maintenance schemes	PMO, LGED	Cost to be borne by LGED, GOB
<b>Impacts on Socioeconomic Environment</b>							
<b>Impacts on Labor Rights during Construction</b>							
30	Employment of labor	Rigorous living and working conditions affect workers' health	Provide laborers and others resident at the site lodging in a camp setting outside of any danger zone, food service facilities, safe drinking water, adequate washing and bathing facilities for maintaining personal hygiene, and	Labor camps	Construction contractor	Environmental Consultant	Cost is included in the construction contract

Serial No.	Action	Resource Impact	Mitigation	Location	Responsibility		Cost
					Implementation	Monitoring	
			access to health care				
31	Set up of construction camps	Sanitary waste and litter degrade local environment around construction camps	Camp facilities should be located at a distance from nearby communities. Provide sanitary facilities (dry pit or pour flush latrines) for workers and arrange for disposal of solid waste in accordance with local practice	Construction and labor camps	Construction contractor	Environmental Consultant	Cost is included in the construction contract
32	Operation of construction camps	Threat of HIV/AIDS and other STDs	HIV/AIDS awareness-raising campaign among the construction workers and in the nearby communities.	Construction and labor camps and local community	Construction contractor	Environmental Consultant	Cost is included in the construction contract
<b>Public Liability of Contractors and Damage to Local Infrastructure during Construction</b>							
33	Water supply disruption (Targeted impacts during construction)	Water supply systems along road section a are put out of commission during construction, disadvantaging local people	Devise a plan with necessary design features to assure these water sources are maintained during construction and left in as good or better condition after construction is complete. Provide prior notice of two weeks to the communities regarding possible disturbance and have measure to provide alternative supply such as via mobile tank during temporary disruption	Jobsites in road and market implementation	Construction contractor	Environmental Consultant	Cost is included in the construction contract
34	Disruption of foot path or mule tracks (Targeted Impacts during construction)	Passage is impaired for people with no alternative path of access to homes, schools and public facilities	Maintain a safe and accessible pathway for both children and adults that need to pass through the area during the period of construction	Beside the road alignments and inside the market under implementation	Construction contractor	Environmental Consultant	Cost is included in the construction contract
<b>Impacts on Archeological Remains during Construction</b>							
35	Construction excavation: archaeology	Damage to archeological monuments and unearthed evidence.	Halt nearby work upon discovery of archeological relics. Notify LGED to contact relevant government authority to investigate and undertake recovery. Work to remain halted at the specific location until recovery is complete.	Construction zone	Construction contractor	Environmental Consultant	Cost is included in the construction contract

## **B. Institutional Requirements for Implementing EMP**

81. PMO will be responsible to ensure adherence and implementation of the EMP at all stages of works by the contractors. An environmental consultant will assist PMO to undertake following tasks:

- (i) Review of project design and specifications to ensure their adequacy and feasibility with respect to the implementation of EMP and or Environmental Code of Practices (ECoP).
- (ii) Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by the various agencies, namely, ADB, DOE and local bodies;
- (iii) Interact with the counterpart of the Contractor(s), review work progress/ plans and ensure implementation of the EMP;
- (iv) Co-ordination with the nongovernment organizations (NGOs), community groups and Government departments on environmental issues, provide clarifications/ and obtain clearances during project implementation if any;
- (v) Monitoring sensitive environmental attributes during construction to ensure that the suggested mitigation measures in the EMP are implemented;
- (vi) Documentation of the environmental management/ monitoring activities for the regular project implementation progress report; and
- (vii) Conducting environmental training/ awareness programs for the contractors, the project implementation personnel and the communities.

82. The Environmental Unit (EU) of LGED is now headed by a Superintending Engineer. EU has two full-time positions at present: one Executive Engineer and one Assistant Engineer. EU will be expanded into a team of environmental scientists/engineers with provision for mid- and junior level environmental scientists. The EU will also play a proactive role in environmental monitoring during project implementation as well as in undertaking post-project evaluation of projects in order to assess environmental compliance and develop future strategies on the basis of 'lessons learned'. The EU will also be entrusted with the task of organizing and administering training modular courses for the LGED staff and other stakeholders on environmental assessment and monitoring, social impact assessment, and public consultation/ participation.

83. The LGED through its PMO is responsible to implement the overall EMP. However, during the construction stage, the contractors are responsible to mitigate all environmental impacts related with the construction activities. In this context, the EMP will be included into the Bidding Documents (BD) of all the construction packages.

**Table 3: Environmental Monitoring Control Matrix – Construction Phase**

<b>Environmental Attributes / Project Actions</b>	<b>Mitigation measures (for detail description refer to EMAP of IEE)</b>	<b>Monitoring Frequency During construction</b>
Setting out & clearing RoW	Archaeological evidence/ idols/ tombs if noticed/ found – inform Archaeological Department	Weekly
Traffic Diversions & Sign Boards	Diversions to be smooth sign boards in place, clear & bold particularly in night & cause least inconvenience to road users	Weekly
Borrow Areas	Seek prior approval from local environmental regulatory agencies and compliance at all stages of operations. After borrowing ensure re-vegetation, drainage, erosion protection as per EMAP	Monthly
Work sites	Comply with local Environmental regulations for air quality, noise, occupational hazard & safety procedures at all stages of work	Weekly
Ground water level in and around construction tube wells	Bore wells shall be away from human settlements; determine sustainable yield and restrict withdrawal of water within yield recommended for region. Monitor depth of water below ground level in wells in and around construction tube wells before start and after completion of water withdrawal for the day	Monthly
Construction Equipment/Vehicles	Ensure vehicles are regularly maintained; have pollution under control certificates revalidated every month	Quarterly
Noise at all operational areas	Record noise levels at every 5 minutes for 24 hours (both day time & night time)	Monthly
Top soil from land clearing operations	Preserve and restore the topsoil. If cannot be used for restoration, divert for other applications like re-vegetation, embankment turving and alike	Weekly
Hot Mix Plants	Located at least 1.5 km from settlements, barren land and not agricultural lands. Monitor air quality, waste discharge and noise levels regularly as mentioned under Sl. No. 10, 11 above. Ensure all operations comply with local environmental Regulations	Quarterly
POL (liquid & solid waste) /Hazardous Storage Areas	POL storage areas have impervious lining, containment ditches, oil & grease traps as per EMAP. Regular inspection & Maintenance. Comply all local environmental regulations	Weekly
Soil erosion and conservation	Borrow areas shall have gentle slopes connected to nearby natural water bodies, re-vegetated	Monthly
Channel / River beds	Ensure most activities are scheduled for dry months reshaping of channel bed after completion of construction	Monthly
Water Supply Sanitation & Health at camp sites	Adequate water supply as per norms septic tanks and soak away pits. Kerosene and LPG supply, health care facilities vaccination for work force camps	Weekly
Construction of Noise Barriers	Consult affected parties like hospitals, educational institutions for eliciting opinion during constructing barriers	Quarterly

**Table 4: Environmental Management Cost**

<b>Project Action/ Environmental Attributes</b>	<b>Mitigation Measures</b>	<b>Implementing/ Responsible Organization</b>	<b>Cost in lacs(BDT)</b>
Diversion of traffic	<ul style="list-style-type: none"> <li>• Appropriate traffic diversion schemes shall be implemented so as to avoid inconvenience due to project operations to present road users, particularly during nighttimes.</li> <li>• Proper diversion schemes will ensure smooth traffic flow minimizes accidents, traffic snarl ups, and commotion.</li> <li>• The diversion signs should be bold and clearly visible particularly at night.</li> </ul>	Consultants and contractors	5.0
Construction Camp Sites	<ul style="list-style-type: none"> <li>• The construction campsites shall be away from any local human settlements and preferably located on lands, which are not productive barren/waste lands presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. This would minimize dependence of construction personnel on outside resources, presently being used by local populace and minimize undesirable social friction thereof.</li> <li>• The camps shall have septic tank/ soak pit of adequate capacity so that it can function properly for the entire duration of its use.</li> <li>• All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible.</li> <li>• The construction camps shall have health care facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible.</li> <li>• The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use.</li> <li>• All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible.</li> <li>• The construction camps shall have health care facilities for adults, pregnant women and children.</li> <li>• All construction personnel shall be subjected to routine vaccinations and other preventive/ healthcare measures.</li> <li>• The construction camps shall have in house community/common entertainment facilities. Dependence of local entertainment outlets by construction camps should be discouraged /prohibited to the extent possible</li> </ul>	Supervising engineer with contractor and Department of Environment	10.0
Work sites	<ul style="list-style-type: none"> <li>• All personnel in work sites shall have protective gears like helmets, boots, gloves, etc. so that injuries to</li> </ul>	Design consultants	5.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
	<p>personnel are minimized.</p> <ul style="list-style-type: none"> <li>• Children and pregnant women shall not be allowed to work under any circumstances.</li> <li>• No personnel shall be allowed to work at site for more than 10 hours per day (8 hour makes one work shift). Personnel who are likely to exposed to noise levels beyond stipulated limits shall be provided with protective gears like ear plugs etc and regularly rotated.</li> <li>• Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum</li> </ul>	Supervising engineer with contractor and DOE	
Construction Equipment Vehicles	<ul style="list-style-type: none"> <li>• All equipment/ vehicles deployed for construction activities shall be regularly maintained and not older than 5 years.</li> <li>• Vehicles/equipment shall be regularly subjected for emission tests and shall have valid Pollution Under Control certificates. Revalidation of certificates shall be done once in a month.</li> <li>• All vehicles deployed for material movement shall be spill proof to the extent possible.</li> <li>• In any case all material movement routes shall be inspected daily twice to clear off any accidental spills.</li> </ul>	Design consultants Supervising engineer with contractor and DOE	15.0
Water resources & drainage channels	<ul style="list-style-type: none"> <li>• The rural road construction will also require construction of several cross drainage structures, minor and major bridges to facilitate development in accordance with design requirements and standards.</li> <li>• Impacts arising out of construction of drainage structures is not likely to impact drainage pattern since under the road design, pattern of flow and discharge capacities of all drainage structures are reviewed and designed to negate any heading up or flooding problems.</li> <li>• Impacts on water quality are not significant or either negligible since construction activities to be scheduled to complete during dry months of year.</li> <li>• Adequate precaution is to be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. Spillage if any shall be immediately cleared with utmost caution to leave no traces.</li> <li>• Channel beds are to be cleaned up (50 m u/s &amp; 50 m d/s sides of water courses) and restored to its previous state after completion of construction but prior to onset of monsoon.</li> </ul>	Design consultants Supervising engineer with contractor and DOE	30.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
Borrow areas	<ul style="list-style-type: none"> <li>• Borrow areas identified/ suggested during project preparation are to be investigated for presence of ecologically sensitive areas if any and cleared thereof.</li> <li>• Within these locations, the actual extent of area/zones to be excavated areas is to be demarcated with signboards. All such operational areas are to be access controlled particularly for locals and for grazing cattle.</li> <li>• Through this project, the borrow areas/pits may be converted into surface/ ponds wherever possible, as a derivative of development. Some of the ponds could serve as source of water for agriculture, a practice prevalent in some part of the country.</li> <li>• The top soil recovered from newly acquired land areas for road construction is preserved and used for turfing of embankment(s) of project highway.</li> </ul>	Supervising engineer with contractor	10.0
Soil erosion and conservation	<ul style="list-style-type: none"> <li>• Along rural roads the widening activities will raise, extend and enlarge existing roadway/tracks all along the alignment therefore mitigation measures to contain erosion and drainage problems are essential along RoW</li> <li>• Measures to ensure embankment stabilization including selection of less erodable material, good compaction, re-vegetation, placement of gabions or any suitable measures around bridges and culverts etc. (in case required) are included in technical specification and contract documents. The engineering measures for countering soil erosion, slope protection, drainage wherever required considered for project highway and detailed project report.</li> <li>• Many of impacts on soil due to road construction can be significantly mitigated by some of the following measures               <ol style="list-style-type: none"> <li>a) Minimizing area of ground clearance only to the extent required.</li> <li>b) Balancing the filling and cutting of earth to the extent possible.</li> <li>c) Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type.</li> <li>d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and not after construction has been completed.</li> </ol> </li> </ul>	Design consultants Supervising engineer with contractor	50.0
Hot Mix Plants	<ul style="list-style-type: none"> <li>• Hot mix plants shall be at least 1.5 km away from any human settlements and preferably located on leeward side.</li> <li>• Hot mix plants/sites shall be located on barren/ uncultivable lands. Diversion of cultivable/ agricultural lands, even preferred by local people for economic gain shall not be allowed unless otherwise warranted by specific local conditions.</li> </ul>	Design consultants Supervising engineer with contractor and DOE	5.0
Loss of fertile	<ul style="list-style-type: none"> <li>• Clearing operations within RoW and at all places of</li> </ul>	Design	20.0

Project Action/ Environmental Attributes	Mitigation Measures	Implementing/ Responsible Organization	Cost in lacs(BDT)
soil	<p>operational areas like borrow areas, work areas, labour camps, construction of new/ upgradation of existing to new haulage roads, hot mix plants, storage areas etc. shall consider preservation of fertile soil .</p> <ul style="list-style-type: none"> <li>• As a first option, topsoil should be restored to its initial place after the specific activity is completed for which the area was vacated, or for enriching some other place like embankment slopes for turfing/ erosion protective measure.</li> </ul> <p>The topsoil can also be used for supporting re-plantation activities within RoW/ median.</p>	consultants Supervising engineer with contractor and DOE NGOs, LGED	
Location of campsites, storage depots	<ul style="list-style-type: none"> <li>• The location of campsites, storage depots shall preferably be on unproductive/ barren lands, away from forest areas (minimum 1.5 km).</li> <li>• Use of agricultural/ cultivable lands shall not be allowed under any circumstances.</li> <li>• All fuel loading, unloading, storage areas shall be spill proof, leakage proof and carried out on paved areas.</li> <li>• The sites shall have suitable system to drain storm water, sanitary facilities and shall not contaminate any nearby water courses/ drains.</li> <li>• The site shall also have a system for handling any emergency situation like fire, explosion etc.</li> </ul>	Design consultants Supervising engineer with contractor and DOE , LGED	10.0
Storage of hazardous materials	<ul style="list-style-type: none"> <li>• All areas intended for storage of hazardous materials shall be quarantined and provided with adequate facilities to combat emergency situations.</li> <li>• The personnel in charge of such areas shall be properly trained, licensed and with sufficient experience.</li> <li>• The areas shall be access controlled and entry shall be allowed only under authorization</li> </ul>	Supervising engineer with contractor and DOE, LGED	5.0
<b>Total</b>			<b>170.0</b>

## VII. CONCLUSIONS AND RECOMMENDATIONS

84. The potential environmental impacts of this project are insignificant, and temporary, which will mostly occur only during the construction stage. All the potential environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EMP. The widening and strengthening of the road network by creating additional road capacity between different points of the road network will improve operational efficiency and can act as an effective mechanism for reducing economic and environmental costs of the road stretches. The project will bring considerable improvement to possible exposure levels of population when compared with no project scenario. The benefits from the implementation of the proposed subprojects are more significant and long term in nature compared with the adverse impacts most of which could be mitigated or avoided. The institutional requirements for implementation of mitigation measures have been identified and monitoring is elaborated in the EMP. Several actions and measures are suggested to strengthen the in-house capacity of the LGED in dealing with environmental issues with special reference to the climate change impacts.

It is concluded that the subprojects are not expected to lead to significant adverse impacts on the environment if appropriate mitigation measures (both protective and compensatory) are considered with adequate environmental monitoring. Further environmental assessment of the subprojects to EIA level is not required. The subproject is environmentally cleared and can go ahead with implementation.