NATIONAL HOUSING AUTHORITY (NHA)

LOW INCOME COMMUNITY HOUSING SUPPORT PROJECT (LICHSP)

Environmental Assessment (EA) Report

For

Kobdaspara Settlement, Sirajganj

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
DC	Deputy Commissioner
DFID	Department for International Development
DoE	Department of Environment
DPD	Deputy Project Director
DPHE	Department of Public Health Engineering
EA	Environment Assessment
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
EIA	Environment Impact Assessment
EMF	Environmental Management Framework
EMP	Environment Management Plan
EPA	Environmental Protected Areas
ESA	Environmental Sensitive Areas
FAR	Floor Area Ratio
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanisms
GRO	Grievance Redress Officer
GRS	Grievance Redress System
GSB	Geological Survey of Bangladesh
LICHSP	Low Income Community Housing Supporting Project
MoEF	Ministry of Environment and Forest
MoHPW	Ministry of Housing and Public Works
NGO	Non-governmental organization
NHA	National Housing Authority
OP	Operational Policy
PD	Project Director
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPPR	Urban Partnership for Poverty Reduction
CSC	Community Support Center
WASA	Water Supply & Sewerage Authority
WB	The World Bank

EXECUTIVE SUMMARY

Introduction

Bangladesh, one of the most densely populated countries in the world, with 160 Million people live in 144,000 Sq. Km. area and is rapidly urbanizing. Over the last 40 years, the country experienced the most rapid urbanization in South Asia. About 40 Million people of Bangladesh live in urban areas, out of which 21 per cent live below the poverty line. One of the natural consequences of this has been the growth of informal and low-income settlements in cities and towns.

Most of the urban poor live in informal and low-income settlements, which are characterized by substandard living conditions. The informal and low-income settlements are characterized by acute problems of infrastructure in the form of poor housing, inadequate availability of drinking water, poor drainage and sewerage facilities and pollution. The poor living conditions of informal and low-income settlements undermine the economic growth and poverty reduction efforts. Informal and low-income settlement are found in all major cities in Bangladesh although their concentrations may vary depending on the size of cities.

Following government's request, a World Bank team together with National Housing Authority (NHA) of the Ministry of Housing and Public Works (MoHPW) performed an assessment of the strength and capabilities of urban poor communities in Bangladesh to undertake a community-based program on improving living conditions. In particular, efforts have focused on assessment of urban poor community groups mobilized through Development Partner (DP) programs, such as the Urban Partnerships for Poverty Reduction (UPPR) (DFID/UNDP) and the Urban Governance and Infrastructure and Improvement Project (ADB/GIZ), as well as through NGOs, CSOs and other community efforts. The results of these assessments have demonstrated that, while there is significant variation in community strength and capability both by towns, and within towns, that there exists a solid base of urban poor communities with good capacity, community savings, and a demonstrated willingness and capability to participate in a demand driven program around improving living conditions, most notably shelter. The project will focus its efforts where community capacity demonstrates a "graduation" of sorts to be able to play a key role in upgrading and improving their settlements.

Subproject Background

A total of 654 low-income settlements are identified in Sirajganj Municipality. These settlements consist of 38,941 houses and 51,977 households. Kobdas Para is one of the selected low-income settlements of Sirajganj Pourashava. There are 290 houses with 329 households but living environment of the low-income settlements is substandard and unhygienic. The settlement area is at two meter lower than the road level and occurrence of waterborne diseases are common during the wet season. Other facilities like internal road, sanitation, solid waste management are insufficient. Hence, to improve the living condition of the Kobdas Para community LICHSP will finance a multi-sectoral package of tertiary infrastructure and service improvements. This includes a combination of land development work, water

supply, drainage, paved access, electricity, sanitation services and solid waste management upgrading works, depending on the expressed demands of the Kobdas Para community.

Purpose of the Study

The objective of the overall assignment is to carry out a site specific Environmental Assessment (EA) and to prepare comprehensive Environmental Impact report for the implementation of the proposed settlement upgrading project. The study is projected to meet the requirements of the Government of Bangladesh, World Bank's safeguard policy and the project specific EMF.

Study Approach & Methodology

Environmental screening has been performed for all the subproject components. Baseline data on subproject design was generated through discussion with the client and review of subproject documentation, and from secondary and primary sources. Opinions formed were revalidated through field work entailing site investigations and Interviews with representatives of the relevant NHA officials, beneficiary and affected people within the subproject influence zone (1km).

Policy and legislation

Legislative basis for the Environmental Assessment (EA) are the Environmental Conservation Act 1995 (ECA'95), the Environmental Conservation Rules 1997 (ECR'97) and the World Bank Safeguard Policies. Department of Environment (DoE), under the Ministry of Environment and Forests (MoEF). The World Bank's position for compliance with the environmental concerns is clearly elaborated mandatorily in the form of Operational Policy (OP) and Bank Policy (BP). The proponent (NHA) has conducted an Environmental Assessment (EA) of development proposal and the responsibility of DOE is to review EAs for the purpose of issuing Environmental Clearance Certificate (ECC) and the World Bank will provide no objection letter to the proponent.

Description of Subproject Intervention

The proposed Kobdas Para low income settlement /subproject site is located within the jurisdiction of the ward no 7 of Sirajganj Pourashava. The Kobdas Para Settlement Subproject is considered with the interventions like; land development, water supply, drainage, paved access, electricity, sanitation services and solid waste management in a single package of upgrading works, depending on the expressed demands of the Kobdas Para communities. The specific interventions are:

- Relocation of the electric poles and site clearing works;
- Construction of site office;
- Land development work by sand/earth filling;
- Construction of retaining wall
- Road development work in and around the settlement area;
- Construction of integrated drainage network in the settlement area;
- Installation of waste collection bin and select a place for the secondary transfer station;
- Construction of sanitary latrines with septic tank;

- Installation of tube wells;
- Providing water supply networking facilities if possible;
- Installation of street light.

Subproject Area Baseline Environment

An environmental baseline survey has been carried out in areas surrounding the proposed site. The specific objectives of the baseline study were to gather information on the existing physical environment of the areas within and around the project sites, and to assess peoples' perception on different aspects of the proposed project.

Physico-chemical environment

As a part of the baseline survey, different physical features covering in and around the proposed settlement site were identified and documented. Relevant data on climate, geology and soils, air quality, noise level, and water quality (surface water and groundwater) of the subproject area were collected through field investigation, lab test and secondary sources.

Ecological environment

Ecological information in and around the proposed settlement areas were collected through field research, consultation with local people, and literature review. The baseline ecological survey primarily focused on identifying floral and faunal diversity and their distribution and abundance as well as their biological status in Bangladesh (e.g. threatened flora and fauna).

Socio-economic environment

An assessment of the baseline of socio-economic conditions of the settlement was made. Efforts were made to identify the socio-economic attributes that may be impacted due to the proposed subproject activities by conducting field study, formal and informal interviews.

Environmental Screening and EA Categorization

Environmental screening is an important part of the EA report. After site visit Environmental screening report was prepared by following the EMF. In the EMF of LICHSP, all of the intervention to be implemented by the LICHSP fall in Category B as per WB guideline. But according to GOB guideline only for housing, road and drainage intervention are classified as category Orange B. Remaining intervention to be implemented by the LICHSP are not address in GOB guideline. As per EMF of LICHSP, EA (IEE) is required to meet the regulatory requirement of the project.

Specific Impacts, Mitigation and Enhancement Measures

This section identifies and predicts the probable impacts on different environmental parameters due to construction and operation of the proposed settlement up gradation subproject. In addition, this section will also provide mitigation and enhancement measures. After studying the existing baseline environmental scenario, monitoring environmental parameters, reviewing the process and related statutory norms, detailing the waste management measures, the major impacts can be identified during pre-construction, construction and operation phase. During pre-construction phase main adverse impacts associated with resettlement of the existing Community, demolition/shifting of existing houses, disposal of demolished toilet waste, land filling and leveling work and clearing of vegetation and cutting of trees. During construction period, the impacts are directly related to the construction and those are;

generated waste management, sound and dust hazards, air pollution etc. and proper environmental safeguard compliance issues are to be ensured during construction period. Also, special attention needs to be maintained during operation and maintenance, i.e. maintenance of water supply, toilet, solid waste management, and drainage subproject interventions in order to ensure environmental sustainability in the selected community.

Positive Impact:

Since the proposed LICHSP project is designed to upgrade the living condition of low income community involving construction of different interventions and those will yield a lot of environmental benefits like; developed living standard, smooth communication , hence there will be expected some positive impacts. All these impacts are divided into two categories. First is the certain positive impacts i.e. the impacts that are expected from interventions, second is the probable positive impacts i.e. the impacts that are expected from the enhancement measures.

Environmental Management Plan (EMP)

The EMP consists of a set of Institutional Arrangement, Mitigation Measures and Plan, Monitoring Plan, Documentation and reporting, Contractual arrangements for EMP implementation, EMP implementation cost, Capacity building and Grievance redress mechanism to be taken during the design, construction and operation (post-construction) stages of the project. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Facilitate the implementation of the environmental and social mitigation measures identified during the present EA and discussed in specific impact assessment chapter.
- Assign responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project interventions;
- Define a monitoring mechanism and identify monitoring parameters to ensure effective implementation of the mitigation measures.
- Assess environmental training requirements for different stakeholders at various levels.
- Describe communication and documentation requirements.

Institutional Arrangement for Safeguard Compliance

This project will be implemented by National Housing Authority under the Ministry of Housing and Public Works. The PMU of LICHSP will be responsible for overall environmental management including implementation of mitigation measures and monitoring, and preparation of quarterly progress and monitoring reports. The PMU has been formed with the Project Director, Deputy Project Director, Environment Specialists, Social Specialist, Procurement Specialist and Financial Management Specialist. In the institutional arrangement procedure, Project Director, and Team Leader/ Deputy Team Leader will directly involve in planning, design and implementation. During implementation, the PD, TL/DTL would be supported by PMU Environmental Specialist and Social Specialist and NHA divisional offices. To ensure the effective implementation of safeguard compliance, NHA will ensure active engagement of community support center (CSC), Pourashava and community development committees (CDC). The community support center (CSC) will be established in Sirajganj under the

project during construction period. The CSC will be monitored by the PMU. The CSC officials, especially engineer will be responsible for supporting the construction supervision. In addition, Engineering head of Sirajganj Pourashava, CSC focal person for Environment and local community head will be responsible to monitor and supervise the overall environmental concern. The civil works contractors will implement the environmental mitigation measures.

Grievance Redress System

A common GRM will be in place for social, environmental, or any other grievances related to the project; the resettlement plans (RPs) and EAs will follow the GRM, which is developed in consultation with key stakeholders. The GRM will provide a reachable and reliable platform for receiving and facilitating resolve of affected persons' grievances related to the project. The multi-level GRM for the project is outlined below, each level having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required.

Emergency Response and Disaster Management

Disaster management can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular the preparedness, response, and recovery to lessen the impact of disasters. Emergency Preparedness Planning (EPP) and Contingency Planning (CP) are the processes of disaster management plan for developing strategies, arrangements, and procedures to address the humanitarian needs of those adversely affected by the crisis. There are four main types of disasters, namely: Natural disasters, Environmental Emergencies, Complex Emergencies, and Pandemic Emergencies.

For the Low Income Community Housing Supporting Project (LICHSP) activities, with the help of PMU, would identify the immediate needs, prioritize the tasks and identify resource requirements to address the humanitarian needs of those adversely affected by the crisis.

Environmental Monitoring Plan

Environmental monitoring is an essential component of environmental management plan, as it provides the basic scenario of the impact of the project on baseline condition. Hence, a three tire of monitoring schedule (compliance monitoring, community monitoring and effect monitoring) has been sketched for this subproject based on the environmental components that may be affected during the construction and operation of the project. Since project is likely to have impact on various components of environment, a comprehensive monitoring plan covering all parameters of environment i.e. physicochemical, ecological and socio economic. Monitoring Plan has been separately suggested for construction phase and operation phase. Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors. The main purpose of this monitoring program is to ensure that the various tasks detailed in the EMP particularly the mitigation measures are implemented in an effective manner, and also to evaluate program impacts on the key environment and social

parameters. Various types of EMP monitoring are Compliance Monitoring, Community Monitoring and Effects monitoring

Public Consultation and Participation

Public consultation forms an important part of the EA study. It ensures people's participation at all levels, i.e., in planning, designing, implementation, and operation and maintenance of the subproject. The main objective of the consultation process is to explain the households living in the project and surrounding area about the proposed project and to seek their opinions regarding the possible impacts of the project. Public involvement is a fundamental principle of any environmental assessment study. In fact, inclusion of the views of the affected and interested public helps to ensure that the decision making process is justifiable and fair and gives to more informed choice and better environmental outcomes. The findings from the public consultations carried out as a part of the EA study has been utilized in the development of the EMP especially in identifying the significant impacts of the proposed project and developing the corresponding mitigation measures.

Conclusion and Recommendations

The present EA report finds that though there are certain adverse environmental impacts associated with the construction activities under consideration, these are manageable. The impact on the social environment is positive through creation of job and business opportunities for local residents from the subproject. The subproject is essential for improvement of living standard of the Kobdaspara peoples. The subproject has been designed to comply with the country's environmental laws and regulations, and WB environmental safeguard policy especially on physicochemical, Ecological and socio-economic parameter. The subproject management will take steps to ensure that the interventions meets the World Bank's environmental standards. Given the management measures and monitoring commitments by the NHA for the subproject, environmental impact of the subproject will be manageable. In a nutshell, the subproject is recommended for implementation, in compliance with the environmental measures mentioned in the environmental management plan.

CHAPTER 1. INTRODUCTION

1.1 Background of the Project

Bangladesh is one of the most populous, as well as one of the most densely populated countries in the world**.** With a population of about 160 million living in an area of 144,000 km^2, Bangladesh is rapidly urbanizing. Over the last 40 years, Bangladesh experienced some of the most rapid urbanization in South Asia. The proportion of urban population rose from 15% in 1980 to 28% in 2010. Approximately 40 million people in Bangladesh live in urban areas, out of which 21 per cent live below the poverty line. One of the natural consequences of this has been the growth of informal and low-income settlements in cities and towns.

The urban centers in Bangladesh are playing a vital role in the national development despite the prevailing adverse socio-economic and urban environmental conditions. Though at present the urban population is about 30 percent of the total population of the country, but their contribution to GDP is more than 60 percent. However, poor infrastructure and services in the urban centers are posing challenges to achieving higher productivity from them.

Most of the urban poor live in informal and low-income settlement, which are characterized by substandard living conditions. The informal and low-income settlements are characterized by acute problems of infrastructure in the form of poor housing, inadequate availability of drinking water, poor drainage and sewerage facilities and pollution. The poor environmental conditions in informal and low-income settlement exact a heavy toll on the quality of life of the low income dwellers. The poor living conditions of informal and low-income settlements, which are an integral part of the urban centers, undermine continued economic growth and poverty reduction efforts. Informal and low-income settlement are found in all major cities in Bangladesh although their concentrations may vary depending on the size of cities.

Following government's request, a World Bank team together with National Housing Authority (NHA) of the Ministry of Housing and Public Works (MoHPW) undertook an assessment of the strength and capabilities of urban poor communities in Bangladesh to undertake a community-based program on improving living conditions. In particular, efforts have focused on assessment of urban poor community groups mobilized through Development Partner (DP) programs, such as the Urban Partnerships for Poverty Reduction (UPPR) (DfID/UNDP) and the Urban Governance and Infrastructure and Improvement Project (ADB/GIZ), as well as through NGOs, CSOs and other community efforts. The results of these assessments have demonstrated that, while there is significant variation in community strength and capability both by towns, and within towns, that there exists a solid base of urban poor communities with good capacity, community savings, and a demonstrated willingness and capability to participate in a demand driven program around improving living conditions, most notably shelter. The project will focus its efforts where community capacity demonstrates a "graduation" of sorts to be able to play a key role in upgrading and improving their settlements.

1.2 Subproject Background

To reduce vulnerability of designated urban poor communities by providing improved, secure and affordable shelter in select informal settlements in five ULBs of Bangladesh has been selected. Sirajganj Pourashava is one of them. Sirajganj lies just west of the Brahmaputra River and beside the Jamuna River, about 70 miles (110 km) northwest of Dhaka. It has an area of 28.69 sq. km. There are 15 wards and 50 mahallas. Accordingly to the census of 2011, the total population of Sirajganj Pourashava is 158,913. 80,241 of these are males and 78,672 are females. The literacy rate among town residents is 63.2%.

A total of 654 low-income settlements are identified in Sirajganj Municipality. These settlements consist of 38,941 houses and 51,977 households. The land area of the low-income settlements is 1,577.2 acres (about 43.8% of Sirajganj Municipality's total area of 3,602.8 acres). Out of 654 settlements, 142 settlements are categorized as "Very Poor", 494 settlements as "Poor" and 18 settlements as "Not Poor" with respect to land entitlement, infrastructure, utility services, community facilities, employment, income and vulnerability. However, Kobdas Para is one of the selected low-income settlements of Sirajganj Pourashava. There are 290 houses with 329 households but living environment of the low income community is substandard and unhygienic. Ground level of the area is about 2 m lower than the road level. So during rainy season total area goes under water. Other facilities like internal road, sanitation, solid waste management are insufficient. Hence, to improve the living condition of the Kobdas Para community LICHSP will finance a multi-sectoral package of tertiary infrastructure and service improvements. This includes a combination of land development work, water supply, drainage, paved access, electricity, sanitation services and solid waste management upgrading works, depending on the expressed demands of the kobdas Para community.

1.3 Purpose of the Study

The objective of the overall assignment is to carry out a site specific Environmental Assessment (EA) and to prepare comprehensive Environmental Impact report for the implementation of the proposed low income settlement upgrading project. The study is projected to meet the requirements of the Government of Bangladesh, World Bank's safeguard policy and the project specific EMF.

1.4 Objectives of the EA study

The overall objective of the EA study of low income settlement upgrading is to ensure that environmental and social management practices are cohesive in the design, construction, operation and maintenance of the low income settlement upgrading related interventions .The specific objectives of the EA study are to:

- Preparing an environmental baseline within the sub-project influence area, against which impacts of the proposed slum upgrading project would be evaluated;
- Assessment and evaluation of impacts of major project activities on the baseline environment during preconstruction phase and operational phase;
- Identifying mitigation and enhancement measures and environmental code of practice

(ECoP);

- Development of environmental management plan (EMP) including preparation of environmental monitoring plan with responsibility and estimation of budget for implementation EMP.

1.5 Scope of the EA

The subproject assessment is included environmental screening ***(Appendix-1)*** for all of intervention which will be implemented under this low income settlement upgrading project. According to screening, EA report is required to meet the regulatory requirement of slum settlement upgrading interventions. Furthermore, during preparation of EA report proposed engineering works, field investigations, stakeholder consultation, primary and secondary data collection, and review of other similar project reports in Bangladesh has been considered. The EA covers the general environmental profile of the subproject area including physical, ecological, environmental, social, cultural and economic resources. Baseline environmental monitoring (primary data) was carried out on water (surface and ground water), and noise quality measurements. The EA includes an overview of the potential environmental impacts and their severity, and proposes necessary mitigation measures and environmental management plan for each of the identified and anticipated impacts. Since, as per screening this subproject is required EA report hence, initially for bank concurrence a draft report has been prepared. After getting concurrence from WB it will be sent to DoE for clearance and has to be ensured before commencement of work.

1.6 Methodology of the EA

Based on the above scope of work, the following steps were followed during the EA process:

- Review of legal and statutory requirements;
- Preliminary reconnaissance to identity environmentally sensitive issues relating to the project and base line conditions;
- Collection of Primary and secondary data;
- Stakeholders Consultations;
- Understanding the technical aspects of the proposed intervention of low income settlement;
- Conducting modeling exercise to analyze environmental impact;
- Undertaking identification of potential environmental impacts (along with residual impacts and cumulative impacts, if any) and evaluation of socioeconomic consequences of such impacts.

CHAPTER 2. POLICY AND LEGISLATION

2.1 Relevant Government Policies, Acts, Rules, and Guidelines in Bangladesh

Protection and improvement of environment and biodiversity is one of the fundamental principles of the State Policy. It is the constitutional accountability of the State to protect and improve the environment and to preserve and safeguard country's natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens (GoB 1972, Sec. 18 A).

The requirements for compliance with environmental regulations are laid down by the policy, legal and regulatory framework in the country. A large number of laws related to environmental issues, some dating back to the 19th century exist in Bangladesh. The most important of these are the Environment Conservation Act 1995 (ECA, 95) and the Environment Conservation Rules 1997 (ECR, 97). Many of the other laws are cross-sectoral and are only partially related to environmental issues pertinent to the project. Most of the old legislations have become mostly obsolete also with the promulgation of the ECA, 95 and the ECR, 97.

The focus of the slums integration project is towards the poor segment of the society that is the most vulnerable to natural hazards and environmental degradation. The project is concentrated toward slum integration, and the components for development include housing, with the provision of basic services and facilities like road, water and sanitation, waste management, education, and health care. Thus, a number of relevant rules and acts, other than the ECA, 95 and the ECR, 97 that are relevant to the project components were reviewed.

2.1.1 The Bangladesh Environment Conservation Act 1995, amended 2002 and 2010

The ECA (1995 amended 2002 and 2010) was enacted for the 'conservation of environment'. It is also focused for the 'improvement of environmental standards'. Similarly, it is emphasized on the 'control and mitigation of environmental pollution'. Moreover, 'conservation of environment' defines the improvement of the qualitative and quantitative status of the environment. Accordingly, the components of the environment should not be degraded (ECA, 1995; Section 2). Furthermore, the ECA (1995 amended 2002 and 2010) specified different types of environmental pollution (ECA, 1995; Section 2). Accordingly, it is expected that:

- Any development project should not contaminate or alternate the physical, chemical or biological condition of air, water and soil. Moreover, there should not be any change of these environmental components in terms of temperature, taste, odor and density Projects should not discharge any liquid, gaseous, solid, and radioactive or other substances (waste) into air, water and soil which are harmful for the public health and the environment.
- The discharge of waste should not degrade the air, water, soil, livestock, wild animal, bird, fish, plant or other forms of life in the project area.

According to the ECA (1995amended 2002 and 2010), 'control and mitigation of environmental pollution' is applicable for development interventions. Therefore:

- Development project should encourage environment friendly use, store, transport, import and export of hazardous substance (ECA, 1995; Section 2).
- The project should take precautionary measures so that there should not be any incidents which lead to environmental degradation (ECA, 1995; Section 2).
- The project intervention should consider the national environmental standards and the information should be available in the project area (ECA, 1995; Sections 4 & 6).

It is also specified in the ECA that Environmental Clearance Certificate is required before initiating of the project from the Director General of Department of Environment (ECA, 1995; Section 12).

2.1.2 The Environment Conservation Rules 1997, amended 2003

The Environment Conservation Rules provide a first set of rules under the Environment Conservation Act, 1995. The ECR is further amended in 2002 and 2003. These provide, amongst others items, standards and guidelines for: (1) Categorization of industries and development projects, including roads and bridges on the basis of actual and anticipated pollution load, (2) Requirement for undertaking Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), as well as formulating an Environmental Management Plan (EMP) according to categories of industries/development projects/activities, (3) Procedure for obtaining environmental clearance, and (4) Environmental quality standards for air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust.

Under the Environmental Conservation Rules (1997) a classification system was established for development projects and industries on basis of the location, the size and the severity of potential pollution. It classifies industrial units and projects into four categories for the purpose of issuance of Environmental Clearance Certificate (ECC): (i) Green, (ii) Orange A, (iii) Orange B, and (iv) Red.

Green Category projects are considered relatively pollution-free and hence do not require initial environmental examination (IEE) and EIA. An environment clearance certificate (ECC) from the Department of Environment (DoE) is adequate for a project that fall into the Green category. **Orange Category** projects fall into two categories. Orange A projects are required to submit general information, a feasibility report, a process flow diagram and schematic diagrams of waste treatment facilities along with their application for obtaining DOE environmental clearance. Orange B projects are required to submit an Initial Environmental Examination (IEE) report, along with their application and the information and papers specified for Orange B projects. **Red** Category projects are those which may cause significant adverse environmental impacts and are, therefore, required to submit an EIA report. It should be noted that they may obtain an initial site clearance on the basis of an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers, such as feasibility study reports and no objections from local authorities. The DoE has recently developed IEE and EMP checklists in order to simplify the preparation of conventional and voluminous IEE and EMP reports that may contain irrelevant and unnecessary information. It is

understood that the interventions related to housing and other facilities will lead to deterioration of air and water quality. The national standards of different environmental components are placed in the ECR. The ECR (1997 amended 2003) has clearly specified the standard of air and water quality for the residential areas (i.e. for residential area the suspended particulate matters in the air and drinking water should be within 200 microgram per cusec meter and 50 total coliform number (per 100 ml) (ECR, 1997; Rule 12). It has also set limit for the generation of waste from household (ECR, 1997; Rule 13), emission from cooking stoves (ECR, 1997; Rule 12), vehicular exhaust from the adjacent pathways (Rules 12 & 13) and noise pollution during construction or from vehicular movement (ECR, 1997; Rule 12). Thus the ECR (1997 amended 2003) would guide the planners and designers on the accepted level of the pollution during the intervention in the slums. Table 3.1 presents are standards for air, water, wastewater, and noise set by Department of Environment.

2.1.3 Standards provided under Environment Conservation Rules (ECR) 1997

Table 2-1: Drinking Water Quality Standards (ECR, 1997)

Sample ID	Units	WHO drinking water guidelines	Bangladesh drinking water
pH	--	6.5 – 8.5	6.5 –
Turbidity	NTU	15	1
Iron, Fe	mg/L	0.3	0.3 –
Manganese, Mn	mg/L	0.4	0
Arsenic, As	ppb	10	5
Chloride, Cl^-	mg/L	250	150 -
Electrical Conductivity	mS/cm	--	-
Total Dissolved Solids, TDS	mg/L	1000	10

Source: ECR 1997

Table 2-2: Waste Water Quality Standards (ECR, 1997)

Parameter	Unit	Places for determination of standards		
		Inland Surface Water	Public Sewerage system connected to treatment at second	Irrigated Land
BoD_5 at 20^0 C	mg/l	50	250	100
CoD	mg/l	200	400	400

Source: ECR 1997

Table 2-3: Sound Level Standards (ECR, 1997)

Locations	Noise level (dBA)	Noise level (dBA) at night
Silent zone	50	40
Residential area	55	45
Mixed area	60	50

Commercial area	70	60
Industrial area	75	70

Source: ECR 1997

Table 2-4: Air Quality Standards (ECR, 1997)

Categories of Area	Suspended Particulate Maters	Sulphur-dioxide	Carbon Monoxide	Oxides Nitrogen
	Density in microgram per cusec meter			
Industrial and mixed	500	120	5000	100
Commercial and mixed	400	100	5000	100
Residential and rural	200	80	2000	80
Sensitive	100	30	1000	30

Source: ECR 1997

2.1.4 The Pourashava Act, 2009

The Pourashava Act (2009) clearly states the responsibilities of the Pourashava. The relevant sections of the Act are described below.

- Each Pourashava will publish "Citizen Charter*" containing* a provision of citizen services, description of citizen services and time frame for providing citizens services (GoB, 2009; Act 58, Section 53(1), p. 6722).
- Pourashava will form permanent committees for city planning, citizen services and development; and communication (GoB, 2009; Act 58, Section 55(1), p. 6723). Pourashava will form permanent committees for disaster management, poverty reduction & slum up gradation, health, water & sanitation; and waste management if necessary (GoB, 2009; Act 58, Section 55(2), p. 6723).

Health

If there is any unhealthy building or place, Pourashava will give notice to the owner to clean the place (GoB, 2009; Act 58, p. 6751). Pourashava will establish adequate number of hospital and dispensary according to the need of the citizens (GoB, 2009; Act 58, p. 6751). Pourashava will organize awareness programs for health education (GoB, 2009; Act 58, p. 6754).

Solid Waste Management

Pourashava will take all necessary steps for management and disposal of waste from roads, public toilet, drain, surroundings under its authority. Pourashava will set up 'dustbin' in different locations and alert the citizens for proper usage (GoB, 2009; Act 58, p. 6751).

Water Supply & Sanitation

Pourashava will ensure to all citizens of pure drinking water. Establishment of new water well, tube well or any other sources of water supply are restricted without Pourashava's permission (GoB, 2009; Act 58, p. 6754).

Water Drainage Management

Pourashava will build and maintain proper drainage system. Citizens can connect household drain to the main system upon submitting a fixed amount to the Pourashava (GoB, 2009; Act 58, p. 6755).

Public Water Body

Person responsible for pollution of public water bodies will be punished by the Pourashava (GoB, 2009; Act 58, p. 6756).

Punishable Acts (GoB, 2009; Act 58, p. 6778):

- Any change or providing layout of drain without Pouroshava's permission.
- Establishment of private drain by the public roads.
- Pollution of drinking water supply.
- Use of drinking water for other purposes like – taking bath, taking domestic animals for drinking, or any other deeds which can pollute the water source.
- Existent of leather industry within the residential area of Pourashava.
- Dig soil, well or stone within the residential area.

2.1.5 Bangladesh National Building Code, 2010

The objective of Bangladesh National Building Code (BNBC) is to follow minimum standards for design, construction and quality of materials. It also regulates the use, occupancy, location and maintenance of a building within Bangladesh. Rules and regulations of BNBC should be followed strictly to avoid the adverse impact of housing on environment. Set back rules and Floor Area Ratio (FAR) should be followed to minimize the impact of both natural disasters-like earthquake and man- made disasters like-building collapse and fire hazard (MoHPW, 2006; Chapter 4). According to this code the following issues should be considered before constructing a building. Appropriate sites should be chosen for development (MoHPW, 2010; Part: 2, Chapter: 1, section: 1.2.1). Adequate spaces between buildings and around buildings should be allowed for natural ventilation (MoHPW, 2010; Part: 2, Chapter: 1, section: 1.2.3). Existing water-bodies should be preserved (MoHPW, 2010; Part: 2, Chapter: 1, section: 1.2.6). Ecologically sensitive sites should be conserved and avoided for building construction (MoHPW, 2010; Part: 2, Chapter: 1, section: 1.2.8). No building shall be constructed on any site which is water logged. Site should be avoided where any part of site is deposited refuse, excreta or other objectionable material (MoHPW, 2010; Part: 3, Chapter: 1, section: 1.5.1.1). the relevant permitting authority may waive the requirement of side setback for approved low income row type, cluster or site and service schemes (MoHPW, 2010; Part: 3, Chapter: 1, section: 1.7.12.3). There should be provision of water seal latrine in low income housing. Water seal latrine can be provided on the basis of community toilets or shared toilets (MoHPW, 2010; Part: 3, Chapter: 3, section: 3.4.9). Requirements of fire safety, structural design, building services and plumbing services shall be as specified in the Code for low income housing. Piped water supply should be provided for all household in low income housing. In the absence of piped water, hand pump may be provided for all (MoHPW, 2010; Part: 3, Chapter: 3, section: 3.6).

2.1.6 National Housing Policy, 2016

Ensuring safe and secured housing with minimum standard of living facilities can improve the existing condition of housing in the slums. National Housing Policy (2016) of Bangladesh has also emphasized providing minimum standard of living to improve the existing unhealthy conditions in the slums (NHA, 2008; Section 5.9.2, p. 14). Night shelters and water supply, toilet facilities have to be provided to improve the existing condition of slum (NHA, 2016; Section 5.9.2, p. 14). But at the designing and planning phase, environmental impacts have to be considered before the provision of housing in slums. To ensure environment-friendly housing; agricultural land, forest, rivers and water bodies must not be altered into settlements (NHA, 2008; Section 5.2.2, p. 6). Natural heritage and historically important sites have to be conserved to balance equilibrium between cultural and natural environment (NHA, 2008; section 4.20, p. 5). Multi-storied, model and compact housing would be encouraged for the best use of land. Hazardous and toxic construction materials should be avoided for housing. Environment-friendly, healthy, inexpensive local construction materials, i.e. local natural resource and available materials should be used in housing (NHA, 2008; Section 5.3.2, p. 7).

2.1.7 National Land Use Policy, 2001

According to the National Land Use Policy the declared park, open space, play field and water bodies cannot be changed or modified for other usage. Identical characteristics (e.g. a tree) of a park cannot be cut down. Any kinds of development which affect the surrounding environment would be discouraged. For an example, if the establishment of a restaurant inside a park create noise and air pollution, it would be strictly prohibited. Water bodies under private ownership cannot be filled up without the permission of responsible agency. Green buffer area and open space have to be created in both coastal region and beside highways. Tree plantation would be encouraged socially to keep the environmental balance (MoL, 2001; Section 17.11, p 13; Section 17.12, p 13; Section 17.14, p 13; Section 17.15, p 13).

2.1.8 National Water Act, 2013

According to the policy of the Government of Bangladesh, the water sources should be free from any type of pollution (MoWR, 2013; Section 4.15.2 (i), p. 2789). However, the run-off of chemicals from the agricultural land into the water bodies will pollute the water. Serious consideration should be given to non-point pollution of water systems by fertilizers and pesticides as the pollution of water in urban outfalls and reservoirs, e.g., lakes, canals, ponds and ditches may result in amenity losses, fisheries depletion, and health problems and fish and aquatic species contamination. According to the policy of the Government of Bangladesh, the water should be examined in order to find ensure water quality (MoWR, 2013; Section 4.15.2 (i), p. 2783). In this regard, the treatment of wastewater is also important (MoWR, 1999; Section 4.6, p. 15). Though construction on the bank of river is seen in order to protect the area from flood and erosion, but construction activities in the water bodies are strictly discouraged (MoWR, 2013; Section 4.15.2 (i), p. 2786). Thus, there will not be any encroachment on the bank of water body, clearance of vegetation, engineering intervention to drain water from beels (a type of natural water body) in order to turn it to cropland.

2.1.9 Safe Water Supply and Sanitation Policy, 1998

The collection, disposal and management of sewage in the slums of Bangladesh are very poor although the City Corporations or Pourashava in the urban areas are responsible for these activities. Water Supply & Sewerage Authority (WASA) is also responsible for the sewerage and storm water drainage system. However, these organizations may transfer the responsibility of collection, removal and management of sewage waste to the private sector (MoLGRD, 1998; Section 8.4.2, p. 12).It falls under the responsibility of City Corporation or Pourashava to promote sanitary latrine in every household along with the set-up of public and community latrines. Similarly, the drainage system in the cities and municipalities will be integrated with the overall drainage system with the coordination of Ministry of Water Resources (MoLGRD, 1998; Section 8.4.1, p. 12). At the same time, measures will be taken to recycle, as much as possible, the contaminated ground water by sewerage and drainage (MoLGRD, 1998; Section 8.4.10, pp. 13). The use of sewage waste for compost and bio-gas will be promoted, and contamination of water by sewerage waste will be discouraged (MoLGRD, 1998; Section 8.2.7, p 10).

The policy for Safe Water Supply and Sanitation states that the City Corporation or Pourashava is the responsible authority to collection, disposal and management of solid waste. However, private sector can also take the responsibility of collection, removal and management of solid waste with the permission of proper authority (MoLGRD, 1998; Section 8.4.2, p. 12). In this regard, Department of Environment should deal with the private sector for solid waste management. The Policy also states that the collection of solid waste from urban areas will be used in various purposes, such as production of organic fertilizer (MoLGRD, 1998; Section 3 (viii), p. 5). Moreover, the ground and surface waters should be free from the contamination of solid waste (MoLGRD, 1998; Section 4 (q), p. 6).

2.1.10 National Urban Sector Policy, 2011

National Urban Sector Policy for Bangladesh is prepared to ensure urbanization through decentralized development. Some major issues are discussed in this policy regarding the low income housing and slum improvement. According to this policy participation of poor in decision making and in implementation process should be ensured (MoLGRD, 2011; Chapter: 3). Access of poor people to varied livelihood opportunities, secure tenure and basic affordable services is necessary to increase their security (MoLGRD, 2011; Chapter: 3). The government can increase the pool of land through the implementation of land banking, land pooling, land readjustment, land sharing, sites and service schemes etc. In addition to these lands, khas (government acquired) land can be used for low-income housing sites in the cities (MoLGRD, 2011; Chapter: 5; Section: 5.5.7). According to this policy government should undertake slum improvement project to provide housing for poor (MoLGRD, 2011; Chapter: 5; Section: 5.6). Environmental friendly local building materials and construction techniques should be encouraged for low-income housing (MoLGRD, 2011; Chapter: 5; Section: 5.6.5). Slum improvement is a priority program of Bangladesh government. There should be allocation of land for slum improvement project in national policies. There should be designated areas

in Master plan for slum rehabilitation. Access to infrastructure and services should be provided by the government to all slum dwellers (MoLGRD, 2011; Chapter: 5; Section: 5.6.6).

2.1.11 National Energy Policy, 2004 and Renewable Energy Policy of Bangladesh, 2008

The sustained economic growth in the country means the demand for electricity is also increasing at a very high rate. To develop the living of the slum dwellers ensuring access to electricity is very much important. In the circumstances of providing electricity access to any new development is challenging. It is suggested that fossil fuel based electricity production should be minimized as much as possible and renewable sources of energy should be introduced. The National Energy Policy, Renewable Energy Policy and Poverty Reduction Strategy Paper provide guidelines and acknowledge the need of introducing renewable energy sources (MoPEMR, 2008; Section 1.2, p. 3; MoPEMR, 2004; Section 7.1.9 B, p.27; MoP, 2011; p. 127). Renewable energy policy also outlined the importance government incentives to renewable energy production and involvement of local resources and NGOs in electricity generation (MoPEMR, 2008; Section 5.2, p. 7, Section 5.3, p. 7). Power Division of the Ministry of Power, Energy and Mineral Resources, Power Development Board, City Corporations or Local Municipalities and local NGOs will help implementing and monitoring the electricity development options. Another issue regarding the electricity production is the in site generation of electricity during the construction phase (e.g. the use of oil-based generators). According to Bangladesh Environmental Conservation Act it is advised that measures should be taken to ensure sound use and disposal of polluting and hazardous substances (DoE 1995; Section 4.2.C, p. 156). Department of Environment (DoE) will be the monitoring agency regarding this issue. Provision of cooking facilities in any housing improvement project is an integral component. In Bangladesh, especially in the low income and informal settlements, the cooking smoke is one of the main sources of indoor air pollution (Dasgupta *et al.*, 2009). The main source for cooking fuel in slum settlements is burring of wood and other biomass (MoPEMR, 2008; Section 1.2, p. 3). An increase in the use of wood as the main cooking fuel will result in the reduction of nearby vegetation area. Also burning of wood and other biomass will increase the risk of indoor air pollution. In this regard, it is proposed that the use of biogas as the main cooking fuel in the slum areas (MoPEMR, 2008; Section 4.6, p. 7). National Energy Policy also discourages the use of wood as cooking fuel and suggests introduction of alternative fuels (MoPEMR, 2004; Section 7.1.9 C, p. 28). City Corporations, local NGOs and Sustainable Energy Development Agency (SEDA) will help implement and monitor the fuel generation.

2.1.12 National Disaster Management Act, 2012

Every year many people face one or more disaster like flood, earthquake, cyclone, landslides etc. in Bangladesh. Hence, it is very essential to consider the disaster management perspective before the initiatives of any sort of development project in Bangladesh. For example, hazard-prone area should be avoided for the construction of such projects to minimize the risk of hazards. Thus, to combat with the disasters, the Government of Bangladesh has developed a framework to manage the disaster in a comprehensive way. In such context, three phases, namely preparedness, prevention and recovery are needed to be considered for the disaster management process in the proposed slum improvement

project areas. Hazardous sites should not be encouraged at the time of housing site selection. Because housing structures are usually affected by some natural conditions, like seismic activity. In relation to this, Bangladesh National Disaster Management Act emphasizes the equipment purchase, preparation of volunteers for earthquake emergency management plan (MoFDM, 2012; Section 3.3.1, p.13). During the development works low quality raw materials should be avoided to minimize the risk of hazards.

2.2 International Obligations

Bangladesh has signed a number of international environmental conventions, treaties and protocols (ICTPs) related to environmental issues. These have to be taken into account in the implementation of LICHSP sub-components where applicable. In the implementation stage of the project, NGOs and Citizens Groups may invoke these agreements if they have concerns on infringements. The following conventions, treaties and protocols mainly focus on the adverse environmental impacts of development activities worldwide. As Bangladesh has ratified these treaties and the conventions, it is also important not to violate these during the slum integration project. Relevant ICTPs are reviewed in the following section.

2.2.1 Global Strategy for Shelter, 1998

In 1988, the United Nations Conference on Human Settlements (UN Habitat) declared Global Strategy for shelter to the year 2000 with an objective to ensure clear and visible improvement of shelter to poor and disadvantaged group of people by the year 2000. This declaration came in the 83rd plenary meeting of UN general assembly. In the annex of that declaration they mentioned guidelines to be taken to formulate strategy for shelter at the national level. In the national strategy, construction and maintenance of housing and related services should be mentioned properly in the operational objectives. Shelter development should be seen as such kind of process where men and women should be benefited gradually. Similarly, finance, land, manpower and institutions, building materials and technology as well as the ownership i.e. public, private, formal or informal, should be addressed properly. National strategy will be linked with other national and international policies e.g. social, economical and environmental. Government sector will play the leading role including administrative and legislative issues like land registration while private sector will be responsible to develop action plans, locally based small-scale building industry as well as provide adequate training to execute the plans. Equal participation of women should be ensured at all level i.e. design, construction, and maintenance of housing and they will be given preference to get shelter. Finally, monitoring and maintenance will be ensured by either government or financial organization.

2.2.2 UN Istanbul Declaration on Human Settlement, 1996

Istanbul declaration on Human Settlements has its foundation on the universal goal of ensuring satisfactory shelter for all and making human settlements safer, healthier, livable, equitable, sustainable and productive. In the current urbanizing world it is necessary to work towards adequate shelter and sustainable human settlements development. Deterioration of condition in human

settlements is particularly eminent in low income urban areas of developing and less developed countries. This declaration avows that global leaders must address, unsustainable population changes including changes in economic structure and wealth distribution. Priority consideration should be given to the tendency towards over concentration of population, homelessness, increasing poverty, unemployment, social exclusion, lack of basic infrastructure and services; absence of planning, growing insecurity and violence; environmental degradation; and increased vulnerability to disasters. The challenges of human settlements are global phenomenon. The need to intensify efforts and cooperation to improve living conditions in the cities, towns and villages throughout the world, especially in developing countries and countries with transitional economies is recognized. At the same time particular needs of women, children and youth for safe, healthy and secure living conditions is also recognized. Efforts to eradicate poverty and discrimination, to provide for basic needs and above all adequate shelter for everyone should be intensified. According to this declaration, living conditions in human settlements should be improved in ways that are in lieu with local needs and realities. At the same time there is a need to address the global, economic, social and environmental trends to ensure the establishment of better living environments for all. For this adoption of the principles of partnership and participation is deemed as the most democratic and effective approach. In the implementation of the Habitat Agenda, local authorities are essential agent of the process. Steps should be taken towards strengthening financial and institutional capacities of democratic local authorities simultaneously ensuring their transparency, accountability and responsiveness to the needs of people.

2.2.3 Convention on World Cultural and Natural Heritage, 1972

The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, was adopted in 1972 (also known as World Heritage Convention) and was ratified by Bangladesh in 1983. The Lalmai-Mainamati Group of monuments of Comilla was proposed to declare as world heritage by UNESCO in 1999. Moreover, the ecologically critical areas (ECA) should be treated carefully. No project site can be selected near the ECA. For an example, as Gulshan- Baridhara Lake was declared as an ECA in 2001, so project site should not be located there. According to Article 4 of the Convention, it is the responsibility of the state party to ensure the identification, protection, conservation, preservation and transmission of cultural and natural heritages. In this regard, the LICHSP cannot be undertaken in a site which may have any kind of environmental impact upon cultural or natural heritage site.

2.2.4 United Nations Framework Convention on Climate Change, 1992

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and came into force in 1994. The objective of the UNFCCC is “to protect the climate system for the benefit of present and future generation of mankind”. The UNFCCC says that the countries with obligations would take measures to mitigate the effects of climate change and they would provide finance to developing countries for their obligations under the UNFCCC to help them adapt with the adverse effect of climate change. Under this project, no housing integration initiatives shall be implemented out in the climatic hotspot areas without appropriate risk management.

2.3 World Bank Safeguard Policies

The Bank's position for compliance with the environmental concerns is clearly elaborated mandatorily in the form of Operational Policy (OP) and bank Policy (BP). Operational Policies (OP) is the statement of policy objectives and operational principles including the roles and obligations of the Borrower and the Bank, whereas Bank Procedures (BP) is the mandatory procedures to be followed by the Borrower and the Bank. The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.

The World Bank's environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment. This policy is considered to be the umbrella policy for the Bank's environmental "safeguard policies" which among others include: Natural Habitats (OP 4.04), Forests (OP 4.36), Pest Management (OP 4.09), Physical Cultural Resources (OP 4.11)), and Safety of Dams (OP 4.37). These directives framed as environmental ("Safeguard") policies are designed to achieve a number of objectives: i) to avoid harm to the environment and affected people and provide affected people an opportunity to participate in the development process; ii) to improve project design and performance; and iii) to protect the reputation of the Bank.

For the current project it is planned that the donor will provide loan for developing some of the components and the community will act as the borrower. Therefore, it is mandatory that environmental consequences should be recognized early in the project cycle and taken into account in project selection, sitting, planning, and designing by preventing, minimizing, mitigating or compensating for adverse environmental impacts and enhancing positive impacts. The Environmental Assessment Source Book (1991) and its updates (1998) provide technical guidance on these issues. OPs/BPs relevant with the proposed LICHSP are discussed below:

2.3.1 OP/BP 4.01 Environmental Assessment

This policy is considered to be the umbrella safeguard policy to identify, avoid, and mitigate the potential negative environmental impacts associated with Bank lending operations. The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensuring that they are environmentally sound and sustainable, and thus to improve decision making. The assessment evaluates potential environmental risks and impacts, examines project alternatives, identifies ways of improving project selection, sitting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts, and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigation or compensatory measures, whenever feasible.

The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements. The Bank classifies the proposed project into three major categories, depending on

the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts:

- Category '**C**': The proposed project is likely to have minimal or no adverse environmental impacts. Expected impacts are small in scale, beyond screening, no further EA action is required for this category.
- Category '**B**': The proposed project's potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects. These projects require preparation of a Limited Environmental Assessment (LEA) and incorporation of recommended mitigation measures into subproject design.
- Category '**A**': The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. For a Category A project, the project sponsor is responsible for preparing an EIA.

2.3.2 OP/BP 4.04 Natural Habitats

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development by ensuring protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

2.3.3 OP/BP 4.11 Physical Cultural Resources (PCR) and Chance-Find Procedures

Physical cultural resources (PCRs) are the foundation of valuable scientific and historical information, assets for economic and social development. It is believed that physical cultural resources are integral parts of people's cultural identity and practices. Operation Policy 4.11 addresses reserving physical cultural recourses, which are defined as movable or immovable objects, sites, structural, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

If any physical cultural resources are found above or below the ground, or under water, the policy must be strictly followed to avoid any environmental degradation resulting from the project. For example, connectivity or linkage of the Lalmai and Maynamoti Monument and Temple sites in Comilla district possesses notable archaeological significance, located adjacent to the urban area and needs to be carefully managed. Therefore, the following guidelines should be strictly pursued to avoid any harm to the archeological and cultural resources.

- Projects which have chance of excavations, demolition, movement of earth, flooding, or other environmental changes need environmental screening before initiating the project.

- Projects which are located in the surrounding area of a physical cultural resources site also need environmental screening first.
- Proper Environmental Assessment (EA) process has to be accomplished when there is a chance of occurring harm to the PCR.

2.3.4 Implications of Policies on the LICHSP Interventions

The Development Objective of the Low Income Housing Support Project (LICHSP) is to reduce vulnerability of designated urban poor communities by providing improved, secure and affordable shelter in select informal settlements in Bangladesh. The National Housing Policy, 1999 (amended in 2008) will have an implication in successful implementation of the LICHSP, provisions have been created for the government to increase lawful ownership of land, enhance purchasing capacity of lands by giving priority to the women, children, women lead family, socially neglected, vulnerable, and sick and the deprived, poor and homeless people. The government will provide land in the appropriate places among low-income groups by giving subsidy, if necessary.

National Housing Policy (2008) of Bangladesh has also emphasized providing minimum standard of living to improve the existing unhealthy conditions in the slums. Any kinds of development which affect the surrounding environment is discouraged in the policy. While Urban Sector Policy suggests government to undertake slum improvement project to provide housing for the poor, it encourages environmental friendly local building materials and construction techniques for low-income housing. The policy states that government should provide access to infrastructure and services to all slum dwellers. The Pourashava Act (2009) facilitates planning and designing of development interventions in the urban and peri-urban areas. However, Safe Water Supply and Sanitation Policy specifies responsibility of City Corporation or Pourashava for establishing sanitary latrine to every household. In addition, drainage system in the cities and municipalities will be integrated with the overall drainage system. The policy for Safe Water Supply and Sanitation states that the Pourashava is the responsible authority to collection, disposal and management of solid waste. Bangladesh has always been a disaster-prone country, and the lower income strata of the society are much more vulnerable to different natural disasters. The LICHSP aims to build safer and environment- friendly houses for the low income dwellers. Hazardous site should be avoided at the time of site selection. The Environmental Conservation Rules (ECR) 1997 (DoE, 1997) classifies projects into four categories according to potential environmental impacts: (1) Green; (2) Orange A; (3) Orange B; and (4) Red. Green category projects are those with mostly positive environmental impacts or negligible negative impacts whereas Orange A category projects are those with minor and mostly temporary environmental impacts for which there are standard mitigation measures and Orange B category project are those with moderately significant environmental impacts. As discussed in Section 2.4, most of the subprojects to be implemented under LICHSP would fall either under Orange A or Orange B category and a few would fall under Green category, and none are likely to fall under Red category.

These interventions would be done at a very small scale which might have low impact on the environment. Therefore, planning and implementation of the LICHSP subproject interventions will be done through a systematic Initial Environmental Examination which will suggest appropriate mitigations

for mitigation of adverse impacts, if any. Also it is unlikely that any designated physical cultural resources will be affected by the subprojects. However, the impacts will be examined as part of the environmental screening/assessment of each sub-project.

CHAPTER 3. DESCRIPTION OF SUBPROJECT INTERVENTION

3.1 Setting of the Subproject Site/Kobdas Para Settlement

The proposed Kobdas Para settlement /subproject site is located within the jurisdiction of the ward no 7 of Shirajgonj Pourashava. In or around the settlement there is no protected area. The settlement occupies an area of 7.92 acres (32,051.13 sq. meters). The geographic coordinate of the proposed settlement is 24°28'27.46"N & 89°42'21.85"E. The base map of settlement, layout plan of settlement and topographic view of settlement are shown in figure 3.1, 3.2, 3.3 & 3.4, 3.5 & 3.6

Figure 3-1: Topographical location of proposed subproject

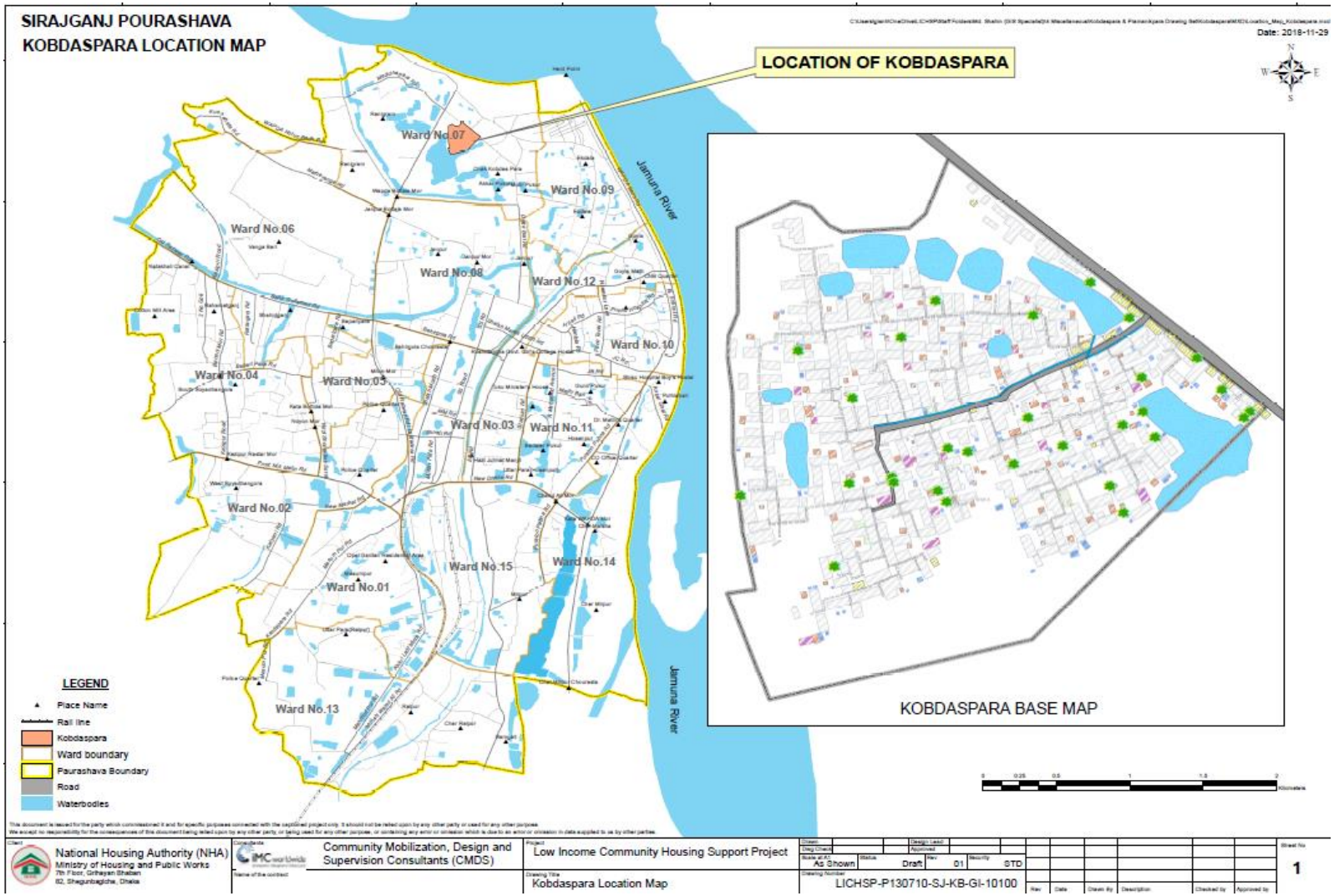


Figure 3-2: Proposed Kobdas Para Settlement Location within Pourashava map

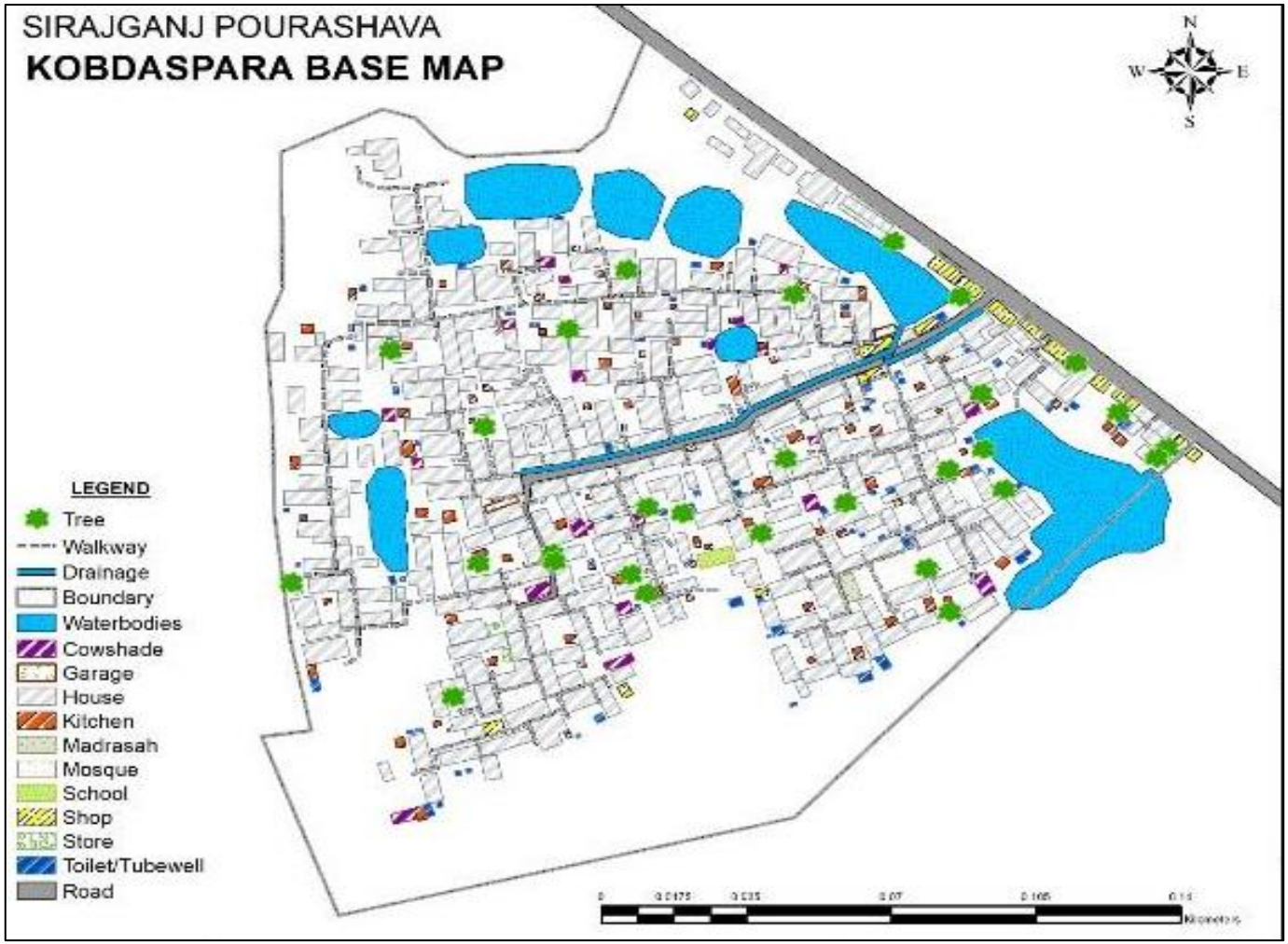


Figure 3-3: Base Map of Kobdas Para Settlement

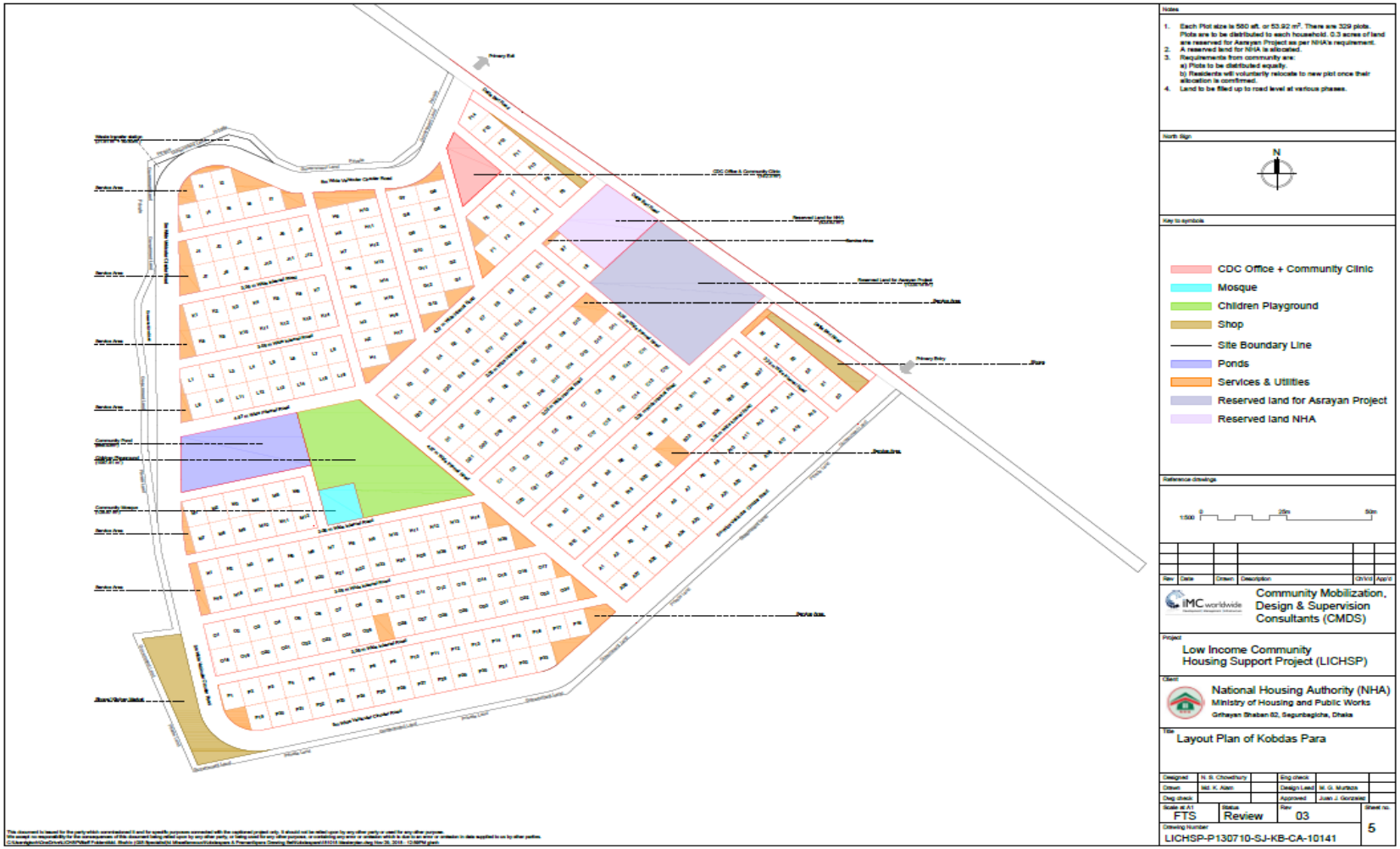


Figure 3-4: Proposed Layout Plan of Kobdas Para Settlement

Figure 3-5: Proposed septic tank & dustbin location of Kobdas Para Settlement

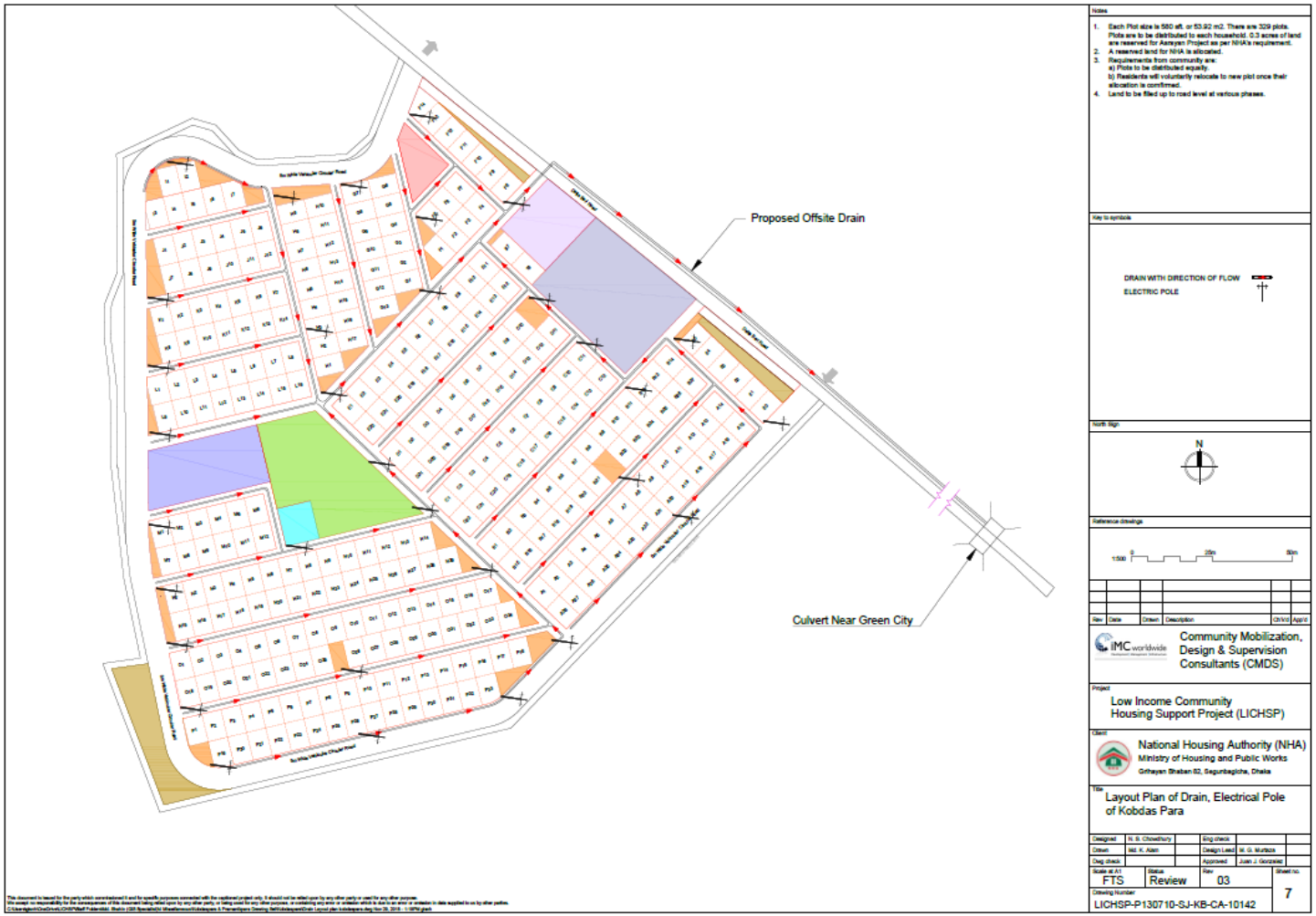


Figure 3-6: Proposed drain lay out plan of Kobdas Para Settlement

3.2 Subproject Scope of its Components

LICHSP is divided into five components, designed to cover the three key factors of shelter improvement—land, infrastructure, and housing—and with a strong focus on monitoring and evaluation of the project's results to better understand the impacts and the potential for scaling up such a program in the future. However, under this low income settlement upgrading program a multi-sect oral component has been included. This settlement includes a combination of water supply, drainage, paved access, electricity, sanitation services and solid waste management upgrading works, depending on the expressed demands of the Kobdas Para communities.

3.3 Justification of Selection of the Subproject

NHA has been selected the long and short list of low income settlement for the implementation of LICHSP with the assistance of data sources of LGED, Sirajganj Municipality, Urban Partnership for Poverty Reduction (UPPR) officials and open sources. The following flow chart shown in ***Figure 3-5*** was considered during the selection of low income settlements. Based on the overall selected list of low income settlement, NHA has prepared short list on the priority basis. Afterward, PMU and Consultant team was visited the site as a part of the reconnaissance survey. After site inspection, it is revealed that the anticipated impacts due to the implementation of low income settlement upgrading intervention will not be severe since it is considered as pilot scale project. Hence, considering the low environmental and social impacts due to this low income settlement upgrading, this subproject has been selected. The low income settlement is mostly located at the existing right of way. In addition, land tenure like land owner, type of tenure and eviction etc. is not an issues for the implementation of interventions as the Kobdas Para settlement is solely owned by NHA. After completion, living condition will improve in the low income community. Hence, considering the benefit that will derive after construction, this low income settlement has been selected.

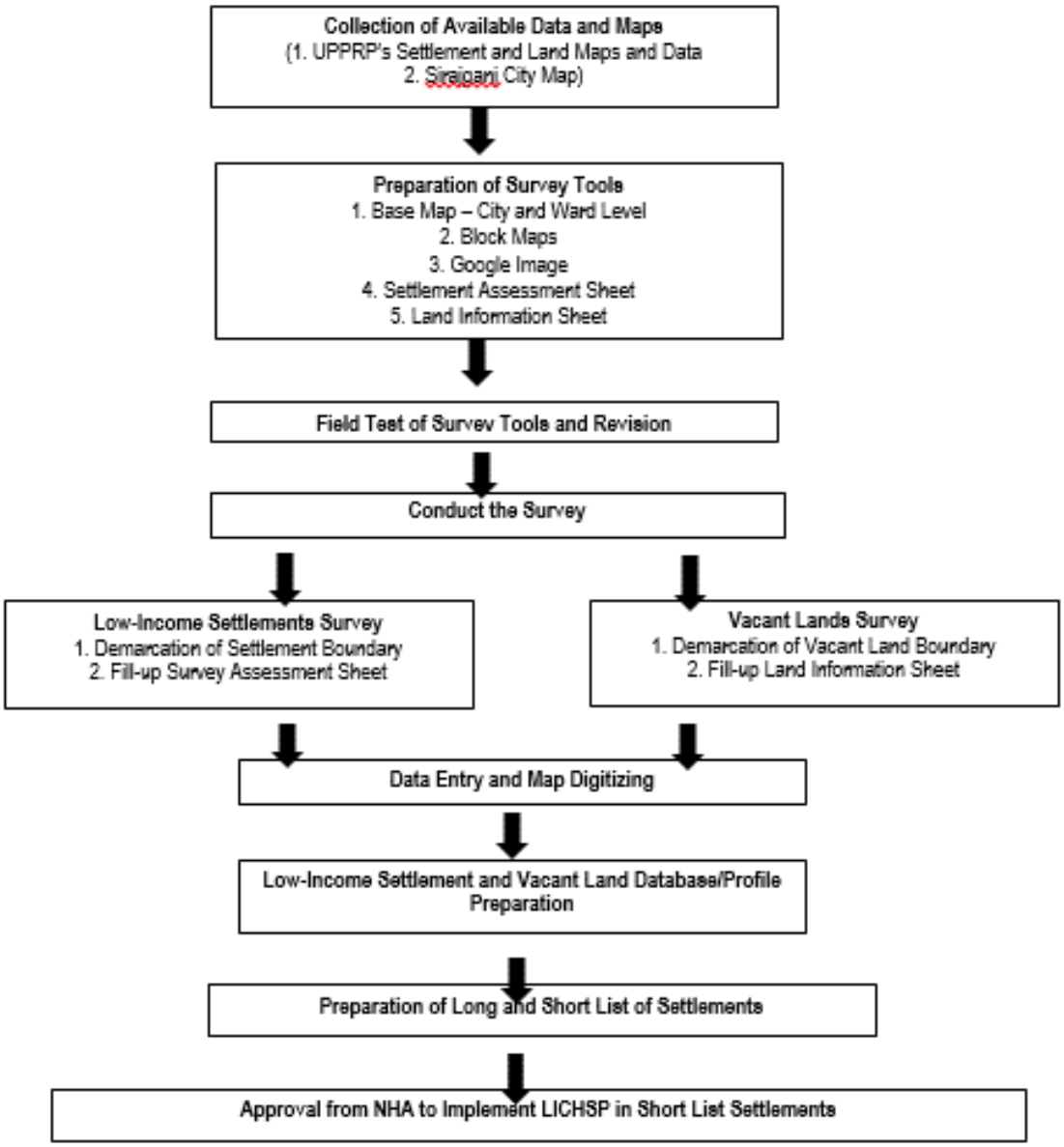


Figure 3-7: Selection Approch of Low Income Settelment

3.4 Current Situation, Proposed Intervention and Need for the Kobdas Para Settlement

3.4.1 Land Filling Work

Land level of the settlement area fluctuates from one place to other place. Hence, after site clearing work first step is filling work as a part of settlement upgrading work. Filling work will follow engineering practice of Bangladesh considering the neighboring community's land level and site condition and its location. Before filling of the settlement area exiting 300mm top soil will be cut down and stockpile in the separate zone from other filling material. Then local sand from Jamuna River will be used to fill the settlement area except top 300mm. This top level of the settlement area will be filled with stockpiled top soil. Existing land of the settlement area is flat or gently sloping. Thus, trench method is to be applied for the filling work. In addition, during filling work to avoid drainage congestion in and around the settlement area drainage contour has to be provided by creating earthen drain with connection of nearby water bodies if needed. To get a clear idea about required depth of filling work location plan and cross section are shown in ***figure 3-8.***

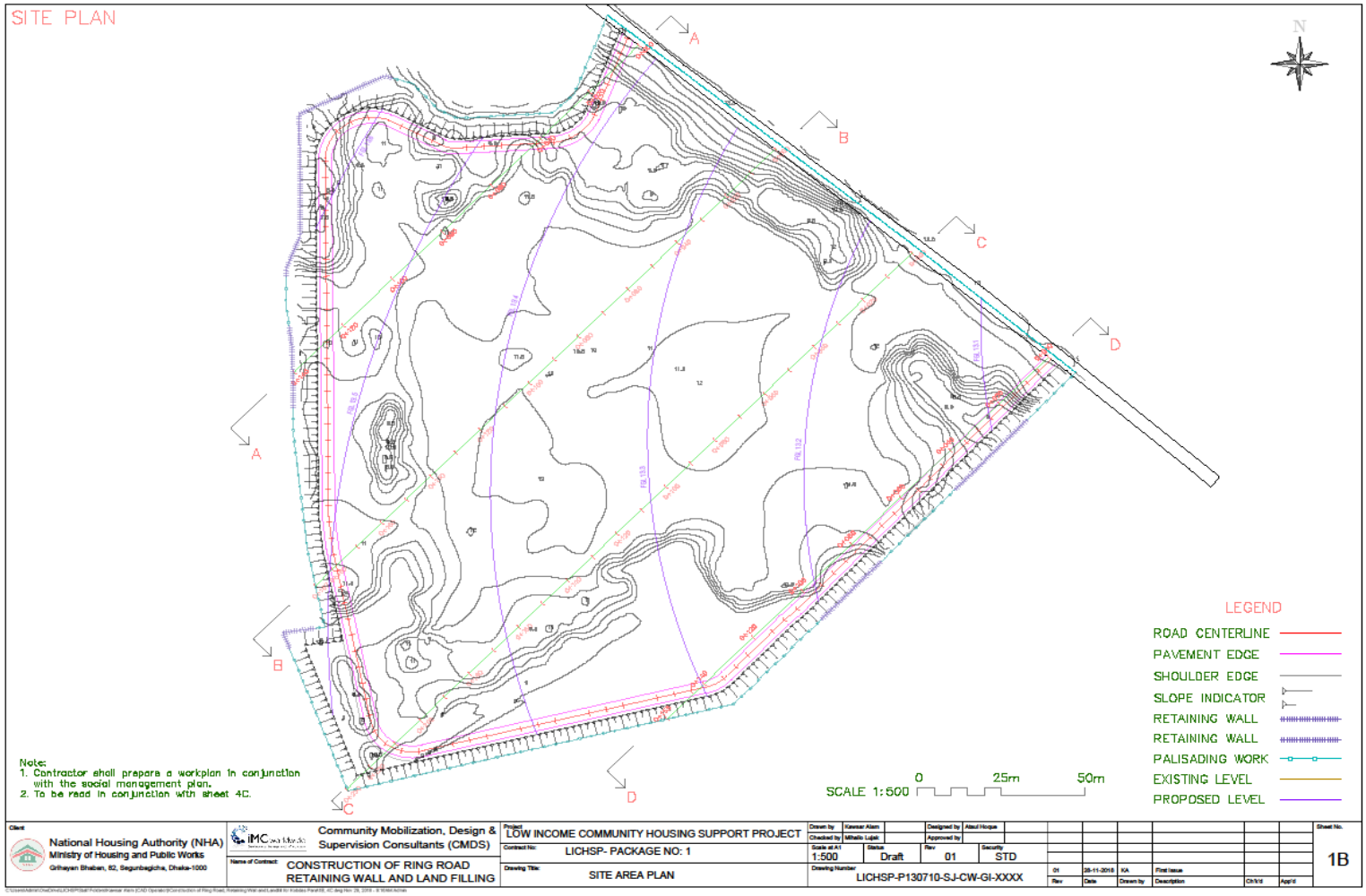


Figure3-8: Lay out plan of the filling work

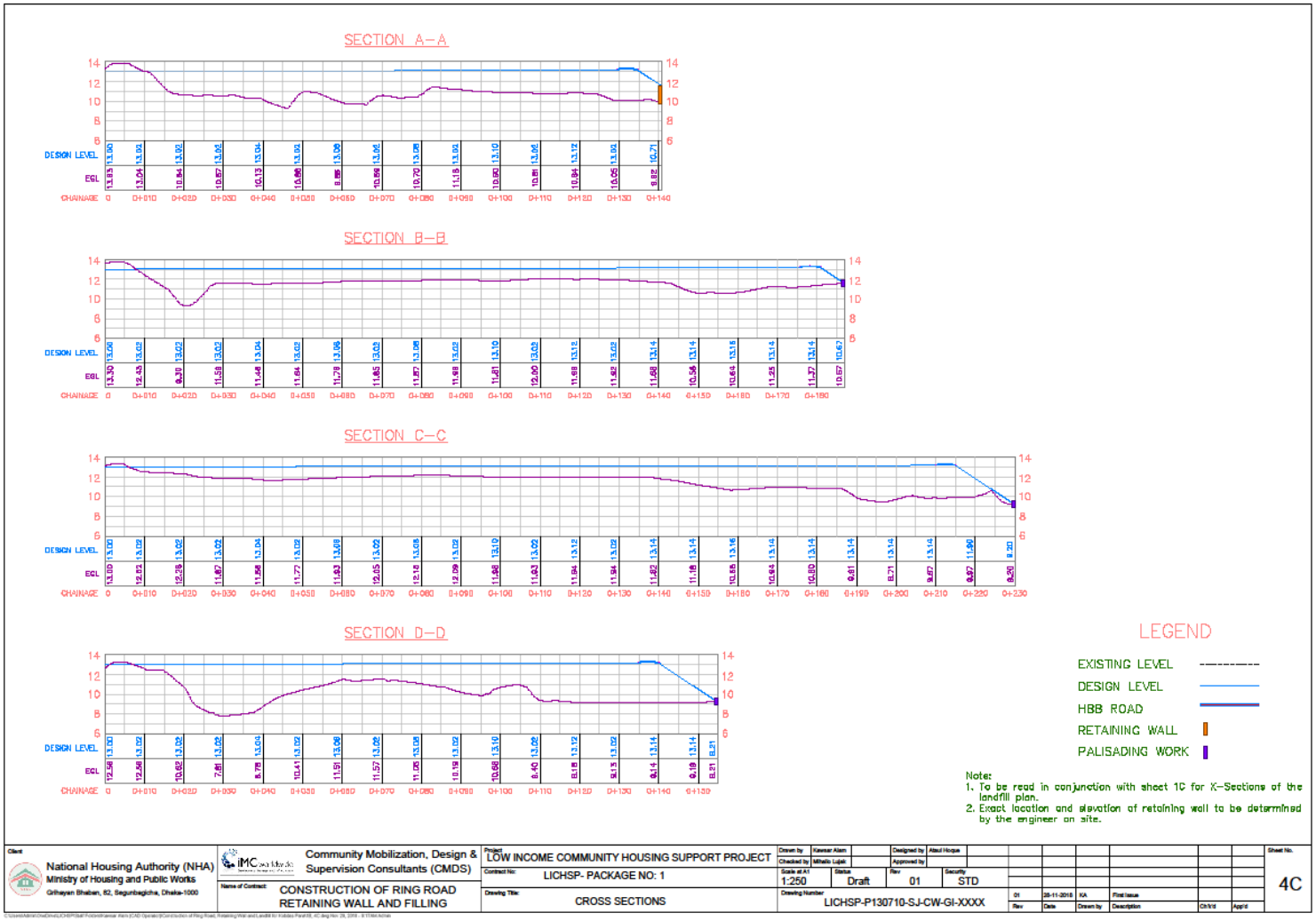


Figure 3-9: Cross section of filling work

3.4.2 Housing

There are three major types of houses are reported in the Kobdas Para settlement during the environmental reconnaissance survey. Most of the houses are semi-pucca and tin shed and few are pucca houses. During site visit it is revealed that, buildup area is unplanned and haphazard where living condition has lots of shortage to meet the basic need. Thus, to meet the basic demand of the community people a well-designed with proper ventilation and access road into the houses area badly needed. Considering the shortage of community and improving living condition NHA has planned a re-blocking housing model for this settlement.

3.4.3 Drainage system

In the subproject area there is no proper drainage system. There are few earthen and brick drain in the study area but most of them are silted up with household's wastes. Most importantly, in the community area there is no municipal drain where these drain can be connected. Therefore, waste water remain in the stagnant condition on the earthen drain. However, few drain are connected with nearby ditch but does not nonfunctional due to its clogged condition. In addition, the low income settlement/subproject site has low elevation in comparison to the adjacent area. Hence, most of the section of settlement are become waterlogged especially during monsoon period and houses are remains in damp condition. Subsequently, inhabitants of the study area become affected by waterborne diseases. Considering the suffering of the low income community, it is necessary to build up an integrated drainage system in the settlement. Hence, National Housing Authority has taken initiative to construct planned drainage system in the settlement area.

3.4.4 Toilet/Community Toilet

Sanitation is one of the most important services for any kind of housing. If sanitation is not hygienic then many types of diseases can assail to human beings. In the settlement area, the supplies of sanitation facilities are mostly inadequate and inappropriate nature. Two types of latrines are observed there. One is sanitary latrines which are linked with septic tank or ring pit. Other type is latrines which are linked with open water body. In fact, most of the dweller depend on shared latrine where there is no inside water facilities. Overflow of latrines during any flood or heavy rainfall is a common phenomenon in the settlement area. In addition, direct connection of improved latrine with water bodies pollute the quality of water and creates water borne diseases there. Thus, to ensure better environment in the community, NHA is proposed 7 numbers of septic tank and soak well to promote installation of hygienic latrine instead of pit latrine with water supply facilities.

3.4.5 Water Supply

In the study area, low income dwellers depend on two major sources of water, (i) hand tube well and (ii) nearby pond. No tap water service is exists here. Dwellers of low income settlement collect their drinking water from tube-wells in different distance but few dwellers have personal tube well which is insufficient to meet the demand. It is clearly expressed that the need of establishing more deep tube-

wells is high for fifty percent of dwellers. Hence, NHA has taken initiative to design a water supply network in the settlement area and installation of 17 tube well at different location of settlement area depending on the demand.

3.4.6 Connecting/ Ring Road

At present, there is one connecting road at east side of the settlement area. Due to lack of connecting road solid waste management like emptying of excreta from back side or middle of the community which are away from this connecting road are facing vary much troubles. Even, emergency service like fair services and ambulance do not access in to the affected area or person. Hence, under this project HBB ring road will be constructed at three sides of the settlement to integrate the waste management facilities and to ensure smooth emergency service facilities to the community peoples.

3.4.7 Pathways/ Internal Road

There is no adequate connecting road to house access. Thus, people's uses the gap between two houses and yards of neighbor houses to entry their own houses which is very much embracing for the dwellers and their privacy also decline. In addition, existing BC road is also have been damaged with the contact of water since most of the time of settlement remains waterlogged. Thus, NHA is proposed a planned design where there will be adequate pathway/ internal road to house connection. Cover slab of RCC drain at internal roads will be used as paved width and remaining gap of internal road after cover slab will be occupied by placing CC block.

3.4.8 Solid Waste Management

In the Kobdas Para area, there is no arranged waste dumping zone for the dwellers. It is found that, the highest numbers of households throw their household waste here and there. However, in practice people dump their solid waste in the open dumping area which are any small water logged areas near their houses and vacant space between two houses are also using as solid waste dumping site which are causing the environmental degradation in the settlement area. This sort of dumping is also responsible for the spreading of bad odor in the settlement area. Hence, for betterment of the study area ample amount of waste bin and secondary transfer station is needed. Considering the necessities and its adverse impact NHA has been proposed for installation of 17 numbers primary bin and one secondary transfer station.

3.4.9 Street Lighting Facilities

There is no lighting faculties in the settlement area. Hence, it interrupts pedestrians and traffic safety at night. Therefore, fixing of the street light is needed which will be fixed in the settlement area.

In this circumstance, NHA has decided to upgrade the Kobdas Para settlement by using re-blocking model where will be contains planned water supply facilities, drainage system, lighting facilities, sanitation and waste management system.

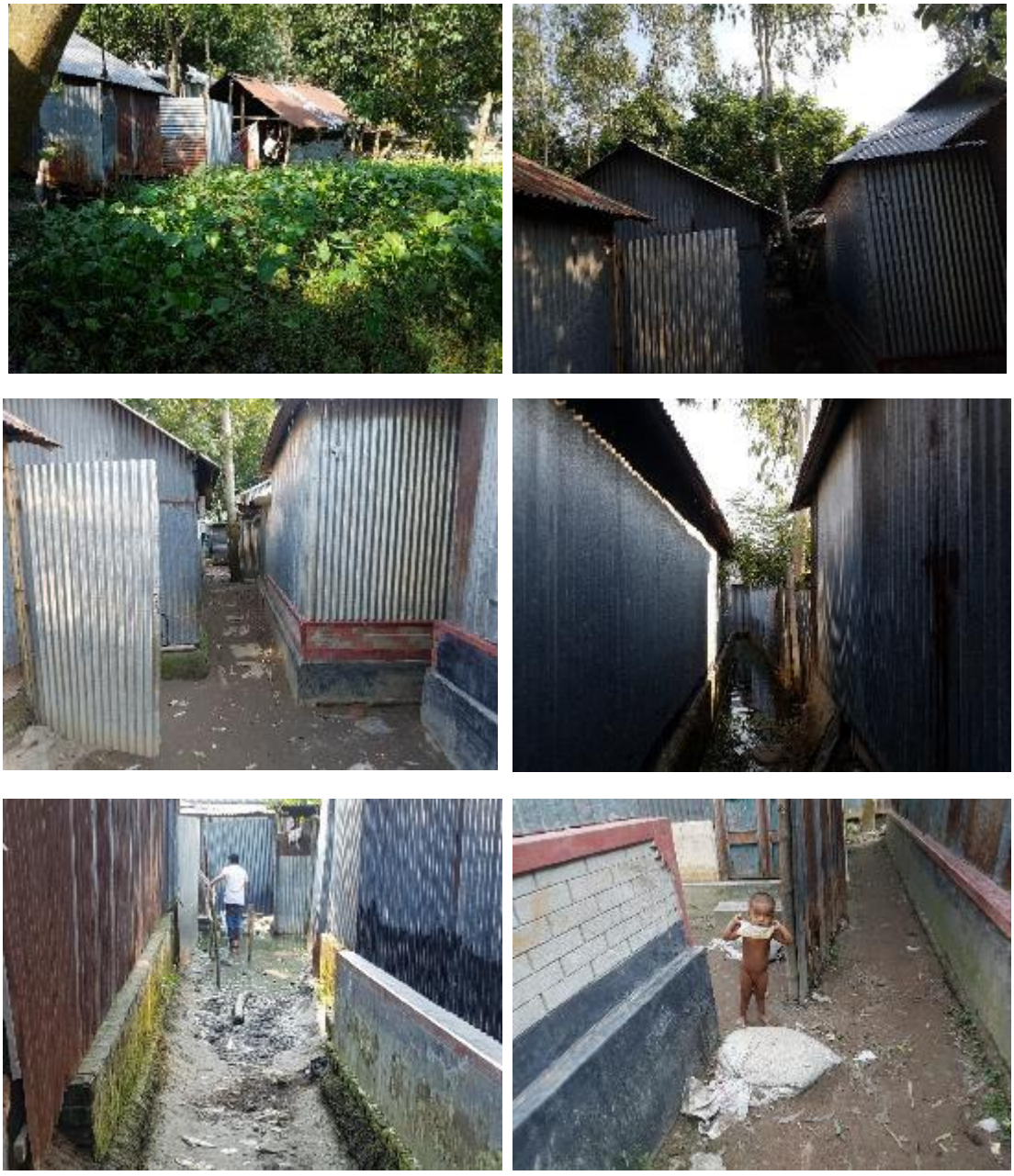


Figure3-10: Current situation of the settlement and their infrastructural facilities

3.5 Interventions/development to be funded outside the community

Under the Kobdas Para settlement upgrading subproject, about 1000m RCC open drain will be constructed from settlement area to katakhali Khal for ensuring proper outfall of the settlement drainage system.

3.6 Major Subproject Activities:

The key physical activities to be performed for the implementation of the subproject are cited in below:

- Relocation of the electric poles and site clearing works;
- Construction of site office;
- Land development work by sand/earth filling;
- Construction of retaining wall
- Road development work in and around the settlement area;
- Construction of integrated drainage network in the settlement area;
- Installation of waste collection bin and select a place for the secondary transfer station;
- Construction of sanitary latrines with septic tank;
- Installation of tube wells;
- Providing water supply networking facilities if possible;
- Installation of street light.

3.7 Schedule of implementation :

a) Duration : 14 months

b) Tentative start date : April 2019

c) Tentative completion date : July 2020

d) Estimated cost of intervention : 100 million in BDT

CHAPTER 4. SUBPROJECT AREA BASELINE ENVIRONMENTAL

4.1 General Consideration

This section includes the existing environmental baseline status of subproject study area, covering both the natural and social environments. The analysis was completed through the use of a combination of secondary data sources in addition to extensive on ground reconnaissance and baseline studies to establish an understanding of the environmental and socio-economic baseline of the subproject influence area (1km). The likely impacts on the environment based on the actual and foreseeable events/project activities. Data for this chapter were collected from:

- Secondary Sources: This included data from literature reviews, maps and monitoring reports;
- Primary Sources: This included gathering information from field surveys, laboratory analysis and public consultations in the study area.

The baseline condition of environmental quality in the locality of subproject site serves as the basis for identification, prediction and evaluation of impacts. The baseline environmental quality is assessed through field studies within the influence zone for various components of the environment like air, noise, water and socio-economic etc. Data was collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall and humidity), physiography, geology etc. Firsthand information have been collected to record the micro-environmental features within and adjacent to the subproject area. Collection of primary information includes extrapolating environmental features on proposed subproject design, location and measurement of socio-cultural features adjoining proposed subproject area. Ambient noise and water quality samples were collected in terms of environment quality to prepare a baseline database. Consultation was another source of information to explain local environmental conditions, impacts and suggestions etc. The following section describes the baseline environment into four broad categories:

4.2 Physical Environment

4.2.1 Important Environmental and Infrastructural Features

Generally, for preparations of any kind of subproject need a detailed conditional survey to get a clear profile. However, due to immediate requirement for the National Housing Authority, Environmental Consultant prepared this Environmental Assessment (EA) Report by conducting quick field survey. The data collected from the field visits by visual observation and from secondary sources, are addressed in the EA report. Therefore, if any adjustment is needed it will be updated on the later stage. Moreover, as it is live document, so for any circumstances it can need to be updated. The important environmental and infrastructural features have been identified during site visit within 150 m from the center of the subproject. The key findings of the site inspection and investigation are given in Table 4.1.

Table 4-1: Major Environmental and Infrastructural Features

Side/ Direction	Major Environmental and Infrastructural Features
North	Open space, Low land, Trees;
South	Trees, Houses, Shops,
East	BC Road, Pond, Trees, Semi Pucca and Pucca Houses, Shops, Electric Pole;
West	Aquaculture Ponds, Trees, Vacant land, Houses

Figure 4-1 : Drone fly view of Kobdaspara settlement area

4.2.2 Utilities and Services in the Study Area

Information on existing status of the utilities such as Water supply, Sanitation facilities, Electric supply, Drainage system, Solid waste management etc. has been collected from field survey and secondary sources and presented in below:

Water Supply System

The water supply system in Shirajganj Municipality is tube well based. It has underground municipal piped water supply in some areas. However, Water supply of Kobdas Para settlement is tube well based. But, currently in the settlement area there is no adequate tube well for supply drinking water to the community dwellers. In the settlement area, most of the dwellers have no individual tube well. Thus, they are using shared tube wells.

Sanitation Facilities

There is no network based sanitation system in the Shirajganj. Pourashava. Sanitation facilities of the Pourashava is categorized mainly as pucca and Katcha. Pit latrines with pre-cast RCC rings and improved latrine which are connect with water bodies exist in the Kobdas Para settlements. Individual and joint toilets both area are found in the Kobdas Para area.

Drainage System

Shirajganj Municipality has no drainage (storm water drain) master plan (Shirajganj Municipality, 2018). But there are some storm water drain within Pourashava area. This indicates very poor drainage network coverage within the town and their used outfall Katakhali Khal is almost silted up. However, in the Kobdas Para settlement area drainage system is inadequate and inappropriate. In fact, existing drain has no connection with proper outfall. Therefore, maximum area of Kobdas Para goes under water during monsoon season.

Electricity Supply

Electricity facilities are provided to the Kobdas Para area by Northern Electric Supply Company Limited (NESCO). Due to rapid increase of residential buildings, industries and commercials enterprises consumption of electricity is increasing rapidly. As supply of electricity is not increasing as per load demand of electricity, load shedding occurs in supply of electricity to the consumers.

Solid Waste Collection Service

Condition of solid waste management system is not satisfactory at Shirajganj Pourashava. In fact there is no structured solid waste management system. People are found to be dispose their waste to nearby lowland, vacant place and drain. The Pourashava does not have the sufficient capability to handle the huge waste generated by the resident due to narrowness of roads, lack of local collection sites sands as impediments to waste management. However, deficiency of waste management scenario of the

Kobdas Para settlement area is more severe than other place of the municipality as there is no input of municipality for solid waste collection. As there is no solid waste dispose point and collection system, hence they dispose waste here and there. During site visit it is seen that, there is a small low land just entrance of the Kobdas Para settlement. Dwellers of nearby this lowland are using it to dispose solid waste. It produces bad smell which is harmful for their health.

4.3 Physico-Chemical Environment

4.3.1 Climate

Bangladesh is located at the central part within the Asiatic monsoon region where the climate is tropical. Relatively small size of the country and generally low-lying area cause moderate spatial variation of temperature, precipitation, relative humidity, wind speeds and other climatic variables. However, the climate of Bangladesh exhibits pronounced temporal variability. This is because of the moisture-laden monsoon winds flowing predominantly from the south-west during summer and the comparatively dry and colder north-western winds during winter.

Three seasons are generally recognized: a hot, muggy summer from March to June; a hot, humid and rainy monsoon season from June to November during which more than 85% of the total annual rainfall occurs; and a moderately cold, dry winter from December to February. The beginning of the rainy season vary from year to year; heavy rains may commence anywhere between mid-April and early June and may end anywhere between the end of September and mid-November. Usually winter season is dry with occasional rains. The early summer season is considered from March-April. During summer, the air becomes hot with very low humidity. Early summer is also dominated by Baishakhi cyclone and rains. Average annual climate data of the Shirajgonj Pourashava are shown in table 4-2.

Table 4-2: Average Annual Climate Data of the Shirajgonj Pourashava (Year 2017)

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	18.4	20.8	25.2	28.7	28.9	28.5	28.5	28.6	28.5	27.1	23.1	19.8
Min. Temperature (°C)	11.7	13.4	17.9	22	24.2	25.3	26	26.3	25.8	23.4	17.7	13.5
Max. Temperature (°C)	25.1	28.2	32.6	35.4	33.7	31.7	31	31	31.3	30.9	28.6	26.2
Precipitation / Rainfall (mm)	14	19	35	74	224	320	354	315	249	158	24	3
Humidity %	48	50	51	62	71	72	78	76	74	73	62	64
Avg. Wind speed (Kmph)	9.7	8.6	10.8	12.6	14.0	15.1	17.6	15.1	12.6	10.8	9.0	7.9

Source: Bangladesh Meteorological Department.

Precipitation

The general pattern of precipitation (which consists entirely of rain) follows the monsoon pattern with the cooler, drier months of November to March, increasing rains in April and May, and highest rainfall in the summer months of May to September when the prevailing wind direction from the southwest brings moisture-laden air from the Bay of Bengal. The winter period (November to February) is dry with very little rainfall. Even though the temporal pattern of rainfall is pretty much similar throughout the country, there is pronounced spatial variation of rainfall over the country with the northeastern and southeastern part of the country receiving relatively higher amount of rainfall compared to the western part. The project area receives around 1785 mm rainfall annually, which is lower than the average annual rainfall of the country (i.e. 2400 mm).

Relative Humidity

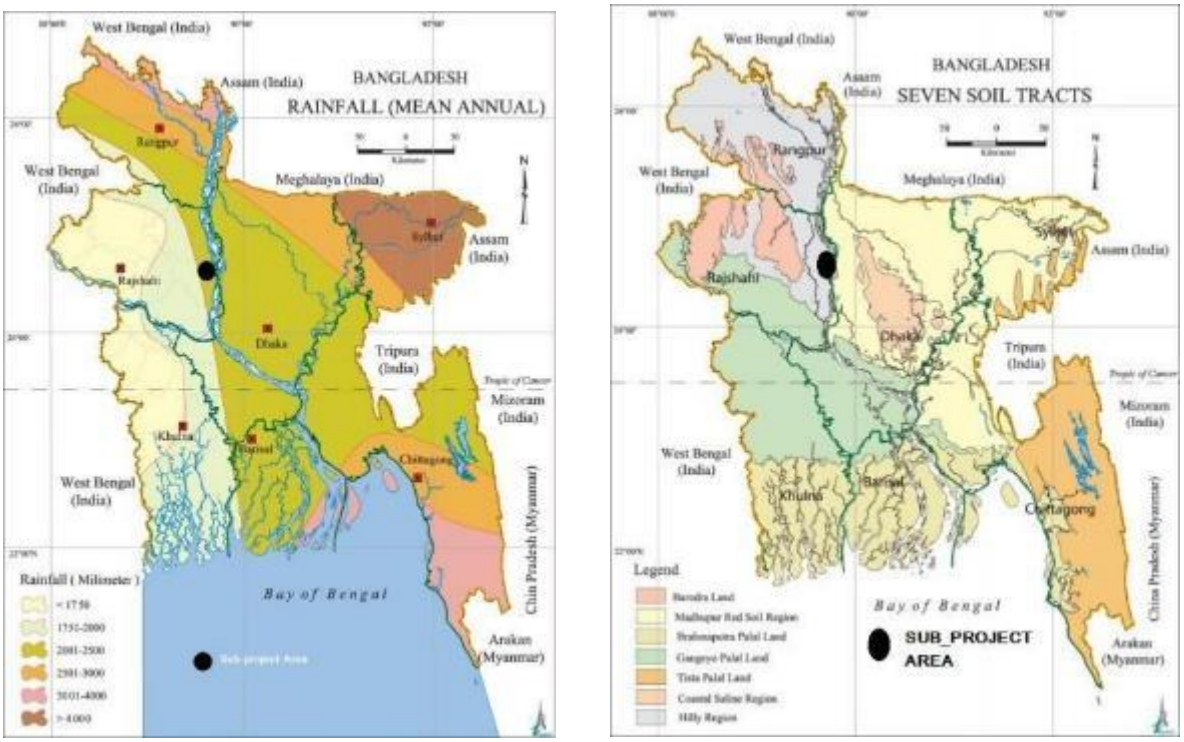
The spatial and temporal variation of Relative Humidity throughout the year is very low in Bangladesh. In the project area, the relative humidity varies from 48% to 78%.

Ambient Air Temperature

The temperature of the country is related to the period of rainfall. In general, cool seasons coincide with the period of lowest rainfall. Table 4.2 shows the monthly average mean, maximum and minimum temperature of the study area. Maximum average temperature over the year is usually observed in April - September and minimum average temperature in January.

Wind Speed and Direction

Wind direction from October to February is the calm condition followed by wind speed of 8.6 Kmph to 10.8 kmph. In the rest of the months, the predominant wind speed is 12.6 to 17.6 kmph. This indicates the weather conditions are favorable for the dispersion of the pollutants released in the air. The monthly wind trend: NE and NW wind prevail in November to February; wind flows multi-directional in March and October; the predominant wind direction is south followed by SE and SW in April; in May the wind direction is south and SE, the predominant wind direction is SE followed by south in June to September.



(a) (b)

Figure 4-2: The locations of Proposed settlement area on (a) the mean annual rainfall, (b) the seven soil tracts map of Bangladesh. (Map source: www.banglapedia.org)

4.3.2 Geology, Soils and Seismicity Geology

Geology of Bangladesh is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age). It is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments were deposited as a mega-delta out built and progressed towards the south. The delta building is still continuing into the present Bay of Bengal and a broad fluvial front of the Ganges-Brahmaputra-Meghna river system gradually follows it from behind.

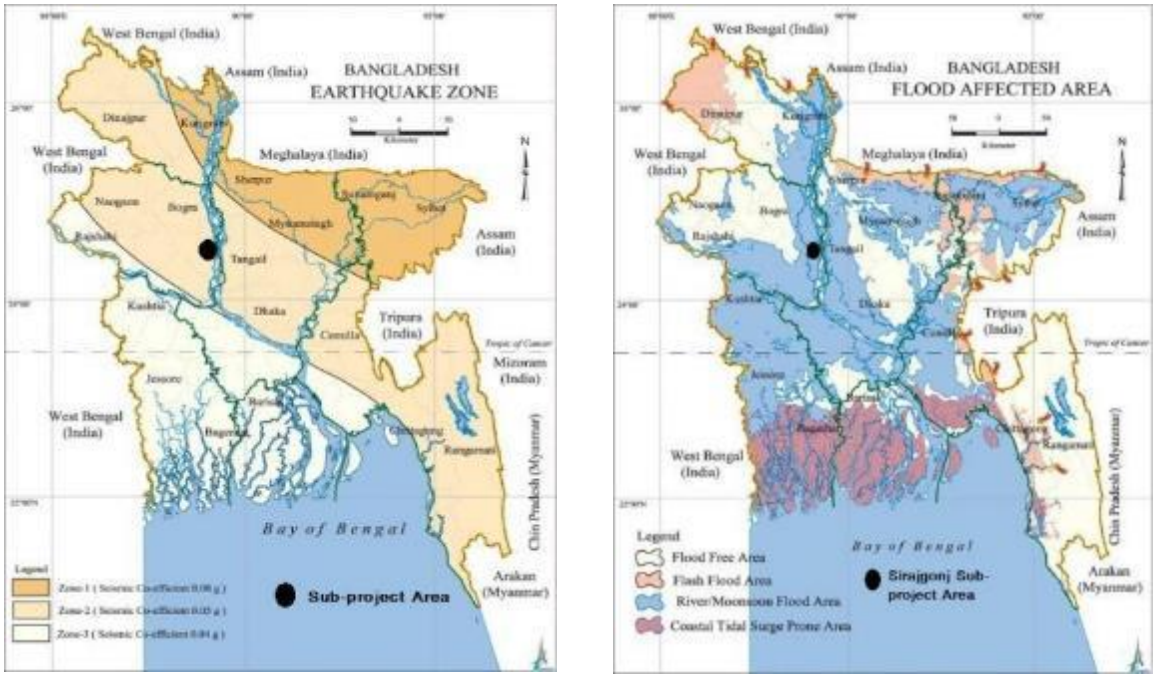
4.3.2.1 Soil Characteristics

The soil formation in Bangladesh is remarkably homogeneous in appearance, both vertically and laterally. It comprises layer of unconsolidated clay, about 10m thick near Dhaka, but apparently thinner to the east and possibly much thicker in the west of the Rajshahi district. The sand mineralogy in this area is broadly similar to that of the tertiary hill sediments. The soil of Bangladesh can broadly be classified into seven tracts: (1) Madhupur Tract or Red Soil Tract, (2) Barind Tract, (3) Tista Silt, (4) Brahmaputra Alluvium, (5) Gangetic Alluvium, (6) Coastal Saline Tract, and (7) Hill Tracts. Figure 4.12(b) shows the position of the sub-project area on the soil tract map of Bangladesh. The soil formation of Sirajgonj sub project area lies on Hill tracts of the Garo Hills of the former greater Mymensingh district. Hill Tracts cover an area of around 15,000 sq km. The soils consist of hard red clay with a mixture of fine sand of the same color and nodules containing a large percentage of sesquioxides. The soils are

moderately to strongly acidic. The soils are highly leached and have a low natural fertility. Hills are mainly under natural and plantation forests. Shifting cultivation is practiced in some places.

4.3.2.2 Seismicity

In the north and northeast of Bangladesh, there are areas of high seismic activity and some of the major earthquakes originating in these areas have affected the adjacent regions of the country. The whole of Bangladesh is divided into three seismic zones (Figure 4.13(a)). The northern part of the country that includes the greater districts of Rangpur, Mymensingh, and Sylhet are in the Zone-I where earthquake shock of maximum intensity of IX of the Modified Mercalli Scale is possible. The Zone-II includes the greater districts of Dinajpur, Bogra, Dhaka and Chittagong and the shocks of intensity of VIII are possible. The southern part of the country, the least active region, where the maximum intensity is not likely to exceed VII, is in the Zone-III. The experts suggest not constructing normal buildings with more than 60m of height. Shirajgonj area falls in zone II. Figure 4.4(a) shows the locations of proposed settlement in the seismic map of Bangladesh.



(a) (b)

Figure 4-3: Locations of proposed settlement on the (a) the seismic map, (b) the flood risk map of Bangladesh (map source: www.banglapedia.org)

4.3.3 Flood-prone Areas

Bangladesh is prone to flooding; the coastal flooding as well as the bursting of Bangladesh's riverbanks is common and severely affects the landscape of the country. Floods in Bangladesh can be divided into three categories: (a) monsoon flood - seasonal, increases slowly and decreases slowly, inundates vast areas and causes huge losses to life and property; (b) flash flood water increases and decreases suddenly, generally happens in the valleys of the hilly areas; and (c) tidal flood short duration, height is generally 3m to 6m, blocks inland flood drainage. The combined annual flood wave from the Ganges, Brahmaputra and Meghna rivers passes through a single outlet, the

lower Meghnatide levels in the Bay of Bengal, reducing the slope and discharge capacity of the Lower Meghna. The effects of these high river water levels extend over most of the country and are the main determinant of the drainage condition and capacity. The discharge from minor rivers is reduced and surface drainage by gravity is limited to land above the prevailing flood level. Flooding caused by this drainage congestion exists nearly everywhere except in the highland and hilly areas in the northern and eastern parts of the country.

Sirajgong Pourashava is not normally affected by annual floods. However, due to flash flood and over flow of the major River such as Jamuna, this area may be affected by flood. However, this area is affected in historical flood events such as 1988, 1998 and 2007. The settlement area is not generally exposed to water logging problems. At present, in the settlement area piecemeal of drain exits in a scattered format and it is also blocked by wastes. Thus, due to continuous heavy rain, delay discharge of storm water causes water logging problem in the settlement area. As per flood zoning map of Bangladesh (shown in ***Figure 4.4),*** this area is considered as a flood free zone.

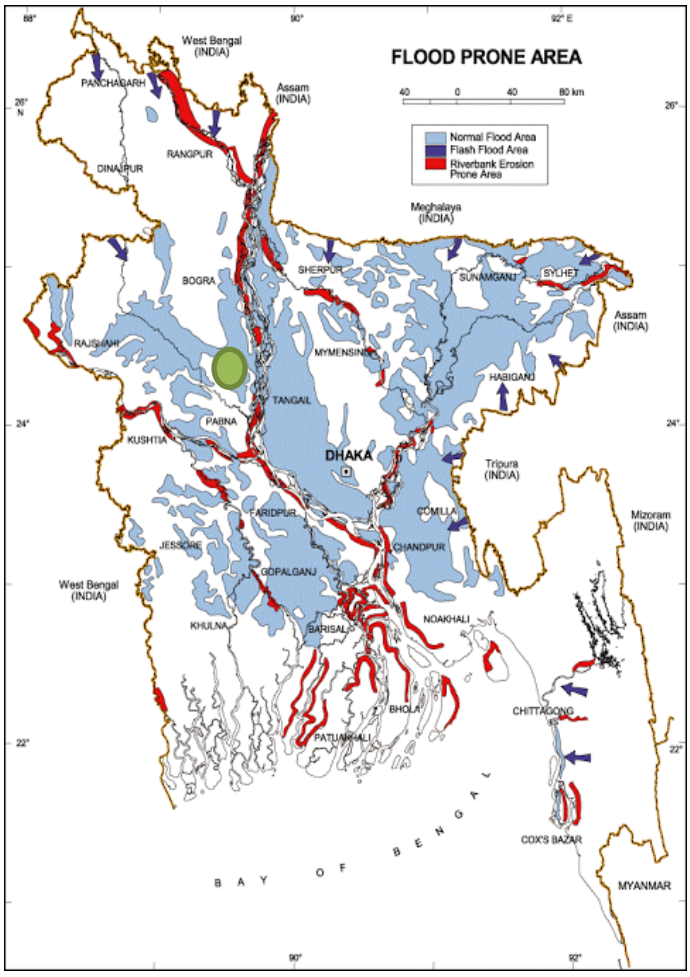


Figure 4-4: Location of Sirajgong Pourashava (Green Circle) in Flood Zone Map of Bangladesh

4.3.4 Cyclone and Tidal Surge

Bangladesh very often becomes the landing ground of cyclones formed in the Bay of Bengal. This is because of the funnel shaped coast of the Bay of Bengal, Most of the damage occurs in the coastal regions of Khulna,

Patuakhali, Barisal, Noakhali and Chittagong and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char and other newly formed islands. The coastal zone of Bangladesh is disaster prone. Port area where the sluice will build is in the exposed coastal area which is frequently subjected to cyclone and storm surges. A cyclone risk map, prepared by the Management Information & Monitoring (MIM). **Figure 4.3** shows that, the proposed settlement site (blue circle) falls under high wind area in the Cyclone affected area Map (Source: SPARRSO).

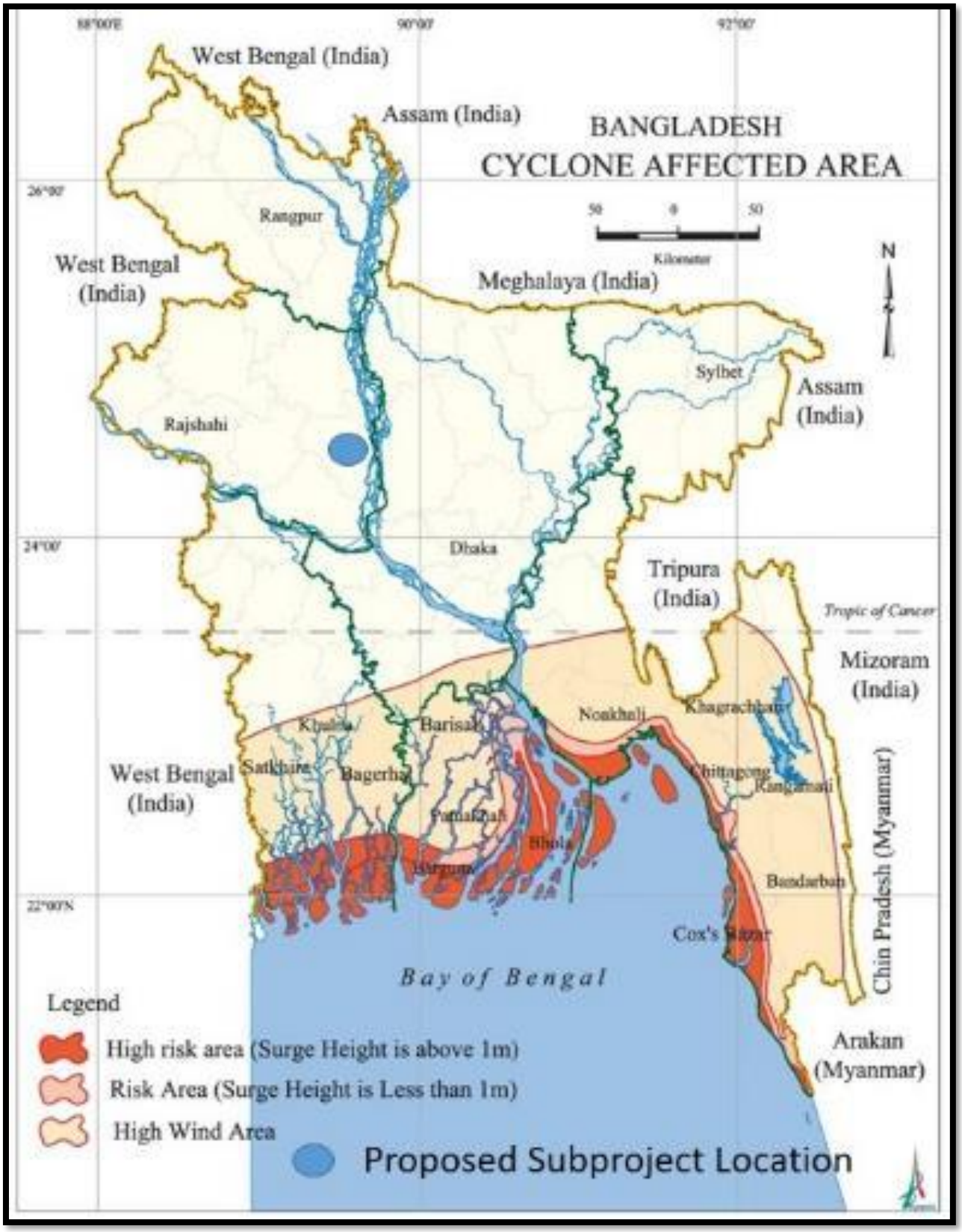


Figure 4-5: Areas Affected by Cyclone in Bangladesh

4.3.5 Air Quality and Dust

The main sources of air pollution are non-point sources such as open burning and block smoke emission from using of vehicles. In addition, during construction period use of subproject vehicles and construction equipment may degrade the air quality. Indoor air quality seems poor in the settlement area, since they are using fire wood such as sawdust, rice husk, leaves and paper for cooking purposes. In addition to burning of wood, dwellers are usually dumped their solid and liquid waste in the open space like in the pond and drain which creates odor pollution. During site visit is also revealed that, dust is speeding in the settlement at dry season from the damaged and unpaved road. However, proper implementation of mitigation measure which are addressed in the EMP is good enough to control the expected air pollution to be raised from construction activities. There are currently no air quality monitoring stations are in operation within Settlement area. Ambient air quality measurements are essential to provide a description of the existing conditions or the baseline against which changes can be measured and to assist in the determination of potential impacts of the proposed Settlement. Hence, baseline air quality will be measured by the Settlement contractors prior to commencement of work. As a part of the analytical monitoring, air quality will be also measured during construction and operation period. The results will all other measurements during implementation will be reported as a part of the monitoring report. Following Table shows the Bangladesh National Ambient Air Quality Standard comparing the WHO Guideline standard.

Table 4-3: Bangladesh national ambient air quality standard comparing the who guideline standard

Parameter	Environmental Conservation Rules,1997				WHO
	microgram/m^3				
	Industrial	Commercial and Mix use	Residential and Rural area	Sensitive area	
SPM	500	400	200	100	-
PM 2.5	65				10
PM10	150				20
SO_2	120	110	80	30	20
NO_2	100	100	80	30	40
Pb	0.5				

4.3.6 Ambient Noise Level

As a part of the baseline study, noise level measurements were carried out at different points in and around the proposed site. Sound level measurements were taken on 28th October 2018 using a data logging sound level meter (Extech HD600). Summary of noise measurements are shown in Table 4.4. The noise level was taken at different points of Kobdas Para area. The 1-minute equivalent noise levels (Leq) in most of these locations exceeded the

noise level standards in Bangladesh for Mixed to Commercial areas (see Table 4.5). However, in the project area noise levels somewhat lower compared to the intersection area as well as between the noise level standards.

Table 4-4: Summary of daytime noise level measurement in the project area

Sl. No.	Location	GPS	Daytime Noise Level (dBA)			
			Measurement Time	L_{MAX}	L_{MIN}	Equivalent Noise Level, Leq (dB)
1	At front side of Kobdaspara (Left)	24°28'31.87"N 89°42'22.67"E	11.20 am	66.15	44.31	52.22
2	At front side of Kobdaspara (Left)	24°28'29.06"N 89°42'26.58"E	11.45 am	62.47	45.55	52.17
3	Inside of Kobdaspara Settlement	24°28'28.50"N 89°42'22.70"E	12.10 pm	55.35	43.2	48.25
4	Inside of Kobdaspara Settlement	24°28'26.83"N 89°42'22.00"E	12. 35 pm	53.18	44.54	47.17

Table 4-5: Bangladesh standards for sound level (GoB, 2006)

Locations	Noise level (dBA) at day	Noise level (dBA) at night
Silent zone	50	40
Residential area	55	45
Mixed area	60	50
Commercial area	70	60
Industrial area	75	70

[Note: Noise Levels are defined as 1 minute Leq]

4.3.7 Water Quality

4.3.7.1 Surface Water

There are some ponds and low lands at surrounding areas of the Settlement. All the ponds are man-made and used for fishing, water supply and domestic uses. In addition, there is a khal (Katakhali khal) with in the subproject influence area (1km) which is the main discharge point of the proposed settlement storm water drain. The nearest channel of the Jamuna is about 2 km far away from the outer boundary of the proposed settlement boundary.

In order to assess any domestic or industrial pollution in nearby areas, surface water can be a good indicator. Thus, to assess the water quality of ponds, ditches, lowlands and canals in the study area, one water sample was collected from seasonal wetland which is connected with Khatakhali kahl and analyzed in the laboratory for selected parameters. The results of the laboratory analysis are presented in Table 4-6. The results indicate that there is no significant organic pollution in any of the surface water resources as the BOD and Ammonia values are relatively low while DO is almost close to the BD inland surface water quality standard.

Table 4-6 Analysis of surface water samples collected near at settlement area

Sl.	Water Quality Parameter	Bangladesh Standard	Concentration	Unit	Analysis Method
1	Biochemical Oxygen Demand(BOD)	0.2	1	mg/L	5 days Incubation
2	Coliform(Fecal)		40	N/100ml	MFM
3	Coliform(Total)	0	84	N/100ml	MFM
4	Color	15	2.3	Hazen	UVS
5	Dissolved Oxygen(DO)	6.0	6.84	mg/L	Multimeter
6	P^H	6.5-8.5	7.0	-	P^H meter
7	Hardness	200-500	290	%	Multimeter
8	Total Dissolved Solid(TDS)	1000	255	mg/L	Multimeter
9	Turbidity	10	3.6	NTU	Turbidity Meter
10	Ammonia	0.5	0.87	Hazen	UVS

Source: DPHE, Memo No I&A/2018 and Dated: 30-10-2018

4.3.7.2 Ground Water

For drinking local people depends on tube well water. During site visit few dwellers of the settlement reported, exist of iron content in tube well water. Thus, to assess the Fe and As content in the ground water of the community a sample was collected from tube well and selected parameter were analyzed at laboratory.

All tested characteristics of the groundwater are shown in table 4-7. The groundwater quality mostly showed compliance with drinking water standards except the Fe and Mn value.

Table 4-7: Analysis of drinking water samples collected at the settlement area

Sl.	Water Quality Parameter	Bangladesh Standard	Concentration	Unit	Analysis Method
1	Arsenic(As)	.05	.001	mg/l	AAS
2	Coliform(Fecal)	0	0	N/100ml	MFM
3	Coliform(Total)	0	0	N/100ml	MFM

4	Dissolved Oxygen(DO)	6.0	7.14	mg/L	Multimeter
5	Iron(Fe)	.3-1	2.51	mg/L	AAS
6	Manganese (Mn)	0.10	0.40	mg/L	AAS
7	P^H	6.5-8.5	6.9	-	PH meter
8	Hardness	200-500	300	%	Multimeter
9	Total Dissolved Solid(TDS)	1000	255	mg/L	Multimeter
10	Turbidity	10	6.94	NTU	Turbidity Meter

Source: DPHE, Memo No I&A/2018 and Dated: 30-10-2018

4.4 Biological Environment

4.4.1 Flora and Fauna (terrestrial and aquatic)

There is no forest in or around the settlement area. In the settlement area, households and road side plantation are the main greenery of the area. Flora consists of various type shrubs, herbs and bushes. In addition, outside of the settlement few agricultural land is found. In summer most of the agricultural land are planted with vegetables. The flora in and around the settlement area are dominated by the fruit plants and flower plants. The common terrestrial plant includes - Am, Jam, Lichu, Kathal, Narikel, Peyara, Kola, Khejur, Supari, Shimul, Kamranga, Sofeda, Bel, Tal, Madar, Dumur, Koroi, Lebu, Mehogini, Neem, Chalta, Boroi, Tatul, Babla, Tulsi, Bot etc. While, in the doba of few households has Kochari pana which is the main aquatic plant in the study area.

Figure 4-6: Terrestrial and aquatic flora within and surrounding of subproject area

There are common local birds such as Shalik, Choroi, Bok, Dowel, Crow, Bulbuli and Tuntuni etc. were found during the site visit. In addition, at few households domestic animal like cow, goat, duck, and hen etc. were observed. Moreover, adjacent to the settlement few aquaculture pond is found where local verities fishes are cultivated.

4.5 Socio Economic Environment

4.5.1 Livelihood

The dwellers of settlement area are generally engaged with rickshaw pooler and workers of brick filed. However, recently few of them are doing vegetable business.

4.5.2 Housing Pattern

There are three major types of houses are found in the city colony during the field survey. Most of the houses are semi pucca and tin shade and few are pucca houses. The roof of pucca houses are concrete based while the roof of semi pucca houses are tin based.

4.5.3 Land Tenure

For the implementation of low income settlement upgrading intervention, land tenure is not an issue. Because this low income settlement land is solely owned by the NHA.

4.5.4 Health Care

There is no health care center in or around the settlement area. Therefore, for getting health care facilities people go to the sador hospital. However, few of them are taken treatment from private hospital who are comparatively financially strong.

4.5.5 Education

In front of the settlement, there is located a Govt. Primary School. Despite of having a numbers of school going children, the access to education is not adequate here. Because parents of the children's are not educated and aware of the importance of education. Instead of education they are likely prefer to involve their children's in different types of child jobs.

4.5.6 Access to Information

In the low income settlement, people have good access to information from TV, radio, mobile and newspaper. They do not have internet and computer. However, few of young people of the low income community are using internet through mobile phone.

4.5.7 Environmental Sensitive areas (ESA)/Protected Areas (EPA)

There are no protected ecologically critical areas, cultural and historical places in and around settlement area.

CHAPTER 5. ANALYSIS OF ALTERNATIVES

5.1 General

In the LICHSP, following aspects have been recommended during the analysis of alternatives:

- Alternative location, route and design, and
- No intervention scenario.

Thus, alternatives of the interventions in terms of location, design and route have been identified and analyzed in order to reduce negative impacts and costs and enhance positive impacts as well as sustainability.

5.2 Analysis of the Alternative Routes/Location

5.2.1 Analysis of the Alternative Routes/Location for Pathway/Connecting Road

This settlement area will be developed with re-blocking upgrading model. Hence, analysis of alternative for the construction of road is not applicable. Because, construction of road will follow the developed re-blocking plan.

5.2.2 Analysis of the Alternative Routes/Location for Drain

Route/Alignment	Advantages	Disadvantages
Alternative-1 (both sides of the road)	-Easier house connection -Ease of construction without much disruption to traffic	-Two drainage lines need to be constructed -Expensive-it needs more money, area and time.
Alternative-2 (median/center of the road)	-Single drain needs to be constructed along the median	-Difficult to make house connection
Alternative-3 (one side of the road)	-Single drain needs to be constructed -It is suitable for single lane road	-Difficult to make house connections from other side of the road -It is not suitable for more than single lane road.

Decision: As per sites requirement three alternative has been recommended. Designer will be decided with the assistance of PMU which one is suitable for the settlement area.

5.2.3 Analysis of the Alternative Routes/Location for Water Supply

Since, only 17 tube well will provide water supply facilities, hence re-blocking upgrading model has been designed considering the 17 suitable location where space for installation of tube well is available and capable to meet the community demand. Though currently there is no water supply facilities in the study area. But Pourashava has future plan to provide pipe water supply facilities in the Kobdas Para Settlement. Hence, under this project along the both side of the internal road of settlement, water supply networking has been considered in comparison to the one side of the road for providing easier house connection.

5.2.4 Analysis of the Alternative Location for Septic tank and Soak well

There will be constructed 7 septic tank and 7 soak well as a part of sewage system of low income settlement. Hence, prior to start design of septic tank and soak well sanitation engineer should be visited the site and select a place which will be effective for sewage management system. However, during selection of place for the sewage pit and soak well following consideration should be taken.

- There should be no water body adjacent to the selected place of septic tank and soak well;
- Selected place never to be sited in the low laying area where has possibilities to water logged in the monsoon period;

5.3 Analysis of the Alternative Design

5.3.1 Analysis of the Alternative Design for Pathway/Connecting Road

Design Alternatives	Advantages	Disadvantages
Alternative 1: Bituminous Carpeting (BC) Road	• Low Construction cost; • Provide smooth surface; • Aesthetic value is high	• Frequency of maintenance is relatively high; • Early damaged in heavy rainfall
Alternative 2: CC Road	• Do not require frequent repairing like BC roads; • Durability is more than BC road but less than RCC road	• Concrete roads do not require frequent maintenance but if damaged the whole concrete slab needs to be replaced; • Costly higher than BC road
Alternative 3: HBB Road	• Require less construction cost; • Construction time is less	• Frequent maintenance is required • Surface is not smooth
Alternative 4: RCC Road	• Capacity of passing heavy loaded vehicles • RCC road is not damaged in heavy rainfall • Frequency of maintenance is relatively low.	• High construction cost • Provide relatively less smooth surface

Decision: Considering the cost effectiveness and site condition, HBB Road is recommended in the connecting road. While RCC road is recommended in the internal road of the settlement because most of the road portion will cover the top slab of RCC drain.

5.3.2 Analysis of the Alternative Design for Water Supply

Design Alternatives	Advantages	Disadvantages
• Alternative 1: • Tube Well	• Easy to construct; • Less expensive than water supply network; • Covering of the supply facilities is lees	• Need more space than supply water; • No scope to water supply connection in the toilet and kitchen;
• Alternative 2: • Pipe Water Supply	• Easy to provide connection in the toilet and kitchen; • Whole community will get supply facilities	• Difficult for construction; • Maintenance cost is high;
• Alternative 3: • Water Harvesting	• Less expensive than other; • Reduce pressure on the extraction of ground water	• Lack of maintenance can contaminate the preserve water;

Decision: At present, there is no pipe water supply facilities in the settlement area. Hence, to serve the water supply facilities in the settlement area 17 tube well is recommended. While rain water harvesting system can be a good solution to reduce the pressure on ground water.

5.3.3 Analysis of the Alternative Design for Drain

Design Alternatives	Advantages	Disadvantages

Alternative 1: RCC drain	• Not prone to encroachment • Area above RCC drain could be used as a part of	• Higher cost of construction
Alternative 2: Earthen drain	• Less construction cost	• Need more land for construction of open earthen drain • Prone to encroachment, disposal of solid waste/ debris
Alternative 3: Pipe drain	• Require less time need to construction	• Maintenance is difficult

Decision: The selected design is alternative 1 because RCC drain is advantageous than other

5.3.4 Analysis of the Alternative Design for Septic tank and Soak well

Following consideration should be taken for the construction of septic tank and soak well

- Proper lined in the bottom of the septic tank and soak well should be ensured,
- Internal wall of the septic tank and soak well should be plastered with net finishing work.
- Future population projection should be considered in the design of septic tank and soak well

5.4 No Scenario

The subproject aims to improve the housing as well as overall living condition of the kobdas Para community people by ensuring drainage system, sewage system, road network, water supply and solid waste management. However, if the community is left without any intervention the housing pattern will remain same and the current environmental consequences may be deteriorated day by day. Moreover, the community will be deprived of access to legal electricity connection, gas connection and other facilities in absence of proposed interventions.

5.5 Additional Interventions Proposed for Environmental Enhancement

The following environmental design consideration is recommended in designing of the low income settlement upgrading re-blocking model to confirm trans-boundary or global issues:

- Provision of roof top Rain Water Harvesting (RWH) system as a part of the water supply system;
- Roof top solar energy system for a part of electricity supply;
- If possible maintain an open space for the playground;
- If possible Biogas plant could be an alternative source of cooking fuel and electricity;
- Training/ awareness/campaign should be continued for the community to promote a hygienic environment
- Solar panel in the houses for energy sources could also be inspired;
- Points for a hosepipe connection, sand store, water tanks etc. can be arranged in the settlement to manage emergency situation like fire hazard, flood etc.
- Environmentally sustainable as well as locally available construction materials could be used to build infrastructures for reducing pressure on the available resources.

CHAPTER 6. SPECIFIC IMPACT, MITIGATION AND ENHENCEMENT MEASURES

6.1 General

This section identifies and predicts the probable impacts on different environmental parameters due to construction and operation of the proposed low income settlement up gradation subproject. In addition, this section will also provide mitigation and enhancement measures. After studying the existing baseline environmental scenario, monitoring environmental parameters, reviewing the process and related statutory norms, detailing the waste management measures, the major impacts can be identified during construction and operation phase. However, it is predicted that, the probable impacts of the subproject are mainly caused by the key activities required during the implementation of the interventions, raw materials and equipment to be used for the execution activities and management of waste during operation phase.

6.2 Impacts during site preparation and construction of interventions

During implementation of the proposed subproject impacts associated with 1) site preparation including demolition of existing poor infrastructures, removal of debris, land filling and leveling, and 2) designing of appropriate subproject interventions and their construction.

6.2.1 Impact during Pre-construction for Site Preparation

6.2.1.1 Resettlement of the Existing Community

For upgrading of this low income settlement area, rebooking model will be followed. So, during site preparation work all of the existing infrastructures of the low income community will be demolished/shifting. Hence, before starting the site preparation work a temporary resettlement will be needed to avoid any social crisis.

Mitigation Measure:

- Above mentioned impact will be resolved according to social impact assessment report.

6.2.1.2 Demolition/Shifting of Existing Poor Infrastructures

As a part of site preparation work, site clearing work is needed. These site clearing work involves demolition/shifting of existing structures. Existing infrastructure of the low income community are mostly tin shed and semi pucca houses few with one storied pucca structure which are brick foundation with concrete slab.

Demolition/shifting work needs simple procedure and commonly used manual equipment-hammer with mechanical drill machine and steel cutter. Therefore, this is not massive demolition work and anticipated impacts are not severe. The generated solid wastes and dust is expected less. In addition, there will have attempt to reuse of demolished materials such as corrugated iron sheet, reinforcement, debris, wooden door, and window.

However, potential environmental impacts is associated with demolition works are taken carefully and corresponding mitigation measures are formulated adequately. The potential environmental impacts in connection with demolition works are: noise & vibration, dust, traffic congestion and generation from demolition wastes including corrugated iron sheet, door, windows, wood, metal frames, debris and visual & aesthetic impacts.

Mitigation Measure:

- Prior to start of demolition work, electrical power and utility services in the community should be shut off;
- To ensure safety site should be fenced out;
- If needed, electric poles will be shifted with the assistance of responsible authority by following proper safeguard;
- Ensure use of the personal protective equipment for the engaged laborers where applicable;
- Ensure careful operation of the machineries and equipment if required;
- Wooden and metal window & door and other furniture should be relocated for re-use;
- Proper location of equipment and machinery on site;
- Ensure careful operation of the machineries and equipment;
- Demolition work should be started from roof and then side brick wall;
- The demolition works shall be taken not any nuisance by the way of noise, dust and vibration to the surrounding environment;
- Generated debris should be disposed in the designated dump site of the Sirajganj Pourashava;
- If possible corrugated iron sheet shall be reused to build up semi-pucca houses of the settlement;
- After demolition brick would be reused as brick chips by removing the mortar;
- Not to be accepted any burning of waste material at subproject site.

6.2.1.3 Disposal of Demolished Toilet Waste

If during demolition of toilet is not properly planned and executed or protection gears are not adopted, it will affect health of residents, construction workers, and neighboring communities. Human excreta of those toilets (if untreated) might result into the health problem, water pollution and air pollution.

Mitigation Measure:

- Ensure use of vacuum pump to collect sewage sludge and it shall be carried with covered drum truck;
- Sewage sludge shall be disposed in the nearby fecal sludge treatment plant if available, or that shall be engraved in the earthen pit and soil cover shall be ensured at least one feet.
- Ensure disposal tanks, drums or containers coming to site are in a satisfactory condition – check for damage or leaks;
- Ensure all deliveries are made as far away from watercourses and drains as possible;
- Ensure use of PPEs for the associate workers;

6.2.1.4 Land Filling and Leveling Work

Existing settlement has low elevation than adjacent to the neighboring community. In addition, there is no proper level from one portion to other portion of the settlement. Hence, to provide the planned re-blocking upgrading model facilities in the low income community land filling will be needed. This land filling work may leads the loss of top soli which may decrease soil fertility, if it collects from agricultural fields. In addition, if

proper measure are not taken it would have impact on dust pollution, noise and soil erosion. Even, this land filling work will have probability to soil erosion by runoff, if proper measure are not taken.

Mitigation Measure:

- Before filling work exiting top soil (300mm) has to be excavated and will stockpile into the separate place from other filling material. Afterward, land will be raised up by local sand except top 300mm. Then, stockpiled soil will take place on the top.
- Top soil of agricultural fields should be avoided for filling work and ensure use of sand for filling of land;
- To avoid soil erosion from contact with adjacent to the water bodies of settlement, in the periphery of the settlement RCC retaining wall shall be constructed;
- For getting compactness and stability to avoid soil erosion proper compaction will be maintained;
- During compaction and leveling of land moist condition should be ensured by sprinkling of water;
- Sand carrying truck should be covered up with tarpaulin or polythene;
- Transportation of the filling material have to be carried during the scheduled times, and mainly during the day;
- Ensure use of face mask to the workers.

6.2.1.5 Clearing of Vegetation and Cutting of Trees

During site visit it was counted that, total 362 numbers of tree will be cut down for the upgrading of the low income community. There is also be needed few vegetation clearing works. Major trees to be cut down are given below in the following ***table 6-1.***

Figure 6-1: Information about affected trees with type

Local Name	English Name	Number
Caplatus	Eucalyptus	116
Am	Mango	101
Jam	Jambul	27
Kathal	Jackfruits	28
Mahogany	Mahogany	32
Payara	Guava	17
Jhika	Lannea Coromandelica	13
kodom	Burflower Tree	6
Boraoi	Plum	12
Pitha		5
Amra	Hog Plum	3
Bot	Banyan	2
Total		362

Mitigation Measure:

- 900 numbers of trees will be planted to compensate the felled down trees and enhance the ecological condition in the subproject area.

6.2.2 Impact during Construction of Intervention

6.2.2.1 Housing and Multi-purpose Community Building

Due to construction of housing anticipated impact is mainly on physicochemical parameter. Construction of houses involves use of equipment/machines which are produced noise, it may temporarily disturb nearby residents. However, if the settlement is located close to human settlements/ schools/ hospitals, noise pollution would be significant though the impacts are anticipated to be limited. Similarly, air pollutants will be emitted from the excavation work, equipment and construction vehicles are expected to remain low. Storing of cement bag without cover may also degrade the air quality. Local residents in the vicinity of the work sites will be temporarily disturbed by the limited dust pollution. If proper measure are not adopted temporary water-logging may be occurred. Moreover, the finishing work of construction stage is plastering, and painting. These work may degrade the soil and surface water quality if measure are not taken. Eventually, lime paint (locally known as white wash) need lime (Chun) to be mixed in water. Mixing lime will pollute air and possess potentials of serious pollutants and health hazards. However, scale of work is minimal. So, anticipated impact is also expected to remain low and site specific.

Mitigation Measure:

- Construction materials must be selected to ensure the least possible negative impact on the environment;
- Water should be sprayed at the work site for dust control;
- Ensure sprinkle and cover stockpiles of loose materials (e.g., fine aggregates);
- Maintain adequate moisture content of soil and sand for transportation, compaction and handling;
- Avoid use of dust generating equipment which produce significant amount of particulate matter far from the local residents;
- Ensure all subproject vehicles are in good operating condition;
- For managing noise nuisance, construction works should be limited to daytime and all employees likely to be exposed to ear noise must use ear plug;
- If needed and applicable, all powered mechanical equipment and machineries will be fitted with noise abating gear such as mufflers for effective sound reduction;
- Place polythene at the ground to prevent discharge of paints, and plastering wastes in the soil ;
- Carefully mixing of lime with water by ensuring safety gear and it should be in confined zone.
- For storing of construction materials like cement bag, shed must be covered as well as must have a concrete floor.
- In the construction process, use of chemical or binder in the concrete to strengthen and fasten the process should be avoided.

6.2.2.2 Water Supply

The water supply network development work consist -laying of distribution pipe and installation of new tube well. The impact associated with laying of distribution pipe are dust blowing, water logging, noise and vibration which disturb the local people. On the other hand, installation of tube well would result in loss of land that might have used for housing or other purposes. In addition, source of water may have health impact if the quality of water is not tested in terms of arsenic and bacterial contamination. Moreover, generation of muddy water from installation of tube well has impact on heath and aesthetic value and

equipment to be used for this work will have impact on noise and air quality. However, aforementioned all of anticipated impacts are site specific and extent is limited.

Mitigation Measure:

- Proper care will be taken by the contractor during trenches cutting , earth work and disposal work to avoid any undue disturbances to the nearby people;
- Avoid loss of the topsoil for the filling work and ensure use of sand for the back filling work;
- Cover the exposed earth works (during construction) with much fabric;
- Ensure no construction materials like earth, stone, distribution pipe or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross drainage channels;
- Provision of pumping facilities should be ensured by the contractor to drain out the water from trenches if required;
- Avoid prolonged exposure to noise (produced by equipment) by workers;
- Disposal of mud or any other generated waste at the designated dumping site;
- Ensure use of the personal protective equipment's (helmet, goggles, ear plug, gloves, safety boot etc.);
- Water should be sprayed to control the dust, which is the main way to suppress dust at worksite;
- Existing quality of source water has to be monitored before installation of tube well;
- Ensure effective planning to loss of land;

6.2.2.3 Toilet /Sanitation

Generally, toilet intervention is mostly included with the housing intervention. Thus, associated impact with construction of toilet will be mitigated accordingly suggested mitigation measures of housing intervention. However, installation of new sanitation system/ toilets is likely to bring significant adverse environmental impacts if not designed properly or constructed in an inappropriate location. The impact may be raised due to improper designing are: land loss, soil erosion, surface runoff, waterlogging, health and safety, air pollution, odor, water pollution, etc. However, by adopting proper design probable impact can be minimized.

Mitigation Measures

- Before designing sanitation system community should be involved;
- Selection of land for the sanitation or toilet should be followed engineering practice;
- Keep safe distance (minimum 10 m) between latrine and tube well or other water sources;
- Distance between ground water table and bottom of latrine pit should be at minimum 3 feet to protect ground water pollution;
- Sufficient ventilation should be ensured in latrine superstructure to reduce odor problem.
- Selection of land for the sanitation or toilet should be followed engineering practice;
- In the design of sanitation facilities, ensuring connection of toilets with septic tank in all establishment;
- Water supply shall be provided in the each toilets to ensure hygienic environment;
- Before construction selected land for toilet should be ensured proper compaction to avoid soil erosion;
- Installation of hygienic latrine instead of pit latrine to stop the microbial contamination to the ground water;
- Keep noise and soil pollution within tolerable limit.

6.2.2.4 Drainage System

The activities to be performed for the construction of drain will be implemented by using equipment like concrete mixture machine, mechanical vibrator, excavator etc. Hence during operation of these equipment air and dust pollutant may be emitted from mixture machine and construction vehicles. In addition, noise and vibration caused by the equipment and movement of the construction vehicles may temporarily disturb

nearby residents. Moreover, erratic rainfall may create temporary drainage congestion. In appropriate design may also create sever water logging problem.

Mitigation Measures:

- Construction activities should be identified based on natural flow of the stream;
- Drainage system has to be designed considering the downstream discharge point; adequate slope and x-section;
- Identify appropriate location for the outlet/ outfall;
- Water should be sprayed at the working site for dust control;
- Ensure sprinkle and cover stockpiles of loose materials (e.g., fine aggregates);
- Maintain adequate moisture content of soil and sand for transportation, compaction and handling;
- Avoid use of dust generating equipment which produce significant amount of particulate matter far from the local residents;
- If needed and applicable, all powered mechanical equipment and machineries will be fitted with noise abating gear such as mufflers for effective sound reduction.

6.2.2.5 Pathway or Connecting Road

The major environmental parameter to be affected due to construction of road are: traffic congestion, noise and air pollution, water logging or drainage congestion. However, considering the extent and scale of pathway intervention, it appears that impact would be minimal in most of the cases.

Mitigation Measure:

- To avoid drainage congestion, construction work will be performed mostly in the dry season;
- For construction of BC road, open burning of the asphalt should be at safe distance;
- Maintain adequate moisture content of soil and sand during, compaction and handling;
- Keep noise pollution within tolerable limit;
- Transportation of construction materials and equipment will be followed in the scheduled time ;
- Water should be sprayed at the working site for dust control;
- Concreting work should be avoid at nighttime to avoid noise nuisance.

6.2.2.6 Impact on Watershed and Drainage Congestion

Except few low land and aquaculture ponds there is no water body found around the settlement area. However, due to implementation of the proposed intervention there will have some anticipated impact to the adjacent water bodies of settlement area, if any sort of construction waste (loose soil, sand, construction waste, effluent from work camps, and food waste etc.) dispose in to the water course. In addition, stockpile of construction materials and filling material may obstruct the natural runoff in the surrounding area if it is not properly placed. Even, excavation work for any intervention that need to be foundation work may leads the temporary waterlogging problem from erratic rainfall.

Mitigation Measure:

- Proper construction management including waste management as well as training of the; operators and other workers should provide to avoid pollution of the water bodies;
- Construction waste will dispose properly (not in water bodies or lowland), for which contractor will be responsible.
- To stop the contact of filling material with adjacent to the settlement water bodies, prior to filling work RCC retaining wall shall be constructed at periphery of the settlement area;

- Temporary storm water drainage congestion in the settlement area due to rainwater should be removed by pumping from the foundation trench;
- Drainage congestion at the settlement area should be removed by temporary earth drain if needed;
- Construction work will be mostly done in the dry season;
- Road side stockpile of any construction or filling material shall be escaped.

6.2.3 Impact during Operation of Intervention

If proper design and construction are maintain, at operation phase probable impact are expected to remain low. However, special attention needs to be given to the operations and maintenance of water supply, toilet, solid waste management, and drainage interventions in order to ensure environmental sustainability in the selected community.

6.2.3.1 Water Supply:

Inadequate and inappropriate design may led the no functionality, leakage and water logging problem at the settlement. In addition, source water may have possibilities to contaminate with arsenic or fecal coliform. Even, over extraction of groundwater by tube-wells would lower the groundwater table and makes the tube-well nonfunctional.

Mitigation Measures:

- Durability and quality of the material to be used for water supply must be ensured;
- There should be alternative sources of water if the construction of new water supply procedures create temporary disturbance in water supply in the settlement area;
- To recharge the ground water, surface water flow shall be protected;
- Proper maintenance shall be ensured to keep the system functioning;
- Water of the reservoir should be cleaned regularly if available;
- Periodic water quality test should be conducted for arsenic, bacteria and salinity contamination;
- Awareness program on efficient water management at community should be conducted;
- To reduce pressure on the scarce groundwater resources rain water harvesting with a filtration system could supplement to the existing water supply options.
- Low income settlement/ community will be encouraged to use of surface water for bathing purpose;

6.2.3.2 Drainage System:

At operation, due to lack of proper maintenance drainage system can be non-functional. Thus, overflow of drain water can create unhygienic situation in the low income community and its adjacent area. In addition, it may have health effect on low income community. Surface water bodies adjacent to the community may be contaminated if any storm water drain has direct connection with toilets.

Mitigation Measures:

- Ensure proper disposal of waste by avoiding disposal of any waste into the drain;
- Not allowing direct connection to drain from toilet;
- Awareness program for the community people should be taken to increase knowledge about improper waste disposal and its impact;
- Proper maintenance and cleaning of the drain and outfall on regular basis;
- There should be regular monitoring of the drainage due to sedimentation;

6.2.3.3 Toilet / Sanitation

During operation phase, the fecal sludge generated from the toilets of the low income community area, will be managed through proper on-site sanitation i.e. through providing proper septic tank and soak pit. If the septic tank will not be cleaned in regular interval with effective sludge transport and disposal systems it may cause environmental pollution (overflow of septic tank etc.) and health hazard to the community peoples.

Mitigation Measure:

- The community dwellers will clean the septic tanks in regular interval with the help of conservancy unit of Pourashava or privately;
- Conducting community awareness programs about health impacts and proper sanitation practices;
- Ensure a functional monitoring system in the community;
- During emptying pits proper handling of excreta carrying containers and maximize container size;
- Ensure use of vacuum truck to collect septage from the toilet and safe disposal;
- Septage shall be disposed in the nearby fecal sludge treatment plant if available, or that shall be engraved in the earthen pit and soil cover shall be ensured at least one feet.
- Ensure disposal tanks, containers used in septage collection shall be free from damage or leaks;

6.2.3.4 Solid Waste Management:

Operation of this settlement will generate different types of households waste. If these, generated waste are not disposed properly, this waste will be disposed in to the nearby drain or ditch. Thus, low income community/subproject area will get unhygienic condition and odor.

Mitigation Measures:

- Introduce ample amount of primary waste bin in the low income settlement ;
- Regularly clear the primary waste storage bin;
- In the design of bins, it should be kept provision of cover to avoid air and water pollution;
- The wastes will have to be collected from primary waste bin by the cleaners (to be engaged by the community or Pourashava) to the secondary transfer station (17 numbers of primary transfer station has been incorporated in the design);
- The Conservancy unit of Pourashava will carry the waste from the primary transfer station to the designated dump site by using the dump truck;
- Entrance of flood water should be blocked through raising the edge of this STS site in order to stop the spread of waste in the area.
- Conducting awareness program in the community about demerits of unplanned waste disposal and regarding their health effect and environmental pollution.

6.3 Occupational health & safety of workers

Proposed construction intervention for the upgrading of community is very simple and it would be required medium to light equipment for the implementation of the intervention. In addition, the scale of work is also small. Thus, under controlled situation, accident is not expected. However, construction activates may will have various health hazards for the workers if proper measures are not taken for the operation of equipment such as hydraulic excavator, steel cutter and accepting head loads for carrying soil, construction materials and construction equipment. In fact, the sudden bad weather working conditions such as storm, thunder storm and earth quake etc. may occur health hazard. Additionally, hazardous substances and wastes pose risks of the infections and diseases.

Mitigation Measures:

- Provision of proper training to all workers for handling the construction equipment
- Dustbins shall be provided at labor camps for collection of waste and waste should be regularly disposed properly by the contractor;
- Temporary storm water drainage system should also be provided at camp site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies ;
- Provision of personal protective equipment like safety jackets, helmets, gumboots, gloves, face mask, ear buds, goggles, safety shoes etc. as per requirement and nature of job in which they are involved
- Job rotation should be carried out for workers exposed to high noise and dust areas especially during land filling and compaction work,
- Provision of first aid facility at the site and the labor camp ;
- Proper sanitation facility including toilets, bathing facility and washing facility should be provided at site and at labor camps for workers;
- Regular inspection for hygiene and safety in labor camps should be done;
- Contractors will bear medical treatment costs. If any sever accidents such as loss of hands, legs or loss of working ability or any case of death needs compensation-(the amount of the compensation should be fixed considering the type of accidents).

6.4 Positive Impact:

Since the proposed LICHSP project is designed to upgrade the living condition of low income community through construction of different interventions, hence there will be expected some positive impact. All these impacts are divided into two categories. First is the certain positive impacts i.e. the impacts that are expected from interventions, second is the probable positive impacts i.e. the impacts that are expected from the enhancement measures.

CHAPTER 7. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 General

The EMP consists of a set of Institutional Arrangement, Mitigation Measures and Plan, Monitoring Plan, Documentation and reporting, Contractual arrangements for EMP implementation, EMP implementation cost, Capacity building and Grievance redress mechanism to be taken during the design, construction and operation (post-construction) stages of the project. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Facilitate the implementation of the environmental and social mitigation measures identified during the present EA and discussed in specific impact assessment chapter.
- Assign responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project interventions;
- Define a monitoring mechanism and identify monitoring parameters to ensure effective implementation of the mitigation measures.
- Assess environmental training requirements for different stakeholders at various levels.
- Describe communication and documentation requirements.

7.2 Access to Information

The environmental assessment report is to be translated into Bengali and disseminated locally. The copies of the report (both in English and Bengali) will be sent to the concerned personnel responsible for subproject implementation. After the clearance from the World Bank, the draft final version of the assessment report will be posted in the website of NHA and it will be made available at the World Bank‘s web site. It will also be made available to the public for further comments and inputs from non-governmental organization, civil society and general public. The EA will be finalized taking into consideration of the comments received on draft version and will also be uploaded in the NHA and World Bank website after approval.

7.3 Institutional Arrangement for Safeguard Compliance

This project will be implemented by National Housing Authority under the Ministry of Housing and Public Works. However, PMU of LICHSP will be responsible for overall environmental management including implementation of mitigation measures and monitoring, and preparation of quarterly progress and monitoring reports. The PMU has been formed with the Project Director, Deputy Project Director, Environment Specialists, Social Specialist, Procurement Specialist and Financial Management Specialist. In the institutional arrangement procedure, Project Director, and Team Leader/ Deputy Team Leader will directly involve in planning, design and implementation. During implementation, the PD, TL/DTL would be supported by PMU Environmental Specialist and Social Specialist and NHA divisional offices. To ensure the effective implementation of safeguard compliance, NHA will ensure active engagement of community support center (CSC), Pourashava and community development committees (CDC). The community support center (CSC) will be established in Sirajganj under the project during construction period. The community support center (CSC will be monitored by the PMU. The CSC officials, especially ‘engineer’ will be responsible for supporting the construction supervision. In addition, Engineering head of Sirajganj Pourashava, CSC focal person for Environment and local community head will be responsible to monitor

and supervise the overall environmental concern. The civil works contractors will implement the environmental mitigation measures.

Furthermore, it is clear that, for effective implementation of the project, a very efficient institutional linkage has to be developed. Therefore, two major bodies are needed to be included, which are:

1. National Steering Committee (NSC) headed by the Secretary, MoHPW;
2. Technical Review Committee (TRC) headed by the PD. This committee will also work as national level environmental committee; and

Environment Specialist will report the PD regarding any issues related to environmental supervision and management and will be responsible for overall environmental management of LICHSP interventions. PD will make final decision on any environmental actions after due consultation with NSC and Technical Review Committee.

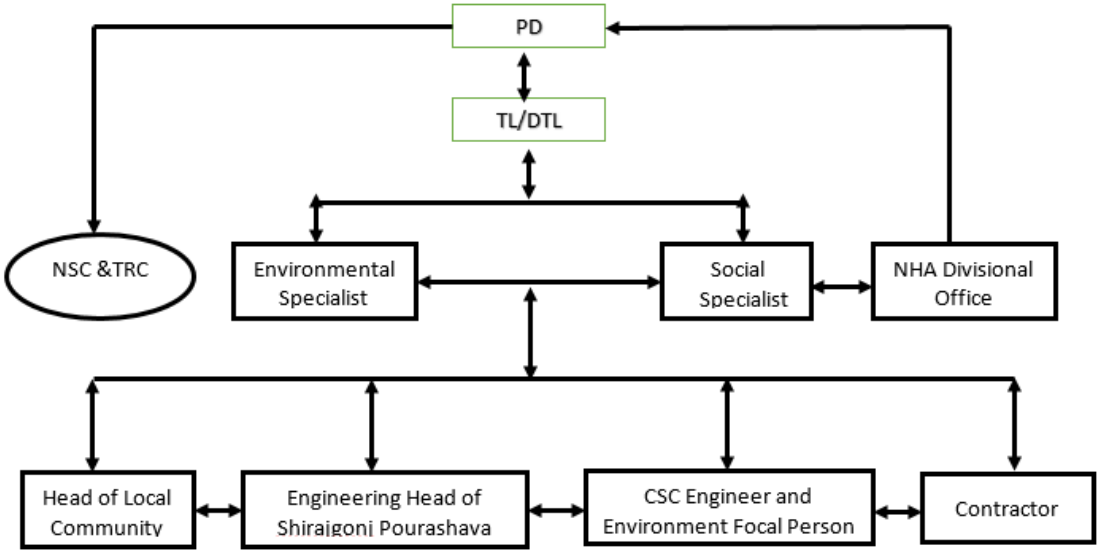


Figure 7-1: A Tentative Institutional Arrangement for Environmental Safeguard

7.4 Capacity Building through Training and Awareness

For proper implementation of environmental safeguard and management, Environmental Specialist of NHA will be responsible for conducting capacity building program on environmental awareness and management in accordance with both WB and GOB requirements. A training module will be developed by the Environmental Specialist, NHA. This modules would be as follows: (i) sensitization to all level of stakeholders associated with the interventions to be implemented; (ii) Environmental Screening, (iii) review of IEEs and integration into the project detailed design; (iv) EMP Implementation, including environmental monitoring requirements related to mitigation measures; and (v) taking immediate action to remedy of the unexpected adverse impacts or ineffective mitigation measures found during the course of the implementation. Before and during the field operations of project four nos. demonstration training programs

will be conducted by PMU with the assistant of Environmental Specialist, NHA. These training programs will be participated by community committee, construction workers, PMU and NHA Divisional /Field Officers and representative of Pourashava. However, the contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. Table 7.1 suggests specific training plans for capacity building of each stakeholder involved in the LICHSP.

Table 7-1: specific training plans for capacity building of each stakeholder involved in the LICHSP.

Target Participants	Type of Training	Responsibility	Duration
Community Organization	Environmental awareness	PMU	1 day
	Environmental concerns and Community monitoring	PMU	2 days
Construction workers	Environmental Health and Safety	Contractor	0.5 day
PMU and NHA Divisional/Field Officers	Environmental Assessment and Monitoring	PMU	5 days
	Environmental Management Framework (EMF)		1 day
City Corporation	Environmental concerns and Environmental Monitoring	PMU	1 day

7.5 Grievance Redress System

A common GRM will be in place for social, environmental, or any other grievances related to the project; the resettlement plans (RPs) and EAs will follow the GRM, which is developed in consultation with key stakeholders. The GRM will provide a reachable and reliable platform for receiving and facilitating resolve of affected persons' grievances related to the project. The multi-level GRM for the project is outlined below, each level having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required.

Affected persons (APs) will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes that have already been installed by NHA at project site just in front of community committee office. In addition to this complain box, online registration link (e-mail, Fax & phone number of CSC office) should be made available at the construction site signboards. Moreover, a sample registration form has sent to the community development committee office (CDC) and community support center office (Template of Registration Form as Appendix-5). After getting any grievance from aggrieved person it will be recorded in written form in CSC office.

The urban resources center, CSC office will have the overall responsibility with the assistants of local level GRO involving GRC committee for timely grievance redresser on environmental and social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party.

With the facilitation of NHA, the Pourashava Mayor nominated the GRC members and included representative from community development committee, government agencies, local NGO, and civil society. The GRC has been formed and established for the kobdas Para Settlement. The GRC members are as follows:

Sl. No	Name	Organization	Designation of Grievance committee
01	Afroja Begum	Chairperson of Asher Alo Housing Shomobay Somity	Chairperson
02	Sahela Akter	Urban Community Mobilizer, DPM, LICSHP	Member Secretary
03	Najma Begum	Community Development Committee Member	Member
04	Saiful	Primary Group Member, Shapla Dal	Member
05	Zoynal	Primary Group Member, Bely Dal	Member

The first stage of grievance redress involves solution of the problem directly at the field level (Locally). At the local level the Chairman of Municipality will act as the Grievance Redress Officer (GRO). Most of the grievances are to be resolved at the field level. The Grievance Redress Officer in the presence of GRC Member resolve on-site in consultation with each other, and will be required to do so within 15 days of receipt of a complaint/grievance.

If the complaint is not addressed within this period of time, the petitioner may go directly to the next level of GRS. That is, if a complaint at local level is not addressed within fifteen working days, the petitioner may directly appeal to the district level GRO. At district level the Deputy Commissioner (DC) will act as the GRO. GRO will attempt to resolve those within 7 days. If it remains unresolved then it will go to the central level where Deputy Project Director will be act as GRO to resolve the issues within 7days. However, if is also failure to resolve it then it will take place in the national level GRO. At this stage, the Chairman of National Housing Authority (NHA) would be given the responsibility to act as the GRO and given the supreme authority to address any compliant. If the National GRO cannot resolve it, then project will be drooped. It is obvious that, always the next level GRO would work as the appellate authority for the previous level.

Despite the project GRM, an aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

Every level must prepare and send a monthly report on the nature and types of complaints to its next level. A resolution register will be maintained by the all level GRO. The resolution register will contain (i) serial no., (ii) case no., (iii) name of complaint, (iv) complaint story and expectation, (v) date of hearing, (vi) date of field investigation (if any), (vii) results of hearing and field investigation, (viii) decision of GRO, (ix) progress (pending, solved) and (x) agreement or commitments. Closing register will keep records such as, (i) serial no., (ii) case no., (iii) name of complaint, (iv) decision and response.

7.6 Emergency Response and Disaster Management

Disaster management can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular the preparedness, response, and recovery to lessen the impact of disasters. Emergency Preparedness Planning (EPP) and Contingency Planning (CP) are the processes of disaster management plan for developing strategies, arrangements, and procedures to address the humanitarian needs of those adversely affected by the crisis. There are four main types of disasters, namely: Natural disasters, Environmental Emergencies, Complex Emergencies, and Pandemic Emergencies.

For the Low Income Housing Support Project (LICHSP) activities, with the help of PMU, would identify the immediate needs, prioritize the tasks, and identify resource requirements to address the humanitarian needs of those adversely affected by the crisis.

7.7 Environmental Management Plan (EMP)

Environmental Management Plan (EMP) is an integral part of all subproject interventions to be designed and implemented under the LICHSP. The LICHSP has prepared the EMP for every subproject intervention where it has been recorded all the anticipated impacts resulting from the sub-project activities and mitigation measures for all the anticipated impacts has been suggested. The major components of an EMP include: Mitigation Measures, Enhancement Measures/ ECoPs, Estimation of Cost of EMP, Environmental Monitoring, and Institutional Arrangement for Implementation of EMP. The following table shows potential mitigation measures as well as ECoPs are recommended in the LICHSP

Table 7-2: Environmental Management Plan (EMP)

Sub-Projects/ Activities	Anticipated Environmental Impacts	Suggested Mitigation Measures/Enhancement Measures/ Environmental Design Considerations	Responsible parties
Preparation of Site/Land at the Kobdas Para Community			
Demolition of existing poor infrastructure and Land Clearing	▪ Potential health and safety risk and accidents due to removing of existing structure (tin shed, semi pucca and houses and toilets)	▪ Prior to start the demolition work, electrical power and utility services of the community shall be shut down; ▪ To ensure safety, the site shall be fenced out; ▪ Ensure use of the personal protective equipment (PPE) for the workers engaged in the demolition works ; ▪ Ensure careful operation of the machineries and equipment required in demolition works; ▪ Transport/handle debris from toilet shall be in a hygienic manner; ▪ Ensure use of vacuum pump to collect sewage sludge and it shall be carried with covered drum truck; ▪ Sewage sludge shall be disposed in the nearby fecal sludge treatment plant if available, or that shall be engraved in the earthen pit and soil cover shall be ensured at least one feet.	Contractor CSC Municipality and that is to be monitored by PMU, NHA
	▪ Physical or social disruption to the communities and temporary loss of income from street vending.	▪ Engage the community members in the construction work; ▪ Contractor will be responsible to avoid any sort of social disruption to the community.	Contractor CSC and monitored by PMU, NHA
	▪ Generation of solid/construction wastes, noise and traffic congestion to dispose the debris	▪ Demolition work shall avoid night time and should follow normal working hour; ▪ Ensure re-use of the materials (use tin for fencing the construction site and bricks may be used for making brick chips); ▪ Collection and disposal of construction debris shall be deposited in a designated dumping place; ▪ No wastes materials and debris shall be burned on the site; ▪ No encroachment of demolition wastes on adjacent road side area and any private property;	Contractor CSC and monitored by PMU, NHA

		▪ Cover the exposed loose wastes with fabric/polythene/tarpaulin; ▪ Placement of construction equipment shall be in a proper place to avoid traffic congestion; ▪ Ensure schedule time to dispose the generated debris.	
	▪ Ecological impact due to felling of trees and vegetation clearing work	▪ Local varieties trees will be planted at boundary/ slope/ open space or any other suitable place of the settlement;	Contractor CSC and monitored by PMU, NHA
Land Filling/ Rising land level	▪ Dust generation and possibilities of soil erosion and loos of top soil	▪ After filling , raised land shall be compacted to protect soil erosion; ▪ Ensure moist condition of the filling material during compaction; ▪ Soil shall be avoided as filling material and will be ensured use of sand for filling material; ▪ To protect soil erosion RCC retaining wall shall be constructed at the periphery of the settlement.	Contractor CSC and monitored by PMU, NHA
Construction of Labor shed and its management	▪ Generation of sewage and solid waste may cause water/ environmental pollution	▪ Ensure construction of the labor shed at the suitable place of the settlement area; ▪ Construction of sanitary latrine considering 15 persons for one toilet at the labor shed and separate toilet for male and female; ▪ Ensure separate waste collection bin for organic and inorganic wastes in the camp site; ▪ Generated waste shall be (solid wastes and other forms of the wastes) disposed at the designated dumping site of Sirajganj Pourashava; ▪ Waste collection bin shall be emptied and cleaned in regularly; ▪ Drum trucks are available in the Pourashava. Hence, drum truck should be used for transportation of the wastes; ▪ Proper disposal of the wastes and effluents;	Contractor CSC and monitored by PMU, NHA
	▪ Health Hazard of Labor	▪ Cleanliness of premises and workers living places and at the Labor Shed; ▪ Arrangement of the proper ventilation and temperature at the Labor Shed; ▪ Protection against dust by using masks and covering of the head and body; ▪ Conduct formal and unofficial discussion to increase awareness about hygiene practices among the workers;	Contractor CSC Municipality and that is to be monitored by PMU, NHA

		▪ Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances; ▪ Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear; ▪ Comply with requirements of Government of Bangladesh Labor law of 2006 and all applicable laws and standards on worker's Health and Safety; ▪ Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal	

Design and Construction of Sub-Project Interventions

Housing (single semi- pucca house to walk up apartment)	▪ Noise Pollution due to using of rod cutter and concrete mixture machine	▪ Using of rod cutter and wielding machine shall be avoid at night. ▪ Avoid use of wooden shuttering work and ensure steel shuttering work. ▪ Proper Acoustically designed machinery should be used.	Contractor CSC Municipality and that is to be monitored by PMU, NHA
	▪ Air pollution due to black smoke emission from diesel based concrete mixer machine and vibrator machine	▪ Regular maintenance of the concrete mixer and vibrator machine shall be ensured to avoid any black smoke emission.	
	▪ Impact on health and safety	▪ The workers should wear PPE (Personal Protective Equipment), safety goggles, and other necessaries. ▪ Restrict access to the construction site.	
	▪ The waste form the site during the construction of houses	▪ Awareness must be raised among workers on solid waste management. ▪ Specific dumping containers are to be kept in the site. ▪ Regular and quick disposal of generated construction debris shall be done.	
Water Supply (Tube-well, municipal pipeline, tap)	▪ Associates impact with trenching work for pipe laying – generation of loose soil, drainage congestion, accident,	▪ Generated loose soil and clay soil shall be disposed at designated dump site; ▪ Avoided Road side storage of excavated soil; ▪ Construction work preferable during dry season;	Contractor CDC CSC Municipality

		▪ Before trenching work barrier shall be provided to restrict the access of peoples;	and that is to be monitored by PMU, NHA
	▪ Possible accident, noise pollution and mud generation due to boring work	▪ Careful operation of the equipment's; ▪ Adequate safety gear is to be provided and will be ensured their effective uses; ▪ Ensure proper collection and disposal of the generated mud due to boring work.	
Toilet (Single/ Community toilet with pour flush / piped sewer system/ septic tanks)	▪ Noise and soil pollution during the construction.	▪ Should be avoided loss of excavated top soil; ▪ Avoid night time to perform activities that may generate noise nuisance such as casting work, welding work, drilling work, rod cutting etc. ▪ Proper acoustically designed machinery should be used to avoid noise nuisance.	Contractor CDC CSC and to be monitored by PMU, NHA
Drains/ Drainage system	▪ Noise Pollution due to using of rod cutter and concrete mixture machine	▪ Using of rod cutter and wielding machine is to be avoided at night; ▪ Avoid use of wooden shuttering work and ensure steel shuttering work; ▪ Proper acoustically designed machinery should be used.	Contractor CSC Municipality and that is to be monitored by PMU, NHA
	▪ Air pollution due to black smoke emission from diesel based concrete mixer machine and vibrator machine	▪ Regular maintenance of the concrete mixer and vibrator machine should be ensured to avoid any black smoke emission.	
	▪ Impact on health and safety	▪ The workers should wear PPE (Personal Protective Equipment), safety goggles, and other necessaries; ▪ Bamboo made barrier is to be provided for restricting access to the construction site.	
	▪ Generation of excavated loose soil and clay soil	▪ Contractor will be responsible for regular and quick disposal of excavated soil in to the designate dumping site;	
Footpath/ connecting road	▪ Dust and noise pollution from construction work	▪ Watering should be ensured to reduce dust pollution; ▪ Proper acoustically designed machinery should be used for minimizing the noise nuisance; ▪ Concreting work is to be performed at day time;	Contractor CSC Municipality and that is to be monitored by PMU, NHA
	▪ Impact on health and safety due to operation of mechanical equipment	▪ Ensure use of personal protective equipment (PPEs) ▪ Carefully operation of mechanical equipment with safety	

		gear.	

Operation of Sub-Project Interventions

Sub-Projects/ Activities	Anticipated Environmental Impacts	Suggested Mitigation Measures/Enhancement Measures/ Environmental Design Considerations	Responsible parties
Housing (single semi- pucca house to walk up apartment)	▪ Drainage congestion/waterlogging	▪ Disposal of household waste in to the drain shall be avoid, ▪ Awareness program shall be conducted regularly in the community, to address the merits and demerits of dispose of waste in to the drain	Community Committee & Municipality
	▪ Water pollution due to unplanned discharge of domestic wastewater	▪ Direct connection of domestic water/toilet in to the drain shall be prohibited; ▪ Regular monitoring should be performed to stop the discharge domestic of waste water in to the drain; ▪ Ensure proper connection of waste water pipe in to the septic tank and soak pit;	
	▪ Unplanned disposal of domestic solid waste	▪ Conducting the awareness program in the community to proper use of given solid waste management; ▪ Introduce ample waste bin in the low income community; ▪ Regularly empty the waste bin; ▪ Avoid disposal of households waste here and there.	Community Committee & Municipality
	▪ Fire hazard	▪ Keeping adequate provisions (including fire/emergency exits) for fire safety in accordance with National Building Code; ▪ At ring road of the low income community better traffic management should be ensured, since during emergency period require service provider transport can get easy access in to the community; ▪ Ensure point of hose pipe and storage of sand in a particular location in the community if possible;	
Water Supply (Tube-well, municipal pipeline, tap)	▪ Depletion of ground water table through over extraction of water. ▪ Land subsidence and increase of salinity due to over pumping of water. ▪ Arsenic contamination or degrading water quality	▪ To recharge the ground water, natural water flow shall be protected; ▪ Proper maintenance shall be ensured to keep the system functioning; ▪ Awareness program on efficient water management at the poor community should be conducted; ▪ To reduce pressure on the scarce groundwater resources rain water harvesting with a filtration system could supplement to the existing water supply options;	

		▪ Choose alternative location for installation of tube well to avoid As contamination, ▪ Low income settlement/ community will be encouraged to use of surface water for bathing purpose;	
Toilet (Single/ Community toilet with pour flush / piped sewer system/ septic tanks)	▪ Microbial contamination to the ground water from the pit latrine. ▪ Inappropriate operation may causes odor, health hazard problem by overflow of human excreta etc.	▪ Encourage to the community peoples for installation of sanitary hygienic toilets to stop the microbial contamination to the ground water; ▪ The community dwellers will clean the septic tanks in regular interval with the help of conservancy unit of Pourashava or privately; ▪ Conducting awareness programs to the community about the health impacts of improper sanitation practices; ▪ Ensure use of vacuum pump to collect sewage sludge and it shall be carried with covered drum truck; ▪ Sewage sludge shall be disposed in the nearby fecal sludge treatment plant if available, or that shall be engraved in the earthen pit and soil cover shall be ensured at least one feet; ▪ Ensure disposal tanks, drums or containers coming to site are in a satisfactory condition – check for damage or leaks; ▪ To reduce odor problem, ventilation facilities should be kept functional	Community Committee & Municipality
Drains/Drainage system	▪ Clogging/ stagnation of flow in the storm drain	▪ Proper maintenance and cleaning of the drain and outfall on regular basis.	Community Committee & Municipality
	▪ Backflow of water through drain (e.g., due to high water level at downstream discharge point, such as khal)	▪ Designing drain considering the downstream discharge point; adequate slope and x-section; RCC cover for drain, where appropriate	
	▪ Discharge from drain pollute downstream water body	▪ Not allowing direct connection to drain from toilet; ▪ Awareness program for the community people should be taken to increase knowledge about improper waste disposal and its impact.	
Footpath/ connecting road	▪ Drainage Congestion/ Water logging due to road	▪ Ensure proper slope of road surface; ▪ Road side area encroachment by keeping solid materials should be avoid.	Community Committee & Municipality
	▪ Damage of natural drainage system due to new road construction	▪ Where require drain and culvert with appropriate designs must be constructed to avoid waterlogging/drainage congestion.	
	▪ Risk of accidents due to vehicular	▪ Improvement and widening of roads;	

	traffic and transport	▪ Ensure better traffic management.	
	▪ Loss of agricultural and housing lands	▪ Ensure effective plan to avoid agricultural and housing land;	
Solid Waste Management	▪ Uncollected wastes blocked the drainage and sewage system. ▪ Air, water and soil pollution during the waste collection; ▪ Smoke from the open burning of uncollected waste. ▪ The loading and unloading of waste at transfer station pollutes the air and soil. ▪ Odor from waste disposal site and composting system. ▪ Contamination of ground water by leachate.	▪ Introduce ample amount of primary waste bin in the low income community; ▪ Regularly clear the primary waste storage bin; ▪ The wastes will have to be collected from primary waste bin by the cleaners (to be engaged by the community or Pourashava) to the secondary transfer station (17 numbers of primary transfer station has been incorporated in the design); ▪ The Conservancy unit of Pourashava will carry the waste from the primary transfer station to the designated dump site by using the dump truck; ▪ Entrance of flood water should be blocked through raising the edge of this STS site in order to stop the spread of waste in the area. ▪ Conducting awareness program in the low income community about demerits of unplanned waste disposal and regarding their health effect and environmental pollution. ▪ Bottom of secondary transfer station should be made of concrete to avoid contamination of ground water from leachate; ▪ Open burning of uncontrolled waste should be avoid; ▪ Ensure quick and regular disposal of waste from STS to final disposal site; ▪ Encourage the community people for using of biogas; ▪ Encourage composting of kitchen waste in the community to use it at garden;	Community Committee & Municipality

7.8 Environmental Monitoring Plan

Environmental monitoring is an essential component of environmental management plan, as it provides the basic scenario of the impact of the project on baseline condition. Hence, a three tire of monitoring schedule (compliance monitoring, community monitoring and effect monitoring) has been sketched for this subproject based on the environmental components that may be affected during the construction and operation of the project. Since project is likely to have impact on various components of environment, a comprehensive monitoring plan covering all parameter of environment i.e. physicochemical, ecological and socio economic. Monitoring Plan has been separately suggested for construction phase and operation phase. Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors. The main purpose of this monitoring program is to ensure that the various tasks detailed in the EMP particularly the mitigation measures are implemented in an effective manner, and also to evaluate program impacts on the key environment and social parameters. Various types of EMP monitoring are discussed below.

7.8.1 Compliance Monitoring

The purpose of Compliance Monitoring at the construction stage is to check whether Environmental Mitigation Measures or Environmental Code of Practices (ECoPs) suggested in the design phase are being followed or implemented properly by the subproject contractor. A simple checklist has been prepared for compliance monitoring by visual observation during construction and operation phase (shown in Table 7-3).

Table 7-3: Compliance Monitoring Checklist during Construction and Operation Phase

Monitored Parameter/ Issues	Monitoring Method/ Key Aspects	Location of Monitoring	Frequency of Monitoring	Responsibility
Safety orientation and training of workers	Frequency of training & orientation of workers for safety	Subproject site	Once in a month	Contractor, CDC, PMU and Municipality
Personal Protective Equipment	Ensure every single person involved in the activities wear and use safety equipment	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Worker's health	Monitoring health and safety of workers	Subproject site/Labour camp	Regular	Contractor, CDC,PMU and Municipality
Sanitation & drinking water facility to the workers	Availability of safe drinking water and sanitation to the workers	Subproject site and work campsite	Regular	Contractor, CDC,PMU and Municipality
Incident record and reporting	Documented record of all incident, accident, its remedial process	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Site security/ Fencing at the site	Isolation of site from general access by fencing, restriction of the un-authorized entry in the site.	Subproject site	Regular	Contractor, CDC,PMU and Municipality

Notice/ announcement boards/ prevention signs	Visible in good condition or not	In front of the Subproject site	Regular	Contractor, CDC,PMU and Municipality
Stagnant water in the excavated pit	Pumping facilities available and functional	Subproject Site	Regular	Contractor, CDC, PMU and Municipality
Stockpile material	Storage material is cover-up or not	Subproject Site	Regular	Contractor, CDC,PMU and Municipality
Equipment /vehicles	-Switched-off diesel engines when not in use; -Search any possible leakage; -Fuelling.	Subproject site	Regular/ Specially when in operation	Contractor, CDC,PMU and Municipality
Dust	Dust is visible or not	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Oily waste generation and disposal	Quantity of oily waste, storage and disposal	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Solid waste generation	Quantity of solid wastes and disposal	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Discrimination on gender	Direct survey in the field by interviews with the women in order to ensure that there is no any gaps between man and women	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Child labor	No child will be engaged in the activities	Subproject site	Regular	Contractor, CDC,PMU and Municipality
Handling of hazardous materials	Fuelling, storage, operation	Subproject site	Regular	Contractor, CDC, PMU and Municipality

Note: All the above mentioned issues of compliance that may be engaged at construction stage will be ensured for which contractor will be responsible and it will be supervised by the PUM, NHA with the assistance of Sirajganj Pourashava and CSC officials. A report on compliance monitoring will be conducted once in a month with the focal person of environment at field level and it will send to NHA Environmental Specialist.

7.8.2 Community Monitoring

The community mentoring has been involved to cover two specifics aspects: 1. Compliance of mitigation measures and 2. Effectiveness of the proposed interventions. This monitoring will be conducted by the residents or community people who reside at the project site. At the beginning of the project PMU, NHA will arrange a short training program to provide an orientation on the process and effectiveness of community monitoring. In addition, a Bangla format community monitoring check list will be prepared prior to the commencement of the work that would concentrate on the compliance of mitigation

measures during the construction phase, whereas functionality of newly implemented interventions will be monitored at the operation stage. A monitoring check list has been prepared for the visual observation during operation phase. While, at construction stage environmental compliance will also be monitored accordingly Table 7.4. With the involvement of community residents.

Table 7-4: Community Monitoring at Operation Phase

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implemented by	Super-vision
During Operation and Maintenance						
Drainage congestion	At subproject site drain	Inspection to find any drain water is in stagnant condition	No waste materials to be disposed into the drain	Regular	Community Committee	Municipality
Waste bin	At subproject site	Visual inspection	Empty the bin	Regular or as required	Municipality Conservancy Unit	Municipality and CDC
Street Light	At subproject site	inspection to find the functionality	Properly functional	Regular	Municipality Electrical Unit	Municipality and CDC
Solid Waste Management	Secondary Transfer Station (STS)	Visual inspection	Deposition and vacating waste in the STS regularly	Regular	Municipality Conservancy Unit	Municipality and CDC
Ground water quality	Tube well or supply water	Visual observation and taste	inspection iron and taste	Regular interval	Municipality water supply section	Municipality and CDC
Toilet connection	subproject site (near drain)	Visual inspection	No connection of toilet with drain	Regular	Whole community	Municipality and CDC
Water harvesting pond	Near Water harvesting system	Visual inspection	Cleaning the source periodically	Two times in year	Community Development Committee	Municipality and CDC
Good house-keeping	At subproject	Visual inspection	Ensure daily housekeeping	Regular	Whole community	CDC
Contaminate STS-nearby lands or dump site lands	Household, STS and dumping ground	Visual inspection	No waste to be stored at outside of house premises, STS and dumpsite	Regular	Whole community	Community people and CDC

7.8.3 Effects monitoring

Effects monitoring is a very important aspect of environmental management to safeguard the protection of environment. The effects monitoring plan proposed for the subproject is presented in Table under 8.5 and 8.6. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during construction. The monitoring will also check whether the Pourashava

and NHA is meeting requirement during operation and maintenance of the subproject. In addition, community will be careful in monitoring activities.

Furthermore, under the effect monitoring two aspect will be served such as environmental management and analytical monitoring during construction and operation phase of the proposed subproject. Hence, environmental management related monitoring has been presented in Table: 7.5. Compliance indicators or threshold limits for the monitoring are also given.

Table 7-5: Effect monitoring for the environmental management

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implement ation	Super-vision
During Construction						
Drainage congestion	Near camp site and in the subproject site	Visual; to ensure temporary drain to drain out excess water during construction	There will be no stagnant water in the drain	Regular	Contractor	CSC, PMU and Municipality
Traffic Safety	Access roads around subproject	Proper traffic signs are in place	Smooth flowing of traffic around	Regular	Contractor	CSC, PMU and Municipality
Dust	Sub-project site	Inspect to ensure dust suppression measures (water spray)	No dust from construction activities	Regular	Contractor	CSC, PMU and Municipality
	Material storage sites and labor camp	Visual ; ensure dust suppression measures	No dust from the material storage sites and labor camp site	Regular	Contractor	CSC, PMU and Municipality
Traffic movement	At subproject site	Inspection & record keeping	Note of accidents	Regular	Contractor	CSC, PMU and Municipality
Accident	At subproject site	PPEs are available at working site	Ensure use of PPEs as per requirement	Regular	Contractor	CSC, PMU and Municipality
Solid Waste Management	Construction sites, and labour shed premises	Visual inspection for proper solid waste collection & disposal	Facilities and works are clean and in place	Regular	Contractor/ CDC	CSC, PMU and Municipality

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implement ation	Super-vision
Restoration of Work Sites	All Work Sites	Visual Inspection	The facilities are clean with no waste at the works sties	After completion of all works	Contractor	CSC, PMU and Municipality
Grievances	In the subproject area	Number of grievances registered and addressed	Record of grievance redress meetings	Monthly	Environ-mental focal person	CSC, PMU and Municipality
Reporting on Environment al Monitoring	During Construction	All parameters	To meet the compliance requirement	Monthly	CSC and contractor Safeguard concern	PMU and Municipality
During Operation Phase						
Tree plantation	At subproject area	Visual inspection of plantation as per EMP	Greenery area will be observed at subproject site	After completion of all work	Contractor	PMU, CDC and Municipality
Drainage congestion	At subproject drain	Visual inspection	There will be no stagnant water in the drain	Regular	CDC, Municipal Conservan cy Unit	PMU and Municipality
Toilet connection	At subproject site (near drain)	Visual inspection	There will be no direct connection of toilet with drain	Regular	Whole community	Municipality and Community Committee

Table 7-6: Effect monitoring for analytical analysis

Environmental Indicator	Means of Monitoring	Frequency	Responsibility	
			Implement ation	Supervision
Air Quality	Air quality monitoring (SPM, PM_{10}) by Portable air quality measuring machine	One time before the commencement of the project Two times in construction period One time after completion	Contractor and CDC	PMU, NHA
Noise Control	(Equivalent noise level (dBA), Leq, Max Noise	One time before the commencement of the project Two times in construction period One time after completion	Contractor and CDC	PMU, NHA

Environmental Indicator	Means of Monitoring	Frequency	Responsibility	
			Implementation	Supervision
	level (dBA), Lmax) by Portable noise measuring machine			
Water quality	Inspection and Water analysis through laboratory (PH, turbidity, hardness, Cl, DS, Mn, As, Fe, TC, FC)	One time before the commencement of work (sample for water source) One time after completion (One sample for each water source)	Contractor and CDC	PMU, NHA

7.9 Environmental Safeguard Cost during Construction Phase

This low income settlement upgrading subproject work has been divided in to three packages. Among three packages one will be allocated for electrical work (Solar panel, RCC pole and 250 VA transformer). In addition, there will be also allocation for community based contract. Thus, cost estimate will be prepared for each package separately.

For the effective implementation of the EMP, adequate environmental management budget has been included in the cost estimation of the packages except electrical work package-3, since this work will have no impact without properly apply of safeguard equipment's and recommended measures. Hence, before appointing a contractor for the electric work NHA will ensure that contractor will be responsible for use of safety equipment from his own cost. However, for other two packages, environmental items that will be performed by the contractors during construction and operation period are included in the BOQ. Furthermore, there will be few works like installation of tube well, solid waste bin and preparation secondary transfer station under community development committee. Hence, BOQ for these items are also included for ensuring proper environmental management and enhance the environmental quality in the settlement area. In addition to this, environmental management budge there is budget for analytical monitoring (construction stage) for package-1 and package -2. Moreover, there is also allocation for analytical monitoring during operation period which is included in the community development community BOQ section because after completion of all work this monitoring will be done by the CDC. Package wise detailed cost estimates for environmental management and analytical monitoring are given in ***Table.7-7, Table 7-8 and Table 7-9***

Table 7-7: Environmental Budget for Package -1

Sl.	Description of the Items	Costs (Tk)
	Environmental Safeguard Cost	
1	Establishment of labor camp (male shed - 15 ft x 30 ft and female shed 12 ft x 15 ft) with living arrangement, drinking water facilities, cooking arrangement, mosquito net,, waste bin etc.	100,000.00
2	Dust suppression measures by water spraying throughout the construction period in and around the subproject site, uncovered aggregates and loose materials such as stockpiles of the sands, excavated earth and sand of filling material etc. daily or as per requirements (lump sum)	50,000.00
3	To provide water supply facilities in the camp site ,1nos. of tube well	50,000.00

4	Sanitation facilities (at the camp site): 2nos. of the toilets preferably portable toilets (1 no. for women and 1nos. for men)	50,000.00
5	Installation of cautionary sign in term of health and safety signs (4nos)	10,000.00
6	Providing PPEs like hand gloves, spectacles for eye protection, helmets, masks, visible jacket, ear plug, safety boots for at least 25 person (20 for workers and 5 for visitor) and one first aid box with necessary medicine	80,000.00
7	Wastes disposal facility during the construction period; collection, transportation, and providing 4 bin to be provided where 2 for organic and 2 for inorganic waste	40,000.00
	Total	**380,000.00**
	Environmental Enchantment Cost	
8	Tree plantation for ecological enhancement work- preferably local fruits, flowers, medicinal and ornamental trees- 450 nos. trees (Lum sum)	140,000.00
9	For installation of rain water harvesting (Depending on the site condition 5 unit has been considered as per EMF rate schedule)	50000.00
	Total	**190,000.00**
	Environmental Monitoring Budget	
10	Noise level measurement. It can be measured from the pre-approved public institute/ university 1 times during construction	10000.00
11	Air quality (SPM, PM10)) measurement- It can be measured from the pre-approved public institute/ university 1 times during construction	25000.00
12	Water quality one for ground water and one for surface water (PH, turbidity, hardness, Cl, TDS, Mn, As, Fe, TC,FC)- by any recognized laboratory	30,000.00
	Total	**65,000.00**
	Grand Total	**635000.00**

Table 7-8: Environmental Budget for Package -2

Sl.	Description of the Items	Costs (Tk)
	Environmental Safeguard Cost	
1	Establishment of labor camp (male shed - 15 ft x 30 ft and female shed 12 ft x 15 ft) with living arrangement, drinking water facilities, cooking arrangement, mosquito net,, waste bin etc.	100,000.00
2	Dust suppression measures by water spraying throughout the construction period in and around the subproject site, uncovered aggregates and loose materials such as stockpiles of the sands, excavated earth etc. daily or as per requirements (lump sum)	30,000.00
3	To provide water supply facilities in the camp site ,1nos. of tube well	50,000.00
4	Sanitation facilities (at the camp site): 2nos. of the toilets preferably portable toilets (1 no. for women and 1nos. for men)	50,000.00
5	Installation of cautionary sign in term of health and safety signs (4nos)	10,000.00
6	Providing PPEs like hand gloves, spectacles for eye protection, helmets, masks, visible jacket, ear plug, safety boots for at least 25 person (20 for workers and 5 for visitor) and one first aid box with necessary medicine	80,000.00
7	Wastes disposal facility during the construction period; collection, transportation, and providing 4 bin to be provided where 2 for organic and 2 for inorganic waste	40,000.00
	Total	**360,000.00**
	Environmental Enchantment Cost	
8	Tree plantation for ecological enhancement work- preferably local fruits, flowers, medicinal and ornamental trees- 450 nos. trees (Lum sum)	140,000.00
9	For installation of rain water harvesting (Depending on the site condition 5 unit has been considered as per EMF rate schedule)	50000.00
	Total	**190,000.00**
	Environmental Monitoring Budget	

10	Noise level measurement. It can be measured from the pre-approved public institute/ university 1 times during construction	10000.00
11	Air quality (SPM, PM10)) measurement- It can be measured from the pre-approved public institute/ university 1 times during construction	25000.00
12	Water quality one for ground water and one for surface water (PH, turbidity, hardness, Cl, TDS, Mn, As, Fe, TC,FC)- by any recognized laboratory	30,000.00
	Total	**65,000.00**
	Grand Total	**615000.00**

Table 7-9: Environmental Budget for Community Contract

Sl.	Description of the Items	Costs (Tk)
	Environmental Safeguard Cost	
1	Dust suppression measures by water spraying throughout the construction period in and around the subproject site, uncovered aggregates and loose materials such as stockpiles of the sands, excavated earth etc. daily or as per requirements (lump sum)	15,000.00
2	Installation of cautionary sign in term of health and safety signs (4nos)	10,000.00
3	Providing PPEs like hand gloves, spectacles for eye protection, helmets, masks, visible jacket, ear plug, safety boots for at least 25 person (20 for workers and 5 for visitor) and one first aid box with necessary medicine	80,000.00
4	Wastes disposal facility during the construction period; collection, transportation, and providing 4 bin to be provided where 2 for organic and 2 for inorganic waste	40,000.00
	Total	**145,000.00**
	Environmental Enchantment Cost	
5	Awareness documents (signs/ posters) for effective use of water source and proper waste management, Lum sum basis,)	20,000.00
6	Environmental awareness training will be arranged by the PMU one at construction period and one at operation phase	100,000.00
7	Training on environmental health and safety will be arranged by PMU at implementation phase	50,000.00
	Total	**170,000.00**
	Environmental Monitoring Budget	
9	Noise level measurement. It can be measured from the pre-approved public institute/ university 1 times during operation	10000.00
10	Air quality (SPM, PM10)) measurement- It can be measured from the pre-approved public institute/ university 1 times during operation	25000.00
11	Water quality one for ground water and one for surface water (PH, turbidity, hardness, Cl, TDS, Mn, As, Fe, TC, FC)- by any recognized laboratory	30,000.00
	Total	**65,000.00**
	Grand Total	**380,000.00**

7.10 Subproject Specific Environmental Compliance Clauses for Tender Document

Apart from the provisions under “General Specification” and “Particular Specification” for different sub-project components, the following special environmental clauses (SECs) shall be included in the Tender Document under General/Particular Specification. These clauses are aimed at ensuring that the Contractor or CDC carries out his responsibility of implementing the EMP and other environmental and safety measures.

7.10.1 Environmental Management Plan (EMP):

All of the prescribed mitigation and enhancement measures in the Environmental Management Plan (EMP), which are related to mitigation of air/noise/water pollution/ drainage/traffic congestion has to be carried out by the contractor. Even, if environmental concern person seems any other new mitigation regarding those parameter is need to be added it will also be carried out by the contractor. Moreover, after completion of work contactor will be responsible for one year (liable period) to monitor the planted trees by him.

7.10.2 Temporary Works

The Contractor shall make sure that all equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run away, barricade, chute, lift, etc. are substantially constructed and erected, so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them.

7.10.3 Health and Safety

- The Contractor have to observe and maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations.
- Where applicable, to prevent workers falling from heights, the Contractor have to make sure that every temporary floor openings shall either have railing of at least 900 mm height or shall be constantly attended; every floor hole shall be guarded by either a railing or a hinged cover, or constantly attended; every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides; every ladder way floor opening or platform shall be guarded by a guard railing; every open sided floor or platform 1.2 m or more above adjacent ground level shall be guarded by a railing on all open sides.
- The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The “safety directives for work equipment” and “safety directives for protective gears”, as specified in the Occupational Health and Safety Guidelines (attached) shall be followed.
- The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), will be provided to staff and labor all time as defined in the Occupational Health and Safety Guidelines along with the Environmental Management Plan (EMP).
- The Contractor has to ensure a first aid kits with adequate medical supplies and other related facilities in the working site. Contractor will also be responsible for ensuring trained personnel who is available at all times to render first aid. In addition, contractor will be kept provision of saline water in the working site especially at dry season while labor has probability to effect on de-hydration.
- The Contractor must provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced such as place of construction chemical storage and construction vehicles re-fueling place etc.
- The Contractor has to record any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not and shall report to the Engineer promptly in writing form.

7.10.4 Disposal and Pollution

- The Contractor shall not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or Statutory Authority having jurisdiction. The Contractor shall not discharge into any watercourse oil, solids, toxic or floating materials.
- The Contractor shall take all reasonable precautions to keep public or private roads clean of any spillage or droppings from his vehicles or equipment. Any spillage or droppings which accrue shall be cleaned without delay to the satisfaction of the Engineer.
- The Contractor has to construct sanitary latrine (one for male and one for female) for disposal of human waste in the site office and temporary labor sheds for workers/ employees; the Contractor shall provide waste bins/ cans for collection of solid waste at appropriate locations (as directed by the Engineer), and ensure proper transfer/ disposal of solid waste with support from the Pourashava.

7.10.5 Earthwork:

Any kind of earth work (such as excavation of trenches in natural soils or filling on the natural top soil) which are involved for the proposed intervention, the contractor has to make sure that the first 300 mm to 450 mm of topsoil be excavated and stored on one side of the trench and the rest of the excavated soil is stored separately/ on the other side; during back filling of trench, the topsoil should be placed on the top again.

7.10.6 Third Party Monitoring

For effective implementation and an independent environment evaluation a third party consulting firm will be hired by the NHA. This consulting firm will be given the responsibility to independently monitor the overall performance of environmental management of the proposed project, including compliance with the DoE conditions.

CHAPTER 8. PUBLIC CONSULTATION AND PARTICIPATION

8.1 Introduction

Public consultation forms an important part of the EA study. The main objective of the consultation process is to explain the households living in the project and surrounding area about the proposed project and to seek their opinions regarding the possible impacts of the project. Public involvement is a fundamental principle of any environmental assessment study. In fact, inclusion of the views of the affected and interested public helps to ensure that the decision making process is justifiable and fair and gives to more informed choice and better environmental outcomes. The findings from the public consultations carried out as a part of the EA study has been utilized in the development of the EMP especially in identifying the significant impacts of the proposed project and developing the corresponding mitigation measures.

8.2 Methodology

Within the framework, public consultation process was conducted in the Kobdas Para community for preparing the Environmental Assessment. All the households living in the project and surrounding area, Local NGO representatives, Officials of the municipalities, local government officials, political leaders as well as NHA officials and consultants were the participants in the discussion sessions. The specific objective for conducting the consultation was to take the opinions from the people of the study area. Informal Focus Group Discussions (FGD) was conducted with different local households. In addition, door to door informal group consultations by waking were also held. Key Informant Interview (KII) were also held there to understand the people's perceptions regarding relevant issues. The local communities were informed about low income settlement upgrading related interventions including their benefits. Different types of suggestion came from the consultation process. Their suggestions and thoughts were listed and has been incorporated to make the project more "community centered". It is noted that, similar type of consultation will be conducted in the community during construction and post construction phases to ensure smooth implementation of the project and collected information will be incorporated in updating EA report.

Figure 8-1: Public consultation with community, PMU officials and other stakeholders at Kobdas Para settlement

8.3 Issues Raised by the Participants

The participants raised the issues related to the settlement upgrading intervention of NHA. They emphasized on their basic need which will be implemented under this LICHSP and also discussed about the procedure for the quality construction work. In the FGD, the participants discussed the requirements of the infrastructure development of Kobdas Para community through a list of desire intervention.

The consultant raised the issue for the effective implementation of the EMP during construction phase. The Community Support Center (CSC) Officials, Community Development Committee (CDC) and Pourashava officials agreed that they will provide full support for the effective implementation of the EMP. Summary of major environmental issues raised by the community people are cited in below:

- Aim of the project and proposed intervention under this subproject and also timeline of the project;
- Likely impacts and their mitigation measures from the subproject;
- Grievances of the people on land or compensation;
- Opportunities and benefit of the community peoples due to the project;
- Roles and responsibilities of the project authority as well as local people;
- Provision of preferential employment as semiskilled and unskilled worker for the settlement people especially unemployed people in the project;
- Cutting of trees, since the settlement area will loss protection of trees from sun;
- Prospects for the local supplier/ businessmen in getting subcontract for supplying of laborers/ commodities in the project;
- Existing road in front of the settlement may be damaged due to use by the construction vehicles;
- Most of the households was concerned about logistic support in term of shifting their houses.

8.4 Opinions, Suggestions, and Recommendations during Consultation:

- The FGD results confirmed that an improved sanitation facilities is urgently needed in the community;
- Most of the participants told that, they have no adequate safe drinking facilities;
- Most of the participants stated that the number of intervention that have been selected settlement upgrading is insufficient in term of volume;
- The participants stated that the public water supply is needed to be incorporated in the sum settlement;
- The participants also addressed the solid waste management issue to reduce environmental and public health hazards.
- The participants states that, due to low elevation most of the time of the year community gets water logging condition;
- They also stated that, they don't have adequate drain to drain off the wastewater from the settlement;
- Inhabitants of the community stated that, there is no services of municipality in term of solid waste management.
- Most of the participants states that, their income is low and cannot capable to construct house without loan.
- They highly expressed that, installation of biogas facilities intervention under this project to minimize the cost for cooking instead of fuel wood
- They also expressed that, emptying the toilet pit is extremely cumbersome work for them as they don't get support from the municipality.

CHAPTER 9. CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

This study is an effort to improve the living condition of low income housing and low income group of the Kobdas Para settlement. This low income settlement was selected on the basis of mobility pattern and the adjustment with housing condition in terms of services and facilities and occupational point of view. Thus, substandard housing area with poor water and sewerage facilities, or lack of access to income earning opportunities will be improved by implementing the new interventions. During execution of these intervention, environmental impact is expected. However, scale of intervention is small. Moreover, strict adherence to various mitigation measures as identified under the EMP, strengthened by adequate environmental monitoring and auditing, and good construction practices will go a long way in effectively reducing the impacts to a negligible level.

It is clear from the objectives of the construction of intervention that it will have significant positive impacts since it will:

- Housing development will raise the living standard of the community;
- After planned housing development, land dispute possibilities will also be minimized among the community people;
- A permanent house will be less vulnerable to any natural disaster;
- Installation of tube well will be ensured safe drinking water for all the community people;
- Proper and functioning drainage system will keep the settlement area free from water-logging;
- Installation of sanitary latrine in the project area will provide hygienic environment in the settlement area.
- Tree plantation in the settlement area will help increasing the environmental sustainability and will provide protection from natural disasters,
- There will be water harvesting system that will reduce extraction of ground water;

Thus it can be concluded that, the proposed settlement upgrading intervention is environmentally acceptable and will bring economic, social and environmental benefits to the area.

9.2 Recommendations

Recommendations made for the settlement development on the basis of EA study are given below:

- Proposed environment management plan should be implemented strictly both during operation and construction phase of the subproject
- Adequate safety measures should be taken and safety related equipment including personal protective and safety equipment (PPE), etc. must be provided in order to reduce the potential for accidents.
- Suggestions & requests made by public for water supply connection in the low income community should be taken into consideration.
- Environmental monitoring should be conducted as proposed in environment management plan.
- It should provide adequate training program in the settlement dwellers for effective management of solid waste at operation stage;

The subproject interventions are recommended to implement following the environmental measures (EMP) guided in the Environmental Management Plan.

APPENDIX

Appendix-1 Environmental Screening

Environmental Screening Checklist, as adopted in Appendix D of the Environmental Management Framework (EMF) of the LICHSP, was administered for identifying the impacts and their extents.

Table-1: Environmental Screening Checklist

	Environmental issues	Yes	No	Remarks
1	Encroach onto an important natural habitat or protected area?		√	
2	Disturbance or harm of historical or culturally important site?		√	In the subproject area influence area (1km), there is no historical place. So, there is no question about disturbance of historical place.
3	Adverse effects or destruction of designated wetlands?		√	There is no effect on designated wetland. However, as the settlement area developed in low land area hence, at few section of the settlement area where no establishment exits become water logged. This portion will be filled up for as an up gradation part of settlement area.
4	Development interventions in high risk (climatic/disaster) area?	√		Since, Jamuna River is located near by the Shirajgong Pourashava. Hence, flood may occurs when rivers or streams overflow their banks. So, damage to infrastructure also causes long-term impacts, such as disruptions to supplies of clean water, wastewater treatment, electricity, transport, communication, education and health care. However, currently in order to limit the damage caused by floods dams is exists in the study area. Thus, anticipated impact on development intervention is expected insignificant.
5	Drainage, water logging or congestion in the project area?		√	Currently, due to low elevation study area is affected with waterlogging and drainage congestion problem. However, initially after site clearing work subproject site will be elevated by filing of sand. Even, during the construction work earthen drainages and

				submergible pump will be provide in the site to avoid drainage congestion.
6	Deforestation or cutting down of trees and vegetation?	√		For the implementation of the subproject, there will be needed cut down of trees during sites clearing work. However, the ecological imbalance to be caused by the feeling of trees will compensate by replantation of trees.
7	Over exploitation of ground water in the project area?		√	Yet, it is not over exploitation but if dependency on groundwater do not minimize it may be lead to over exploitation of ground water. However, there will be rain water harvesting system to create alternative source of drinking water. Moreover, effective use of the water to be ensured.
8	Adverse effects on groundwater quality?		√	Since, the study area's inhabitants are fully depends on ground water hence, ground water can be depleted and has probability of increases the iron in water. However, to minimize the pressure on ground water, water harvesting system and ground water discharged facilities will be incorporated in the design.
9	Adverse effects on surface water quality or flow?	√		At present, surface water (nearby ponds and low lands) quality has degraded due to direct toiles connection and dumping of households wastes. However, it is expected that, after up gradation it will be stooped due to use of waste bins and construction of adequate sanitary latrine with septic tank
10	Involve destruction of top soil?	√		This settlement upgrading subproject involves some excavation work for road and drain construction work. So, it may have possibilities to destruct of top soil. However, during excavation top soil will store in separate place from deep soils and during backfilling work it will aging take place on the top.
11	Conversion or degradation of agricultural land?		√	There is no matter of conversion or degradation of agricultural land because existing settlement area will be improved with adequate and structured facilities.
12	Increased noise due to every day construction activities?	√		Noise and vibration caused by the equipment and movement of the construction vehicles may temporarily disturb nearby residents. However, effort will be given for the use of less noise generating equipment. Eventually, construction work is very small scale.

13	Functional operating system for waste management?		√	There is no functional solid waste management system. However, after installation of waste bin and secondary transfer station it is expected that at operation phase low income settlement area will get functional solid waste management system.
14	Increase of wind-blown dust i.e. fine aggregate, from storage?	√		From the stockpile of construction material, i.e. fine aggregate will have probability to dust blowing if not properly cover up.
15	Use or transportation of any toxic or hazardous materials?	√		Yes, toxic and hazardous material like oil, grease will be used for the operation of construction vehicles and equipment. Hence, there is anticipated impact on the species of aquatic environment because throwing of the waste materials and accidental leakage and spillage of the oil and grease from subproject vehicles and equipment into the existing water bodies.

Decision of EA Category and Further Assessment:

In the EMF of LICHSP, all of the intervention to be implemented by the LICHSP fall in Category B as per WB guideline. But according to GOB guideline only for housing, road and drainage intervention are classified as category orange B. Category of remaining intervention to be implemented by the LICHSP are not address in GOB guideline. However, considering the anticipated impact of the overall proposed intervention and their scale of work, this low income settlement upgrading subproject can be classified as category “B” as per WB and GOB guideline. Hence, as per EMF of LICHSP, IEE is required to meet the regulatory requirement of the project.

Environmental Category		
According to GOB	□ Orange A □ Orange B√ □C or Green □ Non Listed	
According to WB	□ Category B√ □ Category C	
Need Further Evaluation:		
Need IEE	□ Yes√	□ No
Need EIA	□ Yes	□ No√

Concluding Summary on Screening Check List:

- From aforementioned discussion it seems that, there will have significant impact on ecology due to chop down of 362 numbers of planted trees. However, anticipated impact to be caused by the felling of tress will be compensated by planting about three times of felling trees. There will have also impact on physicochemical parameter like air and noise. Most of the probable impact on air and noise would be occurred from filling work since there will be involved compaction works by mechanical equipment. However, it will remain in control if proper engineering practice follows in the filling work. In addition to filling work, there will have large impact on air and noise due to shifting or demolition of the existing structures. There will have also health and safety impact if proper measure are not taken. Unless, rivers or streams overflow their banks there will be no impact on the settlement intervention from Jamuna River. Even, during design stage engineer has to be considered the maximum flood level of the Jamuna River. The wastes generated due to the construction activities and demolition work should be properly collected and disposed in a designated site.
- There is also some adverse impact at operational stage. Household's waste disposal and direct connection of toilet into the adjacent water bodies may degrade the surface water quality of the settlement area. However, there will be adequate primary waste bin and septic tank in the settlement area and it will be emptied regularly.
- Safety concern is an important issue for both the construction and operation phases that should be considered properly. This subproject will have positive impacts in terms of the improvement of living condition of the community people by ensuing community needs like sanitation facilities, water supply facilities, drainage facilities and transport facilities etc.

Appendix 2: List of the Participants

National Housing Authority
Low Income Community Housing Support Project (LICHSP)
Attendance of Local Participants in the Screening Exercise
Local Stockholders , Community Members

Name of Subproject: Settlement Upgrading at Kobdaspara, Shirajganj

Package Name :

District: Shirajganj Upazilla Shirajganj

Pourashava: Shirajganj Date: 27-09-2018

SL	Name	Gender	Social Status	Contact Number	Signature
১.	মোঃ আরিফ	পুরুষ	কৃষক	0127234115	আরিফ
২.	মোঃ হাবিবুর রহমান	পুরুষ	ব্যবসায়ী	01674434271	হাবিবুর রহমান
৩	সবির	পুরুষ	দোকানী	01746980959	সাবির
৪	মুক্তি	নারী	গৃহিনী	01735637985	মুক্তি
৫	মোহাম্মদ হাসি খাতুন	নারী	গৃহিনী	01743123293	হাসি
৬	আফরোজা	নারী	গৃহিনী	01768248190	আফরোজা
৭	নাজমা বেগম	নারী	গৃহিনী	01780[illegible]734	নাজমা
৮	রকিবুজ্জামান	পুরুষ	ইমাম	01712414772	রকিবুজ্জামান
৯	জয়নুল আবেদিন	পুরুষ	ফার্মিচারের ব্যবসা	01712899785	জয়নাল
১০	সায়ফুল ইসলাম	পুরুষ	মিস্ত্রি	01725946197	সাইফুল
১১	মুকদাম	পুরুষ	রিক্সাচালক	—	[illegible]
১২	সামসুল খাতুন	নারী	দোকানী	01788704727	সামসুল
১৩	মালেকা	নারী	ব্যাঙ্কিক	—	মালেকা
১৪	হাবিবা	নারী	গৃহিনী	01779763582	হাবিবা
১৫	আলি আকবর	পুরুষ	রিক্সা চালক	01733871722	আকবর

মোঃ গোলাম মোস্তফা
প্যানেল মেয়র-২
শিরাজগঞ্জ পৌরসভা

National Housing Authority
Low Income Community Housing Support Project (LICHSP)
Attendance of Local Participants in the Screening Exercise
Local Stockholders , Community Members

Name of Subproject: Settlement Upgrading at Kobdaspara, Shirajganj.

Package Name :

District: Shirajganj Upazilla Shirajganj

Pourashava: Shirajganj Date: 27-09-2018

SL	Name	Gender	Social Status	Contact Number	Signature
১৬	শামছুল হক	পুরুষ	ব্যবসা	01716375375	মোল্লাম ছলক
১৭	ফাতেম	মহিলা	ব্যবসা	—	ফাতেমা
১৮	আলেয়া	মহিলা	গৃহিনী	01778147407	আলেয়া
১৯	মরিয়ম	মহিলা	গৃহিনী	01727859977	মরিয়ম
২০	আছিয়া	মহিলা	গৃহিনী	—	
২১	সাকেলা খাতুন	মহিলা	গৃহিনী	—	[illegible]
২২	রজিনা	মহিলা	গৃহিনী	01767788731	
২৩	কদবানু	মহিলা	গৃহিনী	01727830550	কদবানু
২৪	শাহা	পুরুষ	মাঝি	01735125852	শাহা
২৫	দেলোয়ার হোসেন	পুরুষ	রিক্সাবাল	01793325949	দেলোয়ার
২৬	আসলাম	পুরুষ	চা দোকান	01728975043	
২৭	মর্জিনা বেগম	নারী	গৃহিনী	01701900427	মর্জিনা
২৮	শিলপী	নারী	গৃহিনী	01795352291	শিলপী
২৯	রহিমা	নারী	গৃহিনী	01753542105	রহিমা
৩০	রজিবুল	পুরুষ	ছাত্র	"	রজিবুল

মোঃ গোলাম মোস্তফা
প্যানেল মেয়র-২
সিরাজগঞ্জ পৌরসভা

Appendix 3: Surface Water Test Report

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 1162/ CC, DPHE, CL, Dhaka.

Date: 08-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110006	Sample Receiving date: 30-10-2018
Ref. Memo No: I&A/2018/Nill & Dated: 30-10-2018	Sample Source: Suface Water
Sent by:Md. Toufiq Imam ,Imam & Associates , Mirpur, Dhaka-1216.	Dist:Sirajganj, Upa:Sirajganj Sadar
Care Taker: Imam & Associates (SW-01)	Union:Sirajganj Paurasava, Vill.:
Sample Collection date: 30-10-2018	Date of Testing: 30/10/2018-07/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Ammonia	0.5	0.87	mg/L	UVS	0.1
2	Biochemical Oxygen Demand (BOD)	0.2	1	mg/L	5 days Incubation	0.1
3	Coliform (Faecal)	0	40	N/100ml	MFM	-
4	Coliform (Total)	0	84	N/100ml	MFM	-
5	Colour	15	2.3	Hazen	UVS	-
6	Dissolved Oxygen (DO)	6.0	6.49	mg/L	Multimeter	-
7	Hardness	200-500	290	mg/L	Titrimetic	-
8	pH	6.5-8.5	7.0	-	pH Meter	-
9	Total Dissolved Solid (TDS)	1000	255	mg/L	Multimeter	-
10	Turbidity	10	3.6	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: UVS- UV-Visible Spectrophotometer, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:

1.) Name: Mahabuba Sabina Motin
Designation: Sample Analyzer
Signature: Mmotin 08-11-18

2.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature: 08.11.18
Sample Analyzer
DPHE, Central Laboratory
Mohakhali, Dhaka

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature: 08/11/2018
Md. Biplab Hossain
Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka.

2.) Name:
Designation:

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Appendix 4: Ground Water Test Report

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 1162/ CC, DPHE, CL, Dhaka. Date: 08-11-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018110008	Sample Receiving date: 30-10-2018
Ref. Memo No: I&A/2018/Nill & Dated: 30-10-2018	Sample Source: Tube Well
Sent by:Md. Toufiq Imam ,Imam & Associates , Mirpur, Dhaka-1216.	Dist:Sirajganj, Upa:Sirajganj Sadar
Care Taker: Imam & Associates (TW-02)	Union:Sirajganj Paurasava, Vill.:Kobdas Para
Sample Collection date: 30-10-2018	Date of Testing: 30/10/2018-07/11/2018

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Coliform (Faecal)	0	0	N/100ml	MFM	-
3	Coliform (Total)	0	0	N/100ml	MFM	-
4	Dissolved Oxygen (DO)	6.0	7.14	mg/L	Multimeter	-
5	Hardness	200-500	300	mg/L	Titrimetic	-
6	Iron (Fe)	0.3-1	2.51	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.40	mg/L	AAS	0.03
8	pH	6.5-8.5	6.9	-	pH Meter	-
9	Turbidity	10	6.94	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	08-11-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	08/11/2018
2.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	08.11.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Appendix-5: Grievance redress register

To be maintained at the office of Chairman/ Mayor, Deputy Commissioner, Deputy Director of Project and Chairman of NHA for all grievances reported/registered).

Name of the Grievance Registration Office:

Sl No.	**Detail of Complain Received**			**Name of the Compliant**	**Complete Address**	**For Office Use Only**		
	Date	Compliant number	Form of Compliant			Name of the concerned GRO	Action Taken	Date of Final Disposal
Petitioner's Copy								
Complaint no.:					**Code:**			