Government of the People's Republic of Bangladesh
Ministry of Local Government, Rural Development and Co-operatives
Local Government Division
Local Government Engineering Department (LGED)

City Region Development Project (CRDP)
ADB Loan No. 2695-BAN

Environmental Safeguards Assessment
Initial Environmental Examination Report

GAZIPUR WATER SUPPLY AND SANITATION SUBPROJECT
Packages Nos: CRDP/LGED/GCC/GAZIPUR/NCB/2013/W-03
CRDP/LGED/GCC/GAZIPUR/ICB/2013/W-04

AND
ASHULIA WATER SUPPLY AND SANITATION SUBPROJECT
Package No: CRDP/LGED/DHK/ASHULIA/NCB/2014/W-03

Gazipur City Corporation and Ashulia, Savar Upazila

May 2013

CURRENCY EQUIVALENTS

(as of 31 March 2013)

Currency unit	–	BDT
BDT 1.00	=	$ 0.0127
$1.00	=	BDT 79

ABBREVIATIONS

ADB	–	Asian Development Bank
BDT	–	Bangladesh Taka
BOD	–	biological oxygen demand
BOQ	–	Bill of Quantities
CEO	–	Chief Executive Officer
CRDP	–	City Region Development Project
DCC	–	Dhaka City Corporation
DMDP	–	Dhaka Metropolitan Development Plan
DOE	–	Department of Environment
DPHE	–	Department of Public Health Engineering
DSMC	–	Design, Supervision and Management Consultant
DWASA	–	Dhaka Water Supply and Sewerage Authority
EARF	–	Environmental Assessment and Review Framework
ECR	–	Environmental Conservation Rules
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
IEE	–	initial environmental examination
LGED	–	Local Government Engineering Department
LGI	–	Local Government Institution
MDSC	–	Management, Design and Supervision Consultant
NGO	–	nongovernment organization
NOC	–	no objection certificate
O&M	–	operations and maintenance
PIU	–	Project Implementation Unit
PMCU	–	Project Management Coordination Unit
REA	–	Rapid Environmental Assessment
ROW	–	right of way
RPM	–	respiratory particulate matter
RSS	–	resettlement support staff
SPS	–	Safeguard Policy Statement
SWM	–	Solid Waste Management
PTW	–	Production Tube Well
OHT	–	Over Head Tank

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Executive Summary

General

The Government of Bangladesh (GOB) has undertaken the City Region Development Project (CRDP) (the Project) with financial assistance from the Asian Development Bank (ADB) (Loan No. 2695-BAN) together with co-financing from KfW. The CRDP emphasizes economic growth in Dhaka and Khulna city regions of Bangladesh through (i) creation of an enabling environment towards improved governance and capacity building of the local governments, and (ii) prioritized investments in infrastructure sectors in the two regions. This document reports on the initial environmental examination (IEE) for the proposed Gazipur and Ashulia Water Supply and Sanitation Subprojects. The Gazipur Subproject is accompanied by drainage works that are addressed under a separate IEE. Likewise the Ashulia Subproject is a component of the subproject entitled "Strengthening Economic Potential of the Urban Center of Ashulia" and is accompanied by a roads and drainage rehabilitation component for which environmental impacts have been assessed and reported on under a separate IEE. The purpose of the present IEE is to describe the assessment of environmental impacts due to the Subprojects and to specify impact mitigation measures and monitoring within the framework of an Environmental Management Plan (EMP).

Description of Proposed Subprojects

The objectives of the water supply sub-project are to expand service access and improve the urban environment through a) extension and rehabilitation of transmission and distribution water supply networks; b) to augment and rehabilitate production facilities; and c) to provide equipment for metering, leak management, and operation and maintenance.

In Gazipur, sub-project components are divided into 3 parts a) Rehabilitation Works: Rehabilitation of existing production wells, pipelines, etc. b) New Works: Construction of new production tube wells with pump houses, extension of transmission and distribution pipelines and making household water service connections as procurement works and c) Water meter, etc as procurement goods. The Package CRDP/LGED/GCC/GAZIPUR/NCB/2013/W-03 is for rehabilitation works and the Package CRDP/LGED/GCC/GAZIPUR/ICB/2013/W-04 is for new works.

Public toilets are very limited in the core area and a component includes for the construction of 10 new public toilets and wash facilities. The locations for the new facilities have been identified based on land availability and in areas with demand for public toilet facilities. The sanitation component allows for construction of 2,000 new pit latrines in the core and fringe areas, matching the priority needs identified during the course of discussions with representatives of the Local Government Unit. Improved operation and maintenance (O&M) of septic tanks in Gazipur will be achieved through better collection equipment and vehicles for handling septic tank wastes. Sludge drying beds will be developed at an existing solid waste dumping ground at Gazipur.

In Ashulia, based on the results of the consultant teams' preliminary research and discussions with the responsible engineers, it is proposed to install five production/tube wells as a priority, together with 30 km of distribution pipelines serving a population of approximately 80,000 persons.

Environmental Setting

Gazipur area in Gazipur City Corporation is a local government administrative area located 40 km north of Dhaka. It was designated as a Class 'A' municipality based on population

numbers and income now it is Gazipur City Corporation. Gazipur area in GCC is the headquarters of District of Gazipur. It is also understood from discussions with representatives from RAJUK, that Gazipur District will be a location for the long-term development of a Satellite City.

The Ashulia Industrial and Residential Cluster" (Savar Upazila), referred as the Ashulia Cluster, consists of three urban centers formed from the Ashulia, Yearpur and Damsona Unions. Ashulia is located next to Uttara (a residential model town) within Dhaka City Corporation boundary, and is about 30 km from Dhaka. Due to its proximity to Dhaka, Ashulia offers considerable potential locational benefits for the establishment of industry. At the same time, rapid economic growth in the cluster and substantial in-migration of labor are causing environmental and social problems.

Soil conditions, climate and surface/groundwater resources are described in the IEE. Land use and exposure to extreme events are factored into the analysis, as are biological resources and the current state of social infrastructure and services. Alternatives to the components of project designs are considered where they might serve to reduce environmental impact and/or improve performance and lower cost.

Anticipated Environmental Impacts and Mitigation Measures

The IEE report reviews potential environmental impacts of the individual components that comprise the subprojects during the different phases of project development. A summary of the potential impacts is presented for each component. Individual impacts are then analyzed to identify necessary mitigation measures to reduce the overall magnitude of impact.

Impacts can occur due to lack of sufficient planning to assure functionality of the system and distribution of benefits among the poor population of the urban area. Preliminary engineering of the water supply proposal is provided to assure that the various components of the system are properly integrated into an overall expansion plan for water supply. Specific issues that have been considered include aquifer yield, sustaining the water supply without excess drawdown, potential for land subsidence as a result of groundwater pumping, the potential for cross-contamination of the aquifer due to poor installation of wells, and quality of groundwater. None of these impacts are considered significant under the planned implementation procedures and extraction rates proposed during operations.

Numerous potential environmental impacts from construction have been considered and best means for mitigating impacts proposed, including noise, dust and congestion, maintaining access to homes and disruption of existing supplies, damage to public and private property, and land acquisition. Special provisions are set out to accommodate the needs of the workforce, including provisions for food, housing and sanitation. The Contractor should have a basic safety and health plan in place for workers, in which workers are required to wear personal protective gear suitable to the type of work being performed and a worker is suitably trained (or experienced) in the work he/she is assigned to do. Community health and safety is addressed through guidelines for the contractor. Environmental specifications to be included in the construction contract are provided as an appendix. Disinfection of the completed water piping and operations and maintenance issues are described.

In regard to sanitation, pour flush toilets and septic tanks will be installed and connected to public drains. The work will be conducted mainly on private property with the prior consent and at the request of the house owner. A contract may be arranged for connection of septic tanks to drains, or materials may be provided for construction of tanks and soakaways, with local supervisory assistance to homeowners in installation. Means for mitigating impacts on surface water quality from septic tank effluents are recommended in the IEE. Construction

impacts stemming from the installation of street drains are similar to those of water line construction. Operations impacts on water quality can be mitigated through routing flows through constructed wetlands prior to discharge to a natural water body. These are shallow ponds containing aquatic plants that convert organic nutrients to cellulose. Inlets should be designed so that wet weather flows can bypass the ponds.

Finally, resettlement and land acquisition impacts, detailed in the resettlement plans for the subprojects, are reviewed. There are no requirements for land acquisition at Gazipur, whereas at Ashulia, according to preliminary estimates, a total of 11 households are affected by the subproject. The five proposed production tube wells will be constructed on private land amounting to 182 square meters (sqm) and affecting 5 households with 11 fruit bearing mango trees. There are no buildings/structures affected. These five households are considered to be economically displaced households. The land acquisition and resettlement impacts for the subprojects are being addressed through a Resettlement Plan prepared in line with the provisions of the Resettlement Framework for the project.

Information Disclosure, Consultation And Participation

During Project preparation, consultations were held with the officials/elected representatives of Gazipur and Ashulia, and with the communities in the subproject locations. The issues covered during these consultations included selection of subprojects and identification of key issues including addressing the current gaps in provision of basic services and improvement of urban environment conditions in the Gazipur and Ashulia urban areas. These consultations provided inputs in identification of the felt needs of the communities, and the relevant stakeholders. Various provisions are proposed to ensure continued public participation and stakeholder participation into latter stages of the project. This participatory process will ensure that all views of the people are adequately reviewed and suitably incorporated in the design and implementation process. Further, to ensure an effective disclosure of the project proposals to the stakeholders and the communities in the vicinity of the subproject locations, an extensive project awareness campaigns will be carried out. The PMCU will disclose the IEE on its Project website, including any corrective action plans prepared during project implementation and environmental monitoring reports. For the benefit of the community a summary of the IEE will be translated in Bangla and made available at: (i) Office of the Project Management Coordinating Unit (PMCU); and (ii) Office of the Local Government Unit. Hard copies of the IEE will be available in the PMCU/PIU, and accessible to citizens as a means to disclose the document and at the same time creating wider public awareness.

Grievance Redress Mechanism

A grievance redress mechanism will be established in Gazipur and Ashulia soon after subprojects commence construction. The first level and most accessible and immediate venue for resolving grievances is the PIU, through the resettlement support staff (RSS) and Project Manager, with assistance from the Resettlement Specialist (National and International-NRS and IRS) of the Management, Design and Supervision Consultant (MDSC). Should the grievance remain unresolved, the PIU's Project Manager, will activate the second level of the Grievance Redress Mechanism (GRM) by referring the issue (with written documentation) to the local Grievance Redress Committee (GRC) of the local government unit, who will, based on review of the grievance, address them in consultation with the RSS of the PIU and PMCU, and affected persons. Third and fourth levels of redress are available in extraordinary instances where grievances fail to be addressed. The functions of the local GRC are as follows: (i) provide support to displaced persons on problems arising from land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) record grievances of displaced persons, categorize and prioritize them and provide solutions within a month; and (iii) report

to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

Environmental Management Plan

The environmental management plan (EMP) describes the proposed mitigation measures in relation to potential impacts, and the means for assuring their implementation via monitoring. Institutional arrangements and costs related to mitigation and monitoring are discussed. A table provides the potential environmental impacts and the mitigation measures including the responsibilities for implementing the same. Institutional arrangements for project implementation are described, and details the responsibilities of the PMCU and its environmental officer, the PIUs, approval of the IEE, Environmental Specialists within the PSC, and that of Construction Contractors (CC). Environmental Specialists within the PSC will assist the PMCU and PIUs to ensure that all subprojects comply with environmental safeguards and the Environmental Monitoring Plan contained in the IEE. Inspection of progress in construction will be undertaken locally by the PIU, supported by the PMCU and DSC. During implementation the contractor will submit monthly progress reports to the PIUs, which includes a section on EMP implementation. The PIUs will submit reports to the PMCU for review. The PMCU will review progress reports to ensure that the all mitigation measures are properly implemented. The PMCU will consolidate monthly reports and submit quarterly reports to ADB for review.

Mitigation activities fall into three stages: pre-construction (location, planning and design), construction and operations. Mitigation of pre-construction impacts are the responsibility of the PMCU and DSC working with the PIUs to prepare the subproject according to good engineering practice. Mitigation of impacts during construction is the responsibility of the Construction Contractors (CC), which will be monitored by the PIUs. Responsibility for the relevant measures will be assigned to the Contractors via the provisions of the construction contracts, so they will be legally required to take the necessary action.

Environmental monitoring of mitigation activities is described. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. This will be conducted by the Environmental Officer within the PIU supported by the PMCU Environmental Coordinator and the Environmental Specialists on the DSC Team. The Environmental Officer will be responsible for monitoring implementation of mitigation measures and reporting to the PMCU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. Post-construction monitoring will be conducted by the local government units. A table shows the proposed Environmental Monitoring Plan for these subprojects, which specifies the various monitoring activities to be conducted during all phases.

Findings and Recommendations

Water supply is an important infrastructure improvement for Gazipur and Ashulia. Analysis has shown that significant negative impacts are unlikely to occur due to improvement of their water supply facilities. The main impact is expected to be beneficial: the overall improvement of water supply infrastructure within the city corporation. The relative magnitude of this improvement is best assessed through post-project monitoring and evaluation, either by the Government or by ADB.

Recommendations have been made to improve the environmental performance of the subprojects. Many are concerned with pre-planning for the proposed water supply improvements, in order to identify actual improvements needed to existing systems.

Environmental criteria for construction are recommended to mitigate construction impacts. Finally, recommendations are made for maintaining and operating the completed systems to be carried out by City Corporation.

Specific environmental impacts and their associated mitigation measures have been identified in the subproject IEE. Parties responsible for implementation of mitigation measures, and for monitoring implementation, have been identified and the general features of an institutional mechanism have been described. Those features include assignment of tasks and responsibilities for environmental review within the PMCU and PIUs, provision of staff to support the environmental function through the DSC Consultant, and a formal capacity building plan to be undertaken during loan implementation.

Public consultations were held in both Gazipur and Ashulia to review the subprojects that have been proposed for the area. The public consultations are documented in detail in the subproject IEE. No significant issues were raised during the public consultations that have not been addressed in the IEE, nor were there issues that pose a significant constraint on implementation of the proposed subprojects. The IEE contains a proposal for continuing the process of public consultation during construction that includes a mechanism for redress of grievances that arise during the construction phase.

The primary means for environmental management is to enhance performance of the water supply system through good preliminary planning of the system, through mitigation of construction impacts by means of environmental requirements placed on the construction contractor, and through maintaining and operating the completed system to guarantee long term performance.

In the design period, key interventions include evaluation of sustained yield of the aquifer as part of the master plan formulation, and sampling and analysis of existing well points to identify water quality problems associated with iron and barium and propose treatment methods as part of detailed design.

Mitigation measures to be undertaken during construction include special means for minimizing interference with access to residences and businesses, means for reducing dust and noise pollution in the local environment and along roadways and haul routes, means for reducing traffic congestion in the construction areas and along haul routes, provision of alternative services for water supply at times when the system needs to be shut down, and requirements for minimizing worker safety and health risk through use of protective gear and training. Care should be taken in shifting service from any abandoned asbestos cement (AC) pipelines to leave them undisturbed in the ground.

Mitigation measures for implementation during operations of the system include maintenance of the system, servicing of pumps and cleaning of well screens, and periodic testing of the water supply to assure good bacteriological quality and low concentration of inorganic compounds.

Mitigation measures to be undertaken alongside construction of sanitation facilities and installation of the wells include means for minimizing interference with residences and businesses, means for reducing dust and noise pollution in the local environment and along roadways and haul routes, means for reducing traffic congestion in the construction areas and on haul routes, and requirements for minimizing worker safety and health risk through use of protective gear and training.

Mitigation measures for implementation during operation involve gaining public support for maintaining wells and sanitation facilities. Assigning ownership of wells to households will

guarantee to an extent their maintenance. Privatizing the operation of public toilets will help to assure their maintenance.

Conclusions

The environmental impacts of the proposed improvements in water supply and sanitation infrastructure for Gazipur (GCC) and Ashulia (Savar Upazila) have been assessed by the environmental assessment process reported in this document, conducted according to ADB guidelines. Issues related to involuntary resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the project.

The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impact as a result of location, planning, design, construction and operation of the project. There are benefits stemming from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the project is in operation. Further work on the IEE will be provided based on any comments or concerns from ADB or the DoE, pending their reviews.

I. INTRODUCTION

A. Background

1. The Government of Bangladesh (GOB) has undertaken the City Region Development Project (CRDP) (the Project) with financial assistance from the Asian Development Bank (ADB) (Loan No. 2695-BAN) together with co-financing from KfW. The CRDP emphasizes economic growth in Dhaka and Khulna city regions of Bangladesh through (i) creation of an enabling environment towards improved governance and capacity building of the local governments, and (ii) prioritized investments in infrastructure sectors in the two regions. The objectives of CRDP are: (i) to improve the regional economic and social context through long-term development plans and investment programs, set within an institutional and regulatory context that will ensure implementation and review; (ii) to improve the capacity and mandate of local government to govern and to invest in improved economic activity at local level; (iii) to improve the economic context for sustainable commercial and industrial growth; and (iv) to meet the economic and social needs of the urban population, as an inclusive aspect of the CRDP. The Project is active in the following City Corporations: Dhaka City Corporation (North), Dhaka City Corporation (South), Narayanganj City Corporation, Gazipur City Corporation and Khulna City Corporation; pourashavas are: Tarabo, Sonargaon, Kanchon, Narshingdi, Kaliakoir, Singair, Manikgonj, Savar, Jessore, Jhikargacha, Mongla Port, and Nowapara, as well as in 35 numbers of smaller urban centers (in upazilas) of Dhaka and Khulna City Regions.

2. This document reports on the initial environmental examination (IEE) for the proposed Gazipur and Ashulia Water Supply and Sanitation Subprojects. The Gazipur Subproject is accompanied by drainage works that are addressed in a separate IEE. The Ashulia Subproject is a component of the subproject entitled “Strengthening Economic Potential of the Urban Center of Ashulia” and is accompanied by a roads and drainage rehabilitation component for which environmental impacts have been assessed and reported on under a separate IEE. While the two subprojects are at a distance of around 16 km from each other, the timing of the subprojects, the nature of the proposed works, and the physical / environmental settings are sufficiently similar so as to justify including both subprojects in the same environmental review document.

B. Purpose and Contents of the IEE

3. The purpose of the IEE is to describe the assessment of environmental impacts due to the Subprojects and to specify impact mitigation measures and monitoring within the framework of an Environmental Management Plan (EMP). IEEs were prepared for both subprojects during the project preparation technical assistance (PPTA) for the CRDP, and the current IEE is an update of those documents based on findings during the detailed design stage. As stated in the IEEs, Schedule 1 of the Environmental Conservation Rules (ECR 1997) under the Department of Environment (DoE) specify that water, power and gas distribution line laying/relaying/extension projects fall under the Red category, and construction of public toilets is an Orange-B category project. Overall the Gazipur and Ashulia Water Supply and Sanitation Subprojects are categorized according to the most stringent of its proposed component activities, and so are Red Category projects, which according to the ECR requires a feasibility report and IEE, and Terms of Reference for EIA; or EIA and EMP. In order to comply with GOB reporting requirements, the Project Management Coordination Unit (PMCU) has prepared an EIA and is in the process of submitting the EIA to the DOE.

4. The IEE is based on a review of subproject plans and detailed design drawings as well as discussions with planning and design teams to arrive at an understanding of the proposed activities. The Environmental team undertook field visits to the subproject

locations and conducted interviews and consultations with a range of stakeholders. In addition a range of secondary data available in government records was used to characterize the environments of the subprojects and assist in identifying potential impacts.

5. The IEE Report follows the outline for IEE described in the ADB's Safeguard Policy Statement (2009), and includes a description of the policy, legal and administrative framework for project implementation and environmental compliance; descriptions of proposed subprojects, alternative project designs, and environmental settings; anticipated environmental impacts and mitigation measures, means for information disclosure, consultation and participation on the subprojects; the LGED grievance mechanism; and the environmental management plan (EMP) that describes proposed mitigation measures, monitoring requirements, institutional arrangements and costs.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

6. Government of Bangladesh. The provisions for environmental protection and pollution control in Bangladesh are contained in the Environmental Conservation Rules (ECR) 1997. This legislation also provides the principal mechanism for assessing and mitigating the environmental impacts of projects. Projects are classified as green, orange, or red. Roadway and drainage improvements under the Subproject are categorized as Orange B category projects, in accordance with Schedule 1 of the ECR. The Department of Environment (DOE) issued a Environmental Clearance Certificate for CRDP subprojects up through Orange B, excluding water treatment plants and distribution line laying/ relaying/extensions, and landfills, bus and truck terminals by means of a letter No DOE/Clearance/5194/2013/180 dated 21/07/2013. Excluded subprojects are of the Red Category and invoke the environmental assessment process that may include preparation of an EIA. This is the case for the Gazipur and Ashulia water supply and sanitation subprojects. A terms of reference (TOR) was prepared for an EIA and submitted to the DOE. The TOR was approved and the EIA is under preparation, to be submitted as a separate document to the DOE.

7. Asian Development Bank. ADB categorizes projects as A, B or C depending on severity of impact and level of required environmental assessment, a process that is extended to subprojects. The Subproject has been categorized as B, necessitating preparation of an IEE with elements consistent with the ADB SPS: an EMP describing specific mitigation measures to be taken during construction and operation, monitoring and reporting requirements and procedures; requirements for information disclosure; the result of public consultations undertaken during subproject preparation; and a description of the grievance redress mechanism established under the Project.

8. The IEE report and summary are prepared by the Project Management and Coordination Unit (PMCU) during detailed design stage, and is an update of selected parts of the IEEs prepared during the PPTA. The rapid environmental assessment checklist is found in Appendix 1. Reporting on the findings of subproject IEEs will be made available by ADB via the depository library system and the ADB website.

III. DESCRIPTION OF PROPOSED SUBPROJECTS

A. Subproject Objectives

9. Water supply and sanitation (WSS) components under the CRDP provide a sustainable framework in which improvements may be delivered more effectively by incorporating and optimizing existing systems. Since most water supply service systems in Bangladesh rely on groundwater, among other objectives, these subprojects seek to

mitigate as far as practicable depletion of groundwater resources by substantially reducing wastage in water delivery and use. The water supply sub-project will expand service access and improve the urban environment through a) extension and rehabilitation of transmission and distribution water supply networks; b) augmenting and rehabilitating production facilities; and c) providing equipment for metering, leak management, and operation and maintenance. Significant sanitation improvements are planned for Gazipur that fit within the national plan. Subprojects aim for water to be produced and delivered more effectively, and to improve energy efficiency and reduce power consumption within the systems. In terms of objectives, the following are to be realized specifically for the Gazipur WSS Subproject:

i. To rehabilitate existing water supply sources, including production (tube) wells and distribution systems in core areas;
ii. To expand the sources of water supply, including new production wells in the core and fringe areas;
iii. To increase service coverage and to reduce the incidence of water borne disease through provision of piped water supply;
iv. To improve institutional structures of the local governments and the ways in which water sector improvements are planned and delivered;
v. To improve the sanitation services in these urban areas and improve health and sanitary conditions; and
vi. To improve cost recovery for water supply/sanitation services through the introduction of modern accounting, billing and revenue collection procedures.

10. The WSS component at Ashulia provides a slightly different thrust as part of a broader package of interventions aimed at optimizing the economic potential of the Ashulia Industrial and Residential Clusters. While recognizing the need for 100% of existing and future residents have access to sustainable and clean forms of water supply and sustainable forms of sanitation; including septic tanks, the subproject augments other improvements that enhance the rapidly urbanizing environment in the short term, and focuses on improvements in water supply only. The Ashulia Subproject contains other interventions such as improved roadside drainage, roadway rehabilitation, and improved solid waste management that are not included in the current IEE.

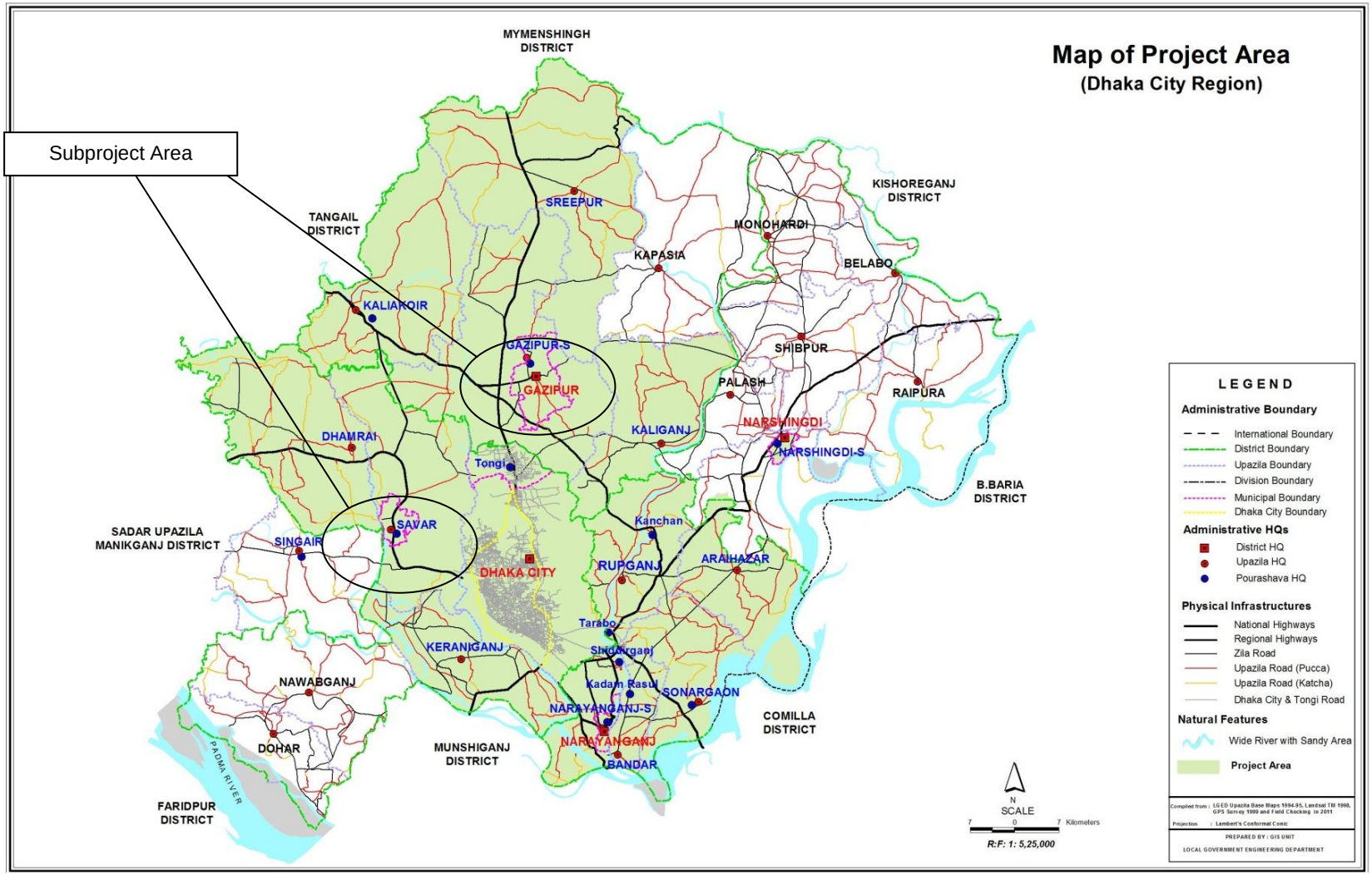
B. Subproject Descriptions

1. Gazipur

11. The sub-project components are divided into 3 parts a) Rehabilitation Works: Rehabilitation of existing production wells, pipelines, etc. b) New Works: Construction of new production tube wells with pump houses, extension of transmission and distribution pipelines and making household water service connections as procurement works and c) Water meter, etc as procurement goods. The Gazipur sanitation package is addressed separately below. The Package CRDP/LGED/GCC/GAZIPUR/NCB/2013/W-03 is for rehabilitation works and the Package CRDP/LGED/GCC/GAZIPUR/ICB/2013/W-04 is for new works.

12. At present there are 12 Public Tube Wells (PTW) and about 36 km pipelines, 2 Over Head Tank (OHT) and 3600 house connections under the Gazipur pourashava water supply system. Of 12 PTWs, one is almost nonfunctional and 2 others are running with poor discharge. Rehabilitation/replacement of the same has been considered under this rehabilitation package. Considering the length of pipelines, the number of house connections is very low. The main reasons behind this are poor line pressure, inadequate supply hours, and less availability of water which results in low interest by the urban dwellers in making service connections. Further, the PPTA Consultant estimated the water loss (unaccounted for water) is up to 40% through leakage and illegal taps.

Figure 1: Subproject Location



13. During the condition survey, the MDS Consultant identified that considerable water loss at consumer's points through leaky taps, house tanks without float valves (over flow control valve), yard stand tap connections without taps, etc. Further, all the service connections are unmetered and the water bill is a flat rate. As a result consumers are less cautious regarding use of water, and preventing water loss. Lack of awareness at the consumer level is a major reason for the high water loss.

14. The present production hours of different wells is 8 ~ 10 hours. Due to power failure/load shedding and poor voltage, operations cannot be made longer at present. The supply is given in three times – morning, noon and evening. The average present production is about 7.02 MLD.

15. As per 2011 population census and growth rate, the projected population for 2013 is about 1.95 lac. Based on estimated population (56,500) within the pipeline service area (considering 45m in both sides of pipelines), the pourashava population coverage is about 33% (year; 2013). Based on present household service connections, the population coverage is 8% only (average house size is 4.5 persons).

16. Further, due to lack of adequate maintenance of the pump house for long time, the condition of the pump house has become poor with broken doors and windows, cracked walls and floor, damaged plaster, etc. and needs repairing. Moreover the pump houses at Graveyard and Talukderpara have only pump operation rooms and need extensions of pump driver's room to improve operations. Besides, some pump houses have no or partial boundary wall risking encroachment and security of water works; hence construction/extension of boundary walls are needed at all sites.

a. Rehabilitation of Existing Production Tube Wells

17. The yield of the existing production wells has declined since construction with one now having been taken out of service. The reduction in yield may be due to the decline in groundwater levels but there are other factors that may be affecting production. Production wells used for water supply require periodic rehabilitation to improve their performance. The proposed rehabilitation de-silts the production well, opens up the pores of the screen and re-establishes the parameters of the tube well.

18. This component is aimed at achieving production well operation over 24 hours per day in an effort to double the current daily water yield. The subproject therefore comprises the following principal parts:

i. Collection of information on the borehole design;
ii. Inspection by closed-circuit television;
iii. Breaking-up of clogging deposits;
iv. Removal of silt and debris by surging and airlift clearance pumping;
v. Borehole disinfection; and
vi. Step-drawdown test.

19. Actual requirements are based on findings of the preparatory hydrogeology study and are expected to cover the eight production wells that are still active.

b. Refurbishment of Existing Water Supply Network

20. The water supply network in Gazipur consists of 28 km of mainly Polyvinyl chloride (PVC) pipelines of 100 mm to 200 mm diameter. Experience in other areas suggests the network suffers from significant leakage rates due to badly constructed joints and illegal connections. In addition, the accumulation of sand from pumping sandy water is a problem in some areas. Based on a Condition and Operability Survey

conducted during the PPTA, it is proposed to refurbish parts of the network where leakage or breakages have been identified. Activities include the following:

i. Removing and replacing broken or leaking pipes;
ii. Installing washout valves;
iii. Flushing of pipes to remove sand; and
iv. Replacing illegal connection with new metered service connections.

c. Interconnection of Existing Networks

21. The Central Gazipur area is served by eight small scale, individual distribution networks, each supplied by one of the eight production wells. One system is currently inoperative. A system interconnecting the networks is being designed as part of the network analysis. Significant operational efficiencies can be realized especially in regard to provision of continuous 24 hr supply by interlinking existing networks and proposed network extensions.

d. Extension of Distribution Network

22. Expansion of transmission, distribution pipelines and water storage is required in conjunction with the construction of new production wells to increase the supply within a given area. New service areas will be determined taking into account the findings of population surveys in order to best target those areas that will benefit from a piped water supply and that offer greater economic rate of return regarding cost recovery. Estimates of length for new service connections are given in Table 1, based on the hydraulic model of the reticulation system.

23. Installation of water meters at consumer premises and production wells are proposed as a part of this subproject component. Allowance has been made for the installation of 1,000 new meters with valved service connections. It is aimed to increase a piped supply from 34% to over 65% of the Gazipur population taking those served to an estimated 200,000 from the 100,000 currently served within the core area.

e. Development of New Production Tube Wells

24. Activities include drilling 12 new production wells to provide additional water corresponding with the expansion of the water supply network. It is envisaged that a minimum of 8 new production wells will be drilled as new wells. The drilling of a further 4 production wells has been allocated as new tube wells to replace existing production wells, if they are found to be economically unproductive based on the findings of the ongoing hydrological survey.

25. The allocation of 8 new production wells is based on supplying 25,000 m3/d of water to an estimated total of 200,000 consumers at a per capita consumption of 100 l/d and with a leakage rate of 20%. The calculation also assumes the realization of approximately 2,000 m3/d from each new well and a total of 9,000 m3/d from the existing wells and the four contingency wells. Improved yields from the existing production wells from redevelopment would reduce the number of new production wells required.

26. Typically these wells will be installed to a depth of 200+ m with large diameter (up to 650 mm) boreholes, standard for production tube wells in Bangladesh. Individual well yields on the order of 200 m3/hr is possible from these wells. Tube well locations in the Gazipur area are shown in Figure 2, and overall subproject component costs are provided in Table 2.

Table 1: Existing and Proposed Piping for GW Supply Model

Ward No.	100 mm dia (m)		150 mm dia (m)		200 mm dia (m)		Total (m)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Ward 1		1,296		1,473		492		3,261
Ward 2		4,585		1,605				6,190
Ward 3	880	1,589	363	2,320		1,568	1,243	5,477
Ward 4	12,039	6,377	16,001	2,480	1,684	2,846	29,725	11,703
Ward 5	366	2,456	423	1,724		1,075	789	5,255
Ward 6		1,250		2,332		991		4,573
Ward 7	2,481	2,103	1,474	2,787		566	3,955	5,456
Ward 8		3,516		2,550		2,068		8,134
Ward 9								
Grand Total	**15,766**	**23,172**	**18,261**	**17,271**	**1,684**	**9,606**	**35,711**	**50,049**

Figure 2: Location Map of Production Tube Well at Gazipur

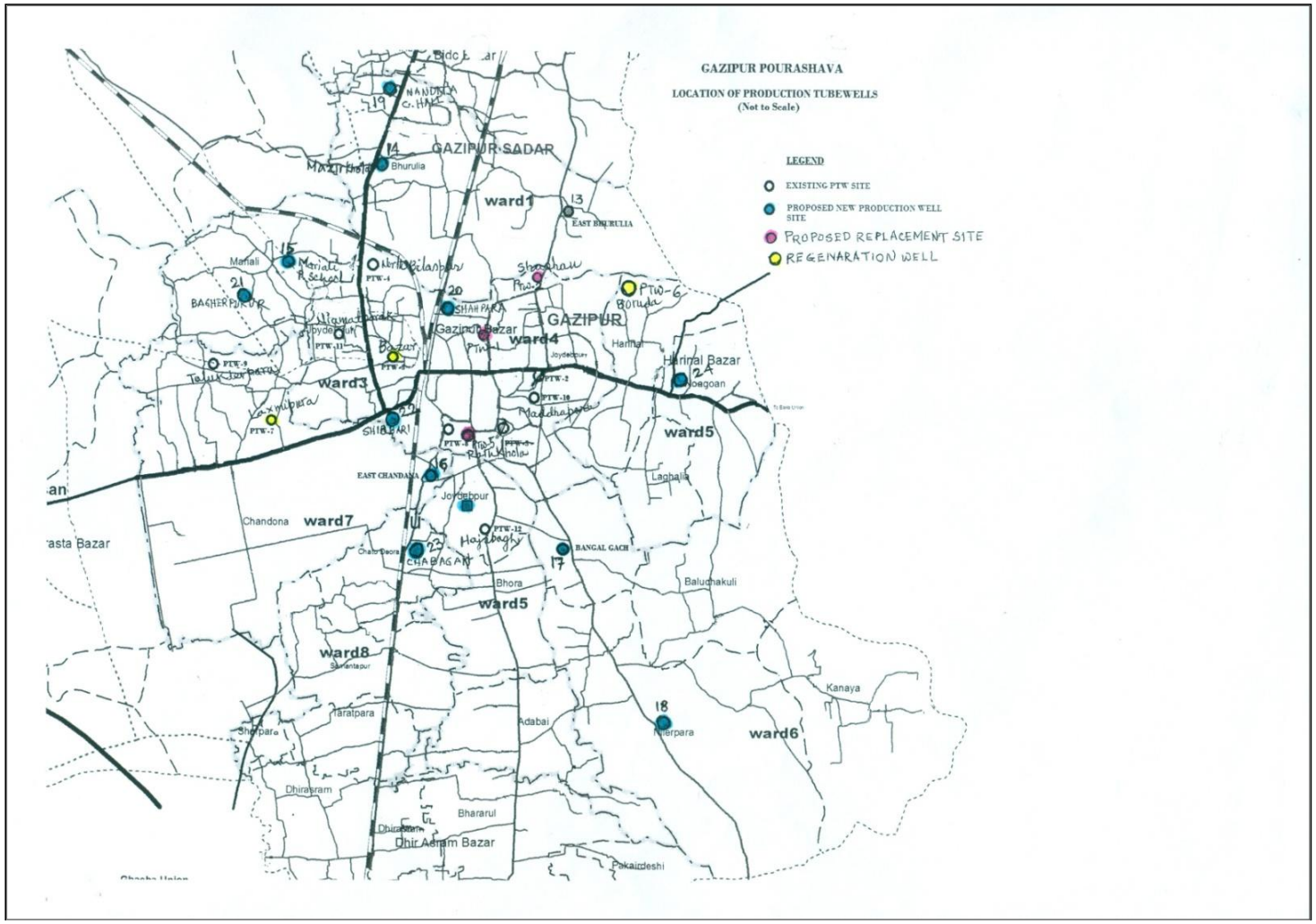


Table 2 : Summary Subproject Component Costs

Rehabilitation Works: Package No. CDRP/LGED/GCC/GAZIPUR/NCB/2013/W-03				
Part	**Name of Works**	**Quantity**	**Unit Cost (BDT)**	**Estimated Cost (BDT)**
A	Replacement of PTWs	3 nos.	2,574,684.51	7,724,054.00
B	Replacement of damaged/ undersized pipelines	3.50 km	1,153,720.00	4,038,020.00
C	Regeneration of PTWs	3 nos.	90,300.00	270,900.00
D	Electromechanical repair work of pumping equipment	8 nos.	78,627.38	629,019.00
E	Construction of pump houses at PTW replaced side	3 nos.	1,431,722.00	2,863,444.00
F	Repairing/Renovation of existing pump house (civil works	9 nos.	339,200.00	3,052,796.00
	Grand Total			**18,578,233.00**
New Works : Package No. CDRP/LGED/GCC/GAZIPUR/ICB/2013/W-04				
A	Construction of New Production Tube wells (PTWs)	12 nos.	2,574,684.51	30,896,214.00
B	Laying of New Pipe lines	50 km.	1,420,614.90	71,030,745.00
C	Construction of Pump house for New PTWs	12 nos.	1,431,722.29	17,180,667.00
D	House Connections	3000 nos.	10,181.34	30,544,000.00
	Grand Total			**149,658,634.00**

f. Water Provision in Informal Housing Areas

27. The subproject will provide new production wells, hand pumps and facilities in areas where gaps in provision have been identified under the Preparatory Studies, including informal housing areas and in rural development clusters.

g. Construction of Public Toilets

28. Public toilets are very limited in the core area and this component provides for the construction of 10 new public toilets and wash facilities. These public toilets will be provided with piped water supply and drainage system with suitably designed soakaways. The locations for the new facilities have been identified based on land availability and in areas with demand for public toilet facilities. The sites identified are located in easily accessible public areas within the core area. The area for new facilities

will be identified by the Municipality in conjunction with the findings of the consultant team, to ensure suitably sized collection and drainage systems are provided.

29. Gazipur City Corporation proposed sites for 8 (eight) nos. new Public Toilets but they provided “No Objection Certificate” for land for two sites only at Dhirasram bazar and Kanaiya Bazar. At this stage design and estimate has been prepared for 2 sites for implementation. The floor plan and profile for the Dhirasram installation are shown in Figure 3.

30. One new Public Toilet has been at Dhirasram bazar in North-East side of Dhirasram Bazar mosque. There is a railway station at Dhirasram Bazar. Many people come daily by train and go to their destination. This is also a densely populated area, especially during the Hat/Bazar, a lot of people gather here. People used to defecate in kancha areas beside the road side due to lack of Public Toilets. Thus the area becomes unhygienic and bad odors prevail. If the proposed Public Toilet is constructed, it will decrease the air pollution and nuisance and improve the health condition of the people living in surrounding area. Another new Public Toilet has been proposed at Kanaiya Bazar in North-West side of Kanaiya Bazar mosque. Kanaiya Bazar is situated beside the Chilai river. So Kanaiya Bazar serves as a small river port. Many people are coming and going through this place for business purposes but there is no toilet facility in this bazar area. People generally use a hanging toilet over the river and also defecate in open areas and along road sides.

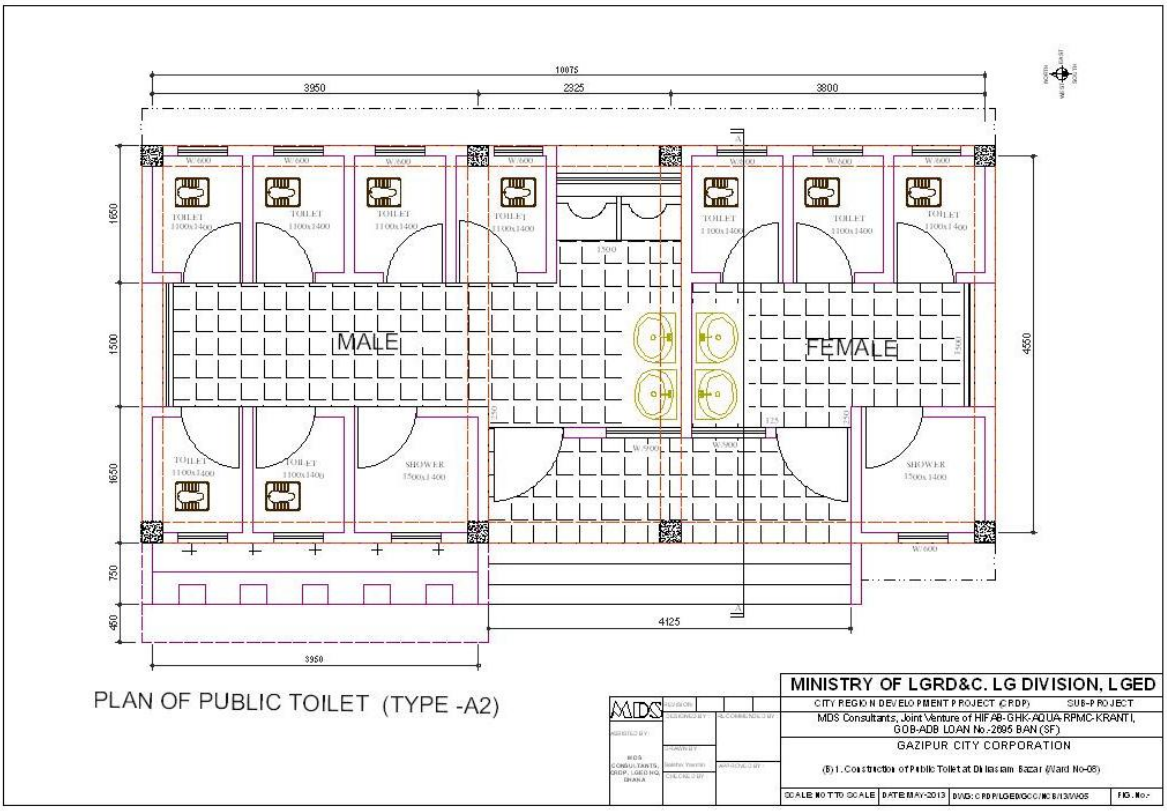
31. Existing Public Toilets are severely damaged due to lack of pourashava maintenance work. These toilets, listed in Table 3, were constructed within 1995 to 2000. Most of the existing public toilets are situated in pourashava bazar, the bus terminal and district court areas. The present conditions of all those are very deplorable. For this reason these toilets are required to be repaired to reduce the unhygienic condition of adjacent area.

32. After completing the repair of the existing eight public toilets and construction of two public toilets air quality will be improved and health condition of the people living in surrounding area. This subproject will provide some coverage to the declaration 100% sanitation by the Government of Bangladesh.

Table 3: List of Public Toilets at Gazipur

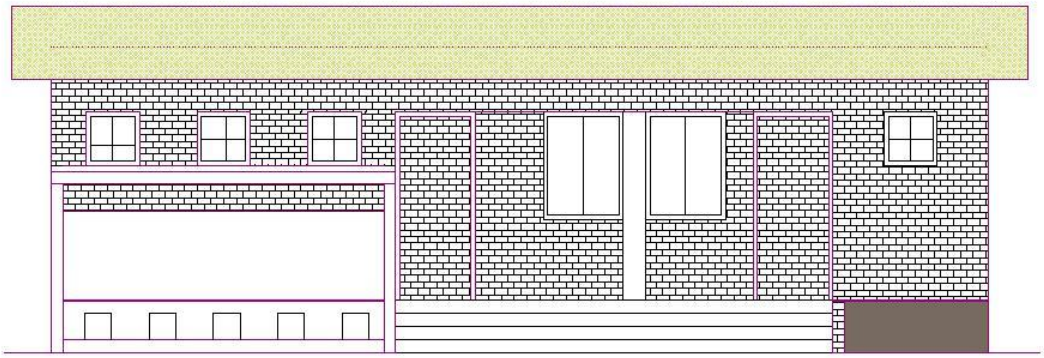
Sl. No.	Location of Public Toilet	Estimated Cost
Repair and Renovation of existing Public Toilets		
01	Repair & Renovation of PT at Mukta Mancha	4,37181.00
02	Repair & Renovation of PT at Maddha Bazar	3,81767.00
03	Repair & Renovation of PT at Joydebpur Bazar Overhead Tank side	4,56,098.00
04	Repair & Renovation of PT at Joydebpur Fish Market	75,255.00
05	Repair & Renovation of PT at Rajbari	3,98,210.00
06	Repair & Renovation of PT at Harinal Bazar	87,174.00
07	Repair & Renovation of PT at Shimultali Bus Stand	5,03,992.00
08	Repair & Renovation of PT at BIDC Bazar	77,320.00
Construction of New Public Toilets		
01	Construction of PT at Dhirasram Bazar	22,18,565.00
02	Construction of PT at Kanaiya Bazar	22,27,231.00
	Total	**68,62,793.00**

Figure 3: Public Toilet Design



PLAN OF PUBLIC TOILET (TYPE -A2)

MINISTRY OF LGRD&C. LG DIVISION, LGED
CITY REGION DEVELOPMENT PROJECT (CRDP) SUB-PROJECT
MDS Consultants, Joint Venture of HIFAB-GHK-AQUA-RPMC-KRANTI, GOB-ADB LOAN No.-2695 BAN (SF)
GAZIPUR CITY CORPORATION
(5) 1. Construction of Public Toilet at Dhirasram Bazar (Ward No-08)
SCALE: NOT TO SCALE | DATE: MAY-2013 | DWG: CRDP/LGED/GCC/WC8/13/W05 | FIG. No:-



FRONT ELEVATION (A2)

MINISTRY OF LGRD&C. LG DIVISION, LGED
CITY REGION DEVELOPMENT PROJECT (CRDP) SUB-PROJECT
MDS Consultants, Joint Venture of HIFAB-GHK-AQUA-RPMC-KRANTI, GOB-ADB LOAN No.-2695 BAN (SF)
GAZIPUR CITY CORPORATION
(5) 1. Construction of Public Toilet at Dhirasram Bazar (Ward No-08)
SCALE: NOT TO SCALE | DATE: MAY-2013 | FIG. No:-

h. Sanitation in Core and Fringe Areas

33. The sanitation component allows for construction of 2,000 new pit latrines in the core and fringe areas, matching the priority needs identified during the course of discussions with representatives of the City Corporation. To ensure that proposed interventions do not pollute groundwater, it is proposed that prior to the finalization of the designs, a detailed assessment of the sanitation facilities in Gazipur will be carried out.

34. The feasibility study, while placing importance on sanitation among the City's poor, recognizes the role of the Department of Public Health Engineering (DPHE) in implementing the proposed improvements. A number of important actions are specified in the study report, including review of options, an O&M plan for interjecting an element of sustainability to their use, improved sludge handling and disposal, and public private participation in the O&M work. An asset and condition survey of public facilities at schools, transport hubs and other locations where public toilets are found is also proposed.

i. Improved Sludge Management System

35. Improved operation and maintenance (O&M) of septic tanks in Gazipur will be achieved through better collection equipment and vehicles for handling septic tank wastes. Sludge drying beds will be developed at an existing solid waste dumping ground at Gazipur. A location of about 30x30 sq m is proposed to be developed for sludge drying beds, to be lined in order to minimize leachate loss.

j. Auxiliary Works

36. Locations of Pump houses requiring extension for the pump driver's room and boundary wall are listed in Table 4.

Table 4: Pump Houses requiring Extension

Name of Pump House	Existing Room	Required Extension
Graveyard (PTW # 08)	Only Pump operation room	1 Pump Driver's room
Talukderpara (PTW # 09)	Only Pump operation room	1 Pump Driver's room
List of Pump House requiring extension of boundary wall		
Name of Pump House	**Existing Boundary Wall**	**Required Extension**
North Bilashpur (PTW # 04)	Only at 2 sides	Rest 2 sides (97 ft)
Bazar (PTW # 03)	Only at 2 sides	Rest 2 sides (86 ft)
Boruda (PTW # 06)	Only at 1 side	Rest 3 sides (58 ft)
Laxmipura (PTW # 07)	Only at 1 side	Rest 3 sides (154 ft)
Graveyard (PTW # 08)	Only at 1 side	Rest 3 sides (88 ft)
Talukderpara (PTW # 09)	None	4 sides (152 ft)
Moddhopara Mondir (PTW #10)	None	4 sides (148 ft)
Niamot Sharok (PTW # 11)	Only at 2 sides	Rest 2 sides (97 ft)

2. Ashulia

a. Water Supply

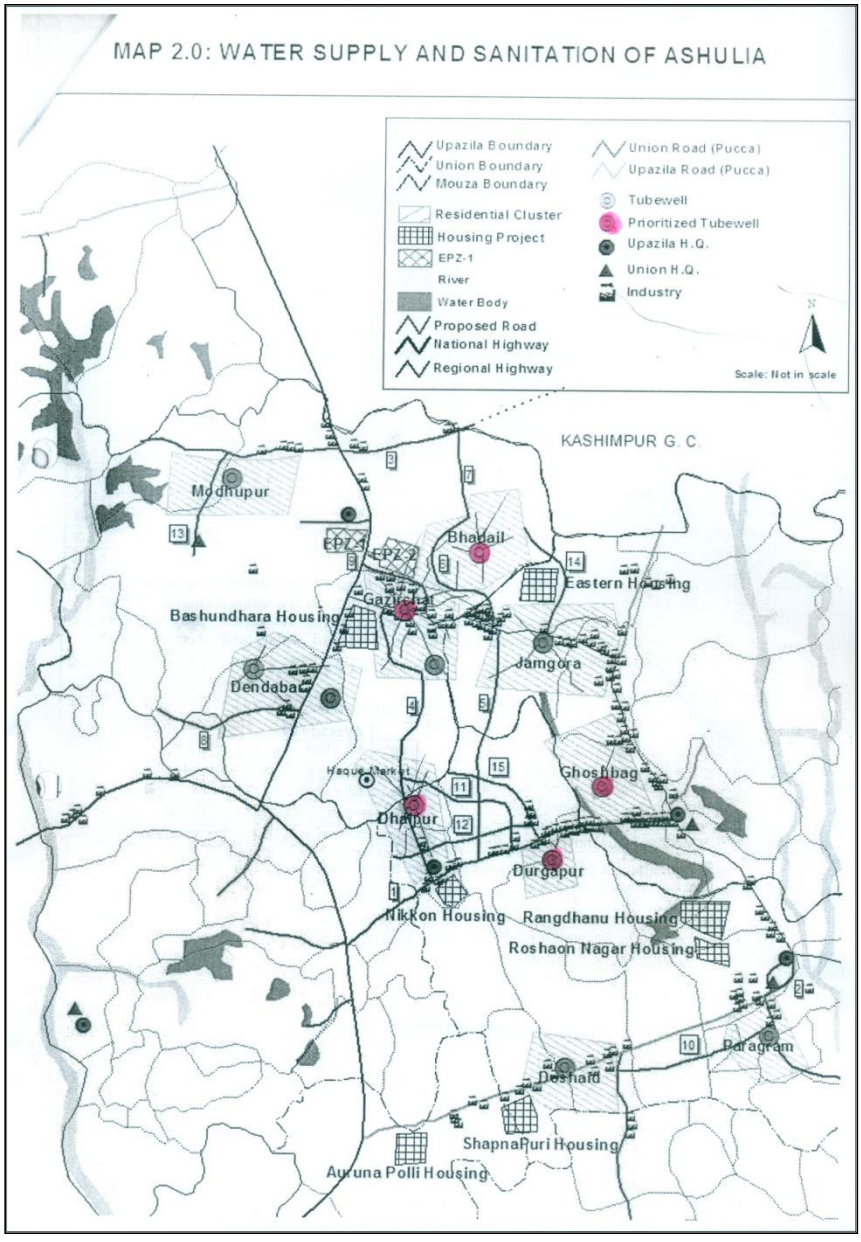
37. Based on the results of the consultant teams' preliminary research and discussions with the responsible engineers, it is proposed to install five production/tube wells as a priority, together with 30 km of distribution pipelines serving a population of approximately 80,000 persons, with the assumption that one production well will serve about 15,000 or more people. Table 5 lists the proposed production tube wells under the subproject. The Package CRDP/LGED/DHK/ASHULIA/NCB/2014/W-03 is proposed for water supply work at Ashulia.

38. The five priority production wells proposed under Phase 1 are shown Figure 4. In selecting the sites for the five priority production wells, cluster communities with low-income residents living in sub-standard and informal housing have the highest priority.

Table 5: List of Production Tubewells for Ashulia Water Supply

Sl. No.	Name and Location of Production Tube Well	
01	Production Tube Well at Bhadail	
02	Production Tube Well at Gazirchat	
03	Production Tube Well at Dhalpur	
04	Production Tube Well at Durgapur	
05	Production Tube Well at Ghoshbash (Kundalbag)	
06	Laying of Pipelines	30.00 km.
07	House Connections	300 nos.

Figure 4: Production Tube Well Locations at Ashulia



39. This is understood to be a pilot project for the area, which can be extended across the whole area over time, potentially as a Phase 2 activity. The proposals for Phase 2 of the CRDP's assistance to Ashulia are concerned with activities which address the "enabling environment" necessary to secure sustainable economic growth and as such, it will be essential for design and implementation of the 2nd phase to be supported by a revised local government unit (LGU) mandate and resources capable of managing the process. Phase 2 proposals will be taken up at a later stage with subsequent environmental assessment and reporting following the EARF.

b. Sanitation

40. The Ashulia subproject does not have a sanitation component except as may be developed under Phase 2 of CRDP financing.

IV. ENVIRONMENTAL SETTING

A. General

41. Gazipur City Corporation is a local government administrative area located 40 km north of Dhaka. It is designated as a Class 'A' municipality based on population numbers and income. Gazipur is the headquarters of District of Gazipur. It is also understood from discussions with representatives from RAJUK, that Gazipur District will be a location for the long-term development of a Satellite City.

42. The Ashulia Industrial and Residential Cluster" (Savar Upazila), referred as the Ashulia Cluster, consists of three urban centers formed from the Ashulia, Yearpur and Damsona Unions. Ashulia is located next to Uttara (a residential model town) within Dhaka City Corporation boundary, and is about 30 km from Dhaka. Due to its proximity to Dhaka, Ashulia offers considerable potential locational benefits for the establishment of industry. At the same time, rapid economic growth in the cluster and substantial in-migration of labor are causing environmental and social problems.

B. Physical Environment

1. Topography, Soil and Geology

43. Both Gazipur and Ashulia are in the vicinity of Dhaka and are situated in the Madhupur tract. Two characteristic geological units cover the cities and their surroundings, including Madhupur Clay of Pleistocene age and Holocene alluvial deposits. The Madhupur Clay is the oldest sediment exposed in and around the city area having characteristic topography and drainage. The major geomorphic units of the city are: the high land or Dhaka terrace, the low lands or floodplains consisting of depressions and abandoned channels. Low-lying swamps and marshes located in and around the city are other major topographic features.

44. The height of the land gradually increases from east to west. The southern parts of the project areas are composed of the alluvium soil of the Bangshi and Dhalashwari rivers. The land areas encompassed by the project have uneven elevations. Once, the areas were covered with green vegetation. Now, due to the rapid growth of population and industrialization, land has been converted to urban uses including buildings, mills and factories.

2. Climate

45. The climate of the project area is average tropical monsoon with alternating dry/wet seasons. Including the pre-rainy season, there are three marked seasons:

I. November to February. The dry (winter) season is the coolest and driest period. Monthly average temperatures are below 290^C with a minimum at 130^C. Rainfall is very rare during this period (below 30 mm/month). Winds are predominantly blowing from the Northwest but with a high frequency of calm wind situations.

II. March and April. In the pre-rainy season (summer) and the early months of the west seasons, the highest temperatures are reached. The monthly average temperature can rise up to 340^C. During this period, air becomes more humid, rainfall increases, and heavy rains with thunderstorm occur. This period is locally called as "Kalbaaishakhi". Sometimes the rain falls with hail.

III. May to October. In the west season ("monsoon period") more than 85% of the total annual rainfall occurs. Monthly average temperatures remain high with a maximum of 330^C. The period of periodic heavy thunderstorms lasts until June. June to mid September to early November is the transitional period with decreasing rainfall, often thunder. During the wet season, the winds are predominantly blowing from the South. Monsoon rains are generally not stormy, but downpours of 50 mm to 75 mm per day are not uncommon and rainfall with more than 250mm per day is occasionally experienced.

46. Total mean annual rainfall occurring in the area is about 2,102 mm. About 75% of the total annual rainfall occurs during the monsoon period.

3. Flood Plains

47. Most of Dhaka is in the natural floodplain of the various rivers in the area, and would have functioned as an important breeding ground for many aquatic species in the past. This function is still evident in the seasonal flooding that affects large parts of the city. The floodplain function has been further degraded by the construction of embankments to protect the city from flooding, and particularly from infilling to reclaim land, which reduces the water retention capacity of these areas and increasing flooding both upstream and downstream.

4. Surface Water Resources

48. Dhaka is enclosed between the Turag-Buriganga River in the west and the Balu-Sitalakhya River in the east, both of which drain into the Meghna in the south, along with the Dhaleswari, old Brahmaputra and other rivers outside the city limits. Like other inland waterways these rivers support a fish fauna that includes carp, catfish, loach, hilsa and shrimp, plus a variety of invertebrates and insects that have been little studied. There is no permanent surface water body within the project area, except Bansi River in Gurail Mouza. Bansi River is used for local navigation and for seasonal fishing purposes. The Danka Khal is on the West Side of the Gazipur, is mainly used by the local peoples for navigation, and other purposes, whereas the Turag River abuts the Ashulia cluster.. Regarding pollution load concern, Danka khal receives discharges from all the industries situated along the Joydebpur-Tangail road and Konabari Industrial Zone, which include textiles, footwear, food, chemical, pharmaceutical, detergent, and steel re-rolling mills. In the absence of effluent treatment plants in the various industries functioning in the Ashulia project area, there is direct discharge of the effluents from the textile industries into the Turag and Daleshwari rivers.

5. Ground Water Resources

49. There are three main aquifers in the central region of Bangladesh:

i. An upper (composite) aquifer, which can reach depths of 50 m and is covered with an upper silty clay layer of less than 20 m;

ii. A middle (main) aquifer of fine to heavy sands, which is generally 10 m to 60 m thick and in most areas is hydraulically connected with the composite aquifer above; and
iii. A deep aquifer of medium, medium-to-fine or medium-to-coarse sand, which is generally found at depths below 100 m.

50. In Dhaka 80% of the domestic water supply is obtained from the middle aquifer, extracted by tube-wells throughout the city. Recent studies have shown that water levels have fallen dramatically (20 m over the past six years) and suggest that the aquifer may be changing from a confined to an unconfined condition, which could make it vulnerable to contamination. There is already evidence of pollution by leaking underground tanks at petrol stations and chemical plants, and seepage from sewers. Dhaka Water Supply and Sewerage Authority (DWASA) is implementing a major project to improve the water supply service, which amongst other things will increase the usage of surface water and extend groundwater abstraction to the deeper aquifer, at a sustainable rate.

51. To address issues pertaining to the decline of ground water levels, the Gazipur City Corporation proposes the following initiatives in the long terms: (i) minimization of water abstraction through reduction in water losses achieved as a result of the rehabilitation of the distribution networks, (ii) minimizing water consumption through awareness campaigns and consumption based tariff, (iii) introduction of rain water harvesting in both private and public buildings, to improve the aquifer recharge, and (iv) improvement to existing sanitation facilities and introduction of better sanitation facilities to minimize pollution of ground water.

6. Ground Water Quality

52. Water quality monitoring surveys show that iron and arsenic in the groundwater is below the World Health Organization (WHO) and national standards for consumption. The laboratory test results of two test boring wells, one located near Hazi Younus Ali Niamat Sharok (Sample A) and the other at Jorpukurpar (near Mandir—Sample B) are furnished below in Table 6. Similar test results are available for wells serving Ashulia.

Table 6: Analysis of Well Water from Gazipur Area

Sl. No.	Water Quality Parameters	Bangladesh Standard	Concentration Present		
			Sample A	Sample B	
A.	Physical & Aggregate Properties				
01.	pH	6.5 – 8.5	7.3	6.9	
02.	Conductivity		380 µs/cum	397 µs/cum	
03.	Alkalinity (HCO_3)		192 mg/L	195 mg/L	
04.	Hardness (as $CaCo_3$)	200 – 500 mg/L	78 mg/L	76 mg/L	
B.	Inorganic Non-Metallic Constituents				
05.	Chloride	150 – 600 mg/L	35 mg/L	32 mg/L	
D.	Metal				
06.	Arsenic	0.05 mg/L (50 ppb)	2 ppb	2 ppb	
07.	Boron	1.0 mg/L	□ 0.4 mg/L	0.52 mg/L	
08.	Barium	0.01 mg/L	47.44 ppb	54.50 ppb	
09.	Iron	0.3 – 1.0 mg/L	0.63 mg/L	0.73 mg/L	
10.	Manganese	0.10 mg/L	0.10 mg/L	0.10 mg/L	

7. Air Quality

53. While there are no major air polluting industries within the Gazipur urban area, there are small and medium industries including various textile dyeing industries which are polluting sources outside the City Corporation boundaries. In addition to the

industries, brick kilns located on flood plains throughout the area are major air pollution sources. In addition, most of the internal roads within the industrial and residential clusters of Ashulia are unpaved, and vehicular movements, especially heavy vehicles, generates dust and impairs air quality. While dust impacts are significant due to the poor road conditions, vehicular emissions are not significant due to the widespread use of Compressed Natural Gas (CNG) as a fuel source.

8. Land Use and Development

54. The Ashulia Cluster is located within the RAJUK boundary and is therefore guided by the Dhaka Metropolitan Development Plan 1995-2015 (DMDP) and the emerging Detailed Area Plan (DAP), which provides a broad prescription for the development of the Savar Upazila (including the Ashulia Cluster). In reality there is little control of development as evidenced by mushrooming unplanned private residential and industrial development throughout the Upazila. An 'Upazila Plan Book' –a form of infrastructure development plan–exists but is out of date and needs revising.

9. Floods and Disasters

55. The project area has less risk of natural disasters like cyclone and flood. As the project area is far away from the coast, so there remains less risk of cyclone. The National Seismic Zoning Map produced by the Geological Survey of Bangladesh divides the country into three regions: a high risk zone between Mymensingh and Sylhet in the north and north-east; a medium risk zone stretching diagonally from Rajshahi in the north¬west through Dhaka and Comilla to Chittagong and Cox's Bazar in the south-east; and a low-risk zone in the south and south-west, around Khulna and Barisal. The project area is in seismic zone II which is vulnerable to earthquake at medium risk, and shocks of moderate intensity are possible, with a probable maximum magnitude of 6 to 7 on the Richter scale.

56. Seismic events in Bangladesh are relatively infrequent but historically have been severe, such as the earthquakes of 1930 and 1950 that caused widespread damage throughout the country, and the earthquake in 2004 that damaged large parts of Dhaka.

C. Biological Resources

1. Forests and Natural Habitats

57. Within Savar Upazila and Gazipur area in GCC, there are little or no natural terrestrial habitats, because in most cases vegetation was cleared many years ago to provide land for development, and for agriculture in the suburbs. The project area is similar to the character to many areas of the alluvial delta in Bangladesh with mixed crop vegetation. Rice, other grains and seasonal vegetables are the main crops in this area. Other than monoculture tree plantations, no forestland is found in the area. Terrestrial plants are now mainly limited to trees, shrubs and flowers grown alongside roads and in parks and gardens, and the crops and fruit trees planted in agricultural areas. The composition of the plant community includes low growing grasses and herbaceous vegetation as well as other cultivated flora. No wild animals or endangered species are present in the area. With the exception of common rodents and birds like crow, sparrow and mayna and some domestic cattle, few other animal types inhabit the area.

58. The Bhawal National Park (24°01'N, 90°20'E) under the Dhaka Forest Division is located 10km to the north of the Gazipur urban area. The park was established in 1974 and maintained as a national park, but not declared officially until 1982 under the Bangladesh Wildlife Act. The park covers 5,000 ha and has a core area of 940 ha. Due to encroachments, the forest is honeycombed with habitations and rice fields. The

topography is characterized by low hills, which rise 3.0 m to 4.5 m above the surrounding paddy fields locally known as 'chalas', which are intersected by numerous depressions or baids. The dominant forest trees Sal Shorea robusta of the national park have been almost completely removed, but now protection programs have planted sal which covers 90% of the area. The Park is managed as a protected landscape, an International Union for Conservation of Nature (IUCN) management category, and is easily accessible throughout the year by road.

59. The wildlife at Bhawal National Park was well known for its peacocks, tiger, leopard (black panther also) elephant, clouded leopard, sambar deer, etc. However, the overall situation is that these fauna have disappeared and only a few mammals (squirrel, mongoose, jackal, civet, jungle cat, etc.), a few reptiles (monitor lizard, snakes) and some indigenous birds remain.

2. Aquatic Flora and Fauna

60. The main aquatic flora in the area is Kalmilata (Ipomoea reprans), Shapla (Nymphaea lotus) Helencha (Alternathera philoxeroides), Kuchuripana (Eihhcormia crassipes). The main aquatic fauna in the area are different types of fishes. The stretch of that rivers provide a habitat for a wide variety of fishes and shellfish species which include carp (Rui, Catla, Mrigal, Ghania, Kalibaus etc), catfish (Boal, Pangas, Shilong, Bacha etc) and various slow-moving blackfish (Koi, Singh, Magur etc) as well as other fauna such as tortoise, frogs, and water snakes.

D. Economic Development

1. Population and Development

61. The administrative status of Gazipur was upgraded from that of a pourashava to a City Corporation in January 16, 2013. Originally the pourashava covered an area of 48.5 km2 and was subdivided into a core area, covering 16 km2 around the middle of the Pourashava, and a fringe area, covering the remaining 32.5 km2. The highest population densities are found towards the centre of the core area but rural or semi rural enclaves are found around the periphery. There is some industrial clustering and unplanned urban residential and other urban fringe land uses scattered across the rural hinterland. Agriculture and other related uses are under pressure from unplanned urban development. As such the rural hinterland increasingly houses a large migrant population.

62. According to Census of 2001, the population of Gazipur Pourashava was 128,429. Gazipur Pourashava carried out a further population count in the year 2005 and the total population of that time was estimated at 300,112 among which 156,586 were male and 143,526 were female. Based on the national average growth rate of 3.3%, a conservative population estimate for 2010 is some 353,008 persons and projected to rise to 371,380 and 422,530 in 2015 and 2020 respectively. The large proportional increase of population is due mainly to migration attracted to employment opportunities provided by the expansion of commercial and industrial activities. Manufacturing facilities include Ceramic industry, beverage industry, press and publication, garments industry, foot ware, jute mills, textile mills, printing and dying factory, transformer industry, automobile industry, biscuit and bread factory, pharmaceutical industry, soap factory, brick field, cold storage, welding, plant nursery, etc. Population growth of Gazipur will continue to be greater than the national average and the population may exceed 500,000 within the next ten years (2020).

63. Agriculture and manufacturing are the two major economic sectors in the Ashulia area. The main crops grown are paddy, jute, peanut, onion, garlic, chili, and other

vegetables. The main fruits cultivated are jackfruit, mango, olive, papaya, guava, kamranga, berry and banana. Manufacturing facilities include ceramic industry, beverage industry, press and publication, garments industry, foot ware, jute mills, textile mills, printing and dying factory, transformer industry, automobile industry, biscuit and bread factory, pharmaceutical industry, soap factory, brick field, cold storage, welding, plant nursery, etc. Bangladesh Export Processing Zone is located in the Savar Upazila.

64. Ashulia, Damsona and Yearpur have been experiencing rapid industrial growth and urbanization since 2000. With the growth of industry and demand for housing in the area, agricultural land has largely disappeared in the core industrial areas. The combined population of the three union parishads has increased from 166,514 in 2001 to an estimated 950,000 in 2010. Population is projected to reach 1.2 million by 2020. The number of industries locating in the combined areas has increased from 54 to 694 over the same period. Currently, it is estimated that a total of 125,000 persons are employed in industry.

2. Infrastructure Services

65. Water Supply and Sanitation. Gazipur is entirely dependent on ground water for its water supply, through means of production (tube) wells. Only eight production wells are currently working and they are located at 'Rajbari water works compound', 'Boruda', 'Madhov bari water works compound', 'Joor pukur', 'Madha para near mondhir', 'Bazar water works compound' and North Bilashpur, Laxmipura water works compound'. Shallow production wells employing mechanical or hand pumps are also widespread in central Gazipur as households cannot depend on the irregular piped supply.

66. Recently four new production wells have been completed but not yet commissioned. The locations of these production wells are 'East Chandana near graveyard', 'Laxmipura Talukder para', 'Niamat sharak' and 'Hajibagh Bhora'. It is expected that these production wells will be commissioned soon.

67. As with the Region in general, the Gazipur area is suffering from a decline in ground water levels. Figures reveal that the static ground water level has declined by approximately 7 meters to 8 meters in the last eight years since 2001, which represents an average fall of around 1m annually. The reduction is particularly acute during the dry season when water demand is high and levels become even lower as a result of high drawdown.

68. The existing sanitation system in Gazipur comprises exclusively pour flush toilets with septic tanks or pit latrines. There is no conventional sewer system. Septic tanks are widely used within urban areas of central Gazipur and surrounds, but the exact number is unknown, though thought to be significant. They are built and paid for by individual householders. Pit latrines are also widespread. Official figures give the number of pit latrines in the original pourashava as 34,912 comprising home-made, single and twin pit pour flush latrines. The exact numbers of each category is not available but the single pit pour flush is the most common. Though currently the 'best' means available, septic tanks have problems in that traditional designs provide systems that are considered too small and ill-designed to effectively retain solids. Percolation into the ground also pollutes the local groundwater abstracted for domestic use from shallow wells.

69. To ensure that the proposed intervention as part of the sanitation sub-component does not pollute ground water resources, it is proposed that prior to the finalization of the designs, a detailed assessment of the sanitation facilities in Gazipur will be carried out. It will also examine the potential for better design and maintenance of septic tanks and in the long-term possible connection to a sewerage system. It will also examine the

upgrading of pit latrines to pour or flush septic tank systems and alternative designs for pit latrines.

70. Desludging of the septic tanks is also a particular problem. Pit latrines fill up with night soil and become unhygienic whilst septic tanks fill up and eventually overflow or block. As a result, householders either construct outlet pipes, which convey the raw sewage into local drains or open areas. Alternatively they pay for private 'sweepers' to manually collect and remove the contents. Effectively the result of manual collection is much the same as there are no designated areas for the sanitary disposal of septic tanks, latrines or other sanitary facilities so again contents end up in drains or are tipped onto open land.

71. There is no piped water supply in Ashulia, Damsona or Yearpur and access to safe water is not assured. Groundwater is not afflicted by salinity or arsenic problems; however the static ground water level is very low at 18 m to 24 m.. As a result normal pumps are ineffective and Tara shallow pumps and submersible pumps are being used within housing premises to access drinking water. The cost of submergible water pumps is approximately $1159 to $1449 per installation. As of 2010 there were 1,041 hand tube-wells installed by the DPHE, which are mostly fitted with Taradev Hand pumps. In general industries are using their own system of water supply through ground water extraction. Of the total population in the Cluster more than 50% are in-migrant workers who share water and latrines with others. Communities with a high concentration of lower middle class workers and residents need improved access to water and sanitation.

72. Solid Waste Management. The Gazipur administration has over the past 3 years initiated with participation of NGOs, vermicompost facilities for treatment of organic wastes. The waste collection and transportation is done by the Municipality. The transported waste is segregated at the disposal site and compost generated. In the absence of a sanitary landfill facility, the inorganic waste is currently crudely dumped within the site.

48. There is no SWM in the Ashulia cluster and random dumping is practiced both for domestic and industrial waste, resulting in both land and water pollution. The problem caused by the SWM vacuum is well understood, but is exacerbated by limited suitable landfill site availability and lack of awareness related to the benefits of solid waste management. Basic estimates suggest that a minimum of four transfer stations and at least one final disposal site are needed to manage the current volume of waste.

73. Drainage. Gazipur, as part of the ADB's Urban Governance and Infrastructure Improvement Project (UGIIP), developed an infrastructure master plan for drainage, and has taken up implementation of the priority drainage networks in the urban areas. However, given that there are several areas that are not covered by roadside drains, and several natural channels that are not properly maintained or protected, local floods and water logging in the monsoon season is recurrent. Water logging is a major problem as expressed during consultations with the Communities and elected representatives of the Gazipur City Corporation. This is exacerbated by the elevation of roadside development which is high compared to the existing road level, and without drainage and outfall.

74. Ashulia does not have a well developed drainage system, which results in local floods and water logging during the monsoon season. This is disrupting mobility in the urban centre including the movement of both workers and goods. Water logging is the single biggest problem in the area. This is exacerbated by the elevation of roadside development which is high compared to the existing road level, and without drainage and outfall. Most of the roads in the area become inundated by the rainwater and industrial wastewater, which causes damage to these road surfaces requiring significant resources for maintenance and repair each year.

75. Roads and Connectivity. While the connectivity to Gazipur is in good condition, the internal roads in Gazipur are either inadequate in width or in poor condition. The situation is exacerbated by the regular water logging of roads during the monsoon season which disrupts efficient movement for up to four months.

76. The Ashulia cluster is well connected to Dhaka through the Dhaka-Aricha highway road and a bypass road from Ashulia to Abdullahpur. As many industries and businesses are located along arterial roads in the urban centre, good connectivity and the effective movement of goods, plays an important part in maintaining the economic attractiveness and competitiveness of the area. At present industry and businesses are connected to national and regional highways by sub-standard arterial roads which are inadequate in width and are either in poor condition. The situation is exacerbated by the regular water logging of roads during the monsoon season which disrupts efficiency movement for up to four months. It is noted that traffic congestion is particularly severe on the double lane roads at Nabinagar, Chandra, Jerabo and Ashulia Bazar Area, and that the road surfaces in these locations are poor.

77. Health and Education Facilities. Given the unorganized growth that has occurred due to the industrial development in Ashulia cluster, the current levels of services, with regards to social infrastructure (health and education) are lacking. While there exists an Upazila Health Complex and a few numbers of private clinics, there is a deficiency both in quantity and quality of health care available to the residents. In terms of educational facilities, there is a lack of higher order educational facilities within the cluster. There are educational institutions as the Morning Glory higher secondary school, apart from private hospitals abutting the project roads.

E. Physical Cultural Heritage

78. There are no archaeological structures/monuments or sites that are of significance in the vicinity of the subproject locations.

V. ANALYSIS OF ALTERNATIVE PROJECT DESIGNS

A. Gazipur

79. The design of the proposed Gazipur water supply and sanitation system improvements were dictated by existing conditions: the need to rehabilitate existing wells and the distribution system in the core areas of Gazipur, to increase system capacity in line with current and future demand estimates, and development within the project area that require extension of the system to new service areas. These were determined based on findings of population surveys that allowed the project to target areas that will benefit from a piped water supply and that offer greater economic rate of return regarding cost recovery.

80. Public health factors also drive decision making on the selection of subproject components, in that an increase in per capita consumption of water generally indicates an improvement in public health, and it is one of the project objectives to increase per capita consumption for the population from its current low level. In line with that, the increase in coverage of safe water supply services also indicates improved public health indicators through reduction in the incidence of water borne diseases due to piped water supply. Project components were also guided by governance considerations, in that improved institutional structures are the way forward for water sector improvements that are planned and delivered, accompanied by greater financial standing of the water supply/sanitation services sector through introduction of modern accounting, billing and revenue collection procedures, which will lead eventually to achieving full cost recovery of the system. Finally, the sanitation component is an essential element of water supply

improvements, which should always be accompanied by improved sanitation services. These are provided for in the subproject design in order to improve health and sanitary conditions.

B. Ashulia

81. The subproject at Ashulia aims to optimize the economic potential of the Ashulia Industrial and Residential Clusters in a way that is sustainable and to the benefit of industrialists, traders, local businesses, residents and workers in the Clusters and the neighboring area. Water supply is a component of an integrated plan involving roads, drainage water supply and sanitation. While the focus is on improved economic viability of the area, it prioritizes better urban services in the view that better service delivery will result in improved economic activity. Improved services includes ensuring 100% of existing and future residents have access to sustainable and clean forms of water supply and sanitation, and the introduction of an integrated solid waste management system for the Ashulia area. Improved roadside drainage is aimed at reducing local flooding in residential and commercial/industrial areas and reducing damage to arterial roads and highways. Improving roadways in general results in improved connectivity to Dhaka. The broad-based, integrated project also provides improved education and health facilities, and other community facilities, to meet the needs of the residents of Ashulia. This is accomplished within a comprehensive and integrated planning context for sustainable medium/long-term development and upgrading and includes ensuring urban growth within a Comprehensive Master Plan and Investment Strategy as part of other existing plans and policies and other key economic and environmental elements, such as (i) environmental upgrading in the industrial and residential clusters; (ii) better traffic management; (iii) better public transport; and (iv) providing serviced land to meet the needs of on-going in-migration. All of this aims at strengthening governance such that the Local Government Unit has the resources to manage economic growth and urbanization of the Ashulia area in a more sustainable way. As seen, water supply and sanitation is but a small component of a broad plan for Ashulia.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

82. This section reviews potential environmental impacts of the individual components that comprise the subproject during the different phases of project development. A summary of the potential impacts is presented for each component and then analyzed to identify necessary mitigation measures to reduce the overall magnitude of impact.

A. Planning, Location and Design

83. Planning: Impacts can occur due to lack of sufficient planning to assure functionality of the system and distribution of benefits among the poor population of the urban area. Preliminary engineering of the water supply proposal is provided to assure that the various components of the system are properly integrated into an overall expansion plan for water supply, will function well together and will provide a system with minimal requirements for operation and maintenance. Awareness of the needs of the poor community also is a prerequisite for good planning, in order to assure that the poor community benefits from the increase in water supply and sanitation facilities and services.

84. The proposed increase in pumping from the deep aquifer underlying the area needs to be sustainable. Pumping at rates that exceed the sustained yield could lead to depletion of the aquifer and saline water intrusion. While it is not possible due to lack of input data to construct a detailed model to depict the hydraulic characteristics of the aquifer, the expert opinion from the CRDP hydrologist concerning the capacity of the

aquifer is that, while drawdown and a lowering of the water table is certain to occur under the extraction rates proposed by the master plan, it is highly unlikely that ground subsidence would occur. The predominant opinion is that, with the exception of the major cities, especially Dhaka, where large-scale extraction has led to long-term drawdown of the water table, groundwater levels across Bangladesh may lower some during the dry season, but the aquifers replenish fully during the monsoon.

85. The subproject feasibility report proposes that a desk study be carried out into the possibility of Managed Aquifer Recharge (MAR) in the Gazipur area. This would include use of a groundwater simulation model to assess the several factors that influence the MAR potential of the Gazipur area. Climatic conditions and catchment characteristics are considered to be the most important. The hydrogeologist on the DSC Team is performing work in that direction at present.

86. Installation of large numbers of deep tube wells runs the risk of contaminating the deep aquifer. Deep wells with arsenic were later found to have become contaminated from upper, shallow aquifers, whereas there is still controversy over how much arsenic is present in deep aquifers[1]. If a condition develops where the water table in the deep aquifer is depressed sufficiently and well bores are not properly sealed at the time of well installation, contaminated water may enter the deep aquifer. During installation of the wells, a hydrogeologist should be present to assess the presence of an impermeable layer between the upper and lower aquifers. The hydro geologist should assess the potential for intrusion via well bores, and specify the method for well installation that will prevent the occurrence of cross-contamination. If the risk is significant, the design engineer should consider alternative means for installing the wells.

87. Groundwater quality is an important consideration for any water supply proposal in Bangladesh due to the potential presence of arsenic and other inorganic compounds (barium, manganese). There is an impact on users of the system if water quality from the proposed deep wells is unsafe, or does not receive sufficient further treatment to assure its safety during use. During planning and design, sampling of existing wells and exploratory boreholes should be used to determine the need for and placement of iron and arsenic removal plants at wellheads. Barium is also noted to be a problem in some aquifers. The design engineer should obtain sufficient analytical results from existing water supply points to determine the likelihood of iron and barium present in the wells proposed at any specific location in excess of the GOB standard as shown in Table 7. The WHO standard is given as a reference. Analytical results of well water samples from Gazipur and Ashulia areas indicate that arsenic is not present in groundwater at these locations.

Table 7: Relevant Drinking Water Criteria and Standards

	GOB / DOE	*WHO*	*Basis*
Arsenic	0.05	0.01	Health
Iron	0.3—1.0	0.3	consumer complaints
Barium	0.01	0.7	Health

88. Location: The project is not adjacent to or in any environmentally sensitive, reserve or protected areas, and hence does not cause an impact on biodiversity values. The project location is the urban, or built up, environment of Gazipur and Ashulia. Infrastructure will be installed and constructed in public rights-of-way, easements, roads and properties held by the Local Government Unit, hence there is not expected to be any need to acquire land in order to implement the project. Encroachment on private property is not expected to occur. Temporary inconvenience of property owners due to blockage of access may occur during construction.

[1] http://www.who.int/water_sanitation_health/dwq/wsh0306/en/index3.html.

89. Design: There is a potential impact on future users of the system if the detailed design fails to incorporate good engineering design practice. Detailed design will be conducted during the period of the loan. Given the variety and quantities of infrastructure, it will be necessary that sufficient attention be paid to the detailed design to maximize its functionality and reduce future overhead costs for operating and maintaining the system. The engineer should undertake a hydraulic analysis of the piping system prior to finalizing the design and provide a system that balances head losses and provides operating pressures in approximately the same range throughout the system. The proposed facilities should be designed with ease of operation and maintenance in mind, since failure of the system due to poor maintenance poses a risk to human health, or otherwise reduces acceptability of the supply. A chlorination system should be considered for the distribution system, and chlorine residual maintained in the system during operations. Despite the benefits of chlorine, the DPHE does not as a practice chlorinate well water supplies, and the design engineer for the present subproject is reluctant to introduce a system that in all likelihood the local government units will not use. As a result, the IEE does not require that chlorine injection systems be included in the design of the proposed systems. Water points should be provided near community latrines to assist in maintaining their functionality. Households targeted for onsite latrines should have assured access to a source of water either through individual or nearby community taps. Suitable means for disposal of septic tank sludge should be proposed along with other aspects of design.

B. Construction

1. Refurbishment and Installation of Wells

90. Well placement generates environmental impacts over a restricted area that in general is minor or insignificant. Noise can be a problem for adjacent households or businesses. If these are close by, the well drilling activity should be restricted to daylight hours. If there are sensitive noise receptors nearby, such as hospitals, schools or mosques, the contractor should consider installation of noise barriers surrounding the operating equipment.

91. Well drilling mud can pollute local streams if allowed to escape from the mud pit. The contractor should prevent loss of drilling mud during the drilling operation by assuring walls of the mud pit are well constructed and unable to be breached. Following completion of the well, the remaining materials in the mud pit should be mixed with dry soil, sand, lime and/or cement in suitable proportions to stabilize and solidify the mud, then the pit should be covered over with a layer of clay and topsoil to seal the pit.

2. General Construction Activities

92. Potential impacts during construction include effects on air quality and noise levels in neighborhoods; congestion in right-of-ways, and blockage of access to homes, buildings and commercial establishments;' spoil materials from excavations that block roadways and public spaces; damage to nearby buildings, walls and existing buried piping; disruption of traffic and human movement from transport of materials to and from the work site; disturbance at social/cultural sites (schools, hospitals, mosques) by noise, dust, vibration and impeded access; land acquisition where route of distribution piping diverges from public ROWs; inconvenience and health risk if the existing water supply system is shut down for a long period; and accident and injury for construction workers and the public in construction zones. Mitigation measures for construction impacts are addressed in the following paragraphs.

a. Worker Camps

93. To accommodate the needs of the workforce, the contractor should provide suitable housing, adequate supplies of potable water, and toilet and bathing facilities within the housing area. Onsite facilities for preparing food need to be provided, or food service contracted. The contractor should provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and sockwell, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite. The labor camp should be located at a distance from any nearby community and workers transported daily to the construction sites. Temporary lodging for workers should not be set up along the alignments where piping is being installed. The labor camp should be set up at a selected and approved location for the duration of the contract, and located such that it does not interfere with or cause a nuisance for the local community. Complete closure of the camp is required at the end of the work, including removal of any underground tanks and above-ground structures.

b. Occupational Health and Safety

94. The Contractor should have a basic safety and health plan in place for workers, in which workers are required to wear personal protective gear suitable to the type of work being performed and a worker is suitably trained (or experienced) in the work he/she is assigned to do. Emergency care should be available on call. The Contractor should maintain a record of accidents, which should be reviewed on occasion with the supervising engineer.

95. The contractor should maintain a high standard of safety in the performance of work. Workers need to be informed of potential risks associated with activities conducted in the vicinity of moving equipment, and workers should not be allowed to enter deep trenches unless they are properly shored.

c. Community Health and Safety

96. The public should be barred from construction areas, and excavations should be barricaded and marked. Paths of access and passage for vehicles and pedestrians should be clearly marked through the work zone.

97. The contractor should minimize use of heavy equipment in congested areas, conduct activities during daylight hours and apply water to suppress dust as needed. In heavily trafficked areas such as markets, the contractor should increase the work force to complete construction quickly, reduce dust by removal of excess earth, and avoid obstructing the paths of travel for pedestrians and vehicles.

98. The contractor should minimize downtime of existing water supply, limit shutdowns to less than four hours and notify the public in advance to store water as necessary.

d. Site and Route Maintenance

99. The contractor should plan haul routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods. Speed limits and other traffic rules need to be strictly enforced among drivers. Traffic detours need to be identified and marked in the event they are necessary to maintain traffic flow through the construction zone. Flagmen need to be posted at the start and finish of construction areas as necessary to direct the movement of traffic.

100. Movable sanitary facilities should be provided at the site and kept clean, free of odors and usable. No materials should be stored onsite for longer than a day before their use. Excess materials should be removed after a segment is complete.

101. The contractor should avoid trenching where damage might occur to buildings, and provide shoring and backfill with sand/cement admixture to prevent caving.

102. The contractor should avoid stockpiling earth and construction materials in areas subject to flooding and flowing water. Loss of fuel oil, engine oil and other types of chemicals to the soil or to drainage courses will not be tolerated.

e. Transient Noise and Air Pollution

103. All roadway surfaces should be repaired as construction progresses; bid packages should contain a unit bid price for roadway repair, and for repair of any other facility, structure or surface that is likely to be damaged in quantity during construction.

104. The contractor should use tarpaulins to cover truck beds hauling sand, dirt or fill, and avoid overfilling trucks and causing spillage along roadways. The contractor should suppress dust along roadways accessible to the public through periodic application of water.

3. Special Conditions related to Refurbishment and Extension of Distribution System

105. The contractor should conduct pipe laying in a manner that has minimum impact on the health, safety and convenience of businesses, residences and users of the street area. This includes the following:

1. Minimize the period of time that a segment of excavation is kept open by not allowing trenching to outpace pipe-laying by more than a day or so. Trenches should be backfilled and ground leveled after installation of piping.

2. Place only bedding and pipe materials at the location that will be used within the next few days work, well out of the line of traffic. Clean up and remove from the site any excess spoil, wood used for shoring and construction materials upon completion of the segment. Compact soil in trench and clean surrounding pavement areas to reduce blowing dust.

3. Provide temporary bridging across the trench at entries to residences and businesses. Otherwise, provide tape barriers to reduce the possibility of an accident.

4. Once work is complete on a segment, pavement surfaces and masonry works (curbs, abutments, stairs, drains, drives, etc.) should be repaired and returned to original condition.

4. Disinfection of Installed Water pipe

106. Newly constructed or repaired water mains, tanks and reservoirs contain pollutants that accumulate during construction. These units can be disinfected through chlorination. Initial chlorine concentrations are made high enough (about 50 mg/L) to overcome the chlorine demand of contaminants. Chlorination is repeated until residual chlorine is one mg/L, after which the structure is flushed out before being placed into use. Installation contracts should include a bid item for disinfection of installed piping.

107. Line flushing may generate large quantities of water, with minor impact on nearby homes and businesses. Water flushed from lines should be routed to a drain of sufficient size to handle the flow. Water should not be allowed to pond around homes, businesses and in roadways. Excess residual material, if flushed from lines, should be removed and disposed of properly.

C. Operations and Maintenance

108. Since the provision of safe water and sanitation is an environmental benefit, compromising it through poor operation and maintenance is an impact on public health and the social environment. Tube well pumps may fail and suction screens clog through poor maintenance. Areas around tube wells may become waterlogged and introduce contamination in the borehole. Storage tanks can develop algae growth if water is not chlorinated. Treatment systems of any sort require continuous operation and maintenance in order to function properly. Water treatment byproducts in the form of sludge and backwash present their own impacts on the environment if not properly disposed of. Water off-take points, whether for community or individual household use, can cease to function properly, causing water losses and contributing to unsanitary conditions. Latrines of any sort will cease to be used if not properly maintained.

109. Introduction of an administrative system for management of the water and sanitation sector at the municipal level provides the necessary foundation for good operation and maintenance. In addition to a basic accounting system for tracking revenues and expenditures and for retaining civil service personnel to attend to administration and operations, pricing of water, cost recovery and attention to reduction of unaccounted for water and unpaid billings, improves the likelihood that the system will be self-sustaining over the long term.

110. The Government's National Urban Sector Policy (NUSP) calls for improving the operation of urban services and cost recovery. Establishing public-private partnerships also is a foundational policy for the sub-sector of environment under NUSP as well as other key sub-sectors. CRDP Criteria include generation of revenue to cover O&M and development expenditure, a commitment to maintenance of basic infrastructure services, and recruitment and retention of qualified staff. Hence the project-related reforms coincide well with current thinking on urban governance policy. There is still the practical question of achieving these goals. Implementation of this subproject and subsequent subprojects in the water supply and sanitation sector should be contingent on implementing the necessary revisions in local practice that will assure proper operations and maintenance over the long term. The Local Government Unit should establish an administrative system, including an office, personnel and facilities for operation, maintenance and cost recovery as a precondition for funding of the subproject in water supply and sanitation. As an alternative, a private operator for the system may be retained through public tender under specific terms and following specific rules following guidance by the loan consultant.

111. Operation and maintenance should assure that wells are maintained in an operable state; pumps are regularly serviced and well screens are cleaned; drinking water quality is acceptable through periodic testing; a chlorine residual is maintained in the system and periodically monitored; system losses are minimized through inspection and repair; treatment systems are maintained in good condition and kept clean; water treatment sludge, filter backwash and tank cleanings are disposed of properly through dewatering and final disposal at an approved location in keeping with the detailed design recommendations; and latrines are kept clean and functional, and water sources nearby community toilets are in good working order. Some or all of these operational measures will be adopted by the operator of the system.

D. Installation of Septic Tanks

112. Pour flush toilets and septic tanks will be installed and connected to public drains. The work will be conducted mainly on private property with the prior consent and at the request of the house owner. Construction impacts are caused by transport of materials to the site and disposal of excess dirt from septic tank excavations; damage to private property; breakage of street curb-lines, and excavation at the edge of roadways. An impact occurs during the operations period, with discharge of primary treated sanitary waste to drains that then discharge to natural surface waters (rivers, streams and lakes), with an impact on water quality.

113. A contract may be arranged for connection of septic tanks to drains, or materials may be provided for construction of tanks and soakaways, with local supervisory assistance to homeowners in installation. In either case, disposal of excess dirt from excavations should be onsite, or materials should be hauled to a designated disposal or fill area. Transport of materials to the site and the removal of excess dirt should be conducted in a way that minimizes blowing dust and spillage along roadways. Caution is needed to avoid damage to gardens and onsite infrastructure. Repairs should be made to sidewalks and curbs as soon as possible after completion of the tie in to the drain, and a bid item should be included in the contract documents for repair of sidewalks and curbs.

114. Septic tank effluent is primary treated wastewater with biochemical oxygen demand (BOD) on average of 100-150 mg-BOD/L and with the presence of various other substances (NH_3-N, phosphorus, and high counts of fecal coliform). Table 8 shows data compiled in the USA from various literature sources. Total nitrogen can be high, 41-49 mg-N/L in the table and as high as 100 mg/L. Insufficient data is available to estimate the quantity of effluent in any single drain. Nevertheless the potential impact on natural receiving waters of these discharges is significant.

115. Various means are noted in the literature for treatment of septic tank effluents, such as peat filters and underground capillary seepage soil bio-filtration systems. Installation of filters at large numbers of urban residences is not feasible. The adaptation being proposed on the present project is installation of constructed wetlands treatment systems at the downstream end of drainage outfalls. Constructed wetlands (CW) simulate natural wastewater treatment systems, using flow beds to support water-loving plants. CW is a passive treatment approach requiring little or no maintenance with the exception of removal of biomass (plant growth) and maintenance of flow paths that may become clogged over time. CW can also be an attractive natural setting where wildlife finds habitat and humans visit. CW consist of shallow basins with emergent and submergent wetland plants that tolerate saturated soil and aerobic conditions. Water flows in one end of the basin, moves slowly through, and is released at the other end. These systems provide habitat and public access. CW is uniquely adapted to smaller communities with limited funds located in tropical environments.

116. Factors that may affect application include the availability of land, quantity of flow and accommodating surge, or peak flow, in the hydraulic design. Communities that are able to reserve land for CW will find these systems capable of attenuating the effects of urban pollution during the early stages of community growth. Later, as the capacity of the CW system is exceeded, the land may be converted for use in a more intensive waste treatment approach.

Table 8: Septic Tank Effluent Composition Quoted in the Literature

Average of Septic Tank Effluent Data						
		*1	*2	*3	*4	*5
BOD	mg/L			129-147	140	110
TSS	mg/L			44-54	75	53
VSS	mg/L			32-39		44
Organic Nitrogen	mg/L		7			11.9
NH3-N	mg/L	38		28-34		24.9
NO2-N	mg/L		<.05			0.025
NO3-N	mg/L	<.5	0	<0.1-0.9		0.25
Organic Phosphorus	mg/L					3.1
PO4-P	mg/L			10-12		15.7
Total coliform	col/100 ml					44.6×10^6
Fecal coliform	col/100 ml					$.42 \times 10^6$
TKN	mg/L	44				
Total Phosphorus	mg/L	7		12	15	
COD	mg/L	384		310-344	300	
NH4-N	mg/L	38	25			
Total Nitrogen	mg/L		32	41-49	40	
pH	mg/L		7			
BOD Filtered	mg/L			100-118		

E. Construction of Street Drains

117. Additional street drains will be constructed in Gazipur and Ashulia. Construction impacts identified previously for installation of water distribution piping may also occur during the installation of drainage piping, open roadside drains, and culverts. Mitigation measures include minimizing the time excavations remain open; avoid obstructing traffic, pedestrian movement, and access to homes and businesses; reduce noise and dust by prescribed means; provide camps, facilities and services for workers; and practice safety in the workplace.

118. Impact during operations occurs if drainage increases pollution load to receiving waters. Drains receive urban run-off, solid waste and septic tank overflow, and may contain high BOD, a measure of oxygen demand, rendering receiving waters unfit for support of aquatic life. Dry weather flows – often on the order of 50-60 mg-BOD/L – may exceed national discharge standards. Installation of low-maintenance constructed wetlands as described in the previous section constitutes a low-cost and appropriate measure for control of urban pollution. These are shallow ponds containing aquatic plants that convert organic nutrients to cellulose. Inlets should be designed so that wet weather flows can bypass the ponds.

F. Land Acquisition and Resettlement Impacts

119. At Gazipur the water distribution network is proposed within the available right of way (ROW). Acquisition of private land will be required for siting some of the production tube wells and the community public toilets, and will be undertaken in accordance with the provisions of the Resettlement Framework for the project.

120. At Ashulia, according to preliminary estimates, a total of 11 households are affected by the subproject. The five proposed production tube wells will be constructed on private land amounting to 182 square meters (sqm) and affecting five households with 11 fruit bearing mango trees. There are no buildings/structures affected. A total of six hawkers and squatters will also be affected and the impacts are limited to temporary

economic displacement and relocation. Of the 11 affected households, five are considered vulnerable as they earn incomes below the poverty line. The five vulnerable households are hawkers. The resettlement cost estimate includes eligible compensation, resettlement assistance, as outlined in the entitlement matrix, and support cost for Resettlement Plan implementation. Further refinement is possible once final locations for wells have been determined. The land acquisition and resettlement impacts for the subprojects are being addressed through a Resettlement Plan prepared in line with the provisions of the Resettlement Framework for the project.

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Process of Consultation

1. Gazipur

121. During Project preparation, consultations have been held with the officials / elected representatives of the Gazipur administration, apart from the communities in the subproject locations. The issues covered during these consultations included selection of subprojects and identification of key issues including addressing the current gaps in provision of basic services and improvement of urban environment conditions in the Gazipur urban area. These consultations (Table 9) provided inputs in identification of the felt needs of the communities, and the relevant stakeholders. Figure 5 shows photos of consultations undertaken.

Figure 5: Consultation with Officials and Communities at Gazipur

Consultation with officials

Consultation with communities

Table 9: Summary of Stakeholder Consultations at Gazipur

Sl. No.	Place	Date	Number of Participants	Participants	Issues Discussed	Incorporation into IEEs and Project Design
A	Gazipur	12th May 2010	8	Executive engineer, CEO, acting Mayor of Gazipur Municipality, and other staff of Municipality	Assessment of the environment safeguard Capacities of the Municipality understanding of the externally funded projects implemented till date, key issues pertaining to environmental management, including clearances for sitting of industrial units within the Municipality.	Capacity building program, for training on environmental aspects to the Municipal Engineers, as part of the project. Training on environmental impacts of industrial units.
B	Gazipur	22nd June 2010	20	Mayor, CEO, Executive engineer, elected representatives, staff of Municipality	Discussion and finalization of the subproject components. Sitting of the project components to avoid impacts on land acquisition. Need for management of pollution from industrial clusters, better sanitation facilities for the residents.	Joint site visits with the elected representatives to identify lands which result in minimum land acquisition impacts. There are interventions (ongoing) with support from Donor agencies as IFC and the World Bank, towards improvement of the pollution control and management of industrial clusters in Greater Dhaka
C	Gazipur	21st June 2010	15	Elected representatives and communities, at locations of distribution networks, locations of production tubewells and community toilets	Sitting of the project components to avoid impacts on land acquisition and clearance of trees etc. There was no objection to the construction activities that may occur when the water network is laid, as these would be temporary and would result in long term benefits to the city residents.	Site visits undertaken, and consultations with owners of the land parcels where the production tubewells, toilets are proposed to be sited. Assets on land, including structures, trees evaluated, and compensation provided for in the resettlement plan for the subproject.

CEO = chief executive officer, IEE = initial environmental examination, IFC = International Finance Corporation. The project is proposed to be implemented in the industrial areas administrated by DCC, Dhaka District, Gazipur District, and Narayanganj District. Given the institutional and governance constraints in Bangladesh, effectively tackling industrial pollution in the Dhaka watershed requires a pragmatic approach, which offers a combination of rewards and penalties that will encourage industries to adopt pollution prevention and abatement practices. Waste water pre-treatment and optimization initiatives are an important first step and significant investments in pollution abatement infrastructure are required. The proposed Dhaka—Water and Environment project (funded by World Bank) is designed to demonstrate (i) the business and environmental advantages of cleaner production, and (ii) a financially and technically sustainable model of central effluent treatment facilities in the greater Dhaka watershed. It will help to develop further capacity of the DOE in monitoring and enforcing pollution control. The project will have four components: (i) Monitoring and Environmental Compliance; (ii) Industry Pollution Prevention and Abatement Demonstration Program; (iii) CETP Design, Construction and Operationalization; and (iv) Program Management, Monitoring and Evaluation and Stakeholder Engagement.

2. Ashulia

122. A similar procedure of consultation was followed at Ashulia that led to a series of meetings (Table 10) and resolution of various aspects of the subproject design as it has developed at Ashulia.

B. Plan for Continued Public Consultation

123. Various provisions are proposed to ensure continued public participation and stakeholder participation into latter stages of the project. This participatory process will ensure that all views of the people are adequately reviewed and suitably incorporated in the design and implementation process. Further, to ensure an effective disclosure of the project proposals to the stakeholders and the communities in the vicinity of the subproject locations, an extensive project awareness campaigns will be carried out.

124. The PMCU will disclose the IEE on its Project website, including any corrective action plans prepared during project implementation and environmental monitoring reports.

125. For the benefit of the community a summary of the IEE will be translated in Bangla and made available at: (i) the Project Management Coordinating Unit (PMCU); and (ii) Office of the Local Government Unit. Hard copies of the IEE will be available in the PMCU/PIU, and accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. On demand, the person seeking information can obtain a hard copy of the complete IEE document at the cost of photocopy from the office of the PMCU/PIU, on a written request and payment for the same to the Project Director. Electronic version of the IEE will be placed in the official website of the LGED.

Table -10: Consultations with Stakeholders at Ashulia, Savar

Sl. No.	Place	Date	Number of Participants	Participants	Issues Discussed	Incorporation into IEEs and Project Design
A	Savar Upazila	May 10, 2010	6	Officials of Savar Upazilla, and Chief Executive officer	Finalization of project components, environment and social safeguard requirements. Assessment of the environment safeguard capacities of the Upazila, understanding of the projects implemented till date, key issues pertaining to environmental management, including clearances for siting of industrial units	Capacity building program, for training on environmental aspects to the engineers, as part of the project, Training on environmental impacts of industrial units.
B	Sreepur	May 10, 2010	10	Communities along the road side	Need for improvement of the drainage conditions. Every year the roads are subject to water logging, due to movement of heavy commercial vehicles. Dust due to the operation of vehicles in the night.	Provisions for roadside drainage included in the design of the priority road stretches to be taken up in the project Provision of hard shoulders and widening of the existing carriageway shall minimize the dust impacts to the adjoining residents, after the improvement of the road stretches. IEE shall include measures to address environmental impacts during construction.
C	Ashulia	June 21, 2010	15	Officials of Savar Upazilla, Ashulia Union Parishad, elected representatives/ councillors, Officials of DPHE, LGED	Discussion on project components. Siting of the project components to avoid impacts on land acquisition and clearance of trees etc, Need for management of pollution from industrial clusters, better sanitation facilities for the residents.	Joint site visits with the elected representatives have been undertaken and potential lands for the production tube wells site have been identified. Concerned officials (DPHE/LGED) have been advised to take advance action on negotiation with land owners and initiate further consultation for smooth acquisition of the required land. Given that CRDP uses a sector approach, there is a potential of inclusion of subprojects pertaining to management of pollution and sanitation facilities in the subsequent phases of the project.

CRDP = City Region Development Project, DPHE = Department of Public Health Engineering, IEE = initial environmental examination, LGED = Local Government Engineering Department.

VIII. GRIEVANCE REDRESS MECHANISM

126. A grievance redress mechanism will be established in Gazipur and Ashulia soon after subprojects commence construction. The first level and most accessible and immediate venue for resolving grievances is the PIU, through the resettlement support staff (RSS) and Project Manager, with assistance from the Resettlement Specialist (National and International-NRS and IRS) of the Management, Design and Supervision Consultant (MDSC). The contact phone number will be posted in the project areas. Grievances will be resolved through continuous interactions with affected persons and the PIU will answer queries and resolve grievances regarding various issues including land acquisition, structures acquisition, livelihood impacts, entitlements, and environmental impacts that affect individuals and groups. Corrective measures will be undertaken at the field-level itself within seven days. All grievances will be documented with full information of the person and issue.

127. Should the grievance remain unresolved, the PIU's Project Manager, will activate the second level of the Grievance Redress Mechanism (GRM) by referring the issue (with written documentation) to the local Grievance Redress Committee (GRC) of the Local Government Unit, who will, based on review of the grievance, address them in consultation with the RSS of the PIU and PMCU, and affected persons. A hearing will be called, if necessary, where the affected person can present his/her concern/issues. The process will promote conflict resolution through mediation. The local GRC will consist of the following persons: (i) Chief Executive Officer of the Local Government Unit (GRC Chair); (ii) representative of the head of the Local Government Unit; (iii) representative of the affected persons; (iv) official of the land registry department; (v) official of the DOE's divisional office; (vi) town planner of the Local Government Unit; and (vii) Environmental Specialist/RSS of the PIU. The local GRC shall meet twice a month, unless the Project Director informs that there are no grievances to address, or they shall meet as needed as per the severity of the grievance. The local GRC will suggest corrective measures at the field level and assign responsibilities for implementing its decisions.

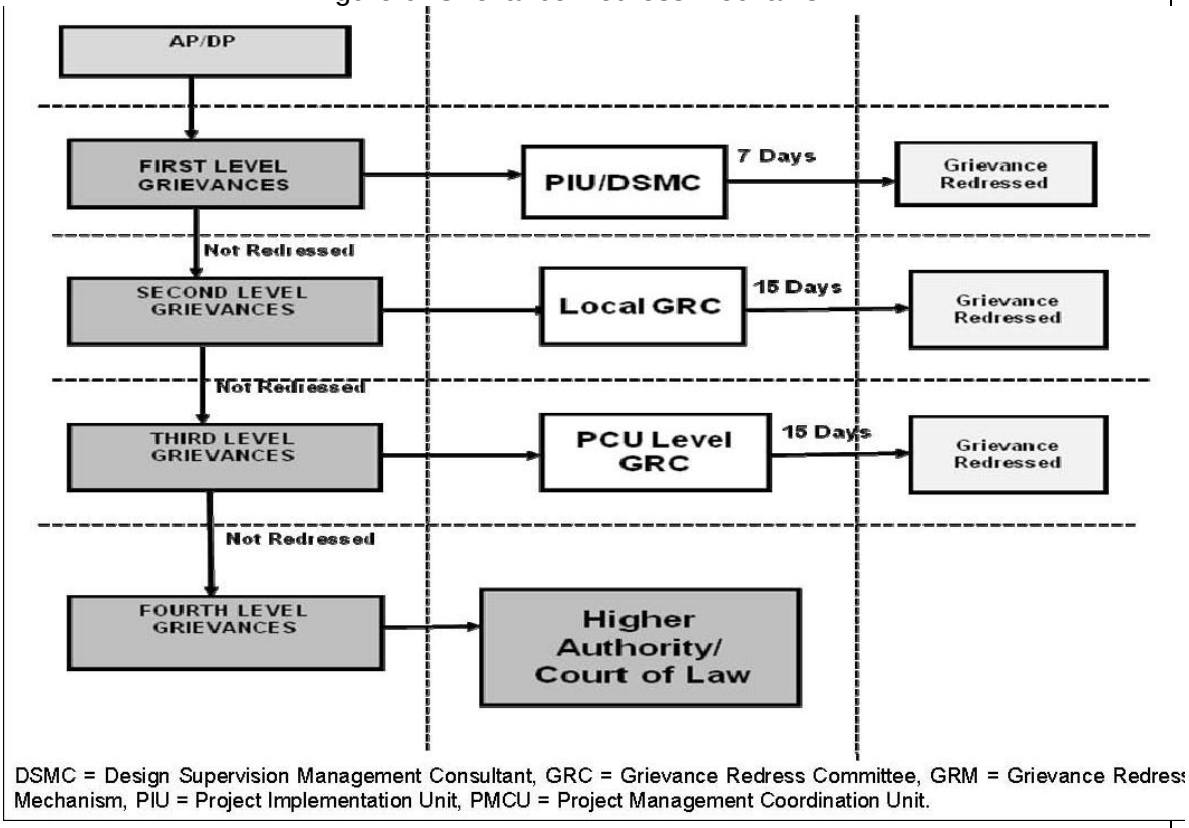
128. The functions of the local GRC are as follows: (i) provide support to displaced persons on problems arising from land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) record grievances of displaced persons, and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

129. Should the grievance still remain unresolved, the PIU Project Manager, will activate the third level of the GRM by informing the PMCU Project Director who will, based on review of the local GRC minutes and consultation with the PIU Project Manager, activate the PMCU level GRC. This committee shall comprise the following representatives:(i) Project Director PMCU, (ii) Environmental/Resettlement Officer of the PMCU; (iii) representative from Land Ministry, (iv) representative from DOE; (v) representative of the displaced persons; and (vi) Safeguards officer of the PIU.

130. The GRC at the PMCU level shall meet based on the receipt of grievances, and the meeting shall be convened within 7 days of receipt of the grievance by the PMCU, and grievances redressed with 15 days. The Environmental / Resettlement Safeguards Officer of the PMCU will be responsible for processing and placing all papers before the PMCU GRC, recording decisions, issuing minutes of the meetings and taking follow up action to see that formal orders are issued and the decisions carried out.

131. In the event that a grievance is not addressed by the PIU, local GRC, or the PMCU GRC, the displaced person can seek legal redress of the grievance in the appropriate Courts (the fourth level of the GRM). A grievance redress mechanism and procedure is depicted in Figure 6.

Figure 6: Grievance Redress Mechanism



DSMC = Design Supervision Management Consultant, GRC = Grievance Redress Committee, GRM = Grievance Redress Mechanism, PIU = Project Implementation Unit, PMCU = Project Management Coordination Unit.

IX. ENVIRONMENTAL MANAGEMENT PLAN

132. The IEE for this package has been prepared in accordance with ADB Safeguard Policy Statement's requirements for environment category B projects and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subproject. The complete IEE can be downloaded from < http://www.lged.gov.bd/ProjectLibrary.aspx?projectID=237>.

133. The environmental management plan (EMP) describes the proposed mitigation measures in relation to potential impacts, and the means for assuring their implementation via monitoring. Institutional arrangements and costs related to mitigation and monitoring are described.

A. Summary of Environmental Impacts and Mitigation Measures

134. Table 11 provides the potential environmental impacts and the mitigation measures including the responsibilities for implementing the same.

Table 11: Potential Environmental Impacts and Mitigation Measures[2]

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	Cost or source of Funds
Planning, Location and Design						
Lack of sufficient planning to assure functionality of the system and distribution of benefits among the poor population of the urban area	S1	P	Assure components of the system are properly integrated into an overall expansion plan and that the poor community benefits from the increase in water supply and sanitation facilities and services	MDSC, PMCU	Hd.qtr	MDSC Contract
Lack of consideration for sustained yield leads to depletion of the aquifer and saline water intrusion	S1	P	As part of master planning a qualified groundwater hydrologist should evaluate sustained yield and provide an opinion on whether depletion and/or saline intrusion might occur under the proposed extraction regime.	MDSC, PMCU	Hd.qtr	MDSC Contract
Lack of sufficient planning fails to schedule construction to allow works to occur in the proper sequence and minimize disturbance/cost	S2	T	Plan the sequence of construction so that roads and easements can be disturbed the least, resurfacing occur only once, and inconvenience to the public minimized	MDSC, PMCU	Hd.qtr	MDSC Contract/ Construction Contract
Presence of arsenic, barium and manganese cause water from deep wells to be unsafe, or require further treatment	S1	P	Sampling and analysis protocol is required prior to well installation to determine treatment needs and assure that well water will be safe for use	MDSC, PMCU	Well sites	MDSC Contract
Detailed design fails to incorporate good engineering design practice causing high overhead costs for operation and maintenance	S2	P	Hydraulic analysis, design of proposed water treatment facilities, consideration for disposal of water treatment plant sludge, water points near community latrines.	MDSC, PMCU	Hd.qtr	MDSC Contract
Construction						
Impact on air quality and noise levels due to construction activity	S2	T	Use of labor intensive methods and reduced use of heavy equipment. Construction during daylight hours only. Application of water to suppress dust where needed. Prompt removal of spoil materials	Contractor	All activities	Included in unit prices for construction
Congestion in rights-of-way, blockage of access to homes, buildings and commercial establishments, failure to backfill trenches and reseal roadway surfaces after trenching and laying	S2	T	Prompt initiation and completion of work. Provision of means to bypass construction where necessary by bridging trenches and providing pathways. Specific clauses in tender documents to backfill trenches and reseal roadways promptly.	Contractor	Water distribution	Included in unit prices for construction
Quarters for workers in the proximity of worksites, and equipment/material yards	S3	T	Contractor to provide workers quarters, equipment yard or onsite repair facility as per needs of project	Contractor	All activities	Overall construction cost
Excavation produces spoil materials that block roadways and public spaces	S3	T	Disposal of spoil material at a location agreed to by the PIU and the property owner. Use of tarpaulins to cover dry soil during transport	Contractor	All activities	Overall construction cost
Sand used to backfill trenches creates a dust hazard and impedes traffic	S3	T	Assure sand is stored outside trafficked areas. Cover and/or suppress dust with water. Remove excess materials to remote disposal.	Contractor	Water distribution	Overall construction cost

[2] Sig = Significance of Impact (S3 = Not Significant, negligible impacts; S2 = Moderate, reversible impacts which are site specific and simple to contain and mitigate; S1 = Significant, potentially irreversible impacts requiring complex mitigation).). Dur = Duration of Impact (T = Temporary; P = Permanent). MDSC = Management, Design and Supervision Consultant, PMCU = Project Management Coordination Unit

Trenching nearby buildings, walls and existing buried piping damages these structures	S2	P	Avoid trenching in these locations. If mandatory, provide shoring and backfill with sand/cement admixture to assure no subsidence occurs.	Contractor	Water distribution	Overall construction cost
Traffic and human movement may be disrupted by trucks carrying waste soil	S3	T	Plan routes to avoid congested areas and narrow roads. Schedule transportation to avoid peak traffic periods	Contractor	All activities	Overall construction cost
Damage to archaeological and historical monuments	S2	P	Local authorities to identify archaeological and historical sites prior to commencement of work; select alternative locations for infrastructure and for movement of goods and materials; contractor to avoid damage to sites. For objects discovered during excavation, stop construction on discovery of objects of archeological origin; and notify the PIU, who will contact the Department of Archaeology, Ministry of Cultural Affairs to investigate and, if desirable, undertake recovery.	MDSC	All activities	Overall construction cost
Social/cultural sites (schools, mosques, hospitals, temples, tourism sites) may be disturbed by noise, dust, vibration and impeded access	S2	T	Increase work force to complete construction quickly in affected areas. Practice good housekeeping to minimize dust / avoid obstruction in the paths of travel of pedestrians and vehicles	Contractor	All activities	Overall construction cost
Potential for benefit from employment for local people	S2	T	Contractor should be required to employ locals in labor force as specified in construction contract tender documents	MDSC	Hdqtr	Overall construction cost
Trees may be removed along pipeline routes	S2	P	Avoid removing trees wherever possible.	Contractor	Water distribution	Overall construction cost
Some land may need to be acquired where route of distribution piping diverges from public R.O.W.	S2	P	Acquire/Purchase land as described in Resettlement Framework	PMCU	Water distribution	Cost specified in resettlement plan
Inconvenience and health risk if existing water supply system is shut down for long period	S2	T	Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in 3 days in advance and advise to store water as necessary.	Contractor	Water distribution	Overall construction cost
Potential for accident and injury for construction workers and public in zone of construction	S2	T	Contractor to implement a safety and health plan for workers. Workers are required to wear personal protective gear suitable to the type of work being performed. Workers are trained in safe work procedures. Contractor maintains a record of accidents that are reported to the supervising engineer. Public is barred from construction areas and excavations are barricaded.	Contractor	All activities	Overall construction cost
Operation and Maintenance						
Well pumps may fail and suction screens clog due to poor maintenance	S2	P	Wells maintained in an operable state; pumps are regularly serviced and well screens are cleaned	Local Government Unit/ LGED EE Office	Well locations	Pourashava water supply operations cost
Treatment systems will not function properly without proper operation and maintenance	S2	P	Permanent qualified operators are hired, or operations are privatized.	Local Government Unit/ LGED EE Office	Local area	Pourashava water supply operations cost
System is not maintained and excess water losses occur	S2	P	Undertake program to reduce unaccounted for water. Record system flows and identify losses. Undertake repair of system	Local Government Unit/ LGED EE Office	Local area	Pourashava water supply operations cost

Latrines are not maintained and fall into disuse	S2	P	Provide personnel to maintain community latrines. Educate users on maintenance of household units.	Local Government Unit/ LGED EE Office	Local area	Pourashava operations cost
Septic tank sludge is not disposed of properly and affects surface water quality, spreads disease	S1	P	Provide for proper disposal of sludge. Maintain records. Limit access, control drainage and close cells in manner in keeping with risk.	Local Government Unit/ LGED EE Office	Disposal site	Pourashava operations cost

B. Institutional Arrangements for Project Implementation

135. LGED is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. LGED is assisted by a Project Steering Committee (PSC), to provide policy guidance and coordination across all towns and subprojects. LGED will establish a Project Management Coordination Unit (PMCU) to manage all aspects of loan project implementation, coordinate construction of subprojects across all towns, and ensure consistency of approach and performance. An Environmental and Social Officer (ESO) appointed to coordinate social and environmental issues. Environmental review of projects and monitoring implementation of mitigation measures are primary functions of the ESO within the PMCU.

136. The PMCU is assisted by Design and Supervision Consultants (DSC) who will assist in overall project implementation, assist in preparation of master plans for infrastructure, design infrastructure improvements, and assist in the management of contract tenders and supervision of construction. International and domestic Environmental Specialists are staffed within the DSC.

137. A Water supply master plan and detailed design for the system improvements both are being undertaken prior to the construction of the subproject. An IEE has been prepared by the Environmental Specialists assisting the DSC based on the IEEs undertaken during the PPTA, and has incorporated new information available at the time of the detailed design.

138. Project Implementation Units (PIUs) will be established in the local government units. The PIUs will be assisted by consultants from the DSC as necessary. An Environmental Officer will be appointed within each PIU, to incorporate environmental components into master planning at the local level, initiate environmental review and monitor mitigation measures during construction and operation. Environmental specialists assisting the DSC will provide capacity building, training and other forms of support to environmental staff of the PIU.

139. Environmental Specialists within the PSC will assist the PMCU and PIUs to ensure that all subprojects comply with environmental safeguards and the Environmental Monitoring Plan contained in the IEE. The PIU will hire Construction Contractors (CC) to build elements of the infrastructure. Special conditions of contract (Appendix 2) are included in the procurement documents to assure compliance by the CC. Inspection of progress in construction will be undertaken locally by the PIU, supported by the PMCU and DSC. Monitoring of mitigation measures is done primarily by the PIU Environmental Officer supported by environmental specialists in the PMCU.

140. During implementation the contractor will submit monthly progress reports to the PIUs, which includes a section on EMP implementation. The PIUs will submit reports to the PMCU for review. The PMCU will review progress reports to ensure that the all mitigation measures are properly implemented. The PMCU will consolidate monthly reports and submit quarterly reports to ADB for review.

C. Environmental Monitoring Plan

141. Mitigation activities fall into three stages: pre-construction (location, planning and design), construction and operations. Mitigation of pre-construction impacts are the responsibility of the PMCU and DSC working with the PIUs to prepare the subproject according to good engineering practice. Mitigation of impacts during construction is the responsibility of the Construction Contractors (CC), which will be monitored by the PIUs. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed (prepared by the DSC during the detailed design stage), so they will be legally required to take the necessary action.

142. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. This will be conducted by the Environmental Officer within the PIU supported by the PMCU Environmental Coordinator and the Environmental Specialists on the DSC Team. The Environmental Officer will be responsible for monitoring implementation of mitigation measures and reporting to the PMCU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. Post-construction monitoring will be conducted by the Local Government Unit.

143. Most of the mitigation measures undertaken during construction are meant to minimize disturbance from the construction in urban areas by maintaining access, planning work to avoid sensitive times and reducing dust and noise pollution. Experienced Contractors should be familiar with the requirements. Monitoring of such measures normally involves making observations in the course of site visits, although some require review of records and surveys of residents.

144. Table 12 shows the proposed Environmental Monitoring Plan (EMP) for these subprojects, which specifies the various monitoring activities to be conducted during all phases. The table describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring). It does not show specific parameters to be measured because as indicated above, most measures will be checked by simple observation, by checking of records, or by interviews with residents or workers.

145. DPHE should conduct monitoring during the operational period to confirm the long-term benefits of the scheme. Table 5 shows that this will cover two elements, monitoring chemical and bacteriological quality of water provided by the system; and monitoring health of the population and the prevalence of disease due to poor sanitation.

146. It is necessary to monitor the quality of water supply sources prior to development of new wells. Monitoring water quality at well points is advised in the early stages of well development. Monitoring chlorine residual at the point of supply to consumers is also recommended. Water quality monitoring will be conducted at various intervals depending on the need for information derived from the efforts. Monitoring should be done to establish an initial baseline in order to understand the particular problems related to water quality at the source.

D. Monitoring and Reporting

147. Monitoring of mitigation measures during construction is the responsibility of the PIU Environmental Management Officer, supported by the PMCU Environmental Specialists. The monitoring system involves a Monitoring Checklist, which reflects the requirements of the EMP and Special Conditions. The checklist will be filled in quarterly by the PIU, and consists of three sections:

a. A section to be completed one-time-only during the period when the design is being finalized, the project tendered, and construction activities started. This section provides monitoring of four performance indicators: Design and Preparations, Worker Provisions, Gender Equity and Community Based Monitoring. The section also contains information regarding public consultation and follow-up.

b. A section to be completed quarterly during the construction period. This section provides monitoring of two performance indicators: Community

Values and Safety, and Hydrology/Water Pollution. This section will be completed for each period quarter of the construction duration.

c. A section to be completed one-time-only during the period when construction work is nearing completion. This section provides monitoring of Project Completion indicators of performance.

148. Monitoring also requires quarterly performance tracking, which involves:

a. Performance Follow-up, where performance shortfalls noted in prior monitoring are listed and checked against current monitoring results.

b. Community Complaints, where issues raised by the affected community are registered, tracked and outcomes recorded.

c. Performance Indicator Results, where environmental performance against indicators are recorded.

149. Analysis and reporting as done by the PIU involve gathering data from quarterly monitoring and submitting results to the PMCU. The ES will analyze the data and compile results for the contracts active during the quarter. Both quarterly and semi-annual summaries of results will be submitted to the ADB.

E. Environmental Management and Monitoring Costs

150. Costs associated with environmental mitigation and monitoring are included in the running costs for various phases of the subproject. Costs related to location and design factors are part of the overall planning and design costs associated with retaining the design and supervision consultant. The costs associated with mitigating construction stage impacts are factored into the contractor's unit cost bid for items in the bill of quantities; monitoring construction stage mitigation measures is the job of PIUs supported by the environmental specialists, and has no additional costs associated with the responsibility. Mitigation measures undertaken during operation, while perhaps incurring an additional cost, are considered herein to be part of the local government unit's normal operating expense, since these costs pertain directly to maintenance of the facility during the operations period. Costs of acquiring land and other forms of compensation are calculated separately in the budgets for the Resettlement Framework.

F. Grievance Redress Mechanism

151. The Grievance Redress Mechanism, as described in Sec. VIII, involves a three tiered process for registering and resolving complaints raised by project affected persons through intervention by the PIU (first level), the local Grievance Redress Committee (second level) of the LGU, or the PMCU (third level). The construction contractor has a role to deliberate along with the PIU and representatives of the PMCU (through the DSCM) solutions to complaints raised by individuals and groups, and to act promptly (within a period appropriate to the nature of the complaint) on executing agreed upon solutions to specific problems, then reporting back to both the PIU and the affected party on solutions undertaken by the contractor. The GRM serves dual functions to register complaints related to both environmental impacts and resettlement and compensation. The contractor will post notices announcing the grievance redress mechanism in local government offices (the City Corporation office) and in strategic places of the subproject's area of influence.

Table 12: Environmental Monitoring Plan

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsibility for Monitoring
Planning, Location and Design					
Assure components of the system are properly integrated into an overall expansion plan. Assure there are benefits for the poor community from the increase in water supply and sanitation facilities and services	Hdqtr	DSC, LGED	Critical evaluation of design outputs	Continuous	Project Director
Retain a trained groundwater hydrologist to evaluate sustained yield and provide an opinion on depletion and the potential for saline intrusion.	Hdqtr	DSC, LGED	Critical evaluation of opinion	Before plan approval	Project Director
As part of master planning a qualified groundwater hydrologist should evaluate sustained yield and provide an opinion on whether depletion and/or saline intrusion might occur under the proposed extraction regime	Hdqtr	DSC, LGED	Critical evaluation of opinion	Before plan approval	Project Director
Plan the sequence of construction so that roads and easements can be disturbed the least, resurfacing occur only once, and inconvenience to the public minimized	Hdqtr	DSC, LGED	Critical evaluation of tender and construction pre-planning	Prior to tender award	Project Director
Plan the sequence of construction so that roads and easements can be disturbed the least, resurfacing occur only once, and inconvenience to the public minimized	Wellsites	DSC, LGED	Review of analytical outputs for completeness and accuracy	In keeping with anal. schedule	Project Director
Incorporate good engineering practice into design	Hdqtr	DSC, LGED	Review of design outputs	Before design approval	Project Director
CONSTRUCTION					
Use of labor intensive methods and reduced use of heavy equipment. Construction during daylight hours only. Application of water to suppress dust where needed. Prompt removal of spoil materials	All sites	Contractor	Site visits; CC records	Monthly	PIU
Prompt initiation and completion of work. Provision of means to bypass construction where necessary by bridging trenches and providing pathways. Specific clauses in tender documents to backfill trenches and reseal roadways promptly.	All sites	Contractor	Site visits	Weekly	PIU
Contractor to provide workers quarters, equipment yard or onsite repair facility as per needs of project	All sites	Contractor	Observations on and off site	Weekly	PIU
Disposal of spoil material at a location agreed to by the PIU and the property owner. Use of tarpaulins to cover dry soil during transport	Inhabited areas	Contractor	Site visits	Weekly	PIU
Assure sand is stored outside trafficked areas. Cover and/or suppress dust with water. Remove excess materials to remote disposal.	Inhabited areas	Contractor	Site visits; CC records	Weekly	PIU
Avoid trenching in these locations. If mandatory, provide shoring and backfill with sand/cement admixture to assure no subsidence occurs.	All sites	Contractor	Observations off site; CC record	Weekly	PIU
Plan routes to avoid congested areas and narrow roads. Schedule transportation to avoid peak traffic periods	All sites	Contractor	Observations on and off site	Weekly	PIU
Acquire/Purchase land as described in Resettlement Framework	Where required	LGED	Landowner surveys; LGED record	As needed	PIU
Compensate businesses for lost income	Where required	LGED	Shopkeeper survey; LGED record	As needed	PIU

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsibility for Monitoring
Provide bridging for people / vehicles to cross trench work	Distribution	Contractor	Site visit; resident survey	Weekly	PIU
Increase work force to complete construction quickly in affected areas. Practice good housekeeping to minimize dust / avoid obstruction in the paths of travel of pedestrians and vehicles	Distribution	Contractor	Site visits; CC records	Monthly	PIU
Inform shopkeepers and residents of work in advance	Distribution	LGED	Resident surveys; CC records	Monthly	PIU
Consult town authority and avoid existing infrastructure	All sites	DSC	Site visit; design reports	Monthly	PIU
Plan work with town authorities – work when traffic is light	Distribution	Contractor	Site visits; CC records	Monthly	PIU
Provide flagmen and traffic diversions when necessary	Distribution	Contractor	Site visits; CC records	Monthly	PIU
Local authorities to identify archaeological and historical sites prior to commencement of work; select alternative locations for infrastructure and for movement of goods and materials; contractor to avoid damage to sites. For objects discovered during excavation, stop construction on discovery of objects of archeological origin; and notify the PIU, who will contact the Department of Archaeology, Ministry of Cultural Affairs to investigate and, if desirable, undertake recovery.	All sites	DSC	DSC records; design reports	As needed	PIU
Avoid removing trees wherever possible	All sites	Contractor	Site visits;	As needed	PIU
Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in 3 days in advance and advise to store water as necessary.	All sites	DSC	Design reports; resident surveys	Monthly	PIU
Provide alternative water to affected residents	All sites	LGED	Site visit; resident survey	Weekly	PIU
Prepare and implement a site H&S Plan (safety of workers/public)	All sites	Contractor	Site visits; CC records	Monthly	PIU
Exclude public from the site	All sites	Contractor	Site visits; CC records	Monthly	PIU
Ensure that workers wear Personal Protective Equipment	All sites	Contractor	Site visits; CC records	Monthly	PIU
Provide Health and Safety training for all personnel	All sites	Contractor	CC records; worker interviews	Monthly	PIU
Keep accident reports and records	All sites	Contractor	CC records	Monthly	PIU
Contractor should be required to employ locals in labor force as specified in construction contract tender documents	All sites	Contractor	CC records; worker interviews	Monthly	PIU
OPERATION AND MAINTENANCE					
Wells maintained in an operable state; pumps are regularly serviced and well screens are cleaned	Well sites	Local Government Unit	Local Government Unit Maintenance Records	Yearly	LGED (during period of loan)

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsibility for Monitoring
Permanent qualified operators are hired, or operations are privatized.	System	Local Government Unit	Administrative records	Quarterly	LGED (during period of loan)
Undertake program to reduce unaccounted for water. Record system flows and identify losses. Undertake repair of system	System	Local Government Unit	Local Government Unit Maintenance Records	Quarterly	LGED/GCC (during period of loan)
Provide personnel to maintain community latrines. Educate users on maintenance of household units.	Surrounding area	Local Government Unit	Local Government Unit Maintenance Records	Yearly	LGED/GCC (during period of loan)
Provide for proper disposal of sludge. Maintain records. Limit access, control drainage and close cells in manner in keeping with risk.	System	Local Government Unit	Local Government Unit Maintenance Records	Quarterly	LGED/GCC (during period of loan)

X. FINDINGS AND RECOMMENDATIONS

A. Findings

152. The Initial Environmental Examination for these Category B subprojects has proceeded through description of the proposed infrastructure works, description of the greater environment in which the infrastructure improvements will take place, and analysis of impacts due to location, planning and design; construction; and operations, with consideration for timing, scale and intensity of impact.

153. Water supply is an important infrastructure improvement for Gazipur and Ashulia. Analysis has shown that significant negative impacts are unlikely to occur due to improvement of their water supply facilities. The main impact is expected to be beneficial: the overall improvement of water supply infrastructure within the city area. The relative magnitude of this improvement is best assessed through post-project monitoring and evaluation, either by the Government or by ADB.

154. Recommendations have been made to improve the environmental performance of the subprojects. Many are concerned with pre-planning for the proposed water supply improvements, in order to identify actual improvements needed to existing systems. Environmental criteria for construction are recommended to mitigate construction impacts. Finally, recommendations are made for maintaining and operating the completed systems to be carried out by local government units.

155. Specific environmental impacts and their associated mitigation measures have been identified in the subproject IEE. Parties responsible for implementation of mitigation measures, and for monitoring implementation, have been identified and the general features of an institutional mechanism have been described. Those features include assignment of tasks and responsibilities for environmental review within the PMCU and PIUs, provision of staff to support the environmental function through the DSC Consultant, and a capacity building plan undertaken during loan implementation.

156. Public consultation is shown to be an integral feature of project preparation, and indeed the subproject originates among a broad cross-section of stakeholders; hence its acceptability is screened from the outset. In addition, public consultation has been conducted to make clear to the directly affected communities the potential social and environmental impacts as identified by the environmental and social reviews. A Public consultation was held in both Gazipur and Ashulia to review the subprojects that have been proposed for the area. The public consultations are documented in the subproject IEE. No significant issues were raised during the public consultation that have not been addressed in the IEE, nor were there issues that pose a significant constraint on implementation of the proposed subproject. A proposal has been described for continuing the process of public consultation during construction that includes a mechanism for redress of grievances that arise during the construction phase.

B. Recommendations

157. The primary means for environmental management is to enhance performance of the water supply system through good preliminary planning of the system, through mitigation of construction impacts by means of environmental requirements placed on the construction contractor, and through maintaining and operating the completed system to guarantee long term performance.

158. In the design period, key interventions include evaluation of sustained yield of the aquifer as part of the master plan formulation, sampling and analysis of existing well

points to identify water quality problems associated with arsenic, iron and barium and propose treatment methods as part of detailed design.

159. Mitigation measures to be undertaken during construction include special means for minimizing interference with access to residences and businesses, means for reducing dust and noise pollution in the local environment and along roadways and haul routes, means for reducing traffic congestion in the construction areas and on haul routes, provision of alternative services for water supply at times when the system needs to be shut down, and requirements for minimizing worker safety and health risk through use of protective gear and training. Care should be taken in shifting service from any abandoned asbestos cement (AC) pipelines to leave them undisturbed in the ground.

160. Mitigation measures for implementation during operations of the system include maintenance of the system, servicing of pumps and cleaning of well screens, and periodic testing of the water supply to assure good bacteriological quality and low concentration of inorganic compounds.

161. Mitigation measures to be undertaken alongside construction of sanitation facilities and installation of the wells include means for minimizing interference with residences and businesses, means for reducing dust and noise pollution in the local environment and along roadways and haul routes, means for reducing traffic congestion in the construction areas and haul routes, and requirements for minimizing worker safety and health risk through use of protective gear and training.

162. Mitigation measures for implementation during operation involve gaining public support for maintaining wells and sanitation facilities. Assigning ownership of wells to households will guarantee to an extent their maintenance. Privatizing the operation of public toilets will assure their maintenance.

XI. CONCLUSIONS

163. The environmental impacts of the proposed improvements in water supply and sanitation infrastructure for Gazipur City Corporation and Ashulia Urban Center have been assessed by the environmental review process reported in this document, conducted according to ADB guidelines. Issues related to involuntary resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the program.

164. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impact as a result of location, planning, design, construction and operation of the project. There are benefits stemming from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the project is in operation.

165. Further work on the IEE will be provided based on any comments or concerns from ADB or the DOE, pending their reviews. No additional work is required at this stage to comply with ADB procedure or national law.

Appendix 1 : REA Checklists

Capital Region Development Project (ADB Loan 2695-BAN)

Rapid Environmental Assessment (REA) Checklist for Screening of WATER SUPPLY AND SANITATION SUB - PROJECT

Subproject Title:	**Gazipur Water Supply and Sanitation Subproject**
Proposed Category:	**Environmental Category B**

	SCREENING QUESTIONS		Yes	No	REMARKS
A.	**Project Siting**				
Is the project area …….			☐	☐	
♦	Densely populated ?		■	☐	Typical urban population density for Bangladesh
♦	Heavy with development activities?		■	☐	Area is rapidly developing; hence need for additional water supply
♦	Passing through commercial area		■	☐	Distribution lines will be in mixed residential/commercial/industrial areas
♦	Adjacent to or within any environmentally sensitive area				
	●	Cultural heritage site	☐	■	
	●	Protected Area	☐	■	
	●	Wetland	■	☐	Low lying areas subject to seasonal flooding
	●	Mangrove	☐	■	
	●	Estuarine	☐	■	
	●	Buffer zone of protected area	☐	■	
	●	Special area for protecting biodiversity	☐	■	
	●	Bay	☐	■	
	●	Road and highways	■	☐	Distribution lines will be installed along existing right of ways
B.	**Potential Environmental Impacts**		☐	☐	
Will the Project cause ……..			☐	☐	
♦	pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		☐	■	
♦	impairment of historical/cultural monuments/areas and loss/damage to these sites?		☐	■	
♦	hazard of land subsidence caused by excessive ground water pumping?		■	☐	Accounted for in environmental review
♦	social conflicts arising from displacement of communities?		☐	■	
♦	conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		☐	■	
♦	unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents) ?		■	☐	Iron and barium may require removal
♦	delivery of unsafe water to distribution system?		■	☐	Chlorination required to maintain distribution system free of pathogens
♦	inadequate protection of intake works or wells, leading to pollution of water supply?		☐	■	
♦	over pumping of ground water, leading to salinization and ground subsidence?		■	☐	Accounted for in environmental review
♦	excessive algal growth in storage reservoir?		☐	■	
♦	increase in production of sewage beyond capabilities of community facilities?		■	☐	Sanitation and drainage included in loan
♦	inadequate disposal of sludge from water treatment plants?		☐	■	
♦	inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities ?		☐	■	
♦	impairments associated with transmission lines and access roads?		■	☐	Environmental specifications for construction reduces impact
♦	health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		☐	■	

♦	health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?	■	□	Capacity building of local government unit includes operational measures
♦	dislocation or involuntary resettlement of people	□	■	
♦	social conflicts between construction workers from other areas and community workers?	□	■	
♦	noise and dust from construction activities?	■	□	Environmental specifications for construction reduces impact
♦	increased road traffic due to interference of construction activities?	■	□	Environmental specifications for construction reduces impact
♦	continuing soil erosion/silt runoff from construction operations?	■	□	Environmental specifications for construction reduces impact
♦	delivery of unsafe water due to poor O&M treatment processes and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	■	□	Operational requirement to maintain and monitor chlorine residual in lines; safety equipment and training provided to workers.
♦	delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	□	■	
♦	accidental leakage of chlorine gas?	□	■	
♦	excessive abstraction of water affecting downstream water users?	□	■	
♦	competing uses of water?	□	■	
♦	increased sewage flow due to increased water supply	■	□	Sanitation and drainage included in loan
♦	increased volume of sullage (wastewater from cooking and washing)and sludge from wastewater treatment plant	□	■	
♦	Damage to the ecosystem - cutting of trees, removal of vegetation due to WTP, reservoir, pump house and pipeline laying	□	■	
♦	Damage to the aquatic ecosystem due to the construction of intake			

Capital Region Development Project (ADB Loan 2695-BAN)

Rapid Environmental Assessment (REA) Checklist for Screening of WATER SUPPLY AND SANITATION SUB - PROJECT

Subproject Title:	**Water Supply Component of the Ashulia Industrial Cluster Subproject**
Proposed Category:	**Environmental Category B**

			SCREENING QUESTIONS	Yes	No	REMARKS
A.	**Project Siting**					
Is the project area …….				☐	☐	
♦	Densely populated ?			■	☐	Typical urban population density for Bangladesh
♦	Heavy with development activities?			■	☐	Area is rapidly developing; hence need for additional water supply
♦	Passing through commercial area			■	☐	Distribution lines will be in mixed residential/commercial/industrial areas
♦	Adjacent to or within any environmentally sensitive area					
	●	Cultural heritage site		☐	■	
	●	Protected Area		☐	■	
	●	Wetland		■	☐	Low lying areas subject to seasonal flooding
	●	Mangrove		☐	■	
	●	Estuarine		☐	■	
	●	Buffer zone of protected area		☐	■	
	●	Special area for protecting biodiversity		☐	■	
	●	Bay		☐	■	
	●	Road and highways		■	☐	Distribution lines will be installed along existing right of ways
B.	**Potential Environmental Impacts**			☐	☐	
Will the Project cause ……..				☐	☐	
♦	pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?			☐	■	
♦	impairment of historical/cultural monuments/areas and loss/damage to these sites?			☐	■	
♦	hazard of land subsidence caused by excessive ground water pumping?			■	☐	Accounted for in environmental review
♦	social conflicts arising from displacement of communities?			☐	■	
♦	conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?			☐	■	
♦	unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents) ?			■	☐	Iron and barium may require removal
♦	delivery of unsafe water to distribution system?			■	☐	Chlorination required to maintain distribution system free of pathogens
♦	inadequate protection of intake works or wells, leading to pollution of water supply?			☐	■	
♦	over pumping of ground water, leading to salinization and ground subsidence?			■	☐	Accounted for in environmental review
♦	excessive algal growth in storage reservoir?			☐	■	
♦	increase in production of sewage beyond capabilities of community facilities?			■	☐	Sanitation and drainage taken up in Phase 2 subprojects
♦	inadequate disposal of sludge from water treatment plants?			☐	■	
♦	inadequate buffer zone around pumping and treatment plants to alleviate					

♦	impairments associated with transmission lines and access roads?	■	□	Environmental specifications for construction reduces impact
♦	health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.	□	■	
♦	health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?	■	□	Capacity building of local government unit includes operational measures
♦	dislocation or involuntary resettlement of people	□	■	
♦	social conflicts between construction workers from other areas and community workers?	□	■	
♦	noise and dust from construction activities?	■	□	Environmental specifications for construction reduces impact
♦	increased road traffic due to interference of construction activities?	■	□	Environmental specifications for construction reduces impact
♦	continuing soil erosion/silt runoff from construction operations?	■	□	Environmental specifications for construction reduces impact
♦	delivery of unsafe water due to poor O&M treatment processes and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	■	□	Operational requirement to maintain and monitor chlorine residual in lines; safety equipment and training provided to workers.
♦	delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	□	■	
♦	accidental leakage of chlorine gas?	□	■	
♦	excessive abstraction of water affecting downstream water users?	□	■	
♦	competing uses of water?	□	■	
♦	increased sewage flow due to increased water supply	■	□	Sanitation and drainage taken up in Phase 2 subprojects
♦	increased volume of sullage (wastewater from cooking and washing)and sludge from wastewater treatment plant	□	■	
♦	Damage to the ecosystem - cutting of trees, removal of vegetation due to WTP, reservoir, pump house and pipeline laying	□	■	
♦	Damage to the aquatic ecosystem due to the construction of intake			

Appendix 2: Environmental Specifications for Contract Tender Documents

General

1. The contractor shall review and comply with the environmental management plan (EMP) prepared for the subproject, and will note and implement any particular requirements therein, in addition to those found in this general specification. At the start of construction, the contractor will provide a Construction Environmental Management Plan for compliance with these specifications, including development of the construction zone, worker camps, equipment yards, haul roads and borrow/quarry areas. The contractor's implementation of mitigation measures will be monitored during the course of the work and reported to the ADB.

2. The contractor will post a public notice regarding the nature, extent and cost of the project at the start of the construction zone; and post notices announcing the grievance redress mechanism in local government offices and in strategic places of the subproject's area of influence. For projects with multiple sites, a single notice may be posted at the pourashava, upazilla or municipal office.

3. The Contractor's Project Manager or other technical staff shall serve as focal person for EMP implementation and for responsibilities under the Grievance Redress Mechanism (GRM). The Contractor's Project Manager or other technical staff is required to obtain construction environmental management training and orientation to be provided by an LGED specialist or the PIU supervisor at the start of construction. Costs for implementing requirements set out herein are considered to be incorporated into the unit bid price for quantities unless indicated as paid for through provisional sums.

Worker Provisions

4. GOB criteria for minimum age, wage and living provisions, benefits, hours of work, overtime arrangements and overtime compensation, and leave for illness, maternity, vacation or holiday should be met for all workers. The Contractor will conform to national law in relation to hiring and employment; and will comply with the principle of equal opportunity, fair treatment, and nondiscrimination with respect to the employment relationship. Hiring of project-affected persons, women, residents of project-affected administrative units and disadvantaged groups is encouraged.

5. The contractor shall implement a safety and accident prevention program involving provision, training and use of safety equipment; minimum skills qualifications for operators and drivers; and record keeping related to accidents.

6. The Contractor will provide Personal Protective Equipment (PPE) to workers that offer adequate protection to the worker without incurring unnecessary inconvenience in its use[3]. Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out; and proper use of PPE should be part of training programs, as appropriate.

7. The contractor will maintain first aid kits onsite along with instructions for use, and personnel trained in basic first aid emergency response measures. In case of injury,

[3] Depending on the application PPE may include safety glasses with or without side-shields, and protective shades; plastic helmets with top and side impact protection; hearing protectors (ear plugs or ear muffs); safety shoes and boots for protection against moving & falling objects, liquids and chemicals; gloves made of rubber or synthetic materials; facemasks with appropriate filters for dust removal and air purification; single or multi-gas personal monitors; portable or supplied air; on-site rescue equipment, and insulating clothing, body suits and aprons of appropriate materials.

the contractor shall arrange treatment of the injured worker(s) and bear the cost of treatment.

8. Laborers and others resident at the site will be provided with lodging in a camp setting, potable water supply, food service facilities and adequate means for maintaining personal hygiene and solid/liquid waste disposal.

9. Safe drinking water will provided at the worksite with sufficient numbers of access points to assure availability for workers. Water will be periodically tested for and assured safe from bacteriological contamination.

10. HIV/AIDS awareness should be incorporated into the contractor's policy and outreach toward workers.

Gender Equity

11. The contractor shall provide equal wage payment for work of equal value for women, as required by the Government of Bangladesh. Separate sanitation and bathing facilities shall be provided for women at work camps and at the construction site.

12. The contractor is encouraged to engage women laborers, project affected women and destitute persons on works suitable for them, and shall follow ILO conventions and relevant protocols. The contractor shall consult with the Women's Ward Councilor and others on the availability of women workers including indigenous women workers in the area to engage them in work suitable to their skills.

Use of Land for Construction Purposes

13. The worksite and ancillary sites shall be surveyed and pegged prior to construction to ensure correct lines and grades for alignments, earth fill, side slopes, flow lines and trees to be removed or preserved in accordance with the design. Final verification of affected persons and assets shall be undertaken prior to the commencement of the works.

14. The contractor will obtain approval from landowners for temporary use of land for ancillary sites such as labor camps and construction yards. Local authorities will be consulted on locations, which will in no case be within 100 m of sensitive receptors such as hospitals, schools, residential communities or identified archaeological, religious or cultural sites. The contractor shall obtain approval and permits from the concerned District Collector for sand mining in rivers. An ancillary site shall be above flood level, at least 10m away from watercourses, and its size kept to a minimum to reduce vegetation clearance and ground disturbance.

15. The contractor will not encroach upon vacant land, or damage forests, wildlife or fisheries in the project area. The Contractor will execute a plan for preventing firewood gathering in the project area and prohibit among workers possession of instruments or poisonous substances for killing or capturing fish or wildlife.

16. Vegetation clearance shall be confined to the minimum area required for construction. Trees within the boundaries of ancillary sites shall be retained wherever possible.

17. Cutting trees is prohibited except inside the construction zone, on upper and lower slopes requiring stabilization, and in quarry areas. Trees to be removed must be specified in the Project plans and specifications. Pits resulting from removal of trees

and stumps shall be backfilled and compacted. The contractor shall dispose of removed vegetation at locations approved by the Engineer.

18. No fuel, oil, or parts cleaning fluids shall be spilled, wasted or disposed of at the project site. Secondary containment (earth or concrete berm with bottom and sides sealed with plastic sheeting) at least equal to the capacity of the fuel storage tank shall be provided at fueling stations. Hazardous materials shall be stored above flood level and at least 20m away from any water course.

19. After completion of occupancy, all affected areas within the general project boundary shall be graded to their original elevation or to a continuous sloping grade that allows positive drainage. Machinery, equipment, structures, contaminated earth, plant matter and waste or unused materials shall be removed and disposed of at locations approved by the Engineer.

Sediment Controls and Spoil Materials

20. Areas to be cleared and excavated are limited to areas where construction will take place. The areas will be protected from flowing water including sheet runoff. The contractor will limit sediment loss from exposed surfaces. Existing drainage patterns should be maintained during construction to the extent possible.

21. Discharge of wastewater into water bodies is prohibited as is the discharge of wash water from concrete trucks to waterways. . Land clearing activity will be suspended during rains to limit sediment loss.

22. Topsoil shall be removed from areas of fill or sub-surface excavation and stockpiled at designated locations for reuse in covering embankment slopes, berms, and other disturbed areas.

23. Unsuitable and spoil materials shall be disposed promptly and properly from the site at locations approved by the Engineer.

Community Values

24. Vehicles transporting dirt, sand and construction materials capable of producing dust will be covered when traveling through community areas or along roadways in use by the public. Vehicles will operate within the legal speed limits in populated areas. The operation of moving equipment in locations accessible to the public will be done in a manner so as to prevent the occurrence of incidents and accidents.

25. The Contractor should use available means to prevent accidents by emphasizing safety aspects among drivers; assuring sufficient driving skills and requiring licensing of drivers; adopting limits for trip duration and arranging driver rosters to avoid overtiredness; specifying and obtaining approval from the PIU in advance, and adhering to haul routes between borrow areas and the project site; avoiding dangerous routes and times of day to reduce the risk of accidents; use of speed control devices (governors) on trucks, and remote monitoring of driver actions.

26. The contractor is responsible for regular spraying of roadway surfaces in use as haul routes and of sites under construction as well as temporary detours where these locations are accessed by the public. The contractor will remove excess debris during construction and after completion of the item of work.

27. The contractor will locate aggregate crushing and batch mix plants at sufficient distance (at least one km) from populated areas, houses, schools and hospitals so as

to reduce air pollution and noise. The contractor shall protect, conserve and maintain access to social and cultural properties in the project area including schools, mosques, hospitals, temples, shrines, graveyards, tourism sites and other public places. The contractor may increase the workforce to minimize the duration of construction in such areas.

28. The Contractor will post flagmen at intersections of transit paths for construction vehicles and local traffic, and along traffic lanes where work is in progress. Traffic detours will be clearly marked.

29. The contractor will provide a path for transit of pedestrians and vehicular traffic through or around the construction area; and barricade open excavations to prevent injury to the public.

30. The contractor shall ensure that working hours do not extend beyond 7.00 a.m. to 7.00 p.m., except in situations when working at night is required to avoid traffic congestion in the work zone, as approved by the PIU supervising engineer.

31. Depending on the conditions affecting work, no more than 300 m of box cut or trench shall be opened before work is completed for that section. Greater lengths will be undertaken only on approval by the PIU supervising engineer.

32. The contractor shall avoid trenching near to buildings, walls and existing buried pipelines. If unavoidable, the contractor shall provide adequate protective measures to prevent damage.

33. The contractor will avoid blocking access to land, homes and businesses; where unavoidable, the contractor will provide temporary access to affected properties and reinstate permanent access on completion of work; minimize the area under construction at any one time and the duration of works at any one location; and minimize impacts on infrastructure, access and services. Backfill and sealing of construction trenches shall be done promptly.

34. The contractor will install signs and lighting, where there is nighttime traffic, in the vicinity of works on public roads, and restrict access to the construction site by the public.

35. All construction machinery and vehicles to be used in works shall be of proven efficiency and shall conform to GOB standards for emissions and noise levels. The contractor shall regularly maintain the construction machinery and vehicles so that emissions, vibrations and noise levels conform to GOB's relevant standards. The Contractor shall prohibit the use of air horns in settlement areas.

36. The contractor shall promptly reinstate any services and reinstall any physical facilities that are cut, disconnected or damaged during construction activities, and shall maintain or provide temporary services that are interrupted by construction. The Engineer shall inspect and certify the adequacy of all reinstated services and facilities.

Site Conditions, Quarries and Haul Routes

37. At the start of construction, the contractor will provide a Site Environmental Management Plan for development of the construction zone, worker camps, equipment yards, haul roads and quarry areas.

38. Haul routes will minimize interference with ongoing activity in the area. Routes shall be approved by the PIU. Haul roads and transport/equipment routes shall be kept within the construction zone, unless authorized by the PIU.

39. Selection of borrow pits, quarry sites and haul routes shall minimize noise and air pollution in the site vicinity, visual impacts in inhabited areas, impacts on land use, air and noise emissions along haul routes, and congestion in populated areas.

40. Quarry and borrow pit locations will be permitted for use by the local authority, and shall be pre-existing sites, e.g. already in use prior to the start of the construction. Newly opened quarry locations require approval of the PIU.

41. The contractor shall select borrow pits that are free from organic materials. The use of dredged materials from rivers is permitted if the materials are sandy and free from organic matter. Topsoil from farmland should not be used as fill.

42. The contractor shall stockpile construction materials in such a way as to prevent any loss of materials to watercourses. Stockpiling of backfill shall be done outside the right of way and not on the side slopes of roads.

43. Borrow pits shall be restricted to areas within the construction zone as defined by right-of-ways for roads, embankments and irrigation canals. Borrow pits along linear alignments will be interconnected; smoothly excavated; of uniform depth, width and slope; and graded to drain after use.

Archeological and Cultural Relics

44. The Contractor will stop construction on discovery of objects of archeological origin; and notify the PIU, who will contact the Department of Archaeology, Ministry of Cultural Affairs to investigate and, if desirable, undertake recovery. Work must remain halted at the specific location until investigation is complete.

Disinfection of Pipes, Tanks and Equipment

45. The Contractor will disinfect water mains, tanks and reservoirs by chlorination and include a bid item for disinfection in piping installation contracts.