Draft Initial Environmental Examination

Project Number: 47254-003
January 2016

BAN: Dhaka Water Supply Network Improvement Project (DWSNIP) Package No. ICB 2.8

Prepared by the Dhaka Water Supply and Sewerage Authority (DWASA), Government of Bangladesh for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 28 January 2016)

Currency unit	–	Taka (Tk)
Tk.1.00	=	$0.0127
$1.00	=	Tk. 78.505

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected person
DMA	–	district metering area
EMP	–	environmental management plan
GRC	–	grievance redressal committee
GRM	–	grievance redress mechanism
IEE	–	initial environmental examination
NRW	–	nonrevenue water
O&M	–	operation and maintenance
PMU	–	project management unit
REA	–	rapid environmental assessment
SPS	–	Safeguard Policy Statement
HDD		horizontal directional drilling

WEIGHTS AND MEASURES

km	–	kilometer
km^2	–	square kilometer
m^2	–	square meter
mm	–	millimeter
m^3/day	–	cubic meter per day

NOTE

In this report, "$" refers to US dollars.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. **Project Description.** Dhaka Water Supply Network Improvement Project (DWSNIP) aims to improve provision of sustainable, reliable, and climate-resilient water supply in Dhaka city. It will enhance the distribution network efficiency gains achieved under two previous Asian Development Bank (ADB) financed projects to Dhaka Water Supply and Sewerage Authority (DWASA) for improving service delivery and capacity building.[1] DWSNIP impact will be safe drinking water made available for all urban population, which is aligned with the Seventh Five-Year Plan, 2016-2020. The outcome will be sustainable provision of more reliable, improved, and climate-resilient water supply in Dhaka city ensured. The outputs will be DWASA's (i) distribution network strengthened; (ii) sustainable district metered area (DMA) management capacity enhanced; and (iii) DWASA's capacity for quality service delivery enhanced.

2. DWASA has made consistent efforts in improving distribution network of water supply, including through ADB-financed projects: (i) Dhaka Water Supply Sector Development Program (DWSSDP), which aims to rehabilitate and reinforce water supply systems and build DWASA's capacity to optimize operational and financial performance; and (ii) Dhaka Environmentally Sustainable Water Supply Project (DESWSP), which aims to develop a new surface water scheme to augment water source and reinforce the distribution network (footnote 1). Under these on-going projects, distribution network improvement (DNI) works have been implemented in seven out of ten zones of Dhaka city by establishing DMAs and focusing on nonrevenue water (NRW) reduction in each DMA. Recent reports reveal good progress in commissioned DMAs, which record uninterrupted 24-hour piped water supply, reduced physical water losses from 40% to less than 15% with the current average of 4.95%, assured good quality potable water directly from taps without any other treatment, and authorized or legalized 9,500 connections.

3. In areas not covered by the ongoing projects, water losses remain the major cause of insufficient service delivery. Reduction of water losses will increase water availability for household, thereby reducing use of suction pumps and underground storage reservoirs. These will lead to improve water quality and reliability, reduce public health risks, and help increase coverage including to low-income communities. Reduction in NRW couped with appropriate tariff level will also generate additional financial revenues for DWASA to further improve their services.

4. DWSNIP civil works is divided into five contracts (packages): ICB 2.8 covering 13 DMAs, ICB 2.9 covering 15 DMAs, ICB 2.10 covering 19 DMAs, ICB 2.11 covering 16 DMAs, and ICB 2.12 covering 19 DMAs.

5. **Implementation Arrangements.** Dhaka Water Supply and Sewerage Authority (DWASA) is both the executing agency (EA) and implementing agency (IA).A project management unit (PMU) has been established in DWASA and will be assisted by a Design and management unit (PMU) has been established in DWASA and will be assisted by a design,

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[1] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Loans and Technical Assistance Grant to the People's Republic of Bangladesh for the Dhaka Water Supply Sector Development Program* (Loan 2382 and 2383-BAN). Manila; ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan to the People's Republic of Bangladesh for the Dhaka Environmentally Sustainable Water Supply Project* (Loan 3051-BAN). Manila.These two loans finance some of feasibility studies of this project.

management and supervision (DMS) Consultants in (ii) capacity building and institutional strengthening; and (iii) project management and implementation support.PMU will have an environmental officer to ensure environmental safeguards compliance of the project. DMS will assist the PMU environmental officer in the day-to-day monitoring activities.

6. **Categorization and Environmental Assessment of Subproject.** An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklist for water supply (Appendix 1) was conducted and results of the assessment show that the subproject is unlikely to cause significant adverse impacts thus the subproject is classified as Environmental Category B per ADB Safeguard Policy Statement (SPS). Per Government of Bangladesh Environment Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules (ECR, 1997), the subproject is categorized as "redwhich need location clearance and environmental cleance certificate from DoE. However, since the project is insignificant impact and the project is national priority, as per Environmental Conservation Rules 1997, sub rule 7(4) to speed up the project work upon application to DG, DoE for approval of ToR for EIA study, DG, DoE May approve ToR for EIA study and without issuing location clearance certificate and may directly issue Environmental Clearance Certificate (ECC). This ECC is mandatory and must be obtained from the DoE.

7. **Subproject Scope.** This report covers Package No. ICB 2.8 (the subproject) which includes rehabilitation and extension of distribution networks in 13 DMAs. The package includes rehabilitation of 457 kilometers of DNI for NRW reduction (including procurement of equipment/plant, and construction of deep tube well [DTW] pump station) with O&M support. For efficient and effective execution, the package will be implemented through a design-built contract, i.e. the civil works contractors will also prepare the detail designs.

8. This draft IEE has been prepared in accordance with ADB SPS requirements for Environment Category B projects and based on best available information as per preliminary engineering designs. However, this draft IEE already provides mitigation and monitoring measures to ensure no significant impacts as a result of the subproject. Preliminary designs have already integrated a number of avoidance and mitigation measures discussed in the IEE, and locations/siting of the proposed infrastructures were considered to further reduce impacts.

9. This draft IEE report has been prepared to meet the following objectives: (i) assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the project's area of influence; (ii) identify mitigation measures and any residual negative impacts that cannot be mitigated; (iii) describe the process undertaken during project design to engage stakeholders, and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (iv) describe the project's grievance redressal mechanism for resolving complaints about environmental performance; (v) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (vi) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (vii) identify who is responsible for carrying out the mitigation and monitoring measures.

10. The subproject sites and water pipe alignments are located in the built-up area of Dhaka City and are not within or adjacent to environmentallysensitive areas such as protected areas, wetlands, buffer zones of protected area, and special areas for protecting biodiversity.

11. Planning principles and design considerations were reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts due to the project design or location are not significant. However, the social impacts (access disruptions) due to construction activities are not avoidable, as residential and commercial establishments exist along the project corridor. A resettlement plan has been developed in accordance with ADB SPS and Bangladeshilaws and regulations.

12. **Environmental management plan.** An environmental management plan (EMP) was developed to provide specific actions deemed necessary to assist in mitigating the environmental impacts, guide the environmentally-sound execution of the proposed project, and ensure efficient lines of communication between the implementing agency, project management unit, consultants, and contractors. The EMP also provides a proactive, feasible, and practical working tool to enable the measurement and monitoring performance on-site. This IEE including the EMP will be updated during detailed design stage.

13. **Public consultation and participation.** The public participation process included (i) identifying interested and affected parties (stakeholders); (ii) informing and providing the stakeholders with sufficient background and technical information regarding the proposed development; (iii) creating opportunities and mechanisms whereby they can participate and raise their viewpoints (issues, comments, and concerns) with regard to the proposed development; (iv) giving the stakeholders feedback on process findings and recommendations; and (v) ensuring compliance to process requirements with regards to the environmental and related legislation. This IEE includes activities to be undertaken during detailed design stage to continuously engage the stakeholders, measures for information disclosure, and processes for carrying out consultation with affected people and facilitating their participation during implementation stage.

14. **Grievance redressal mechanism.** The program's grievance redressal mechanism provides the citizens with a platform for redressal of their grievances and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

15. **Conclusion and Recommendations.** There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is will not cause significant adverse impacts. In addition to the mitigation measures and specifications already considered in the package design, the potential adverse impacts that are associated with construction and O&M can be mitigated to acceptable levels with the specific mitigation measures discussed in the EMP.

16. As per ADB SPS, 2009 the project is classified as environmental category B and does not require further environmental impact assessment. As per Bangladeshilaws, the proposed project requires a Location Clearance Certificate and an Environmental Clearance Certificate (ECC) from the Department of Environment.

I. INTRODUCTION

A. The Project

1. Dhaka Water Supply Network Improvement Project (DWSNIP) aims to improve provision of sustainable, reliable, and climate-resilient water supply in Dhaka city. It will enhance the distribution network efficiency gains achieved under two previous Asian Development Bank (ADB) financed projects to Dhaka Water Supply and Sewerage Authority (DWASA) for improving service delivery and capacity building.[1]

2. **Enhancing efficiency gains.** Development of urban infrastructure in Bangladesh has not kept pace with rapid urbanization. The provision of drinking water in Bangladesh's capital city Dhaka, has been particularly challenging. Dhaka's population has been growing at 3.6% per annum since 2005, much higher than the national average of 1.1%, leading to increasing demand for drinking water supply.[2] DWASA, the water utility for Dhaka, serves 13.5 million people[3] and has made continuous efforts to improve its distribution network among others, with support of two ADB-financed projects: (i) Dhaka Water Supply Sector Development Program (DWSSDP), which aims to rehabilitate and reinforce water supply systems and build DWASA's capacity; and (ii) Dhaka Environmentally Sustainable Water Supply Project (DESWSP), which aims to augment water source and improve parts of the distribution network (footnote 1).

3. Under these on-going two projects, distribution network improvement (DNI) works have been implemented in seven out of ten zones of Dhaka city by establishing district metered areas (DMAs) and focusing on nonrevenue water (NRW) reduction in each DMA. Commissioned DMAs show good progress, which record uninterrupted 24-hour piped water supply, reduced physical water losses from 40% to less than 15% with the current average of 4.95%, assured good quality potable water directly from taps without any other treatment, and authorized or legalized 9,500**.**

4. A remaining challenge for DWASA is to enhance the efficiency gains throughout its service area and reduce overall physical losses and NRW which is still estimated to be about 26%. In areas not covered by the ongoing projects, water losses remain the major cause of insufficient service delivery. Reduction of water losses will increase water availability for households, thereby reducing households' use of suction pumps and underground storage reservoirs. These will lead to improve water quality and reliability, reduce public health risks, and help increase coverage including to low-income communities. Reduction in NRW coupled with appropriate tariff level will also generate additional financial revenues for DWASA to further improve their services.

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[1] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Loans and Technical Assistance Grant to the People's Republic of Bangladesh for the Dhaka Water Supply Sector Development Program* (Loan 2382 and 2383-BAN). Manila; ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan to the People's Republic of Bangladesh for the Dhaka Environmentally Sustainable Water Supply Project* (Loan 3051-BAN). Manila.These two loans finance some of feasibility studies of this project.

[2] United Nations Department of Economic and Social Affairs. 2015. World Urbanization Prospects: The 2014 Revision. New York.

[3] DWASA is a service oriented autonomous commercial organization, entrusted with the responsibility of providing water supply, sewerage disposal, and storm water drainage services to the urban dwellers of Dhaka city.

5. **Impacts, Outcome, and Outputs.** The project impact will be safe drinking water made available for all urban population, which is aligned with the Seventh Five-Year Plan, 2016-2020. The outcome will be sustainable provision of more reliable, improved, and climate-resilient water supply in Dhaka city ensured.

6. The outputs will be DWASA's (i) distribution network strengthened; (ii) sustainable DMA management capacity enhanced; and (iii) DWASA's capacity for quality service delivery enhanced.

(i) **Output 1: Distribution network strengthened**. Further to the ongoing work of two ADB-financed projects,[4] the proposed project will contribute to renewing an entire distribution network in Dhaka city, including (i) new DMAs not financed by the on-going loans in seven zones;[5] and (ii) additional financing to complete civil work contracts of DMAs under DWSSDP.[6] The project will extend new or regularized connections to low-income communities.

(ii) **Output 2: Sustainable DMA management capacity of DWASA enhanced**. Managerial and technical capacity of DWASA will be strengthened to sustain NRW at a low level. The project will assist DWASA in (i) preparing and implementing a sustainable NRW reduction plan,[7] (ii) strengthening monitoring capacity at the zone level with renewed standard operating procedures,[8] upgraded training modules, and supervisory control and data acquisition system and piloting automated of meter reading; and (iii) enhancing in-house design capacity for sustainable DMA management.

(iii) **Output 3: DWASA's capacity for quality service delivery enhanced**. The project will support DWASA to: (i) prepare and implement operational and financial improvement plan through upgrading the 5-year corporate business plan;[9] (ii) enhance its capacity for design, construction supervision and project management; (iii) prepare and implement public awareness program for demand control, water conservation, and health and hygiene; (iv) enhance quality of service delivery to low-income communities including slums and informal settlements; (v) prepare and implement water quality monitoring system; (vi) implement gender action plan; and (vii) enhance project readiness of future investment.[10]

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[4] In two on-going projects, DWASA has been rehabilitating existing water supply network in its five zones (Zone-3, 4, 5, 8, 10) and part of Zone-9 under DWSSDP; and Zone-6 under DESWSP out of ten administrative zones.

[5] The proposed project will cover DMAs of seven zones (Zone-1, 2, 3, 4, 7, 9, 10).

[6] The estimated cost of ADB's additional financing portion is $36.9 million due to increased requirements of work and goods and price escalation.

[7] Sustainable NRW reduction plan will include the long-term and annual targets of NRW; optimal DMA based organizational restructure; incentive mechanism; asset management plan, budget requirement, and training plan.

[8] Standard Operating Procedure will include water loss assessment; water balance calculation; leakage management including pressure management, repairs, and active leakage control; asset management; and smart water management of IT devices.

[9] The existing 5-year corporate business plan comprises of sub-plans such as investment plan, financial plan, tariff plan and human resource development plan. In addition, the proposed project will include the sustainable non-revenue water reduction plan, water quality monitoring plan, and demand management plan in order to address next challenges for improving the quality of service delivery of DWASA.

[10] DWASA will recruit consultants to conduct the preparatory works for future projects including sewerage management.

7. DWSNIP civil works is divided into five contracts (packages): ICB 2.8 covering 13 DMAs, ICB 2.9 covering 15 DMAs, ICB 2.10 covering 19 DMAs, ICB 2.11 covering 16 DMAs, and ICB 2.12 covering 19 DMAs.

8. **Implementation Arrangement.** DWASA will be responsible for the overall management, supervision and execution of DWSNIP. A Project Management Unit (PMU) will be established and will consist of one full-time project director in the rank of additional chief engineer and two dedicated deputy project directors in the rank of superintending engineers, responsible for civil works and electro-mechanical works. The project director and deputy project directors will be appointed exclusively to DWSNIP. At least four executive engineers will assist the deputy project directors in managing the works under them. Project coordination unit (PCU) in 7 zones, headed by an executive engineer, will be responsible for liaising and coordinating with the contractors, consultants, non-government organization (NGO) and other stakeholders on all day-to-day implementation of the project. Design, Management and Supervision (DMS) Consultants will be engaged to assist in the implementation. PMU will have an environmental officer to ensure environmental safeguards compliance of the project. DMS will assist the PMU environmental officer in the day-to-day monitoring activities.

B. Environmental Assessment

9. **Subproject Scope.** This report covers Package No. ICB 2.8 (the subproject) which includes rehabilitation and extension of distribution networks in 13 DMAs. The package includes rehabilitation of 457 kilometers of DNI for NRW reduction (including procurement of equipment/plant, and construction of deep tube well [DTW] pump station) with O&M support. For efficient and effective execution, the package will be implemented through a design-built contract, i.e. the civil works contractors will also prepare the detail designs.

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the process undertaken during project design to engage stakeholders, and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (iv) describe the project's grievance redressal mechanism for resolving complaints about environmental performance; (v) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts; (vi) describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (vii) identify who is responsible for carrying out the mitigation and monitoring measures.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

13. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

14. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

15. **Environmental management plan (EMP).** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

16. **Public disclosure.** ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

(i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;

(ii) final or updated EIA and/or IEE upon receipt; and
(iii) environmental monitoring reports submitted by the Project Management Unit (PMU) during project implementation upon receipt.

17. DWSNIP, as explained above has been classified by ADB as Category B, because it is not expected to have major negative environmental impacts. Under ADB procedures such projects require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required.

B. National Laws

18. The implementation of the projects will be governed by Government of Bangladeshenvironmental acts, rules, regulations, and standards. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. It is the responsibility of DWASA to ensure projects are consistent with the legal framework, whether national, state, or municipal/local. Compliance is required in all stages of the project, including design, construction, and operation and maintenance.

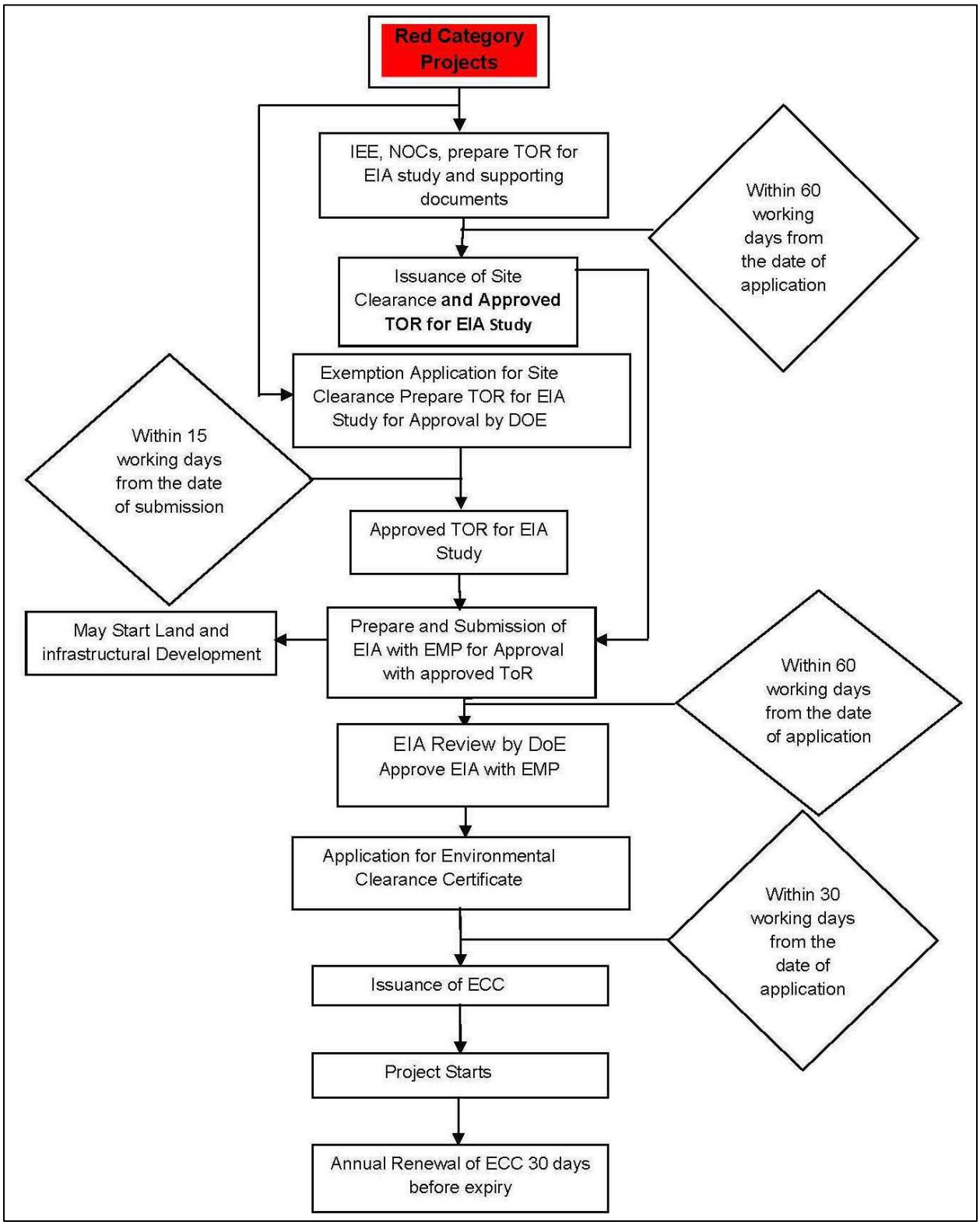
19. The main provisions for environmental protection and pollution control in Bangladesh are contained in the Environmental Conservation Rules 1997. This legislation also provides the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. Projects are classified as green, orange, or red depending on their location and environmental impacts, and Schedule 1 of the law indicates that “water, power and gas distribution line laying/relaying/extension” are considered as red category activities.

20. Rule 7 states that the proponent of such projects must obtain a Location Clearance Certificate (LCC) and an Environmental Clearance Certificate (ECC) from DoE. For proposed Red Category projects this requires submission to the relevant DoE Divisional Officer of the following:

(i) Completed application for ECC, and the appropriate fee, shown in Schedule 13 of the Rules;
(ii) Report on the feasibility of the project;
(iii) Report on the IEE for the project, terms of reference (TOR) for an EIA of the project, and its process flow diagram; or an EIA prepared from a previously approved TOR, layout plan, process flow diagram, and design and time schedule;
(iv) No objection certificate from the local authority;
(v) Emergency plan relating adverse environmental impact and plan for mitigation of the effect of pollution; and
(vi) Outline of the relocation and rehabilitation plan (where applicable).

21. The steps followed for Environmental Clearance of Red Category Project shown in Figure 1. Discussions with DoE (as appendix 2) in 24th November 2015 suggested that DWASA needs to apply to DG, DoE for approval of ToR of EIA study and DG, DoE may issue the ECC for DWSNIP. DWASA with the assistance of the consultant teams, will develop the necessary EIA and ensure the ECC is obtained prior to award of civil works contract.

Figure 1: Steps to be followed to obtain Environmental Clearance of Red Category Projects



III. DESCRIPTION OF THE PROJECT

A. Need for the Project

22. DWSNIP is needed in areas not covered by the ongoing projects to reduce water losses which are the major cause of insufficient service delivery. Reduction of water losses would reduce household use of suction pumps and underground storage reservoirs, increase water availability and generate additional financial sources for DWASA's capital investments and O&M. This would in turn improve water quality and reliability, reduce public health risks, and help increase coverage including to low-income communities.

B. Subproject Components

23. Package No. ICB 2.8 includes (i) rehabilitation and extension of 457 km distribution network in 13 DMAs (DMA 901 to 913); (ii) construction, regeneration of DTWs etc (iii) service connections including installations of meter chamber, domestic meters and floating valve; and (iv) installations of valves, bulk meters and loggers, etc.For efficient and effective execution, the package will be implemented through a design-built contract, i.e. the civil works contractors will also prepare the detail designs.The main activities (the works) of the contract is expected, as a minimum, to comprise the following steps:

(i) Survey;[11]
(ii) Resettlement plan implementation;[12]
(iii) Design comprising of (a) detailed survey of area (location of water pipes, service connections, valves, tube wells, bulk meters, and other utility lines); (b) detailed network modelling of areas and updating of basic model (outline design) with additional information obtained from survey; and (c) submission of detailed design package of area including design drawings (1:2000) and expected work methodologies for each DMA;
(iv) Pipe works comprising of (a) Improvement of Distribution Network, establishment of DMAs; (b installation of bulk meters, valves etc. and construction of inter-DMA chamber; (c) rehabilitation or replacement of 200 km existing pipes according to design;[13](d) network to areas not adequately served and (e) pre-commissioning and commissioning of DMAs;
(v) Service connections[14] comprising of (a) installing a meter chamber for each existing connection; (b) connecting the meter chamber with the water pipes, using new materials; (c) installing water meter in meter chamber; (d) pressure

[11] To establish (i) location of existing water and other utility infrastructure; (ii) location of service connections; and (iii) location of existing valves, meters, and production tube wells
[12] The Contractor will be responsible in implementing the Resettlement Plan (RP) prepared by DWASA and/or resettlement NGO. No civil works will be allowed to begin until all compensation to affected persons is paid.
[13] The term "pipe replacement" means that the existing pipe will be replaced, either by the traditional open trench method, where the existing pipe will be abandoned and a new pipe will be installed or by pipe bursting, where the existing pipe will be used as a host pipe which will be cut open, expanded and a new pipe will be installed inside the old pipe.
[14] The term "service connection" means the pipe between the water distribution network, the distribution or reticulation pipe, and the water meter installed in the meter chamber inside the boundary of the consumer/ customer. It is assumed that all existing service connections need to be replaced. This is due to the long tradition of the use of substandard quality materials and low quality workmanship when connecting customers to the water network.

testing of each service connection; and (e) installing float valves at the first reservoir of the household.

(vi) Other works such as (a) according to given requirements wherever needed; (b) repair of other utility lines in case they are damaged during the work; and (c) provision of alternative sources of water for people while being disconnected from water supply system during the implementation.

24. Table 1 provides detailed information on the components of Package No. ICB 2.8.

Table 1: Details of Package No. ICB 2.8 Components

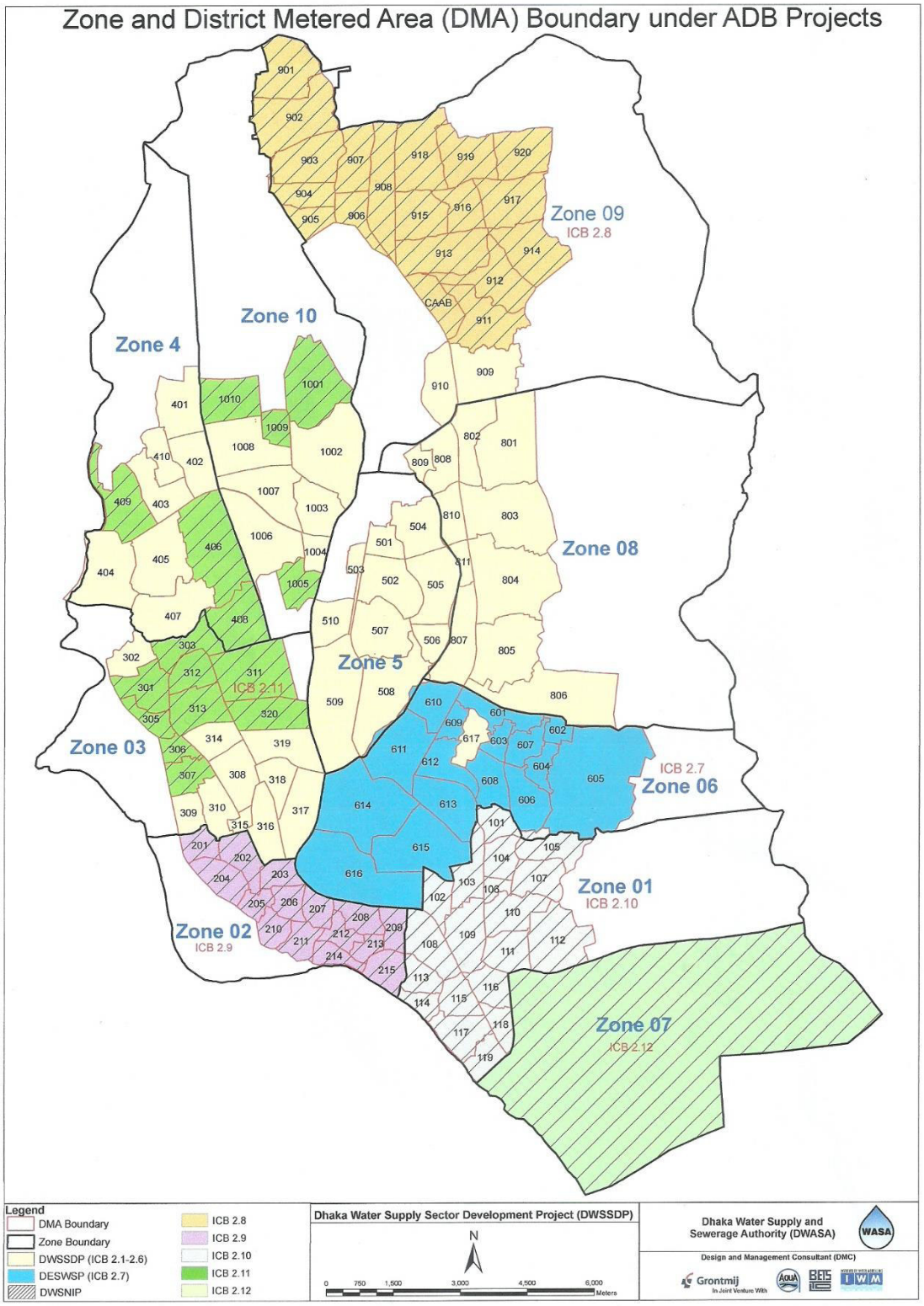
Item	Description	Remark	Unit	Quantity
1.	Network Rehabilitation (ICB-2.8)	13 DMA	No.	457 km
2.	Pipes and Fittings	HDPE (75-450mm)	No.	457 km
3.	Household meter	Domestic water meter with AMR provision	No.	37720
4.	Deep Tubewells (DTWs)	In order to maintain normal water supply	No.	30
5.	Chlorinator	Liquid Chlorine with chlornation equipment	No.	70
6.	SCADA	SCADA will be implemented in 13 DMAs	No.	13
7.	Implementation of AMR	Implementation of AMR will be done in 3 DMAs as pilot basis.	No.	

25. The 13 DMAs (Figure 2) are characterized by high population density, narrow roads, and high traffic congestion at most times of the day. Due to the significant pressure on the transport network in Dhaka, it is foreseen that any open trenching in or near roads, particularly in the larger roads, will only be permitted during the night. For this reason and to minimize public disturbance, it is expected that trenchless techniques[15] will be used for replacement and rehabilitation as well as network extension and service connections. In situations where the contractors prefer the traditional trenching technology,[16] the case must be justified and approved by DWASA.

[15] This involves the use of horizontal direction drilling (HDD) which involves a hydraulic machinery to drill a horizontal tunnel for a new pipe or to insert a flexible plastic lining inside an existing pipe, so no trenches are dug, and excavation is limited to the entry and exit points.

[16] The size of trenches will depend on the diameter of the pipe, but most will be 0.3 to 0.7 m in width and 1.4 to 1.8 m deep.

Figure 2: DMA Map Showing Locations of DMAs covered in Package No. ICB 2.8



C. Implementation Schedule

26. DWSNIP is to be implemented over a period of 5 years. The detailed design stage has to be completed in the first few months, and the construction period will cover 31 months in ICB 2.8. The detailed implementation schedule will be provided in the updated IEE to be prepared once the detailed design is completed.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for the Baseline Study

27. **Data collection and stakeholder consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites. The baseline data prior to start of civil works will be collected and reported in the updated IEE and semi-annual environmental monitoring report.

28. **Data analysis and interpretation.** The data collected was analyzed and interpretations made to assess the physical, biological, and socioeconomic features of the project area. The relevant information is presented in the succeeding paragraphs.

29. The baseline data prior to commencement of civil works will be collected and reported in the updated IEE and semi-annual environmental monitoring report.

B. Physical Characteristics

30. **Location.**The service area of Package No. ICB 2.8 includes all areas of Dhaka City lying in DWASA operation Zone 9.

31. **Topography and Soil.** The project area is at the northern edge of the delta in the centre of the country, between the confluences of the rivers. and the project area is flat and low lying particularly around the delta, which floods extensively in the rainy season. The influence of the rivers is evident in the soils, which are almost entirely alluvial, and generally fertile, with a predominantly loam and silt consistency.

32. **Climate.** The climate is sub-tropical, with a typical three season pattern. Rainfall is <30 mm per month and average temperatures around 20°C. Temperatures start to rise in March and reach the annual maximum of around 29°C in April-May, when daytime temperatures can exceed 40°C. The monsoon begins in May-June as hot air rises over the Indian subcontinent, creating low pressure areas into which rush the cooler moisture-laden winds from the Indian Ocean and the Bay of Bengal. Around 70-80 % of the annual rain falls during this time. The rain is often accompanied by strong winds, sometimes exceeding 100 kilometers per hour. Temperature and rainfall both decline post-monsoon, returning rapidly to the winter lows.

33. **Air Quality.** As there are no major industries in the 13 DMAs, the main sources of air pollution are vehicles and non-point sources such as open burning of garbage. There are no available ambient air quality data in the 13 DMAs. The baseline air quality level will be measured by the subproject contractors prior to commencement of work. The results will be provided in the updated IEE and all other measurements during implementation will be reported as part of EMP implementation.

34. **Acoustic environment.** Subproject components are in the built-up part of Dhaka, with residential, commercial, and institutional establishments. The volume of traffic that passes through these sections is significant and traffic jams are frequent. Vehicular movement can be considered as major cause of noise pollution. The baseline noise level will be measured by the subproject contractors prior to commencement of work. The results will be provided in the updated IEE and all other measurements during implementation will be reported as part of EMP implementation.

35. **Geology and Seismology**. According to the National Seismic Zoning Map produced by the Geological Survey of Bangladesh (GSB), Dhaka lies at the end of the Dauki fault in an area of medium seismic risk. This means that shocks of moderate intensity are possible, with a probable maximum magnitude of 6.5-7 on the Richter scale. 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 City.

C. Ecological Resources

36. **Rivers.** Dhaka City, where the 13 DMAs are located under Package No. ICB 2.8 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. The Ministry of Environment and Forests estimates that 80% of the sewage produced by the 15 million people in Dhaka and surrounding areas enters the rivers untreated, and most of the 7,000 industries dispose of their waste to drainage ditches and rivers without treatment (Dhaka Environment Programme, 2005). It is not surprising that the ecology of the rivers has deteriorated under such pressure, and declining fish catches (26,476 tons in 1983 to 84 to 6,095 tons in 1996 to 97 in North Central Region) are just one indicator of the malaise.

37. **Other Aquatic Habitats.** There are a variety of other aquatic habitats in the city, including man-made lakes inresidential areas (e.g. Gulshan), permanent and ephemeral pools in natural lowlands (known as bheels), and flooded borrow pits excavated for building material. These are of little ecological value as the water is frequently polluted, and these areas are often characterized by dense growths of the water hyacinth Echicornica crassipes, which out-competes other plants through its rapid growth, although species such as water chestnut and lotus can be seen in places.

38. **Terrestrial Ecology.**There is few natural terrestrial habitats in the 13 DMAs, because of the seasonal flooding andthe urbanization of the city, and agricultural development in the outlying areas, which destroyed the natural habitats many years ago. Terrestrial plants are now mainly limited to trees, shrubs and flowers grown alongside roads and in parks and gardens in the city, and the crops and fruit trees planted in agricultural areas. The terrestrial fauna is very limited as a result, and mainly consists of animals able to live close to man, such as lizards and geckoes, scavenging birds like house sparrows and crows, and mice, rats and other rodents. There are more animals in the farming areas, but even these are species commonly found close to man, such as cattle egrets.

39. **Protected Areas and Endangered Species.** There are no areas in or around the 13 DMAs that are designated and protected for nature conservation, and no rare or endangered species. This is because as explained above terrestrial habitats have been destroyed to provide

land for urbanization, and aquatic habitats are damaged and degraded by water pollution, infilling, and other anthropogenic activities.

D. Economic Development

40. **Industry.** Manufacturing is the most important activity, and because of the low cost of labor, many factories have links with major companies in Europe, to which they supply low cost garments and other products. The main industries are leather tanneries, and textile production; but there are factories manufacturing a wide range of other products including fertilizers, pesticides, chemicals, pharmaceuticals, rubber, plastics, cement, and foodstuffs including salt, sugar, and rice. There are also heavier industries including iron and steel mills, ship repair yards, power plants, oil refineries, and pulp and paper mills.

41. **Water supply.** The main features of the existing water supply system are as follows:

(i) 82% of the supply is from groundwater via 710 production tube wells in the City;
(ii) This water is treated by injection of liquid chlorine, but not at all production tube wells;
(iii) The remaining 18% is surface water, extracted from Buriganga and Sitalakhya Rivers;
(iv) This is treated at the Chatnighat (39 MLD) and Saidabad (450 MLD) Surface Water Treatment Plants (SWTP) by sedimentation, filtration, and chlorination;
(v) Water from all sources is distributed via a 2,400 km network of underground pipes (75-450 mm in diameter), mainly buried in roads;
(vi) Water pressure in the area supplied by Saidabad SWTP (Zones 1, 2 and 3) is good near the ring main but poor near the extremities;
(vii) Zone 4 and most of Zone 5 are supplied by tube wells only, pressure is low and variable, and pumps do not function during power cuts;
(viii) Water is treated to Bangladesh drinking water standards, but leaking pipes, low pressure and inadequate treatment/disposal of wastewater often cause contamination; and
(ix) As indicated above, other problems are loss of water through leaks and illegal house connections, a rapidly reducing groundwater table, and inadequate cost recovery.

42. The water supply situation is characterized by the high number of deep tube wells, inadequately sized, leaking and low quality pipes, low workmanship, low operating pressures, inaccurate and inadequate data about location of pipes and service connections, and inaccurate and inadequate data about location of other utility lines.

43. The network in the 13 DMAs is currently supplied by limited surface water and ground water from tubewells across the city. There is no clear distinction between transmission mains and distribution mains which mean laterals and reticulation are often connected to large diameter pipes resulting in loss of pressure and increased leakage. The pipes are mainly buried towards the centre of roads and streets, with larger diameter pipes (>150 mm) generally located in main roads and smaller pipes in minor roads. The pipes are built from a range of asbestos cement (AC), ductile iron (DI), steel (MS) and polyvinyl chloride (PVC) pipe. The majority of newer pipe is PVC.

44. **Sanitation.** Most of the city is not connected to a mains sewer, and most people use water-operated toilets with septic tanks. These do not operate as soak ways because of the

high water table, and the contents discharge into natural drains and low ground, causing unsightly areas, health risks, and water pollution; People living in the slums and other poor areas, use pit latrines, open latrines or other unsanitary methods.

45. **Drainage**. The city drainage system consists of surface and underground elements, maintained by Dhaka City Corporation (DCC) and DWASA respectively. Surface drains are mainly brick and concrete channels (covered and uncovered), built by the Roads and Highways Department alongside roads, and the Rajuk Planning Authority in residential areas. Underground drains are brick-sided tunnels or AC pipes, built by DWASA. The system covers most of the city but does not function properly because drains are blocked with refuse and building rubble and the design is inadequate to cope with the volume of wet season flows.

46. **Solid waste.** Solid waste is the responsibility of DCC, who provide a system through which vans, operated by an NGO, collect refuse from houses and businesses each day, and deposit it at collection points throughout the City. These are emptied daily by DCC, who take the refuse to dumpsites. However, the sites are not engineered or selected carefully, and are often simply areas of open ground in and around the city, where the refuse creates an unsightly appearance and a health hazard. Dumping areas may be covered with sand and soil when full, but this creates a further hazard as these areas may then be built upon and there is a risk of subsidence as the refuse decomposes, and liberated gases can explode if ignited.

47. **Transportation.** The project area heavily congested throughout much of the day, because roads are insufficient for the volume of traffic, and problems are exacerbated by driver indiscipline and ineffective policing of traffic laws.

48. **Roads.** There are a multitude of smaller cross-linking roads, many of which are narrow and suitable for only one or two vehicle widths, which also become congested as drivers seek alternative routes. The problem is compounded by the very large population of Dhaka, which creates a large volume of pedestrian traffic, and the vast array of public and private transport vehicles seeking customers. These include large numbers of buses, taxis, auto rickshaws, private cars, and bicycle rickshaws. These operate throughout the city at both regulated and unregulated stops, and the buses and taxis provide links to surrounding districts.

49. **Classification of roads by size and by surface type.**[17] There is no standard classification of roads based on traffic volume, tonnage, location and function they have to perform. However, depending on use the roads are classified as VIP roads, main roads and other roads. For road restoration purposes the roads are also classified as asphalt road, bituminous road, reinforced concrete cement (RCC)/concrete cement (CC) road, brick pavement, macadam and earthen road depending on construction and surface type.

50. As there is no control on movement of heavy traffic, DWASA considers all types of roads as heavy duty road for design purpose. Dhaka city roads are with foot paths, underground/surface drainage, sewer line, gas, electricity, telephone and other utility services.

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[17] Categories of roads as per surface types are important for road restoration purposes. The pavement restoration, where required, will be carried out by Dhaka City Cooperation (DCC) when all backfill has been settled for 6 weeks. For this purpose DCC will have to be paid as per surface types of the roads. DWASA will apply for the road cutting permission and the contractor must pay therefore. The road cutting plans necessary for the application must be prepared by the contractor.

In order to be systematic and for convenience of work the roads are classified based on width and are defined as Table 2 below.

Table 2: Road Classification in Dhaka

	Road Classification	Description
A.	By Width	
1.	< 2 metre width	The tertiary roads in unplanned areas are usually narrow and mostly less than 2 metres where no vehicles or only one car can pass at a time. These categories of roads will be treated as tertiary roads / lane / access road. The tertiary roads may be of earth, brick pavement, macadam or RCC / CC type. These types of roads have no footpath, have no proper drains and normally a limited number of other utility services beneath.
2.	4 metre width	The internal roads of a planned area and the branch of main roads are within 2-4 m width and are classified as secondary roads. The secondary roads are usually of bituminous surfacing, although RCC / CC and brick pavement and macadam type may constitute a secondary road. These roads may be with or without foot path and in most have all types of utility services beneath.
3.	> 4 metre width	The main roads and VIP roads of Dhaka city are larger than 4 m and are of asphalt / bituminous surfacing. These are heavy tonnage roads, traffic volume is large and traffic congestion is a common feature with these categories of roads. These roads are always with foot path and all other utility services beneath.
4.	Major roads	Main roads are the major roads of Dhaka city allowing all types of traffic including three wheeler rickshaws and heavy truck/lorries.
5.	VIP roads	These are also the main roads of Dhaka city allowing all types of traffic including heavy truck/lorries except the three wheeler rickshaws and pushcart.
B.	By Surface Type	
1.	Asphalt and Bituminous Road	Major roads of Dhaka city are of asphalt/bituminous flexible pavement consisting of wearing course, base course, sub-base and sub-grade. The pavement structure of roads >4 m (main and VIP) have all these elements, however, narrower roads depending on site and traffic conditions may not have the same design.
2.	RCC / CC	Special and access roads are of rigid pavement type and are made of RCC / CC. Usually a rich mixture of cement, sand and course aggregate is laid in a single layer for this type of roads.
3.	Macadam / Brick Pavement	Areas less important and under developed have macadam and brick pavement (200 mm) without base and sub-base course and usually designed for light traffic.
4.	Earth / Kutcha Road	There is also earth / kutcha roads in areas newly developed and sometimes concrete rubbish is used for surfacing.

51. **Land Use.** Present land use is mainly urban in the centre however other land uses as well, including residential units between and above shops in the increasing numbers of high-rise buildings, and some industry. .

52. **Power Sources and Transmission.** Power in the 13 DMAs is provided by Dhaka Electric Supply Authority (DESA) through a network of electricity pylons and poles, mainly located beside roadways. This provides connections to individual houses, and revenue collection is by individual household meters. The power supply is improved recently and power

cuts are rare, generally lasting 1-2 hours when load shedding. Hotels, businesses and the more wealthy residents increasingly use their own generators to augment the DESA supply.

53. **Other Economic Development.** There are few other economic activities in the city, other than those already described. There are no exploitable mineral resources, although mining of sand from river beds to raise the level of land for building is a major activity in floodplain areas. There is also little tourism, because the poor infrastructure and widespread flooding in the months of the northern summer discourage visitors from Europe and elsewhere. As a result, tourism is mainly limited to domestic activity, or Bangladeshis living abroad who return for short-term visits.

E. Social and Cultural Resources

54. **Population and Communities.** Dhaka is the capital and largest city in Bangladesh, and according to recent censuses the population has grown dramatically over the past 25 years, from 3.4 million in 1981 to 6.8 million in 1991, and 10.7 million in 2001 (Bangladesh Bureau of Statistics [BBS]). This is one of the fastest rates of population increase seen anywhere in the world, and if growth continues at the same rate, by 2025 the City will accommodate over 22 million people. At present it is estimated that 55.8% of the population is male and 44.2% female, significantly different from the natural 1:1 ratio. There are around 2.24 million households in the City, so average household size is 4.78 persons, down from 6 per household in 1981. Data for the 13 DMAs are not available.

55. Bangladesh is inhabited predominantly by a single ethnic group, Bengali, who constitute more than 98% of the population of the country. According to the 2001 census over 90% of the country is Muslim, and although this includes both Sunni and Shia, Sunnis are in the majority. Other religions are Hindu (9.2%), Buddhist (0.7%) and Christian (0.3%).

56. **Health Facilities.** Citizens of Dhaka suffer many of the diseases associated with poor sanitation, including dysentery, diarrhea, whooping cough, gastro-enteritis, and tuberculosis. There are a variety of medical facilities, both public and private-sector, covering general health care and specialized services (including cardiac and cholera hospitals, and eye hospitals). There are 16 public hospitals with more than 5,000 beds, and although patients are required to pay for the service, charges are significantly less than in the private sector, and some services are provided free to the poor.

57. **Educational Facilities.** Dhaka provides a large number of educational institutions, run by the public and private sectors. There are over 1696 primary and secondary schools, several hundred colleges and technical institutes, and 52 universities (nine state-funded and 45 in the private sector). Generally, boys and girls are educated together, and there are no major differences in enrolment between the genders in schools, although boys outnumber girls in higher education. Current figures indicate that there are more than 5 million students studying in the City.

58. **Physical and Cultural Heritage.** There are several sites of cultural interest in Dhaka dating from various periods of the City's history. Most of the older sites are in the old part of the City and include:

(i) The 12th century Dhakeshwari temple, which is the oldest Hindu temple in the City and is believed to be the origin of the name of Dhaka;
(ii) Three sites from the Mughal period: the ruins of Bara Katra (enclosed quadrangle building) built on the banks of the Buriganga River in 1644; the smaller Chota

Katra (palace), built nearby in 1663; and the three-storied Lalbagh Fort, built in 1678;

(iii) The 18th century Star Mosque, which has many interesting architectural features including a three domed (Mughal style) structure, mosaic floors and decorated walls; and

(iv) Other mosques such as: The Baitul Mukarram, the largest mosque in the city; the Chawkbazar Masjid built in 1676; the seven-domed Mughal Satgambuj mosque built in the17th century; and Begum Bazar mosque built in 1701.

59. None of these are found in the 13 DMAs.

60. **Indigenous Peoples.** There are no indigenous people identified in the 13 DMAs.

F. Site Specific Existing Condition of the13 DMAs in the Project Area

61. The subproject sites and water pipe alignments are located in the built-up area of Dhaka City and are not within or adjacent to environmentally sensitive areas such as protected areas, wetlands, buffer zones of protected area, and special areas for protecting biodiversity. Table 3 provides description of the 13 DMAs covered by Package No. ICB 2.8.

Table 3: Description of each DMA under Package No. ICB 2.8

	DMA	Existing Conditions
1.	901	DMA 901 is located to the south of a water course which forms the northerly boundary. The area comprises newly built residential blocks in orderly developments. There is little industry and only low level commerce. The area has been infilled in recent years and is low lying, especially to the south. Sub surface water may be present as a result. There are 6 production tube wells in the area which is well served.
2.	902	The area is low lying and has been substantially developed since the satellite imagery presented in the preliminary design. The contractor shall not, initially, rehabilitate the area, which should be subject of a detailed leak detection programme as detailed in these requirements.
3.	903	The area is a fragmented and unplanned area with significant levels of informal slum housing. There area is also very low lying which results in large areas of water surrounding the developed areas
4.	904	The area is well developed with low lying areas to the East. The area is well structured and consists predominantly of long straight pipelines.
5.	905	This area is in the south eastern part of the zone which is largely peri-urban in nature. The network serves some outlying districts. Some informal settlements are present in the area.
6.	906	This is a large area of unplanned residential housing and basic industrial units.
7	907	The area is unplanned area with significant levels of informal slum housing. It is also very low lying which results in large areas of water surrounding the developed areas.
8.	908	This is a planned but very densely developed area There are small slum areas to the north and east.
9	909	The area is generally unplanned multi-storey housing with some informal slum settlements to the south.
10.	910	This is a planned but very densely developed area
11.	911	This is a large DMA. The area is a densely developed mix of planned and unplanned housing with informal slum settlements at many road sides, near Noor Masjif and on the west periphery bordering the water course / low lying land.
12.	912	DMA 912 is a formally planned area with significant residential housing as well government buildings. There is little informal settlement. To the north is an area of reclaimed land which has begun to be developed.
13.	913	This is a mixed area to the south east and residential buildings in the remaining is vacant

	DMA	Existing Conditions
		and pond area. The development of the area is unplanned and includes several areas of informal slum settlement. Any work close to the lines may require additional permission of the rail authorities.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Magnitude and Significance of Impacts

62. The implementation of the subproject will affect most of the city as branches of the distribution network are located in most roads and streets, and the construction process will continue for about 3 years. However, the construction work is in fact not expected to cause major negative impacts. This is because:

(i) most network construction will be conducted by small teams working on short lengths at a time so most impacts will be localized and short in duration; and
(ii) Because of the large population and overcrowded conditions in much of the city, the environment of Dhaka city contains no sensitive features.

63. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected parties; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience.

64. The corridors of impact considered include: (i) existing alignment of pipes to be replaces; and (ii) existing ROWs for the new pipes. Pipe laying will require maximum of 1 m for excavation. No additional land is required beyond the ROWs and existing facilities. Area of influence is limited within the alignments, ROWs, and sites for proposed civil works. Asbestos cement pipes, if found in the existing network to be rehabilitated, will be left in-situ.

65. Categorization of the project and formulation of mitigation measures have been guided by ADB's REA Checklist for Water Supply (Appendix 1) and ADB SPS 2009.

B. Planning and Design Phase

66. Initial designs were conducted by the DWSSDP's DMS based on the on-going packages and DWASA experience in implementing similar projects. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible (salient design features are presented in Table 4). As a result, some measures and design criteria have already been included in the package. This means that the impacts and their significance have already been reduced.

67. The package will be implemented through a design-built contract, i.e. the civil works contractors will also review the detail designs.

Table 4: Environment-Related Design Features of the Package

Activity	Design Consideration
Contractor's responsibility	The contractors shall: - Be familiar with the present traffic congestion of Dhaka city, rules and regulation of Dhaka City Corporation (DCC) for preparaton of road cutting plans before

Activity	Design Consideration
	execution of works;- Arrange for temporary water supply to every household as and when their water supply is disconnected or disrupted; - Protect all underground and overground utility services viz. telephone, electricity, gas, sewer, drainage, etc. from damage during execution of the contract.
Pipe replacement rehabilitation,[18] and network extension[19]	- In all cases, AC pipes shall be replaced. Existing AC pipes, where intact, shall be left in-situ and not disturbed. Where the AC pipe is damaged and where there is a risk of asbestos particles becoming airborne, the contractor shall follow all necessary procedures, guidelines and laws as laid out locally or by this EMP to contain and remove hazardous material. - The network expansion into different residential / industrial areas will be through trenchless or conventional trenching methods whereby the pipelines will be laid with a minimum cover depth of 1.0 metres.
Working hours and times	- All work in major roads and on minor roads that are heavily used by traffic will only be permitted at night between 7:00 pm and 7:00 am. - All the minor roads and alley with less traffic may be considered for both day and night working provided alternative passageway can be maintained.
Road cutting[20]	- Unnecessary road cutting should be avoided. - The contractor has to take all necessary safeguards to avoid accidents at site, prevent loss/damage to all existing utilities like pipelines, telephone/gas/electric cables, poles etc and any government or private property during the contract period. - The contractor will apply for the road cutting permission to the road owning agency and shall give full effort and the cost of road restoration and collect the road cutting permission for required days.Therefore the road cutting plans must be prepared by the contractor. - No temporary or permanent works must proceed before the design and drawings are approved by the Project Manager and road cutting permission will be obtained from DCC by PMU. - The contractor shall prepare a traffic management scheme (road closure program or diversions) and incorporate detail of traffic diversions and pedestrian routes, all traffic signs (for the regulation and for information) and road markings shall be ensured prior to start of road cutting.
Road excavation	- All excavations shall be done to the minimum dimension as required for safety and working facility - The excavation must be carried out in the most expeditious and efficient manner. - The excavation shall be executed in such manner, that the contractor does not damage or interfere with existing services or structures. If damage or interference is so caused the contractor shall make arrangements with the supply and/or building owner to execute the repairs at the contractor's own cost. - All trench and pit excavations and other work shall be carried out during night time and within the limits of any existing road area shall be completed as rapidly

[18] The term pipe replacement is understood to mean that the existing pipe will be replaced, either by the traditional open trench method, where the existing pipe will be abandoned and a new pipe will be installed or by pipe bursting, where the existing pipe will be used as a host pipe which will be cut open, expanded and a new pipe will be installed inside the old pipe.

[19] The term pipe extension is understood to mean the laying of a new pipe where no distribution pipes previously existed. Laying pipes in un-served and underserved area and replacing spaghetti lines (bunch of small diameter coil pipes) with new reticulation pipe lines will be considered as extension work.

[20] Most of the roads are owned and maintained by DCC. Some narrow roads having width even less than 2 m are privately-owned.

Activity	Design Consideration
	as possible and, in the case of roads capable of carrying two or more lanes of traffic, not more than one half of the width of the carriage way shall be obstructed at any one time. In single lane roads, the contractor shall programme his work in such a manner that the minimum inconvenience is caused to those persons who have reasonable grounds for using the road. - Road drains and channels shall be kept free from obstructions at all times. - In case of excavation in VIP and other large roads, the trenches and pits maybe need to be covered by steel plates to allow traffic to pass during non-working periods. The contractor must liaise with the DCC and the responsible police to familiarize themselves and adhere to such rules. All costs involved to adhere to such rules shall be borne by the contractor. - Pits and trenches not backfilled at end of a night shift, the excavation must be covered with steel plates and in alleys with wooden plates. - It is preferable that trench excavation along roads be located in footpaths or verges adjacent to the road rather than in the carriage way itself. Trench excavation shall wherever practicable be carried out in such a way that every part of the excavation is at least 0.5m clear of existing edges of the carriage way. - Where trench excavation or any other part of the works obstructs any footpath or right-of-way, the contractor shall provide, at his own cost, a temporary footpath around the obstruction to the satisfaction of the Project Manager. - The contractor shall have particular regard to the safety of pedestrian, livestock, and shall ensure that all open excavation, access routes and steep or loose slopes arising from the contractor's operations are adequately fenced and protected.
Trenchless pipe installation	- Pipes shall be installed by the horizontal directional drilling (HDD) methods where required. Should survey information indicate that the method is not feasible the contractor shall inform the Project Manager and gain prior approval for an alternative method or for open trench method. - Excavation material shall be removed from the conduit as the work progresses. No accumulation of excavated material within the conduit will be permitted. - The contractor shall provide sediment and erosion control measures in accordance with local environmental legislation. - The contractor shall supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction. Spent drilling fluids and cuttings shall be confined to the entrance and exit pits. - The contractor shall take all necessary precautions to minimize the damage to the adjacent properties. Any drilling fluid that enters the pipe shall be removed by flushing or other suitable methods. - The contractor shall be responsible for cleanup and restoration - Pits excavated to permit connection of bored pipe shall be backfilled, and disturbed areas shall be restored to their original state or better. Sections of sidewalks, curbs, and gutters or other permanent improvements damaged during HDD operations shall be repaired or replaced at the contractor’s expense.
Resettlement plan	The contractor shall: - Implement Resettlement Plans, prepared by DWASA. No civil works will begin until all compensation to affected persons is paid.
Preparation of catalogues, installation and O&M manuals	- The contractor shall supply catalogues and installation manuals for each type of pipes to DWASA at the time of submission the Operation and Maintenance manuals. - All catalogues and manuals shall be printed in the English language or accompanied by an English translation.

C. Construction Phase

68. **Construction method.** Existing pipes are buried within existing roads. Larger pipes (200 mm and above) are normally located in main roads, and smaller pipes (<200 mm) are in minor roads. Similar to on-going projects, the pipeline is mostly to be situated near the centre of the roads.

69. All work in major roads and on minor roads that are heavily used by traffic will only be permitted at night between 7:00 pm and 7:00 am. All the minor roads and alley with less traffic may be considered for both day and night working provided alternative passageway can be maintained. In all cases the contractor shall take prior permission from DCC. Contractors in Dhaka are required to obtain permission from the police for construction work in roads. The work has to be conducted in amounts that can be completed in a single night, and the surface is reinstated for use in the morning.

70. Most of the pipe replacement/rehabilitation will be carried out by use of trenchless technology,[21] where a flexible plastic tube is inserted into an existing pipe and inflated to seal the inner surface. Small chambers are dug to open two ends of a pipe and a wire is inserted to pull through the plastic tube, which is expanded by air pressure and adheres to the inside of the pipe. The only excavation is hand digging to build two small chambers (roughly 1.5 m^3) per length, and the machinery is also small, involving a rotating drum for the wire and plastic liner, and an air compressor and water pump. This approach can also be used to install new pipes bydrilling a horizontal tunnel andinserting the pipe, or by installing a tube inside a faulty pipe and inflating until the pipe bursts below ground, leaving a new pipe with a larger diameter and capacity.

71. At some locations trenches will be built to remove leaking pipes and install replacements, and this will be done using backhoe diggers, supplemented by manual labor where necessary. Excavated soil will be loaded onto trucks and taken offsite for dumping, and sand for infilling will be brought in on trucks and stored on site. Pipes will be installed as per approved design and profile and the trench wil be filled with full sand DCC is responsible for re-applying the final asphalt surface to metalled roads, and this will be done after approximately 6 weeks, to allow settling of the compacted material.

72. Pipes will be of UPVC (100-250 mm) or ductile steel (>300 mm) and will be brought to site on trucks, offloaded manually or by crane, and positioned in the trench by crane or via a pipe-rig. After pipes have been joined, the trench will be backfilled with sand, and soil will be applied to the surface layer and compacted by hand-operated vibrating compactor.

73. Chambers for network valves for diameter 250 mm and above and all bulk meters will be built in the trenches that are dug to install new pipes or at the entry and exit points for the trenchless work, so no separate excavation will be needed. Most chambers will be around 1.5 m^3 with concrete floors and brick sides, which will be built by hand by masons. Valves will be put in place by hand or via small cranes and will be attached to the pipe flanges, and each chamber will be closed by a removable steel manhole cover.

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[21] This applies to all network construction in main roads, and an estimated 25% of the work in minor roads.

74. House connections will be provided when work is conducted on the distribution pipe in the vicinity, and short trenches will be dug between the pipe and each residence, and a short length of small-diameter high density polyethylene (HDPE) pipe will be attached. This will terminate at the boundary of the property with a meter and a small valve (Photo 2).

75. **Impacts on Physical Resources.** Out of 457 km water pipeline network, more than 60% will be done by using trenchless technology. Therby impact will be very low. About 40% will be implemented by open cut method. There will be temporary impact during contruction period. However, proper mitigation measure will be taken.

76. There will however be much greater physical disturbance from the installation of the remainder of the pipes, as this will require the construction of over about 182 km of trenches. If average trench dimensions are 0.6 x 1 m, then this work will excavate almost 110,000 m^3 of soil and brick bats. After construction, approximately 25% of the trench will be occupied by the pipe, 50% by backfilled sand, and 25% by excavated soil replaced on top of the pipe. This means that over the project area as a whole, a total of 82,500 m^3 of sand and breakbats will be brought to site, Total 110,000 m^3 of waste soil and brick bats will be left over.

77. This presents a significant waste management issue, as this is a very large quantity of waste, which could not be dumped without causing physical impacts (on air quality, topography, soil quality, etc.) at the disposal site. There will also be quite large physical changes as a result of trench construction; and as the work will almost certainly be conducted in the dry season, there is also a lot of potential for the creation of dust (during excavation, storage and transportation of soil, and the importation of sand for infilling). Although most actions will be the responsibility of the contractors appointed to conduct this work, DWASA will also need to discuss the waste management issue in detail with DCC, to explore ways of reducing the amount of material to be dumped, by finding alternative beneficial uses.

78. The source of sand for the infilling will be determined by the contractors, and it is likely that this will be purchased from vendors who dredge sediment from the rivers for use in building and as infill in the floodplains to raise the level of building land. This is a major operation that has been underway for some considerable time, and removes very large quantities of sand from the river, without any apparent ill effects. This is probably because of the enormous amounts of sediment that are carried by the rivers and deposited in the delta region, and it could be that the mining activity improves the flood retention capacity of the river and helps protect parts of the city from flooding. The 55,000 m^3 of sand that are required by this project represents a small fraction of the amount that is excavated annually, and will therefore not have significant additional impacts on the river beyond those of the operation as a whole.

79. Another physical impact that is commonly associated with large-scale excavation is theeffect on local drainage patterns if surface- and ground- water collects in voids as they are being dug. This should however not be a problem in this case, given the relatively deep water table in Dhaka City, and the fact that the contractor will almost certainly conduct the excavation in the dry season to avoid difficult working conditions in the monsoon.

80. In overall terms, although a large volume of material will be removed during trenchconstruction, a large volume of sand will be brought to the working sites, and a relatively large area will be affected, physical impacts are not expected to be significant. This is because:

(i) The method of working, whereby small teams work on short lengths of the pipeline for a few days and complete the work before moving on to the next site, means that at each site the effects will be mainly localized and short in duration;
(ii) Physical impacts will be mainly temporary as trenches will be refilled and compacted after pipes are installed, and road surfaces will be re-covered with asphalt; and
(iii) The design criteria and mitigation measures described in the Environmental Management Plan (EMP) will reduce those impacts with more wide-ranging implications to acceptable levels.

81. **Impacts on Ecological Resources.** As most trenches and chambers for the trenchless works will be dug within roads, then there will not be any direct ecological impacts from construction of the network improvements. Contractors will however be required to ensure that no roadside trees are damaged or removed in the course of the work; and to mitigate any accidental losses, contractors will be required to plant and maintain two trees of the same species for every one that is removed.

82. The use of river sand for construction work can have ecological impacts by removing benthic invertebrates that provide food for fish, birds and other organisms, and destroying their habitats. However, these impacts will not be significant in this case because:

(i) The amount of sediment removed for this project is a very small proportion of the total dredging operation;
(ii) The large volumes of sediment carried by the river and the wide seasonal variations in flow mean that the river is a very dynamic ecosystem in which sediment erosion and accretion are part of the natural cycle, to which the invertebrate populations must adapt to survive; and
(iii) Sediments are a sink for many contaminants discharged into water bodies, so the dredging operation may provide some ecological benefit by reducing the overall pollution load.

83. **Impacts on Socio-Economic Resources.** The network improvement works will involve the 391 km of pipes works in the streets of Dhaka City, which house very large numbers of shops, businesses, industries, and other economic activities. As the network is located in roadways, people and activities will undoubtedly be disturbed during the 3years construction period. However, it is not expected that this will result in major impacts on the economy of the city, or on the income of its businesses and citizens. This is because:

(i) The installation of distribution pipes and reticulation pipes will be conducted by trenchless methods as much as possible, which require small-scale excavation at access points only, and will thus result in minimal disruption;
(ii) Of the pipes that will require trenching, local by-laws require that works in roads are conducted at night, when most businesses are closed; and
(iii) Work will mainly be carried out on individual short lengths of the network, so each location will be affected for only a short time (an average of 5 days).

84. As all work will be conducted in existing roads and right-of-ways (ROWs) there will be no need to acquire land from privateowners for the project, so there will be no resulting impacts on the income and assets of landowners or their tenants.

85. There can be economic impacts however if roads have to be closed for short periods and customers are unable to gain access to shops, or if trenches are constructed near the sides of roads, and customers are impeded by the presence of trenches, excavated material, workers and machinery. Although resulting losses in income will be small and short-lived, they can still be significant for small traders and other businesses that exist on low profit margins. A separate Resettlement Plan has been prepared for Package ICB No. 2.8 to examine the social and economic issues in more detail and provide appropriate mitigation where necessary. This establishes that, in addition to the mitigation measures in this IEE, owners and tenants of affected businesses will also be compensated to reduce the economic impact due to construction works.

86. Trenches will inevitably restrict traffic flows to an extent and roads may have to be closed on occasion. Although works in roads will be conducted at night, and individual streets will be affected for relatively short periods only, traffic impacts can still be significant, given the congestion problem that exists in Dhaka already. DWASA and the design consultants have planned the work carefully by including in the design and specifications requiring the contractors to submit a traffic management plan for approval of the Project Manager.

87. **Impacts on Socialand Cultural Resources.** When construction is conducted in residential areas, people may be disturbed by the noise of the construction activities and by dust during dry and windy weather, and trenches may impede access to houses for residents and their vehicles. In this case the fact that work will be conducted at night creates another potential problem as people may be disturbed by on-site lighting, and their sleep may be disrupted by noise. However, these impacts will not be greatly significant because:

(i) Disturbance at most locations will last for a few days only;
(ii) Background noise in much of Dhaka is high, even at night, so residents are adapted to a relatively high noise environment; and
(iii) People will be more willing to tolerate short-term temporary disturbance if they are aware of the benefits they will gain from an improved water supply.

88. DWASA will inform residents fully about the work, its duration and impacts, the mitigation measures, and the benefits of the completed scheme. In addition, officials in charge of facilities of social and cultural importance (e.g. schools, hospitals, mosques, museums, etc.) will be involved in stakeholder meetings so that they can be informed about the work in advance, and can bring specific concerns and issues to the attention of DWASA, if necessary.

89. **Impacts on Communities.** A potentially more significant impact is the effect on people and communities if water supplies are closed down for extended periods when work is conducted on the network. This would be inconvenient in the short term, and there could be health risks if the water supply was unavailable for several successive days or longer. The package design and specifications require the contractors to plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration), provide alternative potable water to affected households and businesses for the duration of the shut-down, liaise with affected persons to inform them of any cessation well in advance, and to ensure that they are provided with an alternative supply.

90. There is inevitably a safety risk when substantial construction such as this is conducted in an urban area, and strict precautions are needed to ensure the safety of both workers and citizens. Contractors will be required to produce and implement site Health and Safety (H&S) Plan.

91. **Impacts due to Existing Asbestos Cement Pipes.** An additional, particularly acute health risk presented by this work derives from the fact that some parts of the existing water supply system include pipes of AC, a material that can be carcinogenic if fibers are inhaled. There is therefore a significant health risk for workers and the public if these pipes are uncovered and damaged or cut accidentally, or deliberately to conduct the necessary pipeline refurbishment. This is in fact not such a major problem as might be expected, because:

(i) There are only a small number of AC pipes in the existing water supply system (around 20 km);
(ii) These pipes are all in the old part of the city and their location is well known and marked on maps prepared by DWASA;
(iii) The design of the project involves the replacement of these pipes and this can be done without removing or disturbing them, so all AC pipes will be left in situ.

92. Given the dangerous nature of this material, additional measures will still be established to protect the health of all parties in the event (however unlikely) that AC pipes are encountered in the course of the work. During the detailed design phase, the design consultant will develop a protocol to be applied in any instance that AC pipes are found, to ensure that appropriate action is taken. This will be based on the approach recommended by the United States Environmental Protection Agency (USEPA)[22] and amongst other things, will involve:

(i) Training of all personnel (including manual laborers) to enable them to understand the dangers of AC pipes and to be able to recognize them in situ;
(ii) Reporting procedures to inform management immediately if AC pipes are encountered; and
(iii) Development and application of a detailed H&S procedure to protect both workers and citizens. This will comply with national and international standards for dealing with asbestos, and will include: (a) removal of all persons to a safe distance; (b) usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material; (c) procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

93. Given the scale of the project it is likely that large numbers of local people will obtain at least temporary socio-economic benefits, by gaining employment in the construction workforce, and thus raising their levels of income. These benefits can bring wider social gains if they are directed at vulnerable[23] groups. Contractors will therefore be given targets for the numbers of women and other vulnerable persons they should employ in their workforces, and DWASA will ensure that vulnerable persons are represented as legitimate project stakeholders in the various consultation forums and administrative committees established by the project. Creating a workforce from mainly local people will bring additional benefits by avoiding problems that can occur if workers are imported; including social difficulties in host communities and issues of health and sanitation in poorly serviced temporary camps.

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[22] In the USA, standards and approaches for handling asbestos are prescribed by the Occupational Health and Safety Administration (OHSA) and the Environmental Protection Agency (EPA) and can be found at www.osha.gov/SLTC/asbestos.

[23] Vulnerable groups as those without legal title to land and other assets; households headed by single earner females, the elderly or disabled; indigenous peoples (based on ADB OM); and households with incomes that are below the poverty line

D. Operations and Maintenance Phase

94. The main O&M activities of the rehabilitated pipes will be detection and repair of leaks and pipe bursts. The generally flat topography and the usage of good quality pipes should mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes and areas where residents continue to attach their own illegal house connections. Leak repair work will be similar to the pipe-laying work as earlier explained. Trenches will be dug to reveal the leaking area and the faulty connection will be refitted, or the pipe will be removed and replaced if necessary.

95. The bulk meters will allow automatic computerized monitoring of amounts of water flowing through individual parts of the network, which will pinpoint areas where there are leaks and/or where water is being taken out of the system illegally. DWASA will visit such areas with audio devices to locate individual leaks, which will then be repaired in essentially the same way that the pipes were installed. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary. If illegal connections are found these will be removed and the pipe will be re-sealed, or a new properly fitted connection with a meter will be provided.

96. **Impacts on Physical Resources.** Generally, the main risk to the physical environment of operating an improved water supply system is that increased abstraction of surface or groundwater will deplete the water resource. However, that will not be the case here, as there will be no additional abstraction. The increase in supply will be obtained from the refurbishment of the distribution network (which will significantly reduce system losses from leakage), and the installation of a new metering system (which will improve leak detection and cost recovery). This is expected to both improve the supply of water to the consumer and reduce the decline in groundwater from over-abstraction.

97. If trenches are dug to locate and repair leaks or remove and replace lengths of pipe or illegal house connections, the work will follow the same procedure that occurred when the infrastructure was improved. In this case soil and backfilled sand will be removed to expose the leaking junction or pipe, and if necessary a new pipe will be brought to site and replaced. The trench will then be refilled and re-compacted. This work should be very infrequent, and will affect individual small locations for short periods only (an average of a few hours for most repairs). Physical impacts will therefore be negligible. Work will not be conducted during rainfall so there will be no effect on drainage, and the removed material will be replaced in the trench so there will be no waste. There should also be no need to cover excavated material to prevent dust as it will have been wetted by the leaking water.

98. **Impacts on Ecological Resources.** The distribution network is located within roads, so any repairs will have no ecological impacts.

99. **Impacts on Socio-Economic Resources.** If network repairs are conducted in areas where there are shops or other commercial activities, these could lose some business while the repairs are conducted if access is difficult for customers. However, these will not be significant and will not need to be compensated, because repairs will be much smaller in scale than the original trenching works and much shorter in duration, so any losses will be at the level of normal day-to-day fluctuations in business income.

100. **Impacts on Socialand Cultural Resources.** If network repairs are conducted in residential areas people may be disturbed by construction noise, and there could be some

interruption of access to houses and locations of social and cultural importance (such as mosques, schools and hospitals) by the trenches and excavated soil. However, these impacts should also not be significant because of the short-term and infrequent nature of the works.

101. DWASA (and the contractors during the defects liability period) will operate the same kinds of H&S procedures as used in the construction phase to protect workers and the public. This will include application of the asbestos protocol if any AC pipes are encountered, and prohibition of the use of AC pipes for any repair and maintenance work.

102. The citizens of the city will be the major beneficiaries of the improved water supply, as they will be provided with a constant supply of better quality water, piped into their homes. This should produce major improvements in the social capital of the city, and significant improvements in individual and community health and well-being. To augment these benefits, DWASA will conduct a public education and information campaign to raise awareness of the health risks of contaminated water and the continuing need to boil municipal water before consumption. Then diseases of poor sanitation, such as diarrhea and dysentery, will be greatly reduced.

103. People will then spend less on healthcare and lose fewer working days due to illness, so the economic conditions of individuals and the community as a whole should improve. There should be fewer deaths in infancy and at other stages of life, so the structure and well-being of families should also improve. The cultural resources of the city may also benefit, because if people are healthier and have more income, they should also have more time and money to spend on cultural pursuits.

E. Mitigation Measures

104. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is will not cause significant adverse impacts. In addition to the mitigation measures and specifications already considered in the package design, the potential adverse impacts that are associated with construction and O&M can be mitigated to acceptable levels with the specific mitigation measures discussed in the EMP.

F. Cumulative Impact Assessment

105. The cumulative impact assessment (CIA) examined the interaction between the project's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing, and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The project's potential cumulative effects were considered with respect to valued components (VCs) in environmental and socioeconomic categories, in four areas:

(i) of any potential residual project effects that may occur incrementally over time;
(ii) Consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the project;
(iii) Potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed project; and
(iv) Future developments that are reasonably foreseeable and sufficiently certain to proceed.

106. The project has identified the VCs as water quality, noise, traffic management, socio-economic and socio-community components, and human health. There are no foreseeable projects that will overlap with the project. The spatial boundary of the project is the area along the pipe alignment, existing right of ways, and building sites. The temporal boundary can be considered as the whole Dhaka City.

107. Given the water supply requirement in Dhaka will be met and the sources considered adequate, there are no significant cumulative impacts expected on the future water supply.

108. Air quality effects will occur during construction. Consequently, although emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites, this impact will be short-term and localized to the immediate vicinity of the alignment. Greenhouse gas (GHG) emissions may increase as a result of project activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, landfilling of residual wastes). Given the project's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

109. Noise levels during construction in the immediate proximity of most work sites are expected to increase. The duration of this exposure will be relatively brief. This exposure represents a temporary, localized, adverse residual effect of low to moderate significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction. Noise levels associated with the project O&M will be largely imperceptible, as the buildings are located in relatively small sites within the city proper.

110. Land use/traffic management concerns will occur spatially during construction. Site-specific mitigation measures will be implemented to address temporary disruptions to land use and access, traffic delays and detours, parking modifications, and increased volumes of construction-related traffic. Traffic movement along the alignment will be improved once construction is completed. Since the project will be the rehabilitation of existing pipelines and a building to be constructed adjacent to existing water supply facilities, it will not conflict with existing or planned land use. However, following improvement in infrastructures and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance the project area. This can be considered a long-term cumulative benefit of the project.

111. Meghna River will be a new source of water supply for Dhaka, which has good water quality and ample quantity even during the dry season. The on-going ADB Loan 3051 DESWSP is developing a new surface water supply scheme for supply augmentation, which includes the development of water intake at Meghna River. With the new water supply source, dependence on groundwater will be rduced and impacts due to groundwater abstraction are not anticipated.

112. DWASA developed a sewerage master plan including two wastewater management projects, which will offset the incremental water supply caused by the project.

113. Upon completion of the project, the sociocommunity will benefit from improved water supply system. This is considered a long-term cumulative benefit.

114. No adverse residual effects to human health will occur as a result of project construction or operation. While exposure to elevated noise levels and fugitive dust and common air

pollutants will occur in proximity to project work sites during construction, due to their short-term, localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

115. Therefore, theproject will benefit the general public by contributing to the long-term improvement of water supply system and community livability in Dhaka City.

VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

A. Public Consultation Conducted

116. The public participation process included (i) identifying interested and affected parties (stakeholders); (ii) informing and providing the stakeholders with sufficient background and technical information regarding the proposed development; (iii) creating opportunities and mechanisms whereby they can participate and raise their viewpoints (issues, comments, and concerns) with regard to the proposed development; (iv) giving the stakeholders feedback on process findings and recommendations; and (v) ensuring compliance to process requirements with regards to the environmental and related legislation.

117. The following methodologies have been used for carrying out public consultation:

(i) Local communities, individuals, and owners and employees of commercial establishments who are directly or indirectly affected were given priority while conducting public consultation.
(ii) Walk-through informal group consultations were held in the proposed project area.
(iii) The local communities were informed through public consultation, with briefing on project interventions, including its benefits; and
(iv) The environmental concerns and suggestions made by the participants were listed, and discussed, and suggestions accordingly incorporated in the EMP.

118. Different techniques of consultation with stakeholders were used during project preparation (interviews, public meetings, group discussions, etc). A questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through adhoc discussions on-site) have been used to discuss the project and involve the community in planning the project design and mitigation measures.

119. Key respondents included project-affected persons, who only include owners of houses/residences and commercial shops/establishmentswho will suffer temporary access disruptions during project implementation due to the laying of pipelines, shopkeepers/businessmen from the project area, and daily commuters consulted randomly. In addition to a number of informal consultations conducted regularly in the project corridor, a total of 37,720 number of connections, selected on a stratified basis to ensure diversified representation, were consulted up to Decemebr 2015. Issues discussed and feedback received along with details of date, time, location, and list of participants are given in Appendix 3.

B. Future Consultation and Disclosure

120. The IEE and other relevant documents will be made available at public locations in the city and posted on the DWASA and ADB websites. The consultation process will be continued

and expanded during the project implementation through a nongovernment organization (NGO), to ensure stakeholders participate fully in project execution, as well as to implement comprehensive information, education, and communication plan.

121. The public consultation and disclosure program with all interested and affected partied will remain a continuous process throughout the project implementation, and shall include the following:

(i) **Consultations during construction phase:** (a) public meetings with affected communities to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and (b) smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and to provide a mechanism through which stakeholders can participate in project monitoring and evaluation.

(ii) **Project disclosure:** (a) public information campaigns including dissemination of construction schedules to explain the project to the wider city population and prepare them for disruptions they may experience once construction is underway; (b) public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in local language; (c) formal disclosure of completed project reports by making copies available at convenient locations in the study areas, and informing the public of their availability; and (d) providing a mechanism through which comments can be made.

122. For the benefit of the community, the Executive Summary of the IEE will be translated in the local language and made available at (i) DWASA office, (ii) area offices, and (iii) contractor's offices/campsites. It will be ensured that the hard copies of IEE are kept at places which are conveniently accessible to citizens, as a means to disclose the document and at the same time creating wider public awareness. An electronic version of the IEE will be placed in the official website of DWASA and the ADB website after approval of the IEE by ADB.

C. Involvement of NGOs, CBOs and Women's Organizations

123. The active involvement of NGOs, CBOs, and organizations representing women and other vulnerable groups is seen by DWASA as essential in fostering positive community participation in the program and ensuring that the views and wishes of the disadvantaged are heard and acted upon. NGOs will perform a number of key roles in the project, in particular:

(i) An NGO have been appointed by the PMU to organize and implement the consultation and disclosure activities described above, and the various awareness raising campaigns;

(ii) The PMU will also appoint an NGO with experience of resettlement issues to implement Resettlement Plans in each hydraulic zone and distribute the entitlements;

(iii) The concern consultant and resettlement expert engaged for monitoring the activities, with the help of the NGO, may fulfill the role of Training Coordinator in the PMU. They will organize training for DWASA staff, environment and resettlement cells, and CBOs in community level;

(iv) NGOs will also be appointed to assist the PMU and PCUs with other technical tasks, for example in conducting some of the resident surveys for the

resettlement activities, where an established relationship with the communities is essential.

124. The main role of CBOs and organizations representing women and other vulnerable groups will be to represent the interests of their members in dealings with the program proponents, in particular the PMU and PCUs and also the contractors. These organizations will be registered stakeholders and will thus be involved in the various consultation and disclosure activities. Together with NGOs they will be assured of representation in the various committees and other forums that are established to plan and implement the program and monitor its progress. As a further safeguard to ensure their representation and involvement key positions on all committees will be reserved for women and vulnerable persons.

VII. GRIEVANCE REDRESS MECHANISM

125. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of AP's concerns, complaints, and grievances about the social and environmental performance at the level of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

126. DWASA has its own Grievance Redress Procedure (GRP), which it operates to address any dissatisfaction and complaints by residents regarding its activities. This is set out in the DWASA Resettlement Policy Framework (RPF), developed with World Bank assistance in January – March 2006 and approved by GoB in April 2006. This procedure will be applied to address any complaints or grievances during implementation of the DWSSDP.

127. DWASA policy as set out in its RPF is to try to resolve complaints at project level through negotiations with community leaders and representatives of Affected Persons (AP). For this program these discussions will be conducted by the PIU, and will involve the AP and members of the relevant Zonal Level Coordination Committee (ZLCC), plus the Site Manager and Chief Engineer of the Construction Contractor if necessary. If a case cannot be resolved in this way it will be submitted to a Grievance Resolution Committee (GRC), led by the PMU Director, with two other members who are (i) a representative of the residents of the project area who is known to be a person of integrity and good judgment who commands respect, and (ii) a representative of a local NGO or CBO (in this case the NGO implementing the Resettlement Plan).

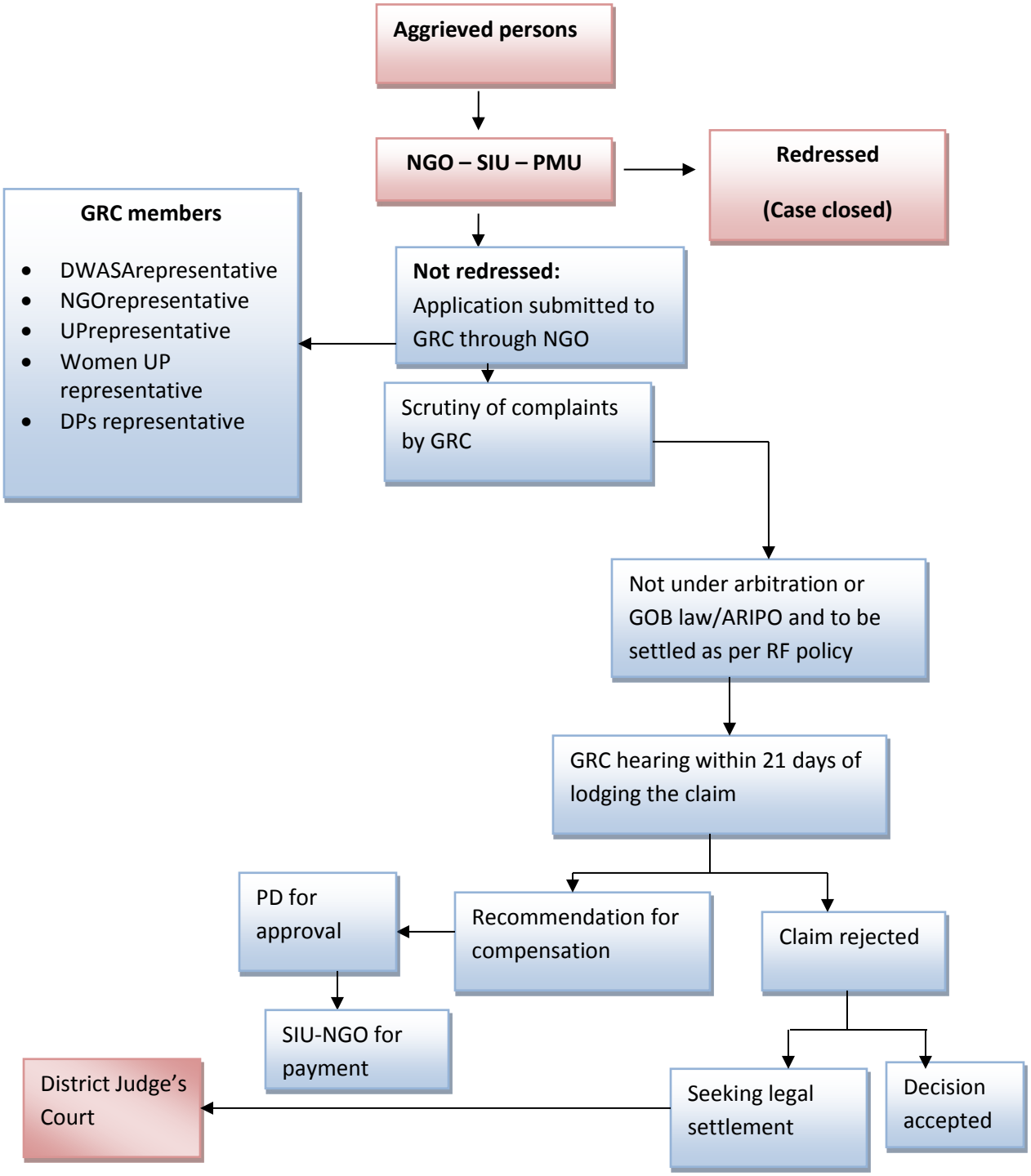
128. The Project Coordinator convenes a meeting of the GRC in the project area, and conducts proceedings informally to reach an amicable settlement between the parties. The report of the committee is recorded in writing, and attested copies are provided to the parties involved. For this program the GRC will be required to meet and reach a decision within 35 days of receiving a complaint (verbally or in writing) from an AP or his representative. There will also be an appeals procedure where, if a person is dissatisfied with the ruling of the GRC, he or his representative may attend their next meeting to re-present the case. The committee will then re-consider the case in private, after which their decision is final. If the appellant is still not satisfied, he has the right to take his case to the public courts.

129. The PMU Resettlement Specialist will keep a record of all grievance cases and will examine these for recurring complaints and solutions and action to address these will be incorporated in subsequent RPs and IEEs.there are 3 APs will be made aware of the GRM via the public consultation meetings, and will be informed of the outcome of cases at subsequent

meetings. All the afe ted households are squatters or enchrochers. DWASA will also publish the outcome of cases on public notice-boards in each hydraulic area. If the aggrieved AP is not satisfied with the decision of the GRC, he/she has the right to refer his/her petition to the court of law.

130. All costs involved in resolving the complaints (meetings, consultations, communication, and information dissemination) will be borne by the PMU; cost estimates for grievance redress are included in resettlement cost estimates as Tk. 53,863.52.

Figure 3: Grievance Redress Mechanism (GRM)



VIII. ENVIRONMENTAL MANAGEMENT PLAN

131. The purpose of the environmental management plan (EMP) is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

132. The draft IEE will be updated based on the detailed designs and submitted to ADB for review, approval, and disclosure prior to commencement of works. All government permits and clearances (if necessary) shall be obtained prior to commencement of civil works. A copy of the EMP must be kept on work sites at all times. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

A. Implementation Arrangement

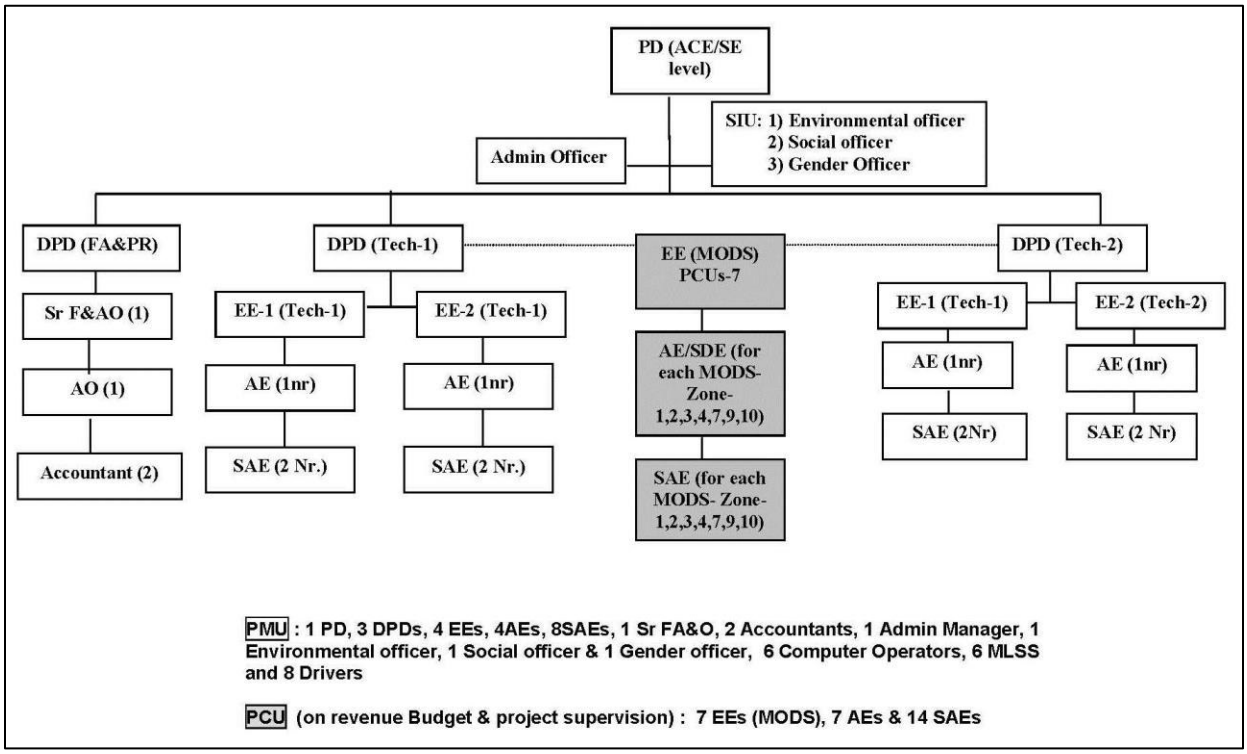
133. DWASA will be responsible for the overall management, supervision and execution of the Project. PMU will be established and will consist of one full-time project director in the rank of additional chief engineer and two dedicated deputy project directors in the rank of superintending engineers, responsible for civil works and electro-mechanical works. The project director and deputy project directors will be appointed exclusively to the Project. At least four executive engineers will assist the deputy project directors in managing the works under them.

134. Project coordination unit (PCU) in 7 zones, headed by an executive engineer, will be responsible for liaising and coordinating with the contractors, DMS, CBS, NGO, and other stakeholders on all day-to-day implementation of distribution network improvement work under the project. To strengthen the PCU in conducting these activities and addressing their day-to-day O&M issues, DWASA will assign additional staff for the project period.

135. An inter-ministerial project steering committee (IPSC), chaired by secretary of LGD, will be established to provide policy guidance and overall coordination of project implementation. Its members will include managing director, DWASA; project director of PMU; Dhaka North City Corporation; Dhaka South City Corporation; Economic Relations Division and the Finance Division of MoF, Planning Commission; Ministry of Home; Ministry of public works; the Implementation Monitoring and Evaluation Division; RAJUK (the capital development authority); Department of Environment; Local Government Division; Local Government Engineering Department; The PSC will hold its first meeting within 3 months of loan effectiveness, and will meet at least twice annually thereafter, to coordinate and resolve any issues in project implementation. Minutes of its meetings will be forwarded to ADB for information.

136. A project implementation committee (PIC), chaired by Managing Director of DWASA, will be established to discuss key project implementation issues and provide guidance for smooth implementation. Its members will include representatives from the same agencies mentioned above, utility services, and Deputy Managing Director (Research, Planning, and Development) of DWASA. The PIC will meet at least quarterly, and more often as needed. Minutes of its meetings will be forwarded to ADB for information. The organizational structure is shown in Figure 4.

Figure 4: Organizational Structure of PMU and PCU



137. The specific responsibilities of the PMU Environmental Officer include:

(i) Review and approve the project's IEEs and EMPs;
(ii) Confirm existing IEEs and EMPs are updated based on detail designs;
(iii) Conform whether the package-specific EMP is included in bidding documents and civil work contracts;
(iv) provide oversight on environmental management aspects of the project and ensure EMPsare implemented by contractors;
(v) Establish a system to monitor environmental safeguards of the project, including monitoring the indicators set out in the environmental monitoring plan of the EMPs;
(vi) facilitate and confirm overall compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements, as relevant;
(vii) review, monitor and evaluate the effectiveness with which the package-wise EMP is implemented, and recommend necessary corrective actions to be taken as necessary;
(viii) consolidate monthly reports of contractors and submit semi-annual monitoring reports to ADB;
(ix) ensure timely disclosure of final IEE/EMP in locations and form accessible to the public; and
(x) address any grievances brought about through the GRM in a timely manner.

138. The PMU will be supported by the Design, Management and Supervision (DMS) Consultants, who design the infrastructure, manage tendering of contractors and supervise the construction process; and NGOs, who conduct public awareness campaigns. Environmental

issues will be coordinated by the DMS's Environmental EIA Expert and Environmental officer. The responsibilities of the DMS Environmental EIA Expert include:

During Detailed Design Engineering Period

- Provide capacity development trainings to PMU, PCUs, contractors (including its subcontractors) and members of the Grievance Redress Committee on ADB SPS and government environmental requirements to be complied during detailed design, construction and operation phase;
- Finalize IEE reports as per detailed design prepared during preliminary design stage;
- Prepare IEE/s for new package/s not assessed during preliminary design stage;
- Provide to contractors (including its subcontractors) all approved IEEs and assist them in ensuring detailed designs include environmental considerations to avoid, minimize, and mitigate potential impacts;
- Ensure contractors integrate in detailed design appropriate measures to comply with conditions stipulated in government-issued clearances/permits/consents;
- Provide guidance to contractors (including its subcontractors) in preparing site-specific EMP including traffic management plan, waste management plan, and any other environmental plans as required in the EMP and by government-issued consents/permits;
- Provide guidance to contractors (including its subcontractors) in developing subproject-specific environmental monitoring program consistent with the site-specific EMP;
- Lead and assist PMU, PCUs and contractors (including its subcontractors) in conducting and documenting public consultations, ensuring any feedback received will be communicated to PMU, and coordinating with contractors to address participants' issues/concerns;
- Assist PMU, PCUs and contractors (including its subcontractors) in ensuring relevant information on environmental safeguards is disclosed to stakeholders, community, and affected people in form and language they understand;
- Disclose IEE summary in local language at PMU and PCUs offices and to the stakeholders; and
- Assist PMU and PCUs in establishing grievance redress mechanism (GRM).

During Construction Period

- Ensure that all necessary clearances/permits/consents are in place prior to start of construction and valid throughout construction period;
- Ensure contractors (including its subcontractors) comply with the measures set forth in the site-specific EMP and government-issued clearances/permits/ consents;
- Lead and assist PMU, PCUs and contractors (including its subcontractors) in conducting and documenting information dissemination, ensuring any feedback received will be communicated to PMU, and coordinating with contractors to address participants' issues/concerns;
- Ensure contractors (including its subcontractors) conduct regular environmental monitoring as per approved site-specific EMP;
- Assist PMU and PCUs in implementation of GRM, and advise contractors (including its subcontractors) on appropriate actions to redress the complaints;
- Ensure that complaints/grievances are addressed in a timely manner and resolutions are properly documented;

- Inform PMU and PCUs promptly in case any significant impacts not identified in the IEEs arise during construction period and immediately develop corrective actions to be implemented by the contractors;
- In case of non-compliance by contractors (including its subcontractors), prepare corrective action plan including budget requirements and ensure timely implementation;
- Review monthly monitoring reports to be submitted by contractors
- Prepare quarterly Environmental Monitoring Report (EMR) on performance of contractors on EMP implementation;
- Assist PMU in preparation of semi-annual monitoring report to be submitted to ADB;
- Assist PMU in disclosure of safeguard documents;
- Provide reminders to contractors on required statutory clearances/permits/ consents prior to commissioning of subproject facilities; and
- Ensure contractors (including its contractors) implement clean-up of worksites and areas used/disturbed during construction period prior to commissioning of subproject facilities.

139. **Contractor.** The contractor will have an environment supervisorto (i) coordinate with DMS on updating the EMP based on detailed designs, and (ii) and ensure implementation of EMP during civil works.

B. Capacity Building

140. A training program on environmental assessment, implementation and reporting has been developed to build the capability of PMU. This is being conducted by the Consultant. The PMUs, consultants and contractors of on-going projects attended the one-day ADB SPS induction workshop provided by ADB safeguard specialist on November 2015. Topics discussed were salient features of ADB SPS, policy triggers, safeguard requirements on environment, resettlement and indigenous peoples, and construction best practices.

141. PMU and the DMS will organize an induction course for the training of contractors, preparing them on:(i) EMP implementation, including environmental monitoring requirements related to mitigation measures; and (ii) taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation. The contractor will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The suggested outline of the training program is presented in Table 5.

Table 5: Indicative Capacity Building and Training Program

Description	Contents	Schedule	Participants
Program 1 Orientation workshop	**Module 1 – Orientation** ADB Safeguards Policy Statement Bangladeshi Environmental Laws and Regulations **Module 2 – Environmental Assessment Process** ADB environmental process, identification of impacts and	1 day	DWASA officials involved in the project implementation PMU

Description	Contents	Schedule	Participants
	mitigation measures, formulation of an environmental management plan (EMP), implementation, and monitoring requirements Review of environmental assessment report to comply with ADB requirements Incorporation of EMP into the project design and contracts		
Program 2 Orientation program/ workshop for contractors and supervisory staff	Environmental issues during construction Implementation of EMP Monitoring of EMP implementation Reporting requirements	1 day	PMU contractors
Program 3 Experiences and best practices sharing	Experiences on EMP implementation – issues and challenges Best practices followed	1 day on a regular period to be determined by PMU and DMS	PMU DMS Contractors NGOs

C. Environmental Management Action Plan

142. The EMP will guide the environmentally-sound construction of the project and ensure efficient lines of communication between the PMU, DMS, and contractors. The EMP identifies activities according to the following three phases: (i) site establishment and preliminary activities, including finalizing IEE/EMP; (ii) construction stage; and (iii) post-construction/operational stage. Table 7outlines the mitigation measures and persons responsible for implementation and monitoring. The EMP will be updated by DMS, in close coordination with the contractors, during the detailed design stage.[24] Note that the final IEE/EMP should be reviewed and cleared by DWASA and ADB at time of detailed design and prior to commencement of construction work.

143. **Environmental monitoring program.** A program of monitoring will be conducted: (i) to ensure that all parties take the specified action to provide the required mitigation, (ii) to assess whether the action has adequately protected the environment, and (iii) to determine whether any additional measures may be necessary. Most measures will be checked by simple observation, by checking of records, or by interviews with residents or workers. This will be coordinated by the PMU and DMS Environmental Specialist (ES). The ES will be responsible for all monitoring activities and reporting the results and conclusions to the PMU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. The ES may be assisted by junior or medium-level environmental specialists and engineers who will make many of the routine observations at the various construction sites. Post-construction monitoring will be conducted by DWASA as part of their overall management of the operating infrastructure.

[24] IEEs will be finalized during detailed design stage. Included in the updating of the IEEs is the development of package- and site-specific EMPs corresponding to Contractor's EMPs (CEMP).

Table 6: Environmental Mitigation Measures Action Plan

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
Planning and Design Phase						
Contractor's responsibility	- Be familiar with the present traffic congestion of Dhaka city, rules and regulation of Dhaka City Corporation (DCC) for preparaton of road cutting plans before execution of works; - Arrange for temporary water supply to every household as and when their water supply is disconnected or disrupted; - Protect all underground and overground utility services viz. telephone, electricity, gas, sewer, drainage, etc. from damage during execution of the contract. Necessary compensation to be paid to the respective organization(s) as per their prevailing rules and regulations.	Contractors	DWASA PMU DMS	- Road Cutting Plan - Arrangement for temporary water supply - Disruption to utilities	As required in the Program of Performance	Contract Provisions EMP
Pipe replacement rehabilitation,[26] and network extension[27]	- In all cases, AC pipes shall be replaced. Existing AC pipes, where intact, shall be left in-situ and not disturbed. Where the AC pipe is damaged and where there is a risk of asbestos particles becoming airborne, the contractor shall follow all necessary procedures, guidelines and laws as laid out locally or by this EMP to contain and remove hazardous material. - The network expansion into different residential / industrial areas will be through trenchless or conventional trenching methods whereby the	Contractors	DWASA PMU DMS	- Residual design life and proposed methods of repair - Inventory of AC pipes	As required in the Program of Performance	Contract Provisions EMP USEPA OSHA Guidelines for Asbestos

[26] The term pipe replacement is understood to mean that the existing pipe will be replaced, either by the traditional open trench method, where the existing pipe will be abandoned and a new pipe will be installed or by pipe bursting, where the existing pipe will be used as a host pipe which will be cut open, expanded and a new pipe will be installed inside the old pipe.

[27] The term pipe extension is understood to mean the laying of a new pipe where no distribution pipes previously existed. Laying pipes in un-served and underserved area and replacing spaghetti lines (bunch of small diameter coil pipes) with new reticulation pipe lines will be considered as extension work.

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	pipelines will be laid with a minimum cover depth of 1.0 metres.					
Working hours and times	- All work in major roads and on minor roads that are heavily used by traffic will only be permitted at night between 7:00 pm and 7:00 am. - All the minor roads and alley with less traffic may be considered for both day and night working provided alternative passageway can be maintained.	Contractors	DWASA PMU DMS	Work hours	As required in the Program of Performance	- Contract Provisions - EMP
Road cutting[28]	- Unnecessary road cutting should be avoided. - The contractor has to take all necessary safeguards to avoid accidents at site, prevent loss/damage to all existing utilities like pipelines, telephone/gas/electric cables, poles etc and any government or private property during the contract period. - The contractor will apply for the road cutting permission to the road owning agency and shall give full effort and the cost of road restoration and collect the road cutting permission for required days.Therefore the road cutting plans must be prepared by the contractor. - No temporary or permanent works must proceed before the design and drawings are approved by the Project Manager and road cutting permission obtained from DCC by PMU. - The contractor shall prepare a traffic management scheme (road closure program or diversions) and incorporate detail of traffic diversions and pedestrian routes, all traffic signs (for the regulation and for information) and road markings shall be ensured prior to	Contractors for preparation of road cutting plan application for permission, and payment for pavement restoration Contractor for preparation and implementation of traffic management scheme DCC for pavement restoration	DWASA PMU DCC for issuance and monitoring of pavement compaction	- Road category along pipe alignments - Budget allocation for pavement restoration - Road cutting plan - Road cutting permission from DCC	Prior to start of civil works After compactiomn and turn-over to DCC for pavement restoration	- Contract Provisions - EMP

[28] Most of the roads are owned and maintained by DCC. Some narrow roads having width even less than 2 m are privately-owned.

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	start of road cutting.					
Road excavation	- All excavations shall be done to the minimum dimension as required for safety and working facility - The excavation shall not damage or interfere with existing services or structures. If damage or interference is so caused the contractor shall make arrangements with the supply and/or building owner to execute the repairs at the contractor's own cost. - All trench and pit excavations and other work shall be carried out during night and within the limits of any existing road area shall be completed as rapidly as possible. - Road drains and channels shall be kept free from obstructions at all times. - In case of excavation in VIP and other large roads, the trenches and pits maybe need to be covered by steel plates to allow traffic to pass during non-working periods. The contractor must liaise with the DCC and the responsible police to familiarize themselves and adhere to such rules. All costs involved to adhere to such rules shall be borne by the contractor. - Pits and trenches not backfilled at end of a night shift, the excavation must be covered with steel plates and in alleys with wooden plates. - Where trench excavation or any other part of the works obstructs any footpath or right-of-way, the contractor shall provide, at his own cost, a temporary footpath around the obstruction to the satisfaction of the Project Manager. - The contractor shall have particular regard to the safety of pedestrian, livestock, and shall ensure that all open excavation, access routes and steep or loose slopes arising from the	Contractors for preparation of road cutting plan, application for road cutting permission, and payment for pavement restoration Contractor for preparation and implementation of traffic management scheme DCC for pavement restoration	DWASA PMU DCC for issuance and monitoring of pavement compaction	- Road category along pipe alignments - Budget allocation for pavement restoration - Road cutting plan - Road cutting permission from DCC	Prior to start of civil works After compactiomn and turn-over to DCC for pavement restoration	- Bangladeshi Standards and Codes of Practice in their latest version, National Building code and Public Works Department (PWD) specification of the Govt. - Contract provisions - EMP

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	contractor's operations are adequately fenced and protected.					
Trenchless pipe installation	- Pipes shall be installed by the horizontal directional drilling (HDD) methods where required. Should survey information indicate that the method is not feasible the contractor shall inform the Project Manager and gain prior approval for an alternative method or for open trench method. - Excavation material shall be removed from the conduit as the work progresses. No accumulation of excavated material within the conduit will be permitted. - The contractor shall provide sediment and erosion control measures to prevent drilling fluid or borehole cuttings from entering water courses or other land adjacent to the site in accordance with local environmental legislation. - The contractor shall supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction. Spent drilling fluids and cuttings shall be confined to the entrance and exit pits. - The contractor shall take all necessary precautions to minimize the damage to the adjacent properties. Any drilling fluid that enters the pipe shall be removed by flushing or other suitable methods. - The contractor shall be responsible for cleanup and restoration - Pits excavated to permit connection of bored pipe shall be backfilled, and disturbed areas shall be restored to their original state or better. Sections of sidewalks, curbs, and gutters or other permanent improvements damaged during HDD operations shall be repaired or replaced at the contractor's expense.	Contractors	DWASA PMU DMS	- Program of Performance - Pipe Bursting Plan - Plan for locating, exposing and re-connecting service connections - Proposed pit size and location - Temporary water supply plan; - Plan for consumer notification. - Traffic management plan	As required in the Program of Performance	Contract provisions

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
Resettlement Plan	- Implement Resettlement Plans, prepared by DWASA. No civil works will begin until all compensation to affected persons is paid.	PMU DMS Contractors NGO	DWASA ADB	- Number of affected person - Compensation to affected persons - Number and type of information dissemination activities - Complaints from stakeholders	Prior to start and during civil works	Resettlement Plan
Preparation of catalogues, installation and O&M manuals	- The contractor shall supply catalogues and installation manuals for each type of pipes to DWASA at the time of submission the Operation and Maintenance manuals. - All catalogues and manuals shall be printed in the English language or accompanied by an English translation.	Contractors	DWASA PMU DMS	- Program of Performance	Completion of civil works and decommisioning	- Contract provisions
Prior to Construction Phase						
Preparation of final IEE/EMP	- Revise/update IEE/EMP based on detailed design - Submit to ADB for approval and disclosure	DMS to update DWASA to submit to ADB	DWASA	- Detailed Design	After completion of detailed design and prior to start of civil works	ADB SPS EARF
Environmental Monitoring Report	- Submit to ADB semi-annual environmental monitoring report	DMS to prepare DWASA to submit to ADB	DWASA	- EMP - Contract provisions	Semi-annual	ADB SPS EARF IEE
Legislation, permits, and agreements	- In all instances, DWASA, service providers, contractors, and consultants must remain in compliance with relevant local and national legislation. - A copy of the IEE must be kept on-site and disclosed in DWASA and ADB website	Contractor	PMU Environment Specialist and DMS Environment Monitoring Specialist	All applicable permits and approvals	Prior to award of contract and as necessary	- Locational Clearance - ECC - Road cutting permit
Education of site	- Ensure that all site personnel have a	Contractor	PMU and DMS	Records of	Prior to start of	Environmental

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
staff on general and environmental conduct[29]	basic level of environmental awareness training. - Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their task. - No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the contractor. - All employees must undergo safety training.			training	civil works and every new employee	management plan (capacity building)
Safeguards supervisors	- The contractor shall appoint one environment safeguard supervisor and one resettlement supervisor who will be responsible for assisting contractors in implementation of EMP, coordinating with the DMS environment management specialist and resettlement specialist, community liaison, consultations with interested/affected parties, reporting, and grievance redressal on a day-to-day basis.	Contractor	Consultant	Hiring and actual work	As work progresses	As work progresses
Identification of disposal sites	- The contractor shall identify and request PMU for approval of disposal sites for pipes to be replaced, spoils/wastes, and other construction-related wastes. - The contractor shall dispose hazardous wastes in accordance with national laws and regulations	Contractor	PMU and DMS	Approved disposal sites	As work progresses	EMP (disposal of wastes and excess construction-related materials)
Sources of materials	- Ensure that sand will not be quarried from river beds.	Contractor	PMU and DMS	Records of source of materials	As work progresses	As work progresses
Construction Phase						
Safety, security and	- Take all necessary precautions	Contractors	DWASA	- ECC	- As required	- ECC

[29] These points need to be made clear to all staff on-site before the project begins.

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
protection of the environment	against pollution or interference with the supply or obstruction of the flow of, surface or underground water. These precautions shall include but not be limited to physical measures such as earth bunds of adequate capacity around fuel, oil and solvent storage tanks and stores, oil and grease traps in drainage systems from workshops, vehicle and plant washing facilities and service and fuelling areas and kitchens - Establish sanitary solid and liquid waste disposal systems - Should any pollution arise, clean up the affected area immediately at his own cost and to the satisfaction of the Project Manager, and pay full compensation to any affected parties.		PMU DMS MoEF	provisions - Program of Performance - Waste Management Plan - Complaints from stakeholders	in the Program of Performance - As work progresses	- Contract provisions - EMP - No complaints received
Protection of waterways	- Every effort shall be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. - Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. - Site staff shall not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing, or for any construction or related activities. - All concrete mixing must take place on a designated, impermeable surface. - No vehicles transporting concrete to the site may be washed on-site. - No vehicles transporting, placing, or compacting asphalt or any other bituminous product may be washed on-site. - All substances required for vehicle maintenance and repair must be stored	Contractor	DWASA DMS	- ECC Provisions - Complaints from community	As work progresses	- No visible increase in turbidity and construction materials/ wastes in surface water, any waterways, or drainage channels - Zero complaints from community

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	in sealed containers until they can be disposed of removed from the site. - Hazardous substance/ materials are to be transported in sealed containers or bags.					
Construction of temporary structures (such as offices, storages, warehouses, scaffolding, etc.)	- Before commencement of the works on the sites submit to the Project Manager the drawings, where the proposed location and general arrangement or site construction survey of the contractor's office premises, workshops, storages, headquarters and other temporary constructions, necessary for adequate and easy execution of the contract. - Obtain own information about the access to all the parts of the sites and, if the contractor wants to use the roads, going through private properties, he shall complete all the formalities with the owners. - Ensure all necessary precautionary measures to avoid any accident due to traffic. He should ensure that for any activities/temporary or permanent structures, machineries and equipment, scaffolding or shoring should not obstruct free flow of surface runoff towards sewer system or drain. - Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. - Encourage recycling and provide separate waste receptacles for different types of wastes. Ensure that all litter is collected from the work and camp areas daily. Ensure camp and working areas are kept clean and tidy at all times. - No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the engineer.	Contractor	DMS	Location plan	- Prior to start of civil works - As work progresses	- Approved location plan - Construction method - No complaints received - No dumped wastes and litter at work sites at all times

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	- The contractor shall submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.- The contractor shall ensure the material safety data sheets of chemicals are posted in conspicuous areas.					
Handling of surface water, flooding event, heavy downpour, etc.[30]	- Protect the working area including pits, trenches, materials, machineries and equipment from any damage due to inundation by downpour. - Ensure not to make any congestion in the open drains or natural or artificial channels by any of his activity. - Take necessary measure to bring the site to the condition prevailing before the downpour without delay. Necessary measure has to be taken so that storm water does not get into the newly installed pipelines. - Be particular in keeping updated weather forecast and maintain a record book at site in which weather condition is recorded.	Contractors	DWASA PMU DMS	- Program of Performance - Bi-weekly 6 weeks running plan - On-site record book	- As required in the Program of Performance - As work progresses	- Contract Provisions - EMP
Handling of excavated soil	- Make own arrangements for the temporary storage of any excavated material.Haul away all excavated materials from the excavation site and deposit these in an area designated by DWASA. - Have regard to the working areas available to him for the construction of the pipeline particularly where this is located in roads or in other places to	Contractors	DWASA PMU DMS	- Program of Performance - Bi-weekly 6 weeks running plan - On-site record book - Complaints from stakeholders	- Prior to start of civil works - As work progresses	- Contract Provisions - EMP

[30] Water logging problem exists during downpours and monsoon. Portions of roads may be flooded for prolonged periods after heavy downpours. The existing drainage facilities of Dhaka are insufficient. Only about 30% of the city's population is connected to the sewerage system. Dispose of wastewater through surface drains, or in low-lying areas, natural drains, or water bodies that find their way to storm sewers. During monsoon period with medium to heavy downpour the roads are inundated for 1-6 hours.

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	which the public has free access. - Be responsible for removal and disposal of any excavated material required for or not suitable for use as refilling as aforesaid or use elsewhere in the works. The cost of such removal of excess excavated earth shall be deemed to be included in the contract rates. - Hauling vehicles must always be present at the excavation site.					
Minimization of public disturbance	- Restrict his work to the sites allocated to him, and keep the sites accessible for inspection by competent authority at any time. - Ensure, as far as possible to minimize public disturbance and work during the nights. - Advance road signage indicating the road detour and alternative routes. Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/ complaints. - Provide adequately illuminated signs and barriers at night. Ensure these are clean, legible at all times and repositioned as necessary as the work progresses. - For the duration of the works, provide convenient access to paths, steps, bridges, crossings or drives for all entrances to property abutting the site and maintain them clear, tidy, and free from mud and objectionable matter.	Contractors	DWASA PMU DMS	- Program of Performance - Inventory of utilities, signs and barriers - access to paths, steps, bridges, crossings or drives for all entrances to property - Complaints from stakeholders and affected people - Records of disclosure and public consultations	- Prior to start of civil works (per pipe section) - During pipe laying/ replacement/ bursting - As work progresses	- Contract provisions - EMP - No complaints received
Warning of users prior to any disturbance in water supply	- Submit detailed work plan for the particular portion of the work to the Project Manager for approval. - Before setting out for the work, inform the inhabitants, businesses and consumers through appropriate means (bill board display, leaflet distribution,	Contractors NGO	DWASA PMU DMS	- Program of Performance - Inventory of utilities - Liason with utilities owners and	- Prior to start of civil works (per pipe section) - During pipe laying/ replacement/	- Contract provisions - EMP - No complaints received - 7-day notice to public

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	using colour papers announcement on radio and TV, publishing in the widely circulated daily newspapers) at least 7 days (or as directed by the Project Manager) before commencement of any work.			operators - Number and type of information dissemination activities - Complaints from stakeholders and affected people	bursting	
Maintaining water supply	- Plan and execute in such a way the water supply shall be kept in operation with maximum disruptions of one working day (12 hours) - Notify existing users about temporary disruption of water supply if unavoidable. - Provide with alternative water source to disconnected consumers to meet their daily requirement. - Ensure only clean water free from deleterious materials and of appropriate quality for its intended use is supplied. - In providing water, ensure that the rights of and supply to existing users are not affected either in quality, quantity or timing. - Inform the Project manager In the event of a dispute over the effect of the contractor's arrangements on the water supply of others.	Contractors	DWASA PMU DMS	- Program of Performance - Number of disconnected consumers - Quantity of supplied water to affected consumers	- Prior to start of civil works (per pipe section) - During pipe laying/ replacement/ bursting	- Contract provisions - EMP - No complaints received
Provision for security of the sites	- Be responsible for guarding all utilities, plants equipment, material, etc. delivered on sites and for ensuring that all sign, lights, fences, etc. are in their proper place. - Provide, install and maintain suitable barriers and/or fences to protect the facilities, constructions camp, storage yard, existing facilities and construction and installation operations and to	Contractors	DWASA PMU DMS	- Program of Performance - Signs and barriers - Security measures in place	- Prior to start of civil works (per pipe section) - During pipe laying/ replacement/ bursting - As work progresses	- Contract provisions - EMP - No complaints received

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	remove same when no longer required by DWASA, or at completion of the project.					
Protection of trees and vegetation	- Ensure that no trees or shrubs are felled or harmed except for those required to be cleared for execution of the works. - Ensure no tree shall be removed without the prior approval of the Project Manager and any competent authorities. - Plant and maintain two trees of the same species for every one that is removed.	Contractors	DWASA PMU DMS MoEF	- Program of Performance - Complaints from stakeholders - Number of trees cut and planted	- As required in the Program of Performance - As work progresses	- ECC - Contract provisions - EMP - No complaints received - 100% survival of trees planted
Use of wood as fuel	- Not use wood as a fuel for the execution of any part of the works, including but not limited to the heating of bitumen and bitumen mixtures and the manufacture of bricks for use in the works. - To the extent practicable, ensure that fuels other than wood are used for cooking, and water heating in all his camps and living accommodations.	Contractors	DWASA PMU DMS	- Program of Performance - Complaints from stakeholders	- As required in the Program of Performance - As work progresses	- Contract provisions - EMP - No complaints received
Fire prevention	- Take all precautions necessary ensure that no buildings and supply utilities, etc. or vegetation along the line of the road outside the area of the permanent works is affected by fires arising from the execution of the works. - Follow any instructions of the competent authorities with respect to fire hazard when working in the vicinity of gas installations. - Immediately suppress if a fire occur in the natural vegetation or plantations adjacent to the road for any reason. - In areas of forest, shrub or plantation damaged by fire considered by the Project Manager to have been initiated by the contractor's staff or labour,	Contractors	DWASA PMU DMS	- Program of Performance - Number of fire occurances	- As required in the Program of Performance - As work progresses	- Contract provisions - EMP - Zero fire occurence

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	replant and restore to the satisfaction of the Project Manager.					
Handling traffic and access	- Submit to the Project Manager for approval a traffic management plan and detailed work plan showing activities on hourly basis. - Plan and conduct work in such a way that can be completed in 6-8 hours with as little as possible of traffic interruption, so all of this work (and probably most of the daytime work in minor roads) will be conducted by small teams of men, working on short lengths of the network (around 100 -150 m) at a time. - Provide, erect and maintain barricades, signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic. The flagmen shall be equipped with red and green flags and lanterns/lights. - Ensure barricades, signs, marking, and flags are of strong design. All barriers on roads and pedestrian areas shall be lit with warning lights during night time or when there is poor visibility. - Where the diversion or closure of any existing carriageway, walkway or public right of way is temporarily necessitated by the works, provide and maintain an alternative, which shall be operational before interference with the existing way. - Where ramps, temporary carriageways and walkways are required, they shall be provided and maintained to a standard suitable in all respects for the class or classes or traffic or pedestrians. These must be kept usable by women, children, patients and disables.	Contractors	DWASA PMU DMS	- Program of Performance - Traffic management plan - Lists and samples of warning signs and barricades	- As required in the Program of Performance - As work progresses	- Contract provisions - EMP - No complaints received

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
Minimizing noise level	- Ensure noise level of the machineries and equipment must not exceed 40 dB(A). - Use modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensure they are maintained to manufacturers' specifications. - Noise-generating equipment must be fitted with silencers. - If a worker is exposed to noise above a noise exposure limit, the contractor must investigate options for engineered noise control such as using low-noise excavators, jackhammers, drills, and power generators. - If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection.	Contractors	DWASA PMU DMS	- Complaints form community - Noise level monitoring record	As work progresses	- Bangladeshi Noise Standards - ECC Provisions - Where noise limits already exceeded, there should be no increase in noise level
Mimimizing dust generation and air pollution	- Limit dust by removing waste soil quickly, bringing sand to site only when necessary, covering and watering stockpiles, and covering soil and sand when carried on trucks. - Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust. - Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. - Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. - The contractor is to have the equipment seen to as soon as possible should excessive emissions be	Contractors	DWASA PMU DMS	- Program of Performance - Complaints from stakeholders - Vehicle emission testing records	- As required in the Program of Performance - As work progresses	- No visible increase in dust and particulate matters - No complaints received

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	observed.					
Protecting the community and facilities and locations of social and cultural importance (e.g. schools, hospitals, mosques, museums, etc.)	- Increase the workforce in sensitive areas to complete the work quickly. - Provide wooden walkways for pedestrians and metal sheets for vehicles to allow access across open trenches, where required. - Use directional down-facing lighting, fitted with effective shades at all times when working at night. - Give special attention to the screening of higly reflective materials on site. - Locate storage facilities and other temporary structures on site such that they have as little visual impact on local residents as possible. - Provide screening in areas where the visual environment is particularly important (e.g., along commercial routes) or privacy concerns for surrounding buildings exist. This can be in a form of shade cloth, temporary walls, or other suitable materials.	Contractors	DWASA PMU DMS	- Program of Performance - Bi-weekly 6 weeks running plan - On-site record book - Complaints from stakeholders - Grievance Redress Mechanism records	As required in the Program of Performance	- Contract Provisions - EMP - Zero complaints from the stakeholders
Protecting health and safety of workers	- Ensure continuing health and safety of the employees by producing and applying a Health and Safety (H&S) Plan for all working sites. The H&S plans will include such measures as: (i) excluding the public from construction sites; (ii) ensuring that all workers are provided with and use appropriate Personal Protective Equipment; (iii) health and Safety Training for all site personnel; (iv) documented procedures to be followed for all site activities; (vi) documented procedures to be followed for AC pipes; and (vi) accident reports and records. - Prior to the commencement of any hazardous operation, submit a Safety Method Statement to the Project Manager for his approval.	Contractors	DWASA PMU DMS	- Program of Performance - Number of accidents - On-site Record	As required in the Program of Performance	- Contract provisions - EMP - Zero accident record - No complaints received

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	- Ensure all workers have been suitably trained prior to commencing work and are to be adequately supervised whilst carrying it out. - Ensure all plant and equipment are suitable for the task to be undertaken and properly inspected/tested prior to being put into operation. - Maintain records and make reports concerning health, safety and welfare of persons, and damage to property. Take remedial action to prevent a recurrence of any accidents that may occur. - Provide hard hats, boots, other protective equipment and first aid box with all necessary medicines. - Train workers in safety issues. Provide suitable arrangements to cater for emergencies, including: first aid equipment (dressings, etc.); person(s) trained to administer first aid; communication with, and transport to, the nearest hospital with an accident / emergency department; monitoring equipment; rescue equipment; fire fighting equipment; and communication with nearest fire brigade station. - Provide adequate welfare facilities including, as a minimum, drinking water; toilets; washbasins with warm water, soap and towels; and clean/dry/warm area equipped with tables and chairs at which food can be eaten.					
Asbestos cement (AC) pipes	- Follow the protocol prepared by the design consultants to be applied in any instance that AC pipes are found. - Train all personnel (including manual laborers) to enable them to understand the dangers of AC pipes and to be able to recognize them in situ. - Inform the management immediately if	Contractor DMS to develop AC pipes protocol	DWASA DMS	- H&S plan - Number of accidents and work-related injuries - Complaints from community	As work progresses	- Construction method - Detailed design documents - H&S Plan - AC Protocol - Zero accident and work-related

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	AC pipes are encountered. - Remove all persons to a safe distance. - Delegate trained persons to deal with AC materials and require use of appropriate breathing apparatus and protective equipment - Implement procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.					injuries
Cultural and historical environment	- All the staff and laborers of the contractor be informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, jewelry, remains, fossils, etc. - If something of this nature is uncovered, the Department of Archaeology shall be contacted and work shall be stopped immediately.	Contractor	Consultant	Chance finds	As necessary	All chance finds shall be reported and turned over to the Department of Archaeology.
Post-construction phase (prior to turnover to DWASA)						
Access	- All excavated roads shall be reinstated to original or better condition.	Contractor	Consultant	Road conditions	Prior to turn-over	Pre-existing conditions
Utilities and other existing infrastructure	- All disrupted utilities restored - All affected structures rehabilitated/compensated	Contractor	Consultant	All affected utilities	Immediately after civil works	All disrupted services restored
Construction camps and storage areas	- After construction work, all structures comprising the construction camp are to be removed from site or handed over to the property owner/community as per mutual agreement (if established on private/community land). - The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. - All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be topsoiled and regrassed using the guidelines set out in the	Contractor	Consultant	General condition of the areas	Prior to end of construction period/demobilization	Pre-existing condition

Activity	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameter to Monitor	Frequency of Monitoring	Guidelines/ Standards
	revegetation specification that forms part of this document. - The contractor must arrange the cancellation of all temporary services.					
Waste management	- All wastes shall be removed from the site and transported to a disposal site or as directed by the environment management specialist. Waybills proving disposal at each site shall be provided for the environment management specialist's inspection.	Contractor	Consultant	General condition of the areas	Prior to end of construction period/demobilization	Pre-existing condition
Operation and maintenance phase (including Defects Liability Period)						
Detection and repair of leaks and pipe bursts	- Ensure leak detection and restoration time is minimized to the extent possible. - Schedule periodic check for leaks and damages to prolong life of structures installed	DWASA	DWASA	Number of reported leaks	As part of operations and maintenance of the improved system	Standards set by DWASA

D. Reporting

144. The contractors will submit monthly monitoring reports to PMU reflecting performance of contractors in EMP implementation. The PMU environmental officer will then submit semi-annual environmental monitoring reports to ADB for review and disclosure on ADB's website, as per ADB's safeguards policy and public communication policies. A sample monitoring template is in Appendix 4. The report should include update and progress of compliance with the ADB and government policies, and specifically on the progress of EMP implementation in relation to design and construction activities, grievances, and corrective actions.

E. Environmental Costs

145. The contractor's cost for site establishment, preliminary activities, construction, defect liability activities, and environmental mitigation measures related to EMP implementation during planning, design, and constructionwere incorporated into the contractual agreements and engineer's costs, which will be binding on him for implementation. The survey will be conducted by the contractor.

146. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of the implementing agency (DWASA). All monitoring during the operation and maintenance phase will be conducted by DWASA; therefore, there are no additional costs.

147. The activities identified in the EMP mainly include site inspections and informal discussions with workers and local community, and this will be the responsibility of PMU with the assistance of DMS, costs of which are part of project management.

148. Table 7 presents the estimated cost to implement the EMP.

Table 7: Indicative Cost for EMP Implementation

Component	Description	Number	Cost per Unit (USD)	Cost (USD)	Source of Funds
Capacity building	(i) Orientation workshop for DWASA officials involved in the project implementation on ADB Safeguards Policy Statement, Bangladeshi Environmental Laws and Regulations, and environmental assessment process; (ii) induction course for the training of contractors, preparing them on EMP implementation and environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation; and (iii) Lessons learned information sharing	Three modules, 1 day per module	$500 per module	$1,500	Covered under DMS contract
Dust suppression at work sites	Application of dust suppression measures during construction phase	As required	Contractor's liability	$5,000	Covered under engineering design and construction–contractor
Baseline monitoring for noise	Once before start of construction works at specified corridor per work day	Two samples (daytime and nighttime) per work day	$100 per sample	$1,000	Covered under engineering design and construction–contractor
Surveys	Ongoing before start of construction work along pipe replacement corridors	Lumpsum	Contractor's liability	$5,000	Covered under engineering design and cost –contractor

IX. CONCLUSION AND RECOMMENDATION

149. The process described in this document has assessed the environmental impacts of all elements of the project in Dhaka City. All potential impacts were identified in relation to pre-construction, construction, and operation phases.

150. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts as being due to the project design or location were not significant. However, the social impacts (access disruptions) due to construction activities are unavoidable, as the residential and commercial establishments exist along the project corridor. A resettlement plan has been developed in accordance with ADB SPS 2009 and Bangladeshi laws and regulations.

151. The EMP will assist the PMU, DMS, and contractors in mitigating the environmental impacts, and guide them in the environmentallysound execution of the proposed project. The EMP will also ensure efficient lines of communication between the implementing agency, project management unit, and contractors.

152. The public participation processes undertaken during project design ensured stakeholders are engaged during the preparation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

153. The project's grievance redressal mechanism will provide the citizens with a platform for redressal of their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

154. A copy of the EMP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site, and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance.

155. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is will not cause significant adverse impacts. In addition to the mitigation measures and specifications already considered in the package design, the potential adverse impacts that are associated with construction and O&M can be mitigated to acceptable levels with the specific mitigation measures discussed in the EMP.

156. Therefore, as per ADB SPS, 2009 the project is classified as environmental category B and does not require further environmental impact assessment.

APPENDIX 1: ADB REA CHECKLIST

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area…			
• Densely populated?	✓		The population distribution shows that the project area is densely populated.
• Heavy with development activities?		✓	
Adjacent to or within any environmentally sensitive areas?			No water supply project components are within locations in or near sensitive and valuable ecosystems, including protected areas and forests.
• Cultural heritage site		✓	
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
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?		✓	The network in Dhaka is currently supplied by limited surface water (18%) and ground water from tubewells (82%) across the city. Surface water use (Buriganga and Sitalakhya Rivers) is limited due to the lack of suitable, non-polluted water. The Ministry of Environment and Forests estimates that 80% of the sewage produced by the 15 million people in Dhaka and surrounding areas; and effluent from 7,000 industries enter the rivers untreated (Dhaka Environment Programme, 2005).
• Impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Not applicable
• Hazard of land subsidence caused by excessive groundwater pumping?		✓	Not applicable
• Social conflicts arising from displacement of communities?		✓	No displacement of communities is required in this project.
• Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	Water quantity is sufficient and there is no additional abstraction.
• Unsatisfactory raw water supply (e.g., excessive pathogens or mineral constituents)?		✓	Raw water is being treated prior to distribution. Water quality of treated water complies with the Bangladeshistandards for drinking water.
• Delivery of unsafe water to distribution system?		✓	The project will provide treated water through new pipes to prevent leakages and contamination.
• Inadequate protection of intake works or wells, leading to pollution of water supply?		✓	The intake will be secured and will be accessible only to authorized persons. It will also be regularly monitored to ensure only treated and unpolluted water are distributed.
• Overpumping of groundwater, leading to salinization and ground subsidence?		✓	Not applicable
• Excessive algal growth in storage reservoir?		✓	Not anticipated. The storage reservoirs are fully enclosed structures. In addition, treated

Screening Questions	Yes	No	Remarks
			water will only be stored for a short period of time.
• Increase in production of sewage beyond capabilities of community facilities?		✓	Sewerage system improvements are being undertaken by DWASA.
• Inadequate disposal of sludge from water treatment plants?		✓	Not applicable
• Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	Not applicable
• Impairments associated with transmission lines and access roads?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate the impacts.
• Health hazards arising from inadequate design of facilities for receiving, storing, and handling chlorine and other hazardous chemicals?		✓	Not applicable
• Health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		✓	Personal protective equipment will be provided to workers. Regular training will also be conducted to ensure that workers are aware of the health hazards of working in excavation and construction sites.
• Dislocation or involuntary resettlement of people?		✓	No displacement of communities is required in this project.
• Disproportionate impacts on the poor, women and children, indigenous peoples, or other vulnerable groups?		✓	Not applicable
• Noise and dust from construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate the impacts.
• Increased road traffic due to interference of construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be required to coordinate with the local traffic police.
• Continuing soil erosion/silt runoff from construction operations?		✓	Not anticipated, as topography of Dhaka is plain. However, the EMP still includes measures to mitigate the impacts. Construction contractors will be required to include channelization where required.
• Delivery of unsafe water due to poor OandM treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		✓	Not anticipated
• Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	Not anticipated. Water quality is being regularly monitored by DWASA.
• Accidental leakage of chlorine gas?		✓	Not anticipated
• Excessive abstraction of water affecting downstream water users?		✓	Not anticipated. Water quantity is sufficient and there is no additional abstraction.
• Competing uses of water?		✓	Not anticipated
• Increased sewage flow due to increased water supply?	✓		Sewerage system improvement will be undertaken by DWASA.
• Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant?		✓	Sewerage system improvement will be undertaken by CMC.
• Large population influx during project		✓	Improved water supply management

Screening Questions	Yes	No	Remarks
construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?			systems through capacity building and institutional development will ensure reduced burden on services and infrastructure.
• Social conflicts if workers from other regions or countries are hired?		✓	Priority in employment will be given to local residents.
• Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel, and other chemicals during operation and construction?		✓	Not applicable. Trenching will be done manually. Construction will not involve use of explosives. For rock and concrete breaking, contractors will be required to use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals. These products come in powder form, and once mixed with water (being the catalyst), simply expand and crack the rock/concrete from hole to hole. Chemical material safety data sheets will be posted in conspicuous areas. The EMP ensures measures are included for the storage areas.
• Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community, or where their failure could result in injury to the community throughout project construction, operation, and decommissioning?		✓	Operational area will be clearly demarcated and access will be controlled. Only workers and project concerned members will be allowed to visit the operational sites.

Climate Change and Disaster Risk Questions	Yes	No	Remarks
The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.			
• Is the project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami, volcanic eruptions, and climate changes (see Appendix I)?		✓	Environmental factors like lithology, regolithic characteristics have very limited or no influence on the foundation, which are already found to be suitable, and the area is free from landslide problems. Any proposed facility will require compliance with government rules for seismic design.
• Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., increased extreme rainfall increases flooding, damaging proposed infrastructure)?		✓	
• Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	Proposed project will not impact any marginalized population, rural-urban migrants, illegal settlement, etc.
• Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by paving vulnerable groundwater recharge areas, or using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		✓	

APPENDIX 2: MINUTES OF THE MEETING WITH DEPARTMENT OF ENVIRONMENT

Minutes of Consultation Meeting with DoE

Date: 24th November 2015

Venue: Office of the Director (Environmental Clearance), Department of Environment (DoE), Agargaon, Sher-E-Bangla Nagar, Dhaka

Meeting Agenda:

1. Categorization of ICBs of Dhaka WASA project
2. Do we need new EC
3. If yes, can IEE for ADB acceptable to DoE

Name: 1. Md. Nazmul Ahsan, Director (Environmental Clearance)

2. Dr. J C Saha (Environmental Safeguard Specialist, DWSNIP)

Mr. Ahsan inform in the meeting that the project is red category as per ECA 1995 and Rule 1997. Which need IEE and EIA report submission to DoE. The project need environmental clearance certificate from DoE.

Dr. Saha explained since the project is a national important priority project which is mainly rehabilitation work and will minor impact during construction period only. Do we need EIA study.

Mr. Ahsan replied that since the project is in the red category of DoE categorization list, so we cannot change the category and avoid the submission of EIA report. However, the project authority may apply to DG, DoE for Environmental Clearance with necessary document including ToR for EIA study and waive IEE. DoE will approve the ToR for EIA study. In this case submission of only EIA will require as the project is a national important priority project.

EIA need to be submitting which is mandatory for final Environmental Clearance Certificate from DoE.

The meeting ended with vote of thanks.

APPENDIX 3: RECORDS OF PUBLIC CONSULTATIONS

ATTENDANCE SHEET OF FOCUS GROUP DISCUSSIONTATION MEETING
Dhaka Water Supply Network Improvement Project (DWSNIP)
(Package No. ICB 2.8)

Location: Purba Ranavola Zone: 9 DMA: 902 Date: 26.12.2015

SL No	Name	Father's name	Address	Mobile no.	Job/Work	Signature
1	Abdul Hafez	Abdul Aziz	Purbo Ranavola		Business	
2	Mubarak	Khokon Mia	,,	01679248735		
3	Md. Khalilur Rahman	Abdul Aziz	,,	01674115273	Ricksha Puller	
4	Julhash	Abdul Aziz	,,	,,	,,	
5	Munsur Ali	Abe Uddin	,,	01825277557	Driver	
6	Rezia	Jonaf Ali	,,		Cleaner	
7	Ful Mia	Bassu Mia	,,	01971811536	Rickshaw puller	
8	Abdul Kuddus	Mohen Ali	,,	01983635260	,,	
9	Md. Hanif	Oman Ali	,,	01557304894	Labour	
10	Md. Ismail	Ohidor Rahman	,,	01845559915	Service	
11	Jorina Begom	Mia Zan	,,		Business	
12	Hasina Begon	Abdul Aziz	,,	.		
13	Asia	Aine Uddin	,,	01680159263	House wife	
14	Zakir Hossain	Abdul Khalek	,,	01621837028	Service	
15	Md. Ismail	Hoimuddin	,,	01828733277	Driver	
16	Md. Lal Mia	Ramjan Ali	,,	01626006434	Driver	


Purba Ranavola, Zone 9, Dist: Dhaka Date: 26.12.2015

Methodology

The IEE Report was prepared in consultation with stakeholders. Meetings and consultations with relevant Government Departments (are these the implementing and executing agency) were carried out to brief the project approach. Public consultations through Focus Group Discussions (FGDs) with project beneficiaries have been carried out. Issues discussed are:

(i) Awareness and extent of the project and development components;
(ii) Benefits of the subproject for the economic and social improvement of community;
(iii) Labour availability in the subproject locations or requirement of outside labour involvement;
(iv) Local disturbances due to civil works
(v) Nuissance, Noise, and Air pollution

Public consultations were conducted in Purba Ranavola area during the site visits and assessment on 26th December 2015. The methods for consultation were open meetings, interviews and focus group discussions. A total of 16 households were interviewed, 2 community leaders with a total of 16 participants, who may experience temporary access disruptions during construction activities, shopkeepers/businessmen from the project area.

The consolidated response, comments and recommendations of the stakeholders on the project are the following:

(i) Inconvenience and traffic disturbances, noise and air pollution due to construction work in the DMA should be minimized as much as possible.
(ii) Project work should be completed with the shortest possible time as people experience a lot of problems due to the absence of proper septage disposal method such as overflowing of septic tanks during monsoon seasons.
(iii) Request for the information on the timeline of project and the schedule of the construction activities
(iv) Road disturbances should be minimized so as to minimize the loss of income from mobile vendors

(v) Minimize water logging due to construction activities

The suggestions, comments, recommendations will be incorporated in the final technical design and environmental management plan of the project.

APPENDIX 4: SAMPLE GRIEVANCE REDRESS FORM

(To be available in Bangla and English)

The _____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.
Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date		**Place of Registration**			
Contact Information/Personal Details					
Name		**Gender**	* Male * Female	**Age**	
Home Address					
Place					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of Official registering grievance)	
Mode of communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Officials Reviewing Grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

APPENDIX 5: SUGGESTED OUTLINE FOR THE ENVIRONMENTAL MONITORING REPORT

I. Introduction

- Overall project description and objectives
- Description of subprojects
- Environmental category of the sub-projects
- Details of site personnel and/or consultants responsible for environmental monitoring
- Overall project and sub-project progress and status

No.	Sub-Project Name	Status of Sub-Project				List of Works	Progress of Works
		Design	Pre-Construction	Construction	Operational Phase		
		☐	☐	☐	☐		
		☐	☐	☐	☐		
		☐	☐	☐	☐		

II. Compliance Status

1. Compliance Status with National/State/Local Statutory Environmental Requirements

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

2. Compliance Status with Environmental Loan Covenants

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

3. Compliance status with the environmental management and monitoring plan

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports (refer to Appendix 7 of this IEE).
- Provide summary of the Environmental Site Inspection Report (findings, corrective action plan, and recommendations)
- Provide summary of the complaint/s received, nature of complaints, and actions taken management system
- Provide summary of information disclosure, consultations, FGDs, and other awareness building activities
- Provide summary of environment-related capacity building activities.

Summary Monitoring Table

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

Overall Compliance with EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

4. Approach and methodology for environmental monitoring of the project

- Brief description on the approach and methodology used for environmental monitoring of each sub-project
- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements
- As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LAeq (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LAeq (dBA) (Monitoring Results)	
			Day Time	Night Time

5. Summary of key issues and remedial actions

    - Summary of follow up time-bound actions to be taken within a set timeframe.

6. Appendixes

    - Photos
    - Summary of consultations
    - Copies of environmental clearances and permits

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER CONDITION: _____

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____Unsatisfactory _____ Incident _____Resolved _____
Unresolved _____

INCIDENT:
Nature of incident: _____

Intervention Steps: _____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition	Yes		No	

Signature
_____

Sign off
_____ _____

Name
Position

Name
Position