PEOPLE'S REPUBLIC OF BANGLADESH

CHATTOGRAM WATER SUPPLY AND SEWERAGE AUTHORITY (CWASA)

FEASIBILITY STUDY FOR SEWERAGE DEVELOPMENT IN CHATTOGRAM (CATCHMENT - 6)

FINAL REPORT

January 2026

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MARUBENI CORPORATION

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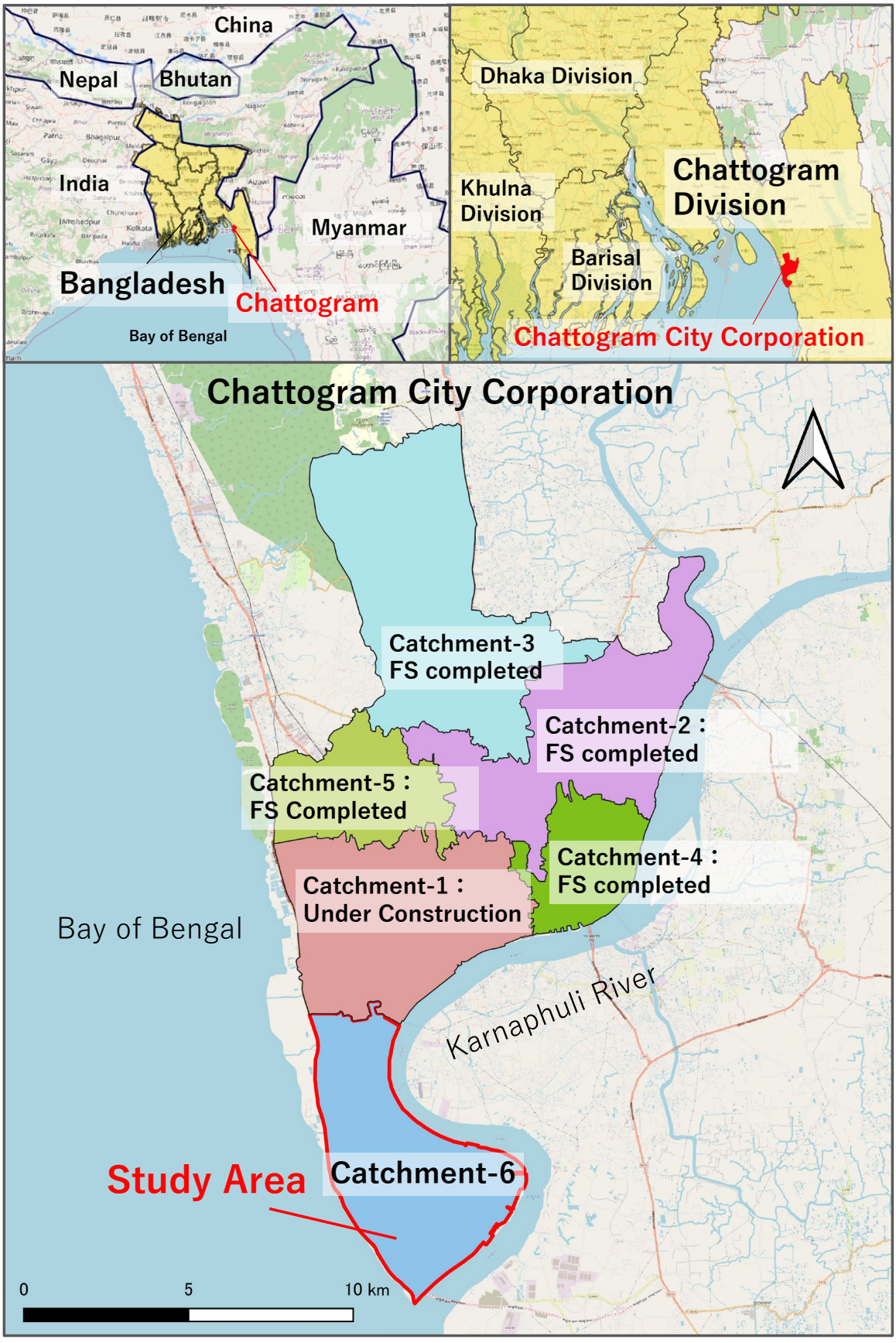
DISCLAIMER

This feasibility study report, including the appendix hereto ("Report"), has been produced to analyze the feasibility of the sewerage project by the PPP project scheme with the financial support from JICA in the Catchment-6 of CWASA's service area.

The contents of this Report are based upon data and information available to the developer as at the date of this Report either through public domain or the field survey conducted by the developers for the purpose of this Report. Accordingly, the contents of this Report, including any cost estimations and economical and financial analysis, are only for reference purpose and may be subject to change. Neither CWASA nor the developers (nor any third party) would be bound by the contents of this Report. This Report (and submission of this Report) does not constitute a proposal by the developers, nor shall it be interpreted as proposal, commitment, or agreement of the developers to implement the project. Final decision to implement the Project by CWASA and the developers shall subject to the approval of each and all stakeholders, including the CCEA final approval as well as the developers' investment committee approval.

Exchange rates applicable to this report	
(As of October 2025)	
USD 1.0	= JPY 148.73
BDT 1.0	= JPY 1.23
USD 1.0	= BDT 120.76

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Source: Marubeni

Location Map of the Study

	
STPs Construction Site Preparatory work for construction of STP-1	**STPs Planned Construction Site** STPs planned construction site seen from the Coastal Road
	
STPs Planned Construction Site Halishahar Disposal Site seen from the north of the planned STP construction STP site	**STPs Planned Construction Site** South side of the STPs seen from the Coastal Road
	
M.A Aziz Road Main road of Catchment-6	**Ali Monshi Road** Branch road of main road Secondary sewer to be installed

	
Community Road Service line to be installed	**CDA Road (Under Construction)** Road to install trunk sewer to connect between sewer in the Main Road and the Coastal Road
	
CDA Road (Planned Construction Site) Road to install trunk sewer to connect between sewer in the Main Road and the Coastal Road	**Bay Terminal Construction site** Across the Coastal Road from STP
	
Residential Area Residential area in southern area of Catchment-6	**Airport Road** South side of the airport

FEASIBILITY STUDY FOR SEWERAGE DEVELOPMENT IN CHATTOGRAM (CATCHMENT - 6)

FINAL REPORT

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Abbreviations

ADB	Asian Development Bank
AECL	Adroit Environment Consultants Limited
AFD	Agence Française de Développement
AMSL	Above Mean Sea Level
APEC	Asia-Pacific Economic Cooperation
ARIPO	Acquisition and Requisition of Immovable Property Ordinance
ASEAN	Association of South-East Asian Nations
ASP	Activated Sludge Process
ATP	Affordability to Pay
BADC	Bangladesh Agricultural Development Corporation
BBS	Bangladesh Bureau of Statistics
B/C	Benefit Cost Ratio
BDT	Bangladesh Taka
BEPZA	Bangladesh Export Process Zone Authority
BIFFL	Bangladesh Infrastructure Finance Fund Limited
BNBC	Bangladesh National Building Code
BOD	Biochemical Oxygen Demand
BOT	Build-Operate-Transfer
BWDB	Bangladesh Water Development Board
CA	Contracting Authority
CAAB	Civil Aviation Authority of Bangladesh
CAMS	Continuous Air Monitoring Station
CAPEX	Capital Expenditure
CAS	Conventional Activated Sludge
CCC	Chattogram City Corporation
CCEA	Cabinet Committee on Economic Affairs
CDA	Chattogram Development Authority
CEDAW	Convention of the Elimination of All Forms of Discrimination Against Women
CEPZ	Chattogram Export Processing Zone
CETP	Central Effluent Treatment Plant
CHTs	Chittagong Hill Tracts
CIT	Corporate Income Tax
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COD	Commercial Operation Date
COVID-19	Coronavirus Disease 2019
CPI	Consumer Price Index
CSO	Combined Sewer Overflow
CWASA	Chattogram Water Supply & Sanitation Authority
CWSISP	Chittagong Water Supply Improvement & Sanitation Project
DBFOT	Design-Build-Finance-Operate-Transfer
DO	Dissolved Oxygen
DOE	Department of Environment
DPP	Development Project Proposal

DPZs	Detailed Planning Zones
DSCR	Debt Service Coverage Ratio
DWASA	Dhaka Water Supply & Sanitation Authority
ECA	Environmentally Critical Area
ECC	Environmental Compliance Certificate
ECR	Environment Conservation Rules
EDCF	Economic Development Cooperation Fund
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EPRG	Extended Political Risk Guarantee
EPRI	Extended Political Risk Insurance
EIRR	Economic Internal Rate of Return
EPC	Engineering, Procurement and Construction ·
EPZ	Export Processing Zone
ESAMF	Environmental and Social Assessment Management Framework
ESIA	Environmental and Social Impact Assessment
ETP	Effluent Treatment Plant
FGD	Focus Group Discussion
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
F/S	Feasibility Study
FY	Fiscal Year
GBV	Gender Based Violence
GDP	Gross Domestic Product
GHG	Greenhouse Gas
G2G	Government to Government
GOB	Government of Bangladesh
GOJ	Government of Japan
HDPE	High Density Polyethylene
HH	Household
HRT	Hydraulic Retention Time
HSMP	Health, Safety and Management Plan
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IMF	International Monetary Fund
IPA	In-Principle Approval
IRR	Internal Rate of Return
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
KEPZ	Karnaphuli Export Processing Zone
KII	Individual and Key Informant Interview
KOICA	Korea International Cooperation Agency
KPI	Key Performance Indicator
LC	Letter of Credit
LCC	Life Cycle Cost

LGD	Local Government Division
LGRD	Ministry of Local Government, Rural Development and Co-operatives
lpcd	Liter per Capita Day
MBR	Membrane Bio Reactor
MD	Managing Director
MIGA	Multilateral Investment Guarantee Agency
MLD	Million Liters per Day
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MODS	Maintenance, Operation, Distribution and Service Office
MOC	Memorandum of Cooperation
MOF	Ministry of Finance
MOU	Memorandum of Understanding
MP	Master Plan
NAAQS	National Ambient Air Quality Standards
NEXI	Nippon Export and Investment Insurance
NLTP	National Land Transport Policy
NO_2	Nitrogen Dioxide
NOC	No Objection Certificate
NOx	Nitrogen Oxides
NPV	Net Present Value
O&M	Operation and Maintenance
OD	Oxidation Ditch
ODA	Official Development Assistance
OHS	Occupational Health and Safety
OPEX	Operating Expense
PA	Project Aid
PAC	Poly Aluminum Chloride
PAPs	Project Affected Persons
PIA	Patenga Industrial Area
PM	Particulate Matter
PMU	Project Management Unit
PPP	Public Private Partnership
PPPA	Public Private Partnership Authority
P/S	Pumping Station
PVC	Polyvinyl Chloride
RFP	Request For Proposal
RFQ	Request For Quotation
RMG	Ready-Made Garments
ROW	Right of Way
SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SLA	Subsidiary Loan Agreement
SPC	Special Purpose Company
SPM	Suspended Particulate Matter
SOFR	Secure Overnight Financing Rate
SOR	Statutory Regulatory Order

SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SS	Suspended Solids
STP	Sewage Treatment Plant
TDS	Total Dissolved Solid
TEU	Twenty-foot Equivalent Unit
TN	Total Nitrogen
TOR	Terms of Reference
TP	Total Phosphorus
TSS	Total Suspended Solids
UN	United Nations
UV	Ultraviolet
USD	United States Dollar
VAT	Value Added Tax
VGF	Viability Gap Financing
VFM	Value For Money
WACC	Weighted Average Rate of Return
WARPO	Water Resources Planning Organization
WASA	Water Supply & Sanitation Authority
WB	World Bank
WTP	Water Treatment Plant
WTP	Willingness to Pay

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Chattogram is the second largest city in Bangladesh after the capital of Dhaka. The Chattogram district, including surrounding area, has the population of 3.2 million, according to demographic statistics in the 2022 census. The city is developing as an industrial and logistical base with one of the largest ports in the country. The rapid development and increasing of the population affect to urban and hygienic environment, and those are being deteriorated further due to no appropriate sewerage facilities in Chattogram at this moment. Under the such situation, Chattogram Water Supply and Sewerage Authority (CWASA) formulated the Chattogram Water Supply Improvement & Sanitation Project funded by World Bank in 2017 (hereinafter called as Sanitation MP-2017) and has started the implementation of the sewerage service improvement with the Catchment-1 as the first priority.

According to the Sanitation MP-2017, sewerage catchment in Chattogram was subdivided into 6 catchments. CWASA is implementing the Catchment-1 by the Bangladesh government's own fund, Catchment-5 will be developed under the financial support from Agence Française de Développement (AFD). AFD has completed the feasibility study for the area by February 2023 and is preparing for the implementation of the project. JICA has completed FS for Catchment-2 and 4 by July 2023, and FS for Catchment-3 has been completed with financial assistance from the Economic Development Cooperation Fund (EDCF: Korea). Among the status of implementation by the government and doners in each sewerage catchment, Marubeni Corporation has an interest to implement the sewerage project in Catchment-6 by Private Public Partnership (PPP) scheme based on the discussion with CWASA.

The PPP Authority of the Prime Minister's Office of the People's Republic of Bangladesh and the Ministry of Land, Infrastructure, Transport and Tourism of Japan signed a memorandum of cooperation (MOC) on June 15, 2017, and that of a five-year extension memorandum was signed on October 5, 2022. Under the MOC, the Japan-Bangladesh Joint PPP Platform was established to improve the quality of life in Bangladesh and accelerate the sustainable economic development of both countries through the promotion and expansion of investment in PPP projects. This sewerage project was proposed by Marubeni Corporation as a Japanese investor at the 5th Japan-Bangladesh Joint PPP Platform held on October 4, 2022 and has been adopted.

1.2 Scope of the Study

The Feasibility Study for sewerage development in Chattogram (Catchment-6) (hereinafter called as the Study) is to confirm the feasibility of the sewerage project in Catchment-6.

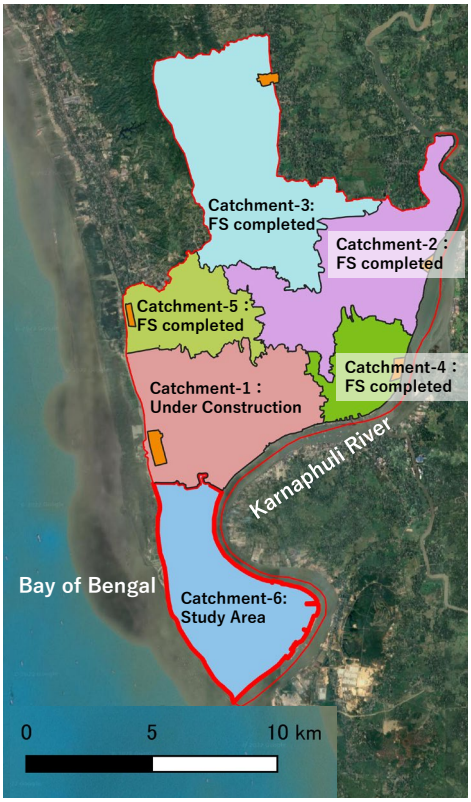
The Project will be expected to formulate by the PPP project scheme. Therefore, it is also confirmed what will be the required procedures to implement by the PPP project scheme in Bangladesh.

Major scope of the Study is as follows:

- Related data collection such as natural condition, law, existing sewerage facilities, organization and financial status of CWASA,
- Formulation of preliminary sewerage plan in Catchment-6 such as
  - ✓ Sewage Treatment Plant (capacity, treatment process, layout plan and sludge treatment facilities),
  - ✓ Sewer (route, collection system, pump facilities),
- Estimation of preliminary project cost including construction cost and operation and maintenance cost,
- Preparation of implementation schedule,
- Confirmation to potential impact related to environmental and social aspects,
- Consideration of project scheme to be implemented by PPP,
- Economical and Financial Analysis (based on Consultant's cost estimation) and
- Preparation of EPC tender documents (Draft)

1.3 Study Area

Sewerage catchment in Chattogram is subdivided into 6 catchments of which the target area of the Study is Catchment-6 as shown in Figure 1.2.1. Catchment-6 with the total area of 28.5 km^2 has features that include not only residential and commercial, but also industrial, airport and navy zones unlike the other catchments. The Study area is located between Karnaphuli River and Bay of Bengal. Therefore, a large number of cargo containerships are always moving around the catchment area for loading and unloading at the ports. The Study area is topographically very flat and located in a place like a peninsula.



Source: Prepared by Marubeni Corporation based on the information from CWASA

Figure 1.2.1 Study Area

1.4 Target Year

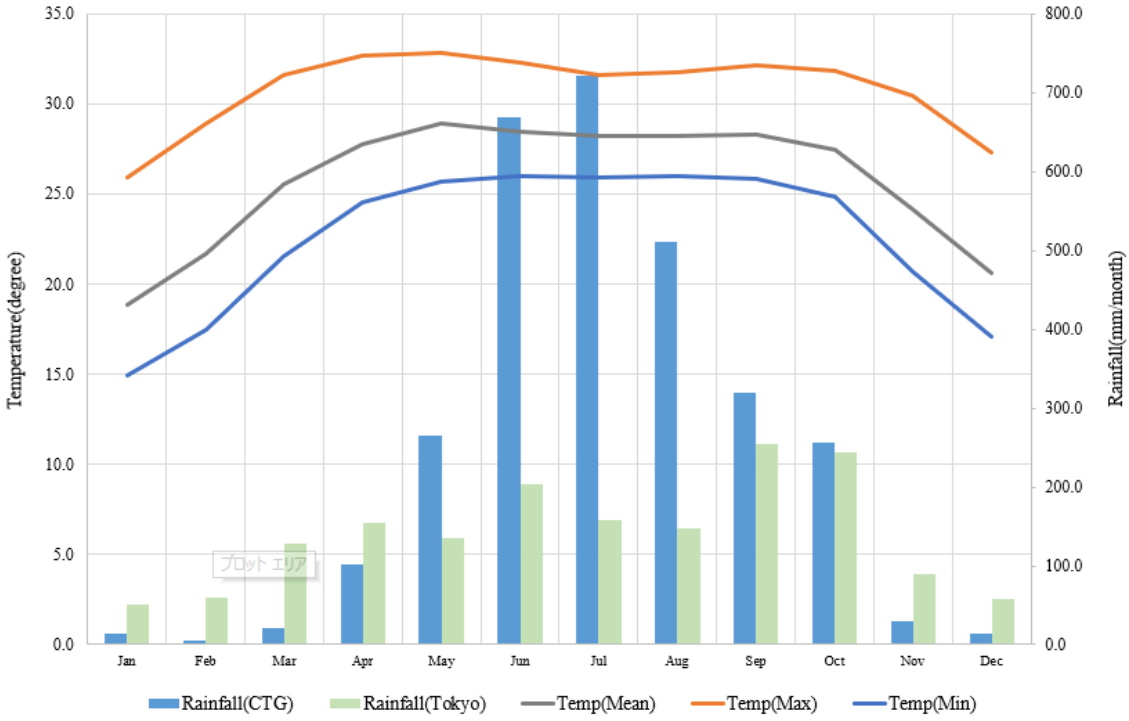
According to the Sanitation MP-2017, the sewerage development was formulated with the short-term and long-term development plan which was targeted in the year of 2030 and 2065 respectively. In the Study, the year 2070 is set as the target year for sewer facility planning in order to avoid expansion work on main roads immediately after the completion of the facilities targeted for 2030 excluding pump facility. On the other hand, 2055 is set as the target year for the sewage treatment facility planning, assuming a 25-year project period.

CHAPTER 2 OUTLINE OF STUDY AREA

2.1 Natural and Physical Conditions

2.1.1 Climate

Chattogram is located in a tropical climate zone with a rainy season from April to October and a dry season from November to March. Rainfall is particularly heavy from May to October due to the monsoon with more than 90% of annual rainfall during this period. It could be identified that it rains a lot in Chattogram since annual rainfall in Chattogram is 3,000 mm, while that in Tokyo is only approximately 1,700 mm. Especially, precipitation in the heaviest months in July is more than three times as shown in Figure 2.1.1. Temperature ranges from 25-30°C throughout the year. The coldest months comes in December and January, and the temperature drops to 15°C.



Source: Japan Meteorological Agency

Figure 2.1.1 Temperature and Precipitation Data for Chattogram (2012.1-2024.2)

2.1.2 Hydrology

Catchment-6 is located between the Bay of Bengal to the west and Karnaphuli river to the east. Karnaphuli River is a tidal river and is frequently flooded by high tides and storm surges especially during the monsoon season as shown in Figure 2.1.2. According to the records between 1960 and 2009 on MP-2017, there were five storm surges over 6 m, four of which were between 6 m and 6.7 m and the highest one was + 10m. The Coastal Road, which functions also as an embankment, is +10 m high, thus it is considered unlikely to be flooded by storm surge. However,

the sluiceway under the embankment must be closed to prevent backwater from the sea at high tide.



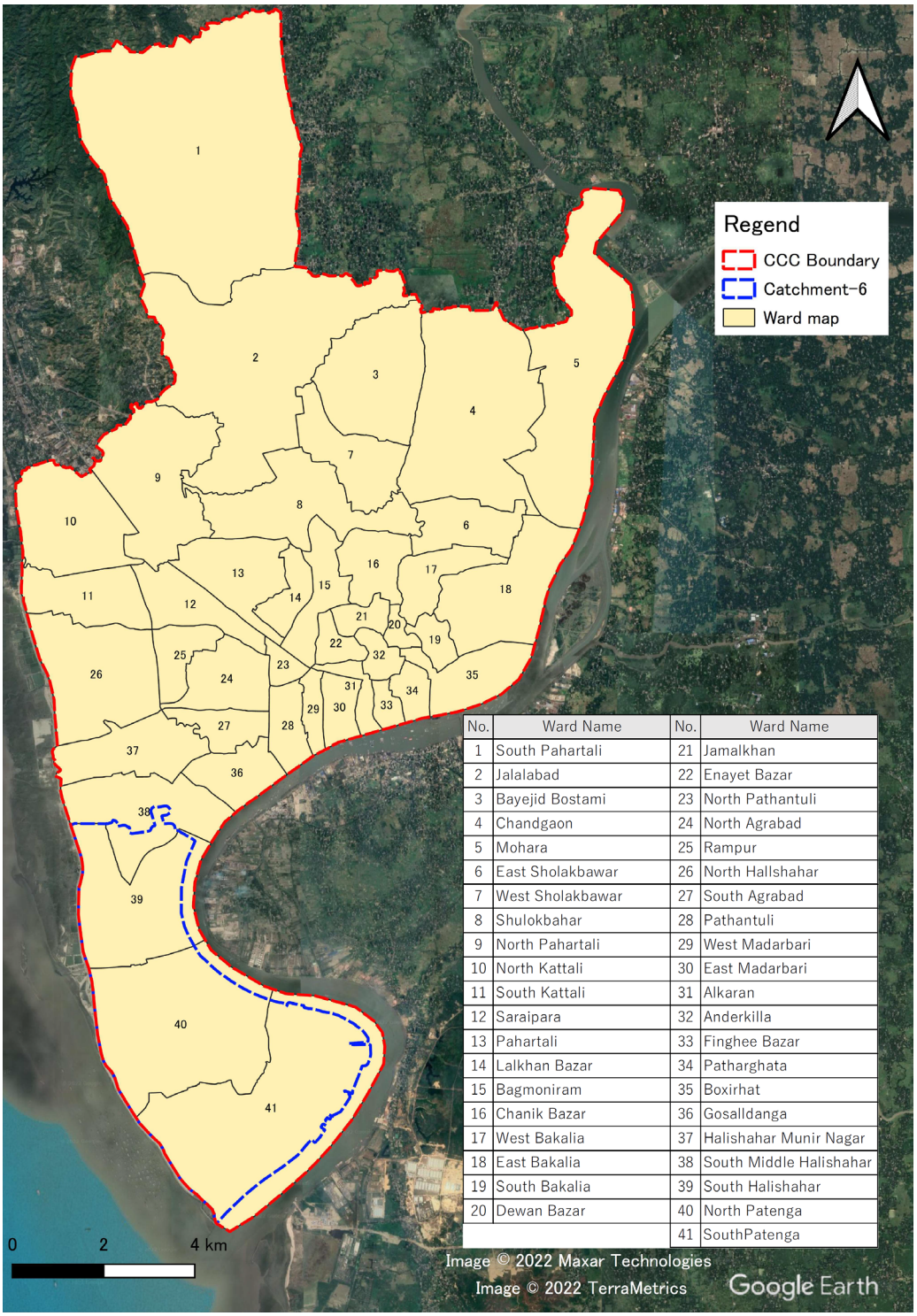
Source: Drainage MP-2017

Figure 2.1.2 Khals in Chittagong City

2.2 Site Conditions

2.2.1 Administrative Boundary

Bangladesh has eight divisions as administrative divisions under the national government, and there are 64 districts under the divisions. Upazila and Thana are established under the district, and Union is established under Upazila and Thana in rural areas. In urban areas, City Corporations have been established for large cities and Pourashava for general cities, spanning Upazila and Thana. Chattogram City is an administrative area (about 155 km^2) that includes the center of Chattogram and is divided into 41 wards. Catchment-6 includes part of South Middle Halishahar (Word No. 38) and South Halishahar (No. 39), North Pathenga (No. 40) and South Pathenga (No. 41). The Wards in Chattogram City Corporation is shown in Figure 2.2.1.



No.	Ward Name	No.	Ward Name
1	South Pahartali	21	Jamalkhan
2	Jalalabad	22	Enayet Bazar
3	Bayejid Bostami	23	North Pathantuli
4	Chandgaon	24	North Agrabad
5	Mohara	25	Rampur
6	East Sholakbawar	26	North Hallshahar
7	West Sholakbawar	27	South Agrabad
8	Shulokbahar	28	Pathantuli
9	North Pahartali	29	West Madarbari
10	North Kattali	30	East Madarbari
11	South Kattali	31	Alkaran
12	Saraipara	32	Anderkilla
13	Pahartali	33	Finghee Bazar
14	Lalkhan Bazar	34	Patharghata
15	Bagmoniram	35	Boxirhat
16	Chanik Bazar	36	Gosalldanga
17	West Bakalia	37	Halishahar Munir Nagar
18	East Bakalia	38	South Middle Halishahar
19	South Bakalia	39	South Halishahar
20	Dewan Bazar	40	North Patenga
		41	SouthPatenga

Source: CWASA

Figure 2.2.1 Location of Wards in Chattogram

2.2.2 Present and Future Land Use

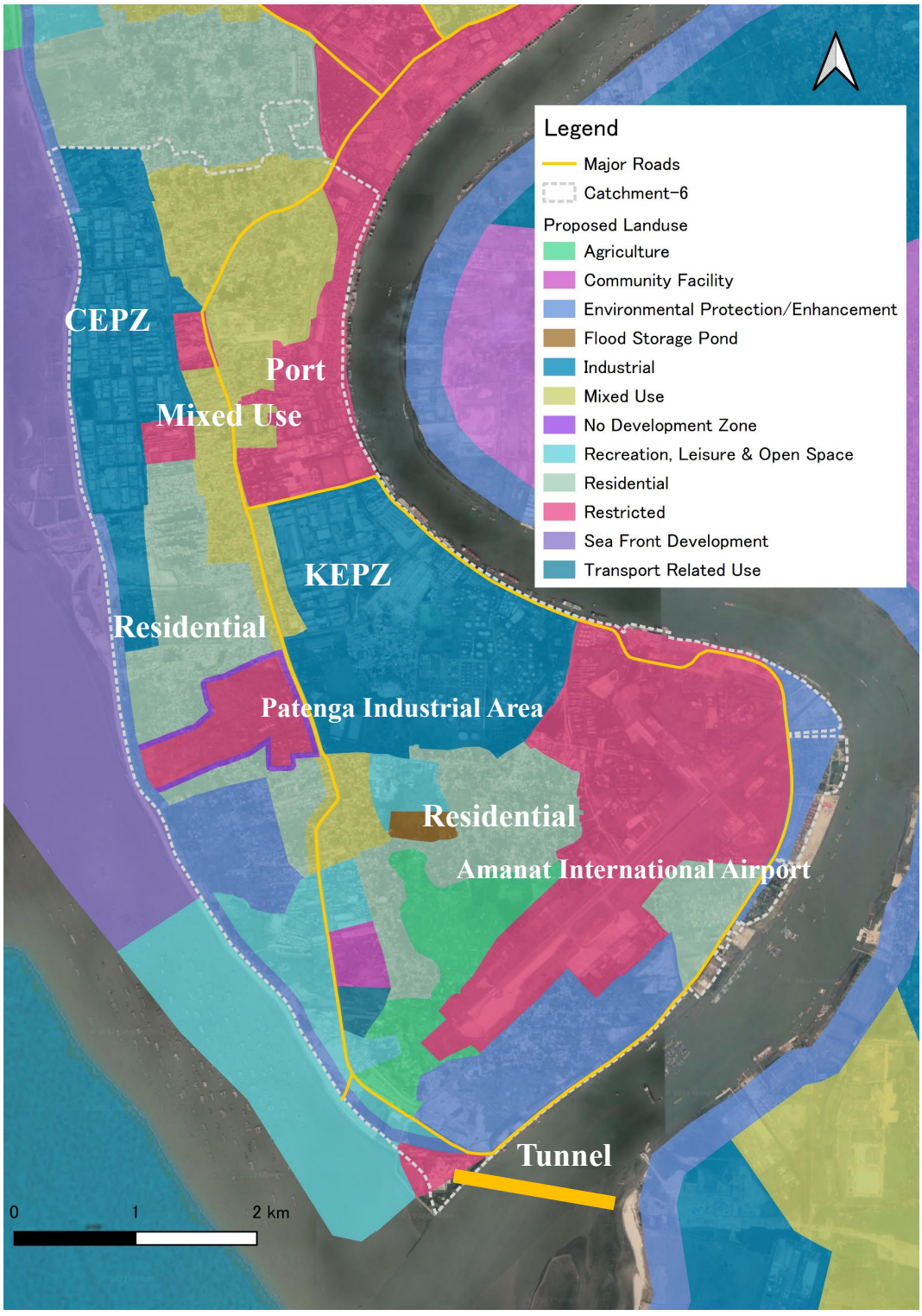
Catchment-6 (2,850 ha) has Shah Amanat International Airport (450 ha) at the south, port-related facilities at the north and Chattogram Export Processing Zone (CEPZ) at the west, and Karnaphuli Export Processing Zone (KEPZ) and the Patenga Industrial Area (PIA) at the east. In addition, naval facilities such as base and naval school are scattered throughout the area. The Mixed use areas, consisting of commercial and residential areas, are mainly located along the main north-south axis road (M.A Aziz Rd), and the residential area is located outside of Mixed used areas. The southern area has many restricted areas due to the presence of the airport and high-rise building is restricted there. Therefore, there are fewer residential areas on the south side.

Regarding future land use, a bay terminal is being developed on an approximately 10 km^2 site along the Bay of Bengal. This bay terminal was scheduled to start operation in 2024, however the terminal is still under construction as of February 2025. Further increase in cargo traffic and employment is expected. To the south of Catchment-6, a tunnel is being constructed through the Karnaphuli river to the Anauara upazila area. Regarding Industrial, CEPZ is planned to be expanded to the extent possible in the future.

Table 2.2.1 Area for Proposed Land Use of Catchment-6

Proposed Land Use (2030)	Area (ha)	Ratio (%)
Restricted	724.4	25.5
Industrial	639.3	22.5
Residential	427.1	15.0
Environmental Protection/Enhancement	355.0	12.5
Mixed Use	346.6	12.2
Recreation, Leisure & Open Space	133.7	4.7
Agriculture	118.0	4.1
River	34.6	1.2
Community Facility	20.9	0.7
No Development Zone	19.3	0.7
Transport Related Use	12.7	0.4
Flood Storage Pond	12.4	0.4
Sea Front Development	0.8	0.1
Total	2,844.8	100.0

Source: CWASA and CDA



Source: CWASA and CDA

Figure 2.2.2 Proposed Land Use Map of Catchment-6

2.2.3 Present Population and Population Projection

In Bangladesh, a census is conducted every 10 years, but it has not been updated since 2011 due to the impact of COVID-19, but the census was released in August 2022. Table 2.2.2 shows the population of Chattogram City in 2022 and the population of Catchment-6 which is the target area of the Study. In terms of population growth from 2011 to 2022, the increase is remarkable in the north area of Catchment-6 (Ward 38 and 39). The future population growth trend in Chattogram is assumed toward the southern area

Table 2.2.2 Population of Chattogram City and Catchment-6

	2011	2022	Growth Rate
Chattogram City	2,592,439	3,230,517	25%
Catchment-6	254,018	450,331	77%
- Ward 38(25.12%)	15,069	29,994	99%
- Ward 39	106,272	256,168	141%
- Ward 40	88,593	97,015	10%
- Ward 41	44,084	67,154	52%

Note: The population of Ward.38 is estimated only for the portion belongs to Catchment-6 which is 25.12% of the population in Ward.38

Source: Statistical Data 2022

2.3 PPP Regulatory Framework

2.3.1 PPP Act

Public-Private Partnership (PPP) in Bangladesh is primarily governed under the "Bangladesh Public-Private Partnership Act, 2015" (Act No.18 of 2015; hereinafter "PPP Act"). Prior to the enactment of PPP Act in September 2015, there was the Policy and Strategy for Public Private Partnership, 2010 which is deemed repealed in view of PPP Act. Based on PPP Act, a number of guidelines and rules are established to regulate the preparation and implementation of PPP. In case of inconsistency with other laws and regulations, the provisions of PPP Act shall prevail. PPP Act has also established the Public Private Partnership Authority (PPPA) under Prime Minister's Office as the nodal government agency for promotion and assessment of PPP projects. Salient outline of PPP Act is as follows:

- **Definition of PPP**: PPP is defined as a contractual agreement between the contracting authority and any private partner to which the private partner "(a) assumes the obligation/responsibility for carrying out any public work or providing any service on behalf of the contracting authority; (b) receives (i) consideration for the work or services

from public funds; (ii) charges/levy or fees from the users or service recipients; or (iii) a consolidated profit through receiving consideration, charges or fees for the said work or services; and (c) accepts the risk arising from carrying out the work in accordance with the terms and conditions of the said PPP contractual agreement or providing any service on behalf of the contracting authority" (Section 2 (27), PPP Act).

- **PPP Modality**: As the precedent PPP projects in the water supply and sanitation sector applies Design-Build-Finance-Operate-Transfer (DBFOT)[1], PPP Act does not limit or specify the modality of PPP.
- **Eligible Sector**: As Section 13 of PPP Act stipulates that the contracting authority or PPP Authority may undertake a PPP project by "identifying any of the projects from within or outside the annual development program", PPP Act does not specify the types of infrastructure or sectors to be eligible for the PPP regime. Since the preceding Gazipur Sewerage Project is being prepared through IFC's transaction advisory in cooperation with PPPA, the proposed sewerage project in Chattogram is also deemed eligible for PPP. The project's eligibility has been also verified through the consultation with PPPA officials during the present study.
- **Approval of a PPP project**: Cabinet Committee on Economic Affairs (CCEA) formed in the government grants the in-principle approval (IPA) and final approval for a PPP project (Section 14, PPP Act) after PPPA assessment and recommendations on each PPP project.
- **Government's Financial Participation**: The government may provide financing against the following activities of PPP projects (Section 16, PPP Act):

(a) Technical assistance financing
(b) Viability gap financing (VGF)
(c) Financing against equity and loan
(d) Financing against linked component
(e) Financing against such other activities as may be determined by PPPA.

2.3.2 Procurement Guidelines for PPP Projects

In exercise of the power conferred in PPP Act, PPPA adopted the Procurement Guidelines for PPP Projects (hereinafter "PPP Procurement Guidelines") in 2018 in accordance with Section 19 (2) of PPP Act which stipulates that the selection of a private partner for a PPP project is made under the regulations as approved by the Board of Governors of PPPA.

The PPP Procurement Guidelines has set forth two types of bidding process as its general procedure: (i) single-stage bidding process with two-envelope bidding (technical and financial

[1] Invitation for Bid of "Development of Water Distribution and Supply Facilities in Purbachal New Town" (2018) and the interview with IFC officials on Gazipur Sewerage Project (January 2022)

proposals); and (ii) two-stage bidding process that consists of RFQ stage (prequalification and shortlisting) and RFP stage (two-envelope bidding).

However, it is noted that, in accordance with Section 3.6 of PPP Procurement Guidelines, these competitive bidding processes of PPP Procurement Guidelines are not applicable to PPP projects implemented under the G2G Partnership Policy (See paragraph 2.3.3 "G2G Partnership Policy" below).

2.3.3 G2G Partnership Policy

2.3.3.1 Concept

In order to accelerate the bilateral cooperation and partnership with foreign governments to promote PPP projects in Bangladesh, PPPA established "Policy for Implementing PPP Projects through Government to Government (G2G) Partnership, 2017" (hereinafter "G2G Partnership Policy") in June 2017. The concept of G2G Partnership Policy stated in its Section 5 is summarized as follows:

1. Through this Policy, GOB may directly engage with other governments and seek their support to implement PPP projects such as:

- Providing financing support
- Selecting appropriate state-owned or private entities as investors

2. The Policy's procedural mechanism shall be governed by bilateral G2G Framework Agreement/Memorandum of Understanding (MOU) between GOB and other government.
3. The financing arranged by other government may be provided to:

- GOB to be injected as equity or debt to the Project Company either directly or indirectly through other entities
- Public sector authorities, state-owned entities or financial institutions to invest as equity or debt in the Project Company
- Investors to invest as equity in the Project Company
- Project Company by a combination of mechanisms mentioned above

4. GOB may take equity stakes or provide debt financing to the Project Company either directly or indirectly through other entities.

2.3.3.2 Procedure for implementation

Section 7 of G2G Partnership Policy sets forth the procedure for implementation of projects under the Policy. According to Section 7.1, the procedure for identification of a PPP project follows that of Chapter 2 of PPP Procurement Guidelines, i.e., the opinion of PPPA and IPA of CCEA are

required for a PPP project to proceed to the procurement stage.

As for the procurement process, it is to be noted that Section 7.4 of the Policy states that the process for selecting the investor and developing, negotiating and agreeing the terms and conditions of the PPP Contract and project documents shall be as set out in the G2G MOU between GOB and the partner foreign government (See paragraph 2.3.3.4 below); in other words, the PPP Procurement Guidelines does not apply to PPP projects under G2G Partnership Policy in terms of the selection of private investors.

Upon completion of the negotiation with investor, the Final Approval by CCEA is required before issuing Letter of Award to the Preferred Bidder and the signing of PPP Contract following Chapter 5 of PPP Procurement Guidelines, according to Section 7.6 of G2G Partnership Policy.

2.3.3.3 Eligibility of PPP Projects for G2G Partnership Policy

According to Section 8.1 of G2G Partnership Policy (as amended), to be eligible for G2G Partnership, a proposed project must comply with the following criteria:

- The project must fall within the definition of PPP project under PPP Act
- Total project cost must be not less than BDT 12,000 million, or the project must be used for launching a subsequent PPP project costing not less than BDT 12,000 million.

2.3.3.4 Japan-Bangladesh Joint PPP Platform

Pursuant to G2G Partnership Policy, GOB represented by PPPA and GOJ represented by Ministry of Land, Infrastructure, Transport and Tourism (MLIT) concluded the Memorandum of Cooperation (MOC) in June 2017 to establish the Japan-Bangladesh Joint PPP Platform (hereinafter "Joint Platform"). The Joint Platform, hosted by PPPA and MLIT, consists of representatives of relevant Ministries and Agencies as well as private sector entities, acts as the implementing body of the G2G Partnership between the two countries, and operates in the following manner in accordance with Section 4 of MOC:

- Both sides provide potential PPP projects to be examined in the Joint Platform. The Joint Platform will select one or more projects in which private sector entities from Japan ("Japanese investors") may show interest (Section 4.2, MOC).
- The Joint Platform will confirm the selected project(s) and Japanese Investor(s) recommended by MLIT in a written form (Section 4.4, MOC).
- GOB may directly select a Japanese investor that will take a part in the project without any tendering process as per G2G Partnership, taking into account information about the Japanese investors provided by MLIT (Section 4.5, MOC).
- The investor selected by GOB will voluntarily carry out negotiation with the contracting authority of GOB, supported by PPPA, on the concrete conditions for the project development (Section 4.6, MOC).

It is to be noted that, most importantly, Section 4.5 of MOC allows direct appointment of potential

Japanese investors by GOB for a PPP project under the G2G Partnership Policy without any tendering process.

According to PPPA and MLIT officials, the annual meeting of Joint Platform is held annually to discuss candidate PPP projects and their progress.

Based on the aforementioned regulations, this sewerage project was proposed and adopted by Marubeni Corporation as a Japanese investor at the 5th Bangladesh-Japan Joint PPP Platform held on October 4, 2022.

2.3.4 Viability Gap Financing (VGF) Rules

2.3.4.1 Outline

Based on the "Rules for Viability Gap Financing for Public-Private Partnership Projects" (hereinafter "VGF Rules") established by MOF in October 2018, GOB may provide financial support called Viability Gap Financing (VGF) to financially not viable but socially and economically beneficial PPP projects. VGF is managed and administered by the Finance Division of MOF.

VGF is provided in the form of either (i) capital grant disbursed during the construction phase of the PPP project on a pro rata basis with the equity contribution spent by the private partner; or (ii) annuity disbursed on a periodic basis during the operation period of the PPP project (Section 3 of VGF Rules).

The VGF amount shall be set by GOB or the preferred bidder's offer. VGF as capital grant shall not exceed 40% of the Total Estimated Capital Cost whereas VGF in the form of annuity shall not exceed 40% of the Total Estimated Project Cost as determined in Section 2 and Section 5 of VGF Rules (See Table 2.3.1).

Table 2.3.1 Maximum VGF Amount

Form of VGF	**Capital Grant**	**Annuity ***
Limit of VGF Amount	40% of **Total Estimated Capital Cost** *(Section 5 (f))*	40% of **Total Estimated Project Cost** *(Section 5 (g) (h))*
Definition of VGF calculation base *(Section 2(19))*	**Total Estimated Capital Cost** Total Estimated Capital Cost means total cost of designing, constructing and commissioning a project determined through Detailed Feasibility Study. Total Estimated Capital Cost includes: - Capital expenditures, - Consultancies, - Capitalized interests, - Contingencies,	**Total Estimated Project Cost** = (a) Total Estimated Capital Cost + (b) Operation Costs Total Estimated Project Cost includes: (a) Total Estimated Capital Cost: - Capital expenditures, - Consultancies - Capitalized interests - Contingencies

	- Margins, overheads, - Applicable government charges, and - Taxes	- Margins, overheads, - Applicable government charges, and - Taxes (b) Operation costs: - Maintenance, - Management, - Consultancies, - Interest, - Contingencies, - Margins, overheads, - Applicable government charges, and - Taxes

Note: VGF in the form of "Annuity" includes the cases that apply both capital grant and annuity as the form of VGF.

Source: VGF Rules

2.3.4.2 Eligibility

Section 4 of VGF Rules states that VGF shall apply to all kinds of PPP projects including the national priority PPP projects taken under Section 15 of PPP Act and PPP Projects taken under G2G Partnership Policy. This means that the proposed project is eligible as it is planned to be developed under G2G Partnership Policy.

Furthermore, Section 5 of VGF Rules has set forth the eligibility criteria as follows:

- The PPP project shall be implemented during the Project Term by a Project Company under PPP Act.
- Economic (Internal) Rate of Return of the PPP project shall meet the threshold level as specified by PPP Unit, Finance Division of MOF or the provision of VGF shall maximize the Value for Money (VFM).
- The Detailed Feasibility Study (F/S) is the pre-requisite for availing VGF. EIRR of the PPP project shall be calculated through the Detailed F/S.
- PPP project shall provide a public service against payment of a predetermined tariff or user charge.
- The VGF amount shall be set by GOB or preferred bidder's offer. Where the VGF is based on the preferred bidder's offer, the VGF shall form a key component of the financial evaluation criteria alongside other technical evaluation criteria.

2.3.4.3 Approval Process

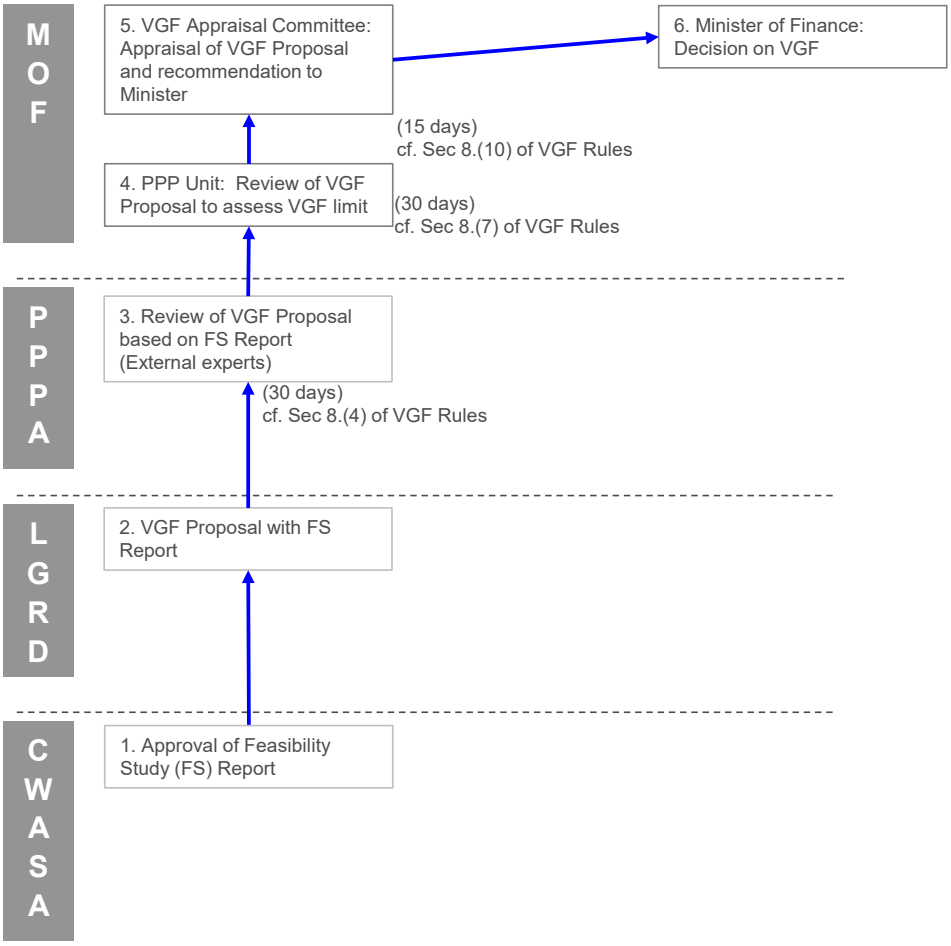
According to Section 8 of VGF Rules, the approval process for VGF support to a PPP project is as follows (See Figure 2.3.1 below and also Chapter 6 on the project development process and

VGF process applied to the proposed project):

- After IPA granted for the project by CCEA, the Contracting Authority or PPPA shall proceed to conduct Detailed F/S including estimation of VGF requirement.
- Contracting Authority shall submit the VGF proposal to PPPA in the formats annexed to VGF Rules, where the Contracting Authority shall certify with the reasons for VGF request that:
    (a) Tariff or user charge cannot be reasonably increased to eliminate or reduce the viability gap or enhance Project viability;
    (b) Project Term (contract period) cannot be reasonably increased for reducing the viability gap or enhancing Project viability; and
    (c) Total Estimated Capital Cost and Total Estimated Project Cost are reasonable and are based on the standards and specifications normally applicable to similar PPP projects and they shall not be further restricted for reducing the viability gap.
- PPPA shall review the VGF proposal within 30 working days through the following:
    (a) Evaluation of the financial model, project structure and underlying assumptions to estimate VGF
    (b) Analysis of the PPP structure to assess VFM and necessity of VGF
    (c) Review of further information from Contracting Authority as needed
- PPPA may endorse the VGF proposal and shall send it with its reasoning along with all project documents to the PPP Unit, Finance Division of MOF, on behalf of Contracting Authority.
- PPP Unit shall review the VGF proposal within 30 working days through the following actions:
    (a) Assessment of VGF limit of the project
    (b) Prioritization or ranking of the received VGF proposals based on EIRR and/or other relevant criteria and the recommendation for the VGF amount accordingly
    (c) Request for further information if needed
- PPP Unit shall prepare a summary of the proposal for VGF Appraisal Committee chaired by Additional Secretary/ Joint Secretary of Finance Division of MOF.
- VGF Appraisal Committee shall appraise VGF proposal within 15 working days and shall recommend the PPP project to Finance Minister for granting the VGF.
- After receiving in-principle decision by the Finance Minister, PPP Unit shall notify it to relevant authorities. The Contracting Authority is not authorized to public RFP or IFB unless

it receives the in-principle approval of VGF.

- In case of PPP projects that require tendering process, the recommendation of the Evaluation Committee regarding the VGF shall be submitted to PPP Unit through PPPA.
- The Line Ministry shall submit the legally vetted and negotiated PPP Contract to CCEA for Final Approval.
- PPP Unit, Finance Division of MOF, Lead Financial Institution and Project Company shall enter into a tripartite "VGF Agreement" which shall be the part of PPP Contract.
- Disbursement of VGF shall be made through the Lead Financial Institution in the manner determined in the VGF Agreement.



Source: VGF Rules

Figure 2.3.1 VGF Process

2.3.5 Other Relevant Guidelines and Regulations

2.3.5.1 Rules for TA Financing

"Rules for PPP Technical Assistance Financing" (hereinafter "Rules for TA Financing") established by MOF in October 2018 regulates the financial assistance by GOB for PPPA to provide the project development such as detailed feasibility studies, transaction advisory, procurement preparation, etc. to PPP projects. To be eligible for the financial assistance, a PPP project has to obtain IPA from CCEA and also be in line with requirements stipulated in PPP Act (Section 7 of Rules for TA Financing). In order to seek supports from this facility, the Contracting Authority shall forward its application to PPPA through its line ministry. Upon approval on the assistance, PPPA will hire local or international consultants to perform the necessary advisory for the Contracting Authority.

For the development of the present project, CWASA has hired the transaction advisory consultants with its own fund without tapping on this government support.

2.3.5.2 Guidelines for Unsolicited Proposals

"Guidelines for Unsolicited Proposals" established by PPPA in 2018 allows a private entity's unsolicited proposal to be considered and approved for implementation through procedures set forth in the guidelines. Under these guidelines, the original proponent of the project may take preferential treatment in bidding process through "Bonus System". It is noted that the proposed sewerage project will not apply these guidelines because it will apply the G2G Partnership Policy for the implementation without any tender process.

2.3.6 Conclusion on PPP Regulatory Analysis and Recent Developments

It has been concluded that the proposed project is in line with the PPP implementation under G2G Partnership Policy using VGF for its capital cost, through the regulatory analysis presented above and the Consultant's consultations with PPPA officials during the Pre-feasibility Study conducted from 2021 through early 2022 prior to the present Feasibility Study.

Since the completion of Pre-feasibility Study in March 2022, the project went through the following developments:

- The project was successfully identified as a G2G candidate project in October 2022 by the Japan-Bangladesh PPP Platform under G2G Partnership Policy after presented by MLIT of Japan to the Joint Platform with its recommendation on the potential Japanese investor. As a G2G candidate project, the project does not require any tendering process for selection of a private partner (See paragraph 2.3.3.4).
- After the Pre-feasibility Study had confirmed the applicability of PPP Act and relevant regulations to the project, CWASA went through the process to obtain IPA from CCEA under authority of Ministry of Local Government, Rural Development and Co-

operatives (LGRD) as the line ministry. CCEA granted IPA to the project in October 2022.

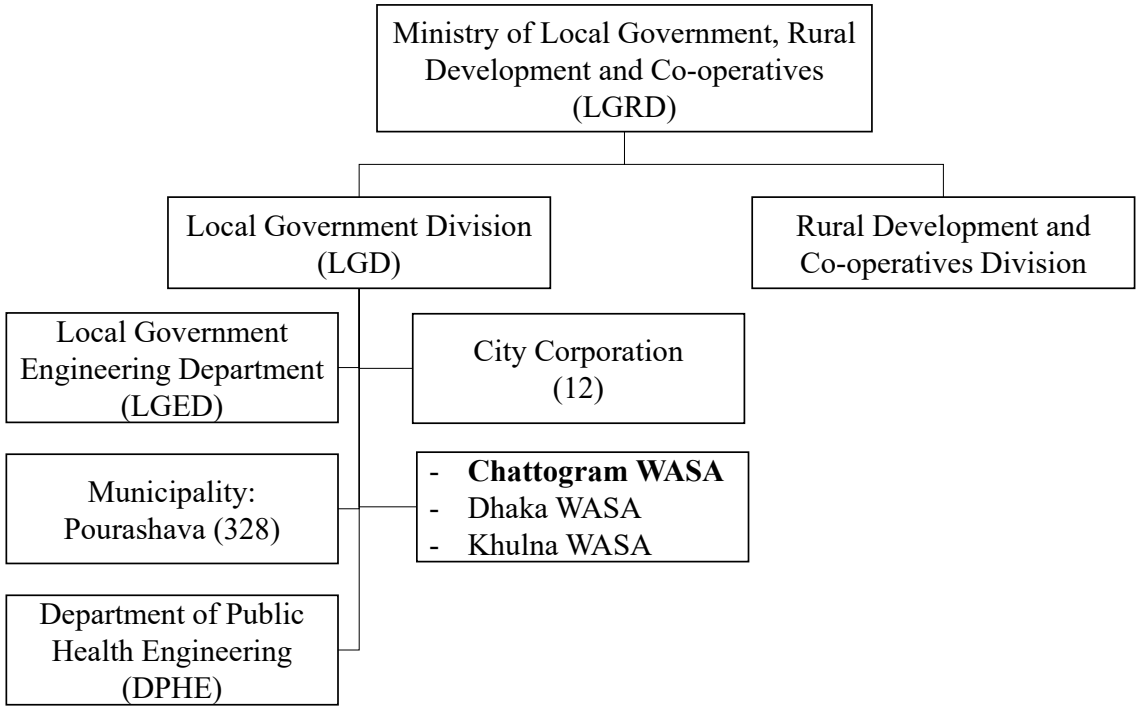
As for the financing support from GOB, the project is deemed eligible for VGF (up to 40% of Total Estimated Capital Cost as defined in VGF Rules) in accordance with the relevant regulations. The VGF amount will be determined by MOF after PPPA's examination of the Detailed Feasibility Study (F/S).

2.4 Institutional Aspects related to Water Sector in Chattogram

The following organization will be the related authorities on the implementation of sewerage project in the Catchment-6.

2.4.1 Chattogram Water Supply and Sewerage Authority (CWASA)

Chattogram Water Supply and Sewerage Authority (CWASA) is the organization who provides water supply and sanitation service to the people, community and company etc. in Chattogram under the Ministry of Local Government, Rural Development and Co-operatives (LGRD) as shown in Figure 2.4.1.



Source: Marubeni Corporation

Figure 2.4.1 Organization Chart Under LGRD

CWASA has three departments under Managing Director (MD) such as Administrative Department, Financial Department and Engineering Department. CWASA has been mainly

implementing construction of water supply facilities since it was established, therefore there is no department specified in sewerage sector. Therefore, currently some of the managers for the water supply sector are also in charge sewerage sector. Under the current situation and for the future development of sewerage facilities in accordance with the Sanitation MP-2017, JICA is providing technical assistance to propose the required organization to implement sewerage development from 2021 to 2023. The technical assistance has completed by the end of September 2023.

2.4.2 Chattogram Development Authority (CDA)

Chattogram Development Authority (CDA) is in charge of formulation of municipal planning for city development, drainage and road. The coverage area of CDA is 1,152 km^2 including Chattogram City Corporation (CCC) and the surrounding districts. The CDA divides the area into 12 Detailed Planning Zones (DPZs) of which 6 DPZs are in the area of CCC and the other 6 DPZs are outside of the area. The Study area of Catchment-6 belongs to DPZ-01 area. In the Project, to install the sewer under the road managed by CDA, no objection certificate shall be obtained from CDA before the construction of sewer.

2.4.3 Bangladesh Export Process Zone Authority (BEPZA)

Government of Bangladesh (GOB) plans to strengthen foreign investments for the economic growth through the industries. And Bangladesh Export Process Zone Authority (BEPZA) is the governmental organization to promote the foreign investment in the Export Process Zones (EPZs). While BEPZA also has responsible for inspection and supervision related to social and environmental issues and safety at industries in order to maintain the better condition in EPZs. There are two EPZs in the Catchment-6, Chattogram EPZ (CEPZ) and Karnaphuli EPZ (KEPZ). Those EPZs are managed by the BEPZA.

2.4.4 Chattogram City Corporation (CCC)

Chattogram City Corporation (CCC) is responsible for providing basic infrastructure in the city such as drainage, roads, electric streetlight, collection of solid waste, park and school etc. In relation to the Project, no objection certificate shall be obtained from CCC for the construction of sewer at the road under the CCC's jurisdiction. CCC is also operating the current two disposal sites in Chattogram which is receiving all the solid waste in Chattogram. However, the generated sludge at the sewage treatment plant will be disposed to the dumping site to be newly allocated at the southern area of the sewage treatment plant managed by CWASA. The area will be utilized as a dumping site for the sludge from STP-1, STP-5 and STP-6. Currently storm water, and black and gray water is disposing to the drain, however, the drain will be received only for storm water after installation of the sewer in the future. After the installation of the sewer, the drain will receive only storm water and the installed sewer will receive black and gray water. Therefore, the scope demarcation between CCC and CWASA is that CCC will manage the drain and CWASA will manage the sewer. On the other hand, the sludge removal from septic tanks by vacuum vehicles currently being conducted by CCC is expected to be transferred to CWASA as sewerage service

will be expanded.

2.4.5 Department of Environment (DOE)

Department of Environment (DOE) under the Ministry of Environment and Forests is responsible for protection of the environment in Bangladesh. Major DOE's activities which are related to the Project are as follows. Under the DOE Head office, there are eight regional offices (Dhaka, Chattogram, Khulna, Bogra, Barisal, Sylhet, Mymensingh and Rangpur) and two metropolitan offices (Dhaka and Chattogram). Local activities are carried out through these branch offices. In this project, environment-related procedures such as EIA will be carried out with the Chattogram Metropolitan Office as the point of contact. In addition, the effluent quality shall be followed the DOE's approval during the course of EIA approval although the standard is basically referred from the latest Environmental Conservation Rules (ECR) 2023.

- Review and approval of Environmental Impact Assessment (EIA) reports of the Project implemented by the Government, non-Government organizations and individuals. and provide suggestions on the completion of the EIA
- Receiving complaints related to environmental pollution and disposal based on the investigation
- Monitoring air and water quality and analysis of the collected samples of air, water and liquid waste in the laboratory

CHAPTER 3 CURRENT CONDITION OF SEWERAGE AND SANITATION SYSTEM IN CATCHMENT-6

3.1 Outline of Current Sewerage System and Sanitation System

3.1.1 Current Condition of Sewerage and Sanitation System

There is no sewerage system in Chattogram at this moment although the first sewerage facilities are being constructed at the Catchment-1 by CWASA. Therefore, current available sewerage facility is only on-site system of septic tank. It was reported in the Sanitation MP-2017 that most of the houses (more than 80% of the households) equipped with the septic tank and several types of hygienic latrines and gray water from households are discharging into the drains along the houses. Therefore, overflowed wastewater from the septic tank and gray water are discharging into the Karnaphuli River or Bay of Bengal without any treatment now.



Photo 3.1.1 Wastewater Discharging into Drain

At the industrial area, most of the industries are garment related factories such as clothes, jeans, shoes and towel. Factory depending on the manufacturing type is doing pre-treatment of the effluent for the process wastewater by themselves in order to meet the effluent quality standard. However, black and gray water from the factory is discharging into the drain without any treatment. While, Chattogram Export Process Zone (CEPZ) has their own Effluent Treatment Plant (ETP). The ETP is receiving the wastewater which is mixed with process, black and gray from the drain inside the CEPZ area. In case of the rain, the drain receives also a storm water, therefore, some of the diluted wastewater is discharge into the Bay of Bengal without treatment process.

3.1.2 Fecal Sludge Collection System

Accumulated sludge in the septic tank in the households are periodically collected by the vacuum track. Chattogram City Corporation (CCC) is providing the service for the collection and dispose at the dumping site. According to the CCC, they have two vacuum tracks, of which one does not work at this moment. Therefore, only one vacuum track is doing the collection service now. To meet the requirement of the collection, CCC is also asking NGO to implement the collection and disposal service. The vacuum track transports the collected sludge from households to disposal site at Halishahar where it is located southern side of the STP sites. It was also reported in the Sanitation MP-2017 that most of the collected sludge from the septic tank by the private cleaner was disposed into nearby drains.

As described in Section 2.4.4, sludge removal from septic tanks by vacuum vehicles currently

being conducted by CCC is expected to be transferred to CWASA as sewerage facilities become more widely used in the future.

3.2 Other Status on Current Sewage and Sanitation Works

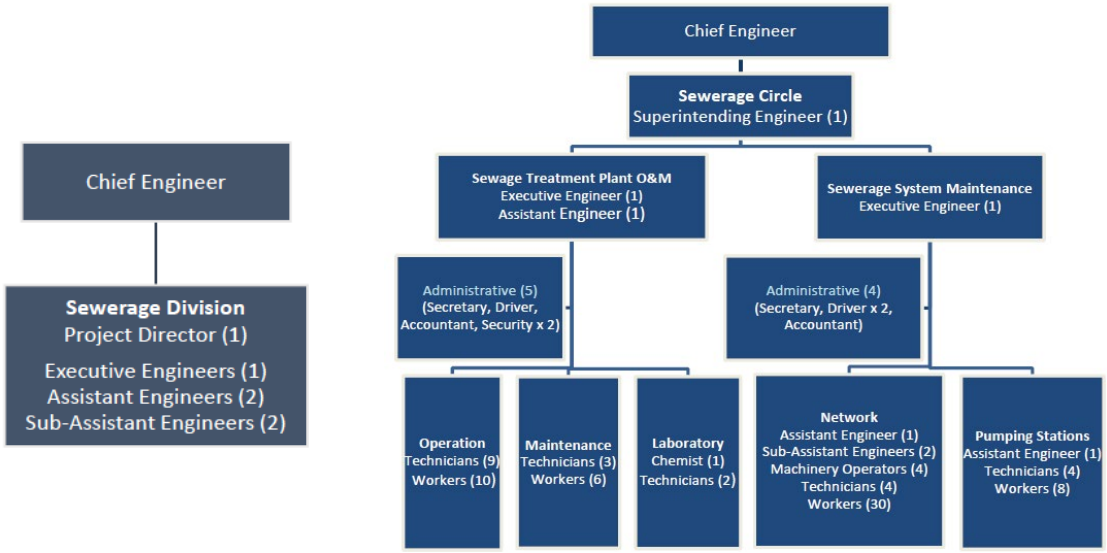
3.2.1 Operation and Maintenance

CWASA is implementing the operation and maintenance of the existing available water supply facilities by a called as Maintenance, Operation, Distribution and Service Office (MODS). MODS divided the whole service area into two in north and south to provide the service efficiently. However, MODS is providing only O&M for the water supply facilities since there is no sewerage facilities at present. Therefore, on the completion of the construction at STP-1 and sewer system in the Catchment-1, several equipment such as cleaning tools, investigation tools and repairing tools will be required. In addition, staff who knows the operation of the plant and maintenance for the sewer shall be allocated to daily operation of the sewerage facilities since the facility will keep working once it starts operation.

JICA has provided an assistance to CWASA aiming at 1) identifying the challenges in sewerage sector of CWASA, 2) the capacity development for the construction of sewerage system in accordance with the Sanitation MP-2017, and thus 3) contributing to the sanitary living environment in Chattogram since 2021 and the Project namely "Advisor on Urban Sanitation Improvement" has completed all the tasks by the end of September 2023. One of the main objectives of the project was capacity development for design and construction supervision in the Catchment-1 Project. It included the organizational setup and financial solution to implement the Sanitation MP-2017, the capacity development for O&M after the completion of the construction, and capacity development for an infrastructure planning after the Catchment-1 Project.

3.2.2 Organization

CWASA is implementing the water services since its establishment in 1963 for around 60 years on the construction, expansion and the O&M supplying water to domestic, industrial and commercial uses in Chattogram. Since CWASA has no experience in sewerage service and there is no specific department, the Sanitation MP-2017 proposed the phased organization setup in the design, construction and the succeeding O&M stage.



Note: (Left) Organization for Design stage, (Right) Organization for Construction and O&M stage
Source: Sanitation MP-2017

Figure 3.2.1 Proposed Organization for Sewerage Sector in CWASA

Currently, CWASA has an organization with around 1,048 employees, of which the number of technical staff is approximately 750. Existing organization chart is shown in Appendix. The on-going Catchment-1 Project has been also managed by the Project Director, who is playing the role of the Superintendent Engineer in water supply sector.

3.2.3 Financial Condition

3.2.3.1 Water Tariff of CWASA

(1) Past and Current Water Tariff of CWASA

Current tariff level of CWASA is shown in the Table 3.2.1. User types are separated into residential users and non-residential users, and the tariff level is approximately 2.1 times higher for non-residential users.

Table 3.2.1 Current Water Tariff of CWASA

User Type	Number of Users	Water Tariff Rate
Residential	75,402	18.00 BDT/m^3
Non-Residential	5,603	37.00 BDT/m^3

Source: CWASA, as of August 2023

Table 3.2.3 shows evolution of water tariffs since fiscal year 2016/17. Water tariffs are generally increased by 5% per year to reflect price increases and in accordance with maximum increase regulation in WASA act. Article 22. Exceptions are fiscal year 2016/17, 2019/20 and 2022/23 which tariff increases were more than 5% to close the gap between the actual cost increase and

the 5% increase in the tariff. In fiscal year 2020/21, no price increase was implemented by considering the impact of COVID-19 on users.

In October 2022, price increase was implemented up to 18.00 BDT/m^3 for residential and 37.00 BDT/m^3 for non-residential users. The main reason for the price increase was announced to be repay loans borrowed from financial institutions such as JICA, the World Bank, and AFD for the implementation of large-scale projects in the past.

CWASA calculates and publishes the average tariff based on the total collected amount and total water billed each fiscal year. The average tariff has increased steadily every year from 2016/17 to 2022/23 and is expected to increase again in 2022/23 due to the October 2022 rate revision.

Table 3.2.2 Evolution of Water Tariff of CWASA

(unit: BDT/m^3)

Fiscal Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Residential	9.00	9.45	9.92	12.40	12.40	13.02	18.00
Non-Residential	25.00	26.25	27.56	30.30	30.30	31.82	37.00
Average Tariff	11.85	11.88	12.84	12.97	13.73	14.73	n.a.
Increase Rate (Residential)	18.3%	5.0%	5.0%	25.0%	0.0%	5.0%	38.2%
Increase Rate (Non-Residential)	16.0%	5.0%	5.0%	9.9%	0.0%	5.0%	16.3%
Inflation Rate in Bangladesh	5.7% (2017)	5.5% (2018)	5.6% (2019)	5.7% (2020)	5.5% (2021)	7.7% (2022)	-

Source: CWASA, as of August 2023

(2) Other Fees

-Service Connection Fee and Meter Replacement Fee

Service connection fees and meter replacement fees per diameter are summarized in the following table. The general connection fee includes "connection costs," "meter costs (+10% VAT)," "meter adjustment costs," and "development costs" stipulated by CWASA. These costs are the same for residential and non-residential use, but different deposit fees are imposed according to the pipe diameter of the connecting pipe. Replacement costs for faulty or stolen meters are also shown in the below table.

Table 3.2.3 Connection Fee and Meter Replacement Fee of CWASA

(unit: BDT)

Diameter of Distribution Line	Residential Users	Industry and Commercial Users	Exchange of Damaged Meter	Exchange of Stolen Meter
3/4 inch	8,650 + deposit 5,000	8,650 + deposit 40,000	4,000	6,000
1 inch	16,100 + deposit 10,000	16,100 + deposit 80,000	5,500	7,500
2 inches	85,000 + deposit 20,000	85,000 + deposit 200,000	18,000	25,000
4 inches	149,000 + deposit 30,000	149,000 + deposit 800,000	25,000	35,000
6 inches	245,000 + deposit 50,000	245,000 + deposit 1,000,000	35,000	45,000

* Connection fee is the sum of connection fee, meter fee (+10% VAT), meter adjustment fee, and development cost stipulated by CWASA. Actual costs may vary depending on local conditions.

Source: CWASA, as of August 2023

-Water Truck Fee

At the request of users, CWASA also supplies water by water trucks called "Bowser". Currently, a total of five water trucks are in operation. When a water truck delivers 10 $m^3$of water 4 to 5 days after the request, the normal unit price is 1,400 BDT/unit, and if the requested delivery date is the same day or the next day after the request, the emergency unit price is 2,500 BDT/unit.

Table 3.2.4 Water Truck Fee of CWASA

User Type	Regular Rate	Emergency Rate
Water Truck (Bowser)	1,400 BDT/10m^3	2,500 BDT/10m^3

Source: CWASA, as of August 2023

-Groundwater Usage Fee

Table 3.2.5 shows the license fee for groundwater usage. Groundwater users pay a license fee in the first year and a renewal fee in subsequent years. Different fees are set according to the user category and pipe diameter.

Table 3.2.5 Groundwater Usage Fee of CWASA

Groundwater Fee (BDT/Year)	License Fee		Annual Renewal Fee	
	Residential	Non-Residential	Residential	Non-Residential
2 to 3 inches	30,000	55,000	15,000	33,750
4 inches	50,000	140,000	25,000	87,500
6 inches	80,000	225,000	75,000	137,500

Source: CWASA, as of August 2023

(3) Collection Method and Collection Rate

For tariff collection, the meter readers visit users every month and input the checked consumption data in the tariff system. Then, the printed bills are distributed to each user. To pay the bill, users can select the bank account from 250 branches of 26 banks all over Chattogram city. In addition to the bank branches, users can pay through mobile money transferring service called Bkash, Nargad account, and it accounted for about 12% of the total collected tariff in September 2022. CWASA can check the collection status through online, and the deposited amount is transferred from banks to CWASA every week. Other than water tariff, other bills including connection fee, connection transfer fee, security deposit, etc. are also collected through the same system.

Billed and collected tariff amount from fiscal year 2016/2017 to 2021/2022 is shown in the below table. The collection rate, calculated by "total amount collected/total billed amount" for each fiscal year, has ranged from 83.4% to 99.6%, with an average of 91.4% over the past 6 years.

Table 3.2.6 Evolution of Billing and Collection Amount of CWASA

Fiscal Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	Avg.
Billed Amount (A)	813.4	925.1	1,088.0	1,199.4	1,423.7	1,806.1	-
Collected Amount (B)	788.0	804.5	996.2	999.9	1,418.0	1,623.6	-
Collection Rate (B/A)	96.9%	87.0%	91.6%	83.4%	99.6%	89.9%	91.4%

Source: CWASA, as of February 2022

(4) Regulation Related to Tariffs

There are 4 WASAs (Water Supply and Sewerage Authority) in Bangladesh which are in charge of water supply, drainage and sanitation services under the Ministry of Local Government, Rural Development and Cooperatives. Operations of WASAs are regulated according to WASA act enacted in 1996.

WASA is entitled to levy tariff for water supply and sewerage services after approvals of the WASA board and LGRD. The tariff rates could be adjusted every year or any time for special reason. Maximum tariff increase is set at 5% to reflect the inflation of expenditures as approved by WASA board. After the sewerage service is provided, sewerage tariff could be collected from users after 6 months nevertheless users do not connect to the sewer line.

In addition to the WASA act, SOR (Statutory Regulatory Order) no. 91-Act/2011 was issued and admitted the tariff rate increase more than 5% in case the reason is justified after the approval of

WASA board and the government. This order also regulates that sewerage tariff rate level is the same as the water tariff.

3.2.3.2 Sewerage Tariff

(1) Sewerage Tariff Plan of CWASA

There is no sewerage tariff currently levied by CWASA as there is no sewerage services provided. CWASA is planning to start collecting the sewerage tariff once the sewerage service becomes operational as approved by LGRD. Tariff level at 100% of the water tariff level is an option, but it is not determined yet. The detail of other fees related to the sewerage service, such as connection fee, are not yet determined.

(2) Example of DWASA Sewerage Tariff

Current water and sewerage tariff of DWASA (Dhaka WASA) is shown in table as an example. Sewerage tariff has been charged in Dhaka more than 20 years at the same rate of the water tariff. Compared with the water tariff of CWASA, the current rates are set 16% lower for residential users and 14% higher for non-residential users(shown in Table 3.2.1).

Table 3.2.7 Current Water and Sewerage Tariff of DWASA

User Type	Water Tariff Rate	Sewerage Tariff Rate
Residential	15.18 BDT/m^3	15.18 BDT/m^3
Non-Residential	42.00 BDT/m^3	42.00 BDT/m^3

Source: DWASA, as of December 2022

3.2.3.3 Financial Conditions of CWASA

CWASA maintain the water supply service using the collected water tariff. The revenue amount could cover the O&M cost, but the amount is not enough to cover the investment cost. The profit and loss of CWASA is firstly presented, and the subsidy amount provided from LGRD is explained in the latter part.

Financial condition of DWASA is similar to CWASA. According to the project appraisal report[1] of World Bank in 2020, the report summarized that "financial stability of DWASA is not high because the current revenue amount could cover only operational cost, and majority of investment cost is subsidized from the government".

(1) Financial Conditions of CWASA

Profit and loss statement of CWASA from 2015/16 to 2019/20 are summarized in the table.

[1] Project Appraisal Document for a Dhaka Sanitation Improvement Project (February 2020)

Financial report for 2019/20 has been audited and published in March 2023 which indicate the audit work delays more than two years.

Comparing income and expenses in 2019/20 and 2015/16, the total income increased by 86%, while total expenditure increased by 112%. During the same period, CWASA posted a loss, with pre-tax losses would be between BDT 300 million to BDT 1.1 billion.

Table 3.2.8 Profit and Loss Statement of CWASA

(unit: BDT million)

Fiscal Year	2019/20 (audited)	2018/19 (audited)	2017/18 (audited)	2016/17 (audited)	2015/16 (audited)
Total Income	**1,548**	**1,422**	**1,259**	**1,052**	**831**
- Operating Revenue	1,287	1,210	1,050	845	641
- Other Income	77	58	72	90	52
- Interest Income	183	154	137	117	138
Total Expenses	**2,524**	**2,491**	**2,130**	**1,731**	**1,189**
- Operating Expenses	1,923	1,867	1,691	1,323	893
- Administ. General Expenses	368	379	357	334	231
- Collection Expenses	47	59	75	45	36
- Financial Expenses	186	186	7	29	29
Net Profit (loss) before TAX	**-976**	-1,069	-871	-679	-358

Note: Information after 2020 is still not published yet due to CWASA's auditing procedures.

Source: CWASA, Annual Report

Balance sheet of CWASA from 2015/16 to 2019/20 are summarized in the table. During these 4 years, total assets, equity and total liability increased by 122%, 171% and 118% respectively. CWASA has been running a deficit in the operation of the water supply service, and the accumulated retained earnings amount has decreased by 3.05 billion BDT. However, the subsidies from the government has increased from 1.82 billion BDT to 9.23 billion BDT over the 4 years period from 2015/16 to 2019/20, offsetting the deficit. The amount of debt increased by 30.11 billion BDT from 24.02 billion BDT to 54.12 billion BDT over the same 4 years due to borrowing from the Government of Bangladesh (GOB), JICA and WB.

Table 3.2.9 Balance Sheet of CWASA

(unit: BDT million)

Fiscal Year	2019/20 (audited)	2018/19 (audited)	2017/18 (audited)	2016/17 (audited)	2015/16 (audited)
Assets	**65,027**	**54,502**	**48,198**	**43,087**	**29,304**
-Non-Current Assets	57,670	48,932	40,624	35,462	22,765
- Current Assets	7,357	5,569	7,574	7,625	6,539
Equity& Liability	**65,027**	**54,502**	**48,198**	**43,087**	**29,304**
Equity	5,828	4,911	4,651	2,347	2,151
- Grant	9,234	7,219	5,881	2,699	1,823
- Equity	861	861	861	861	861
-Retained Earnings	-4,267	-3,169	-2,091	-1,213	-533
Liabilities	59,199	49,591	43,546	40,740	27,152
-Long-term Liabilities	54,125	44,673	39,110	36,098	24,023
-Current Liabilities	5,074	4,918	4,436	4,642	3,129

Note: Information after 2020 is still not published yet due to CWASA's auditing procedures.

Source: CWASA, Annual Report

(2) Financial Supports form LGRD and MOF

CWASA is able to pay the regular maintenance costs with the tariff revenue, but the current revenue cannot afford to pay CAPEX (capital expenditure) in addition to the maintenance costs. In order to implement development projects sustainably, CWASA is provided subsidies from LGD and concessional financing from MOF.

When starting a new project that requires capital investments, CWASA creates a DPP (Development Project Proposal) and requests approval from LGD. LGD examines the content of the DPP and the financial situation of CWASA and allocates funds from three sources: 1) GOB (Government of Bangladesh), 2) PA (Project Aid, Loan), and 3) Own Funds. "1) GOB" means subsides provided by LGD. "2) PA" means direct financing from MOF or provision of incidental concessional financing through CWASA under a financing agreement between the Government of Bangladesh and an international financial institution. "3) Own Funds" are funds disbursed from CWASA accounts.

Table 3.2.10 shows the fund allocation for the past large-scale projects. "1) GOB" subsidies accounted for 36%, "2) PA" loans accounted for 63%, and the remaining 1% was covered by "3) own funds".

Table 3.2.10 Funding Sources for Past Projects

(unit: BDT million)

Project	Funding Sources				Project Start Year
	Total	1)GOB (Subsidy)	2)PA (Loan)	3)Own Fund	
1) 1st IWSRP (Interim Water Supply & Rehabilitation Project)	n.a	n.a	249	n.a	1993
2) 3rd IWSRP (Interim Water Supply & Rehabilitation Project)	n.a	n.a	471	n.a	2000
3) Karnaphuli Water Supply Project (KWSP)	18,485	8,842	9,403	240	2006
4) Karnaphuli Water Supply Project (Phase 2) (KWSP-2)	44,892	16,652	28,009	231	2013
5) Vandaljuri Project	19,941	7,501	12,240	200	2015
6) Chittagong Water Supply & Improvement Sanitation Project (CWSISP -1)	18,908	3,734	14,949	225	2010
Total	102,226	36,729 (36%)	64,601 (63%)	896 (1%)	

Note: Total amount = 3) + 4) + 5) + 6)

Source: DPP/Revised DPP (RDPP) of Each Project, CWASA

As mentioned above, about two-thirds of the past project costs were covered by MOF loans. The loans from MOF and CWASA are called "SLA (Subsidiary Loan Agreement)" in projects funded by the World Bank, JICA, etc. and repay in Taka. In other words, the MOF bears the exchange rate risk of the original loan agreement. After negotiations between MOF and CWASA, the fixed interest rate for subsidiary loans has been set as low as 1.0% ("4) KWSP-2" in the table is the exception, which is 0.01%). The repayment of the loan is an equal principal repayment. The repayment grace period and repayment period of the loan are basically set to the same conditions as for the government and original loans during the loan period.

3.3 Related Projects with Catchment-6

3.3.1 Catchment-1 Project

CWASA is implementing the sewerage project in the Catchment-1 by the Bangladesh government's own fund. After the conclusion of the bidding for the selection of the Contractor in 2021 which the TAEYONG Engineering and Construction (South Korea) was awarded, the project is currently under the construction stage. The construction has commenced since January 2022 based on the prepared Contractor's detailed design. The construction will continue until the end of 2025. Consulting firm of ERINCO (Malaysia) is supporting CWASA as a construction supervision consultant.

3.3.2 Catchment-5 Project

Sewerage development project in Catchment-5 (North Kattoli Catchment) is planned to be implemented by AFD's support. A feasibility study has been conducted by consultants, and completed by February 2023. According to the study, a sewer with a total length of 97km and 50MLD capacity of STP are planned to be constructed in Catchment-5. The total project cost was estimated at approximately 190 million dollars excluding taxes and duties. Loan agreement for the project between Bangladesh government and AFD has been already made. Then, next step will be 1) Procurement of consultants, 2) Procurement of contractors, 3) Detailed design and construction. While a usual implementation plan for pipe laying in the city is proposed to procure of contractors and construction after design by a consultant, for the STP and pipe jacking method construction package, it is proposed to be implemented as an EPC Turnkey project. And it is proposed an additional two-year operation period after design and construction by the contractor or construction.

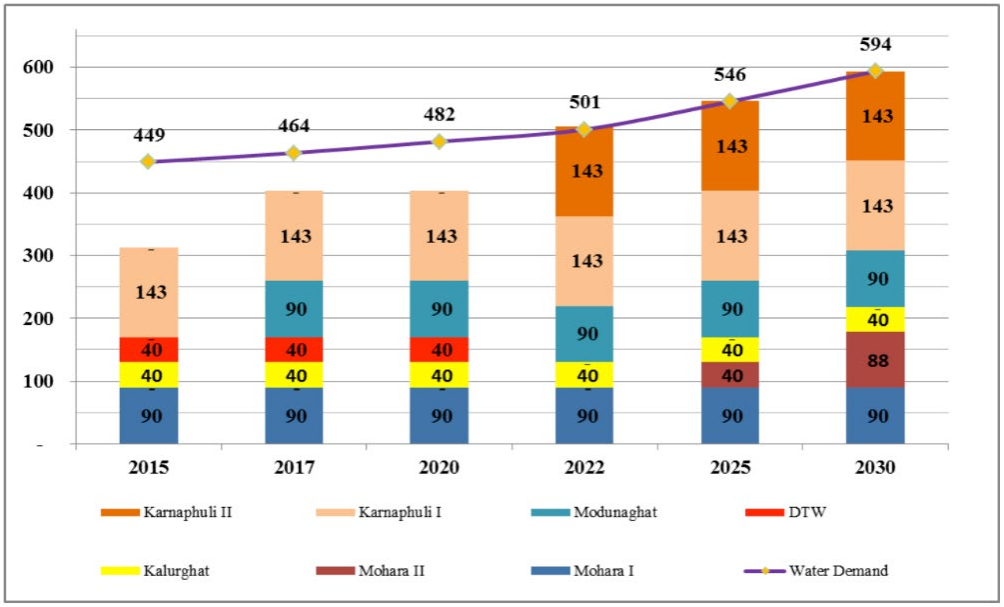
3.3.3 Catchment-2 and 4 Project

The Japan International Cooperation Agency (JICA) conducted preparatory study for Catchment-2 and 4 from 2022 to July 2023, and the project is scheduled to be implemented through a yen loan in the future. In the Sanitation MP-2017, the sewage from Catchment-2 and 4 were planned to be treated at STP after collecting them in each area. However, from the perspective of land acquisition for STP, the two catchments area are planned as one catchment area. In the study, it is planned to construct sewer with a total length of 80km and 60MLD capacity of STP. Loan agreement for the project between Bangladesh government and JICA has been made in December 2024. The next step will be 1) Procurement of consultants, 2) Procurement of contractors, 3) Detailed design and construction.

3.3.4 Water Supply Project

CWASA formulated the water supply plan under the Chittagong Water Supply Improvement & Sanitation Project (CWSISP) funded by the World Bank in 2015. The water supply plan targeted in the year of 2030 includes an evaluation of existing water supply facilities, alternative study for Modunaghat water treatment plant (WTP) to Patenga area and the estimation of the future water consumption for the Patenga Industrial Area which was named as Sector A in the plan.

Water production for Chattogram in 2030 will be 594 million litter per day (MLD) in total as shown in Figure 3.3.1, of which it was planned to supply 90 MLD to the Sector A (Patenga area). The water supply plan to Sector A is being supplied by the Modunaghat WTP since 2017 and that will continue in the future.



Source: Network Rehabilitation Strategy Report in Rehabilitation Report, Chittagong Water Supply Improvement & Sanitation Project, 2016

Figure 3.3.1 Estimated Water Production by 2030

The water consumption in 2030 was estimated in the Study as shown in Table 3.3.1 since area for the Sector A in the water supply plan and the Catchment-6 were slightly different.

Table 3.3.1 Water Consumption

Year	Water Consumption (MLD)			
	Domestic	Small Non-domestic[1)]	Large Non-domestic[1)]	Total
2017	33.8	4.1	42	79.9
2022	37.5	4.5	42	84.0
2030	40.8	4.9	45.5	91.2

Note: 1) Small Non-Domestic means the water consumption of commercial purpose, while Large Non-Domestic means the water consumption of large scale commercial and industrial purpose.

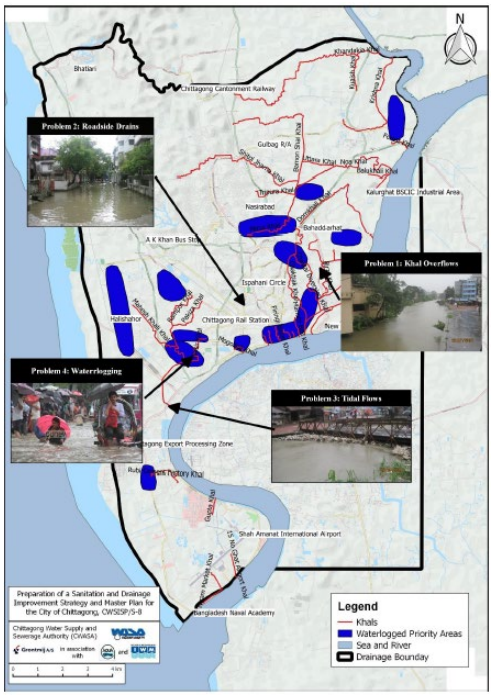
Note: Large Non-domestic does not include water consumption at navy facilities

Source: The Consultant modified the volume to meet with the Catchmet-6 area based on the Network Rehabilitation Strategy Report in Rehabilitation Report, Chittagong Water Supply Improvement & Sanitation Project, 2016

The size of distribution pipeline doesn't have enough to supply the current production volume. In addition, it was reported that the Ward 38 is facing water shortage due to the insufficient pipe size of the main distribution pipe. Therefore, it is required for the current network to rehabilitate and upgrade it.

3.3.5 Drainage Project

World Bank has implemented the Chittagong Water Supply Improvement & Sanitation Project (CWSISP) in 2017. In the project, sanitation master plan and drainage master plan were formulated respectively. The drainage master plan which was targeted in the year of 2030 was updated based on the old drainage master plan prepared by KOICA in 2009 and drainage plan prepared by Chattogram Development Authority (CDA) in 1995. The study area of the master plan was approximately 260 km^2 and the area is for the jurisdiction of Chattogram City Corporation (CCC).



Source: Drainage MP-2017

Figure 3.3.2 Drainage Issues in CCC Area

The updated drainage master plan evaluated the current drainage system in Chattogram as follows:

- Discharging the flood to the Bay of Bengal and Karnaphuli River at the heavy rain have a difficulty potentially due to the low lying and flat ground elevation in the CCC area.
- It is concerned that inundation during rainy season will occur more seriously with the since the development of the city in the future.
- The drainage system is not functioning sufficiently since the construction of drainage is implemented in a haphazard way.
- Many drainages are blocked with silt, sand, garbage, illegal residents on the watercourse and accordingly the flow capacity of is insufficient.
- Solid waste is dumped into the drain and it leads to become obstructs for the flow since the system for collecting and disposing of solid waste is insufficient.
- The Karnaphuli and Halda Rivers are tidal rivers, and since there is no expansion gate at the mouth of the river, the risk of inundation increases when there is high-intensity rainfall when the river water level rises at high tide.

In the Catchment-6, frequent inundation by the waterlogging on the drains were found along the main street of M. A. Aziz Road as shown in Figure 3.3.2. The flooding might not be so serious, however construction method shall be taken into consideration about this flood potential area during construction.

The CCC and the Bangladesh Water Development Board (BWDB) are responsible organization for stormwater drainage facilities and flood protection, and they are implementing the rehabilitation of the drainage facilities, renewing aged drainage facilities and controlling the flood effects by tides. Role of each organization is shown below:

Table 3.3.2 Role of CCC and BWDB

CCC	BWDB
✓ Road kerbs, drains/channels and associated structures ✓ Open drains and channels with associated culverts and structures.	✓ Road with embankment / flood protection wall with retention ponds at outlet of channel ✓ Sea dike along the Bay of Bengal.

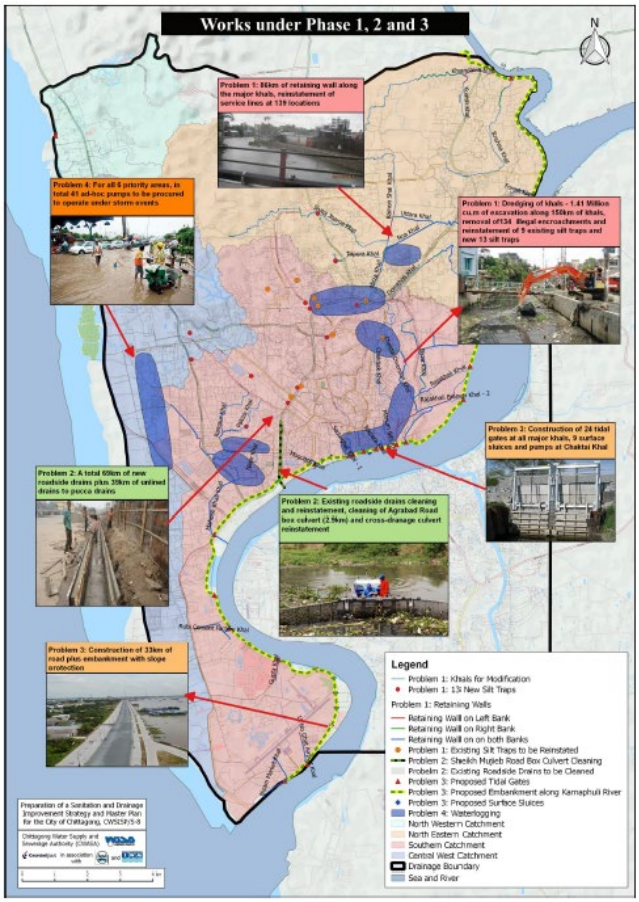
Source: Marubeni Corporation

To improve the current situation, drainage MP-2017 suggested to implement structural and non-structural measures as follows:

- Improvement of flow capacity by dredging and expansion of the channel
- Cleaning and expansion of the roadside drain
- Installation of gate and pump facility at the downstream end of the channel

In the Catchment-6, the following installation and construction are proposed in the drainage MP-2017 as shown in Figure 3.3.3.

- Construction of road with embankment along the right bank of the Karnaphuli River with the length of 33km
- Installation of 4 tidal gates at the end of the channel



Source: Drainage MP-2017

Figure 3.3.3 Measures to Improve the Drainage Facilities Issues in CCC Area

CHAPTER 4 DEVELOPMENT PLAN OF SEWERAGE SYSTEM

4.1 Sewerage System Development Plan

4.1.1 Outline of High-Level Sewerage Plan

This information is confidential corporate information and is not for public disclosure.

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Figure 4.1.1 Catchment-6 on Sanitation MP-2017

Table 4.1.1 Sewerage Plan of Catchment-6 in the Sanitation MP-2017

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4.1.2 Target Catchment Area

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4.1.3 Population Projection

4.1.3.1 Population Projection

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This information is confidential corporate information and is not for public disclosure.

Figure 4.1.2 Correlation Between Population Growth Rate and Population Density

Table 4.1.2 Population Projection for Catchment-6

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4.1.3.2 Service Coverage Ratio and Served Population

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Table 4.1.3 Wastewater Collection Scenario

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Figure 4.1.3 Paths Where It Is Difficult to Lay Sewer

This information is confidential corporate information and is not for public disclosure.

Figure 4.1.4 Sewage Catchment Area in Catchment-6

Table 4.1.4 Served Population in Catchment-6

This information is confidential corporate information and is not for public disclosure.

4.1.4 Wastewater Generation

4.1.4.1 Definition of Wastewater

This information is confidential corporate information and is not for public disclosure.

4.1.4.2 Domestic and Small Non-domestic Wastewater

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4.1.4.3 Industrial Wastewater

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Table 4.1.5 Volume of Black and Gray Water Generated in Industrial Facilities Accepted by CWASA

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4.1.4.4 Groundwater Infiltration and Stormwater Inflow

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4.1.4.5 Summary of Wastewater Volume

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Figure 4.1.5 Wastewater Volume and Service Ratio in Catchment-6

Table 4.1.6 Wastewater Volume in Catchment-6 (Daily Maximum)

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4.1.5 Construction Phase and Target

This information is confidential corporate information and is not for public disclosure.

Table 4.1.7 Construction Phase, Target Year, and Scope of the Project

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4.2 Study on Main Sewer

4.2.1 Planning Conditions and Definition of Sewer

4.2.1.1 Planning Conditions

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Table 4.2.1 Planning Condition for Sewer Network

This information is confidential corporate information and is not for public disclosure.

Table 4.2.2 Comparison Between MP, Two On-going Projects, and the Study

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4.2.1.2 Definition of Sewer

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This information is confidential corporate information and is not for public disclosure.

Figure 4.2.1 Definition of Sewer

4.2.2 Trunk Sewer

4.2.2.1 Trunk Sewer Alignment

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Figure 4.2.2 Options of Trunk Sewer Routes

4.2.2.2 Installation Depth

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Table 4.2.3 Comparison Study of Sewer Installation Depth

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4.2.2.3 Flow Calculation

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4.2.2.4 Land Availability for Pumping Station

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Figure 4.2.3 Planned Pumping Station Construction Site Along Feeder Road 1

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Figure 4.2.4 Location of the Proposed Sites for Pumping Stations

4.2.3 Selection of Sewer Collection System

4.2.3.1 Rider Sewer

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This information is confidential corporate information and is not for public disclosure.

Figure 4.2.5 Concept of Sewer Collection System, Option 1

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Figure 4.2.6 Concept of Sewer Collection System, Option 2

4.2.3.2 Comparative Study

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Figure 4.2.7 Sample Selection for the Comparative Study

Table 4.2.4 Comparison for Sewer Collection System

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4.2.4 Concept of House Connection Method

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Photo 4.2.8 (Left) Outlet of Septic Tank, (Right) Downspout on the Wall

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Figure 4.2.8 Current Condition and Concept of House Connection

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Figure 4.2.9 Scope of House Connection

4.2.5 Installation Method

4.2.5.1 Type of Installation Methods

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Figure 4.2.10 Typical Layout of Construction Yard for Pipe Jacking

4.2.6 Selection of Pipe Materials

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Table 4.2.1 Comparison of Pipe Materials

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4.3 Study on Sewage Treatment Plant

4.3.1 Planning Conditions

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Table 4.3.1 STP Influent Quality

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Table 4.3.2 STP Effluent Quality

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This information is confidential corporate information and is not for public disclosure.

Figure 4.3.1 Boundary of the STP Site

4.3.2 Selection of Sewage Treatment Process

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Table 4.3.3 Comparison of Sewage Treatment Process

This information is confidential corporate information and is not for public disclosure.

4.3.3 General Facility Layout Plan of Sewage Treatment Facility

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Table 4.3.4 Major Sewage Treatment Facilities in Catchment-6 (this Project)

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This information is confidential corporate information and is not for public disclosure.

Figure 4.3.2 Layout Plan of STP

4.3.4 Sludge Treatment Facilities

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4.3.5 Disposal for Generated Sludge

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This information is confidential corporate information and is not for public disclosure.

Figure 4.3.4 Tentative Dumping Site to be constructed by CWASA

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Figure 4.3.3 Existing Final Disposal Site

CHAPTER 5 CONSTRUCTION PLAN, PRELIMINARY COST ESTIMATE AND IMPREMENTATION SCHEDULE

5.1 Condition of Construction Cost Estimation

5.1.1 Condition of Cost Estimation

This information is confidential corporate information and is not for public disclosure.

5.1.2 Condition of Construction Cost

5.1.2.1 Project Component

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Table 5.1.1 Project Component in Each Phase

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5.1.2.2 Basis of Cost Estimate

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5.2 Cost Estimation of the Project

This information is confidential corporate information and is not for public disclosure.

Table 5.2.1 Construction Cost

This information is confidential corporate information and is not for public disclosure.

5.3 Implementation Schedule

This information is confidential corporate information and is not for public disclosure.

5.4 Estimation of Operation and Maintenance Cost

This information is confidential corporate information and is not for public disclosure.

Table 5.4.1 Annual Estimated O&M Cost

This information is confidential corporate information and is not for public disclosure.

CHAPTER 6 PROJECT STRUCTURE

6.1 Proposed Project Structure for Catchment 6

This information is confidential corporate information and is not for public disclosure.

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Figure 6.1.1 Proposed Project Structure

6.2 Discussion on Property Connections

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This information is confidential corporate information and is not for public disclosure.

Figure 6.2.1 Concept of Property Connection

6.2.1 Regulatory Basis

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6.2.2 Precedent Practice in Dhaka by DWASA

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6.2.3 Risks Associated with Property Connection Works

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6.2.3.1 Construction risk

This information is confidential corporate information and is not for public disclosure.

6.2.3.2 Operation risk

This information is confidential corporate information and is not for public disclosure.

6.2.3.3 Security risk

This information is confidential corporate information and is not for public disclosure.

6.2.4 Responsibility Allocation of Property Connection Scope

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Table 6.2.1 Opinions on Responsibility Allocation for Property Connections

This information is confidential corporate information and is not for public disclosure.

This information is confidential corporate information and is not for public disclosure.

Figure 6.2.2 Proposed Design and Construction Coordination Scheme

Table 6.2.2 Proposed Demarcation between SPC and CWASA

This information is confidential corporate information and is not for public disclosure.

6.3 Consideration on Financing Plan

This information is confidential corporate information and is not for public disclosure.

6.3.1.1 VGF and Equity

This information is confidential corporate information and is not for public disclosure.

6.3.1.2 Debt Finance

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6.4 Project Development and Implementation Process

6.4.1 Overall Project Development and Implementation Process

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This information is confidential corporate information and is not for public disclosure.

Figure 6.4.1 Project Development and Implementation Process

6.4.2 Detailed Process for Final Approval

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6.5 Provisional PPP Contract Conditions

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Table 6.5.1 Termination Events

This information is confidential corporate information and is not for public disclosure.

6.6 Preliminary Risk Analysis

This information is confidential corporate information and is not for public disclosure.

Table 6.6.1 Preliminary Risk Analysis

This information is confidential corporate information and is not for public disclosure.

CHAPTER 7 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

7.1 Project Components Which Cause Environmental and Social Impact

The Project is to develop the sewerage collection system and treatment facility in Catchment-6 of Chattogram City. This catchment is in the southern part of Chattogram City.

The project consists of two components, the first component is the development sewage collection system and the second is the construction and operation of the sewage treatment facility. The project is planned to be implemented as a PPP project. In General, PPP study has a certain project period from the construction to the operation of the facilities. In this PPP scheme, the project proponent plans to have the project target as PPP from the installation of the project to the Phase-1 which would cover the northern part of Catchment-6 area.

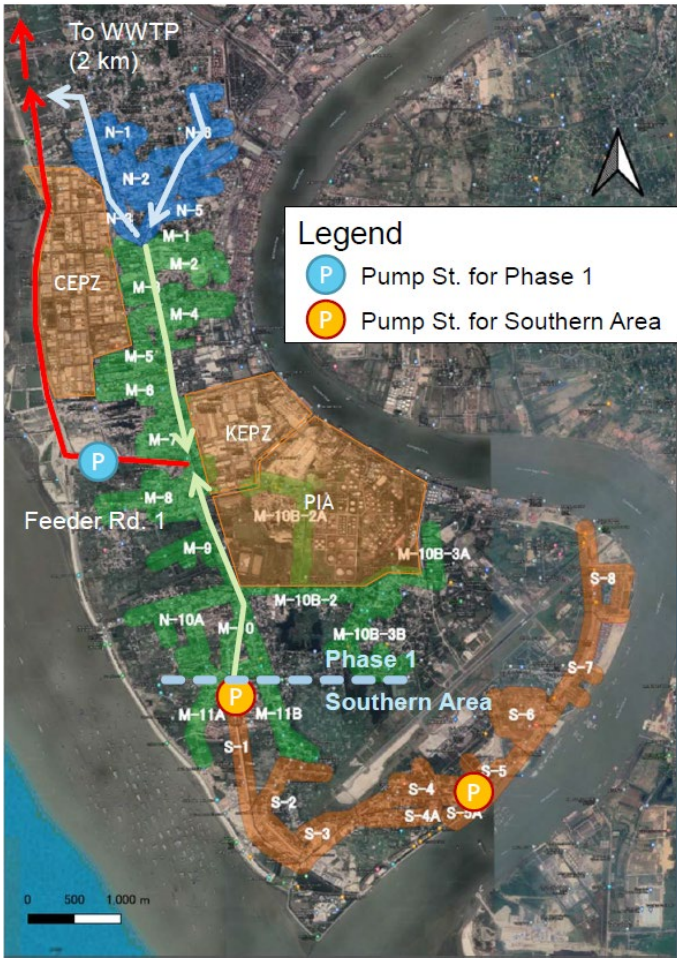
The project activities which would cause the social and environmental impact are shown in Table 7.1.1. The impact would be assumed from the two components respectively.

Table 7.1.1 Project Component Which Cause the Environment and Social Impact

Project component	Construction stage	Operation stage
Sewage Collection System	- The pipelines installation under the road in city area - Construction of one pumping station for Phase-1 in the private land (This area will be purchased by CWASA)	Operation of the pumping station to transport the sewage to the treatment facility
Sewage Treatment facility	Construction works of the Sewage Treatment Plant (STP) in the site which is owned by CWASA	Operation of the Sewerage treatment facility which includes the discharging treated water to the Bay of Bengal

Source: The Consultant

According to CWASA, CWASA has been the landowner of the STP site since 1963. In addition, the sewage collection system will be installed under the existing road which is managed by the government authority. One pumping station for Phase-1 will be constructed in the private land. The pumping station area would be purchased by CWASA.



Source The Consultant

Figure 7.1.1 Sewage Collection Area of Phase-I

7.2 Baseline of The Environment and Social Condition

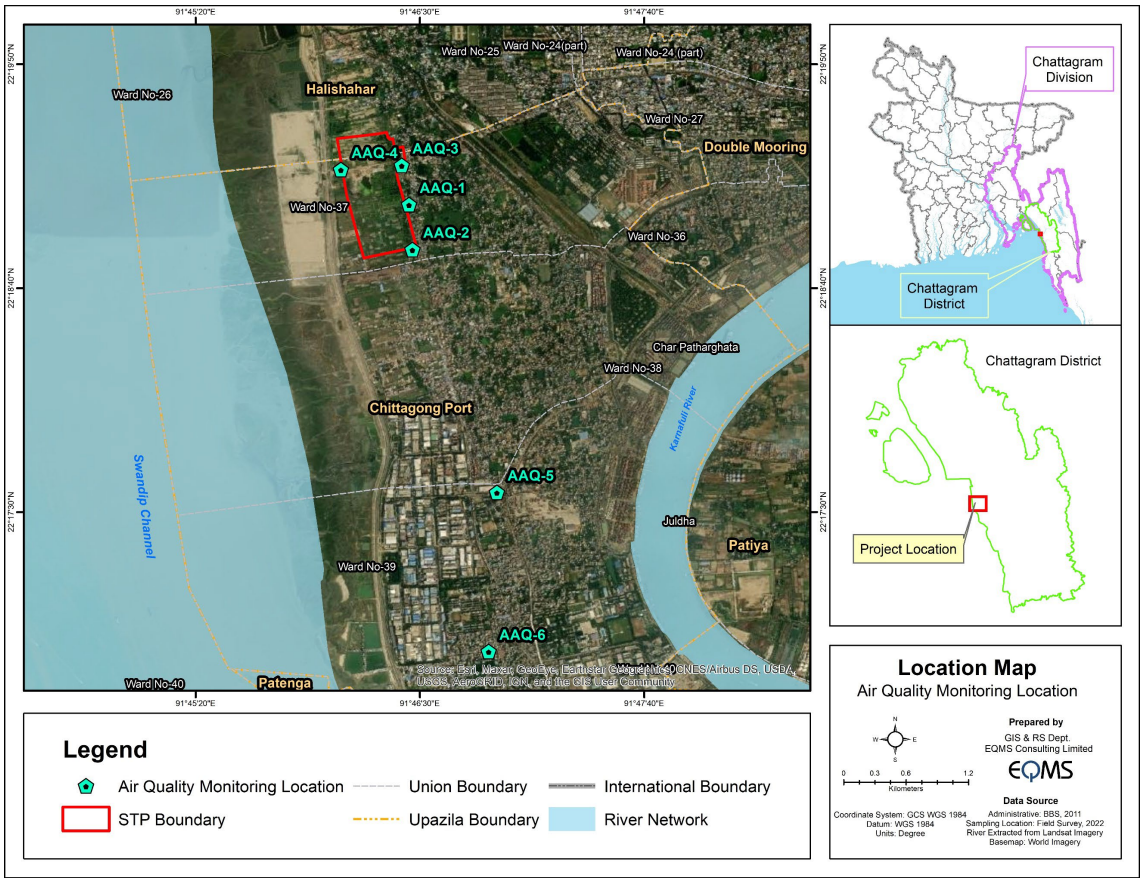
The study area of Catchment-6 is bounded by the Karnaphuli River on the east and the Bay of Bengal on the west this area of 26.5 sq km 7,043 acres (BBS); is on the southernmost tip of the city. Due to its geographical location bordering the river and the sea, the port has been established here. The openness has made it convenient to establish the only airport which has been upgraded to an international one in 1995. Large public sector manufacturing industries and two EPZs have been established here. The riverside, coast and beach are tourist attractions. The Area consists of five wards which are called as Ward 38, Ward 39, Ward 40 & 41.

7.2.1 Environmental Quality and Pollution

7.2.1.1 Air Quality

(1) Monitoring point

Air quality baselines were measured during 8-14 December, 2022 at the six locations shown in Figure 7.2.1. The measurement sites were established based on meteorological data, topography, susceptibility, accessibility, and safety.



Source: The consultant

Figure 7.2.1 Ambient Air Quality Monitoring Location Map

(2) Results

At each measurement point, data were taken every minute and daily average values (8 and 24 hours) were obtained. A comparison of the measurement results, the National Ambient Air Quality Standards (NAAQS), and the WHO standards (recommended values for protecting public health) is shown in Table 7.2.1.

The concentrations of PM10 in the monitoring locations during study period ranged from 22.33 $\mu g/m^3$ to 80.37 $\mu g/m^3$. The result values at all stations were found to be in compliance with the

Bangladesh and WHO Standards, however, the concentrations of PM10 for AAQ-5 and AAQ-6 were relatively higher than the WHO Standard. The concentrations of PM2.5 in the monitoring locations during study period ranged from 9.93 µg/m^3 to 44.68 µg/m^3. The result values at all stations were found to be in compliance with the Bangladesh Standard, however, the result values for AAQ-2, AAQ-3, AAQ-5 and AAQ-6 were relatively higher than the WHO Standard. The average concentrations of SO2 in the monitoring locations during study period ranged from 7.42 µg/m^3 to 37.57 µg/m^3. The SO2 concentrations at all stations were found to be in compliance with the Bangladesh and WHO Standards. The average concentrations of NO2 in the monitoring locations during study period ranged from 5.95 µg/m^3 to 31.99 µg/m^3. The NO2 concentrations at all stations were found to be in compliance with the Bangladesh and WHO Standards, except AAQ-5, the result value for AAQ-5 was higher than the WHO Standard. The concentration of CO in the monitoring locations during study period ranged between 0.01 mg/m^3 and 0.62 mg/m^3. The CO concentrations at all stations were found to be in compliance with the Bangladesh and WHO Standards. The concentrations of Lead (Pb) of all samples collected were found to be less than 0.01 µg/m^3. The results were within the standards (0.50 µg/m^3 – 24-hour average).

Table 7.2.1 Ambient Air Quality of The Nearby Road of The Project Locations

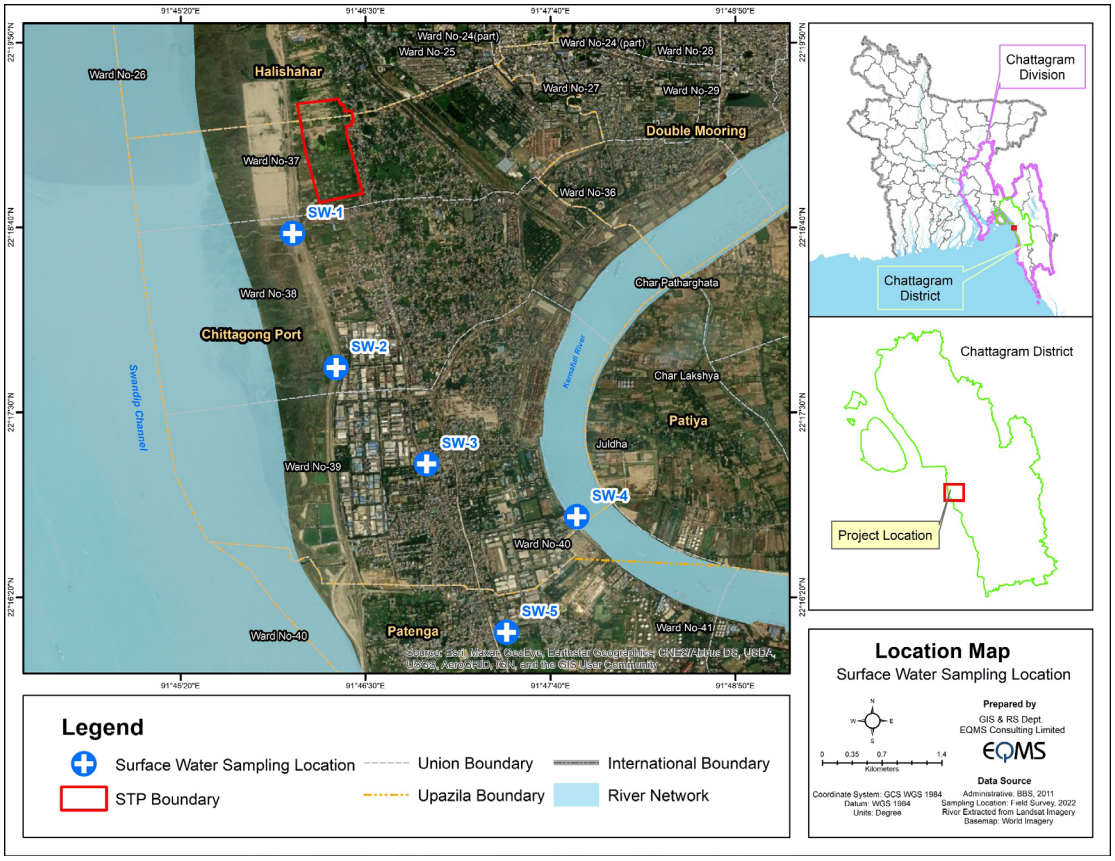
Sampling Locations	Observed	PM10 (µg/m^3)	PM2.5 (µg/m^3)	CO (mg/m^3)	NO2 (µg/m^3)	SO2 (µg/m^3)	Pb (µg/m^3)
AAQ1	Average	22.33	14.38	0.11	14.78	22.38	<0.01
AAQ2	Average	28.71	16.86	0.12	14.23	37.57	<0.01
AAQ3	Average	26.75	17.31	0.24	11.73	18.19	<0.01
AAQ4	Average	22.44	9.93	0.43	19.29	15.86	<0.01
AAQ5	Average	80.37	44.68	0.62	31.99	23.08	<0.01
AAQ6	Average	55.87	15.21	0.01	5.95	7.42	<0.01
Standard							
Bangladesh** (NAAQS)	8-hourly	-	-	5	-	-	-
	24-hourly	150	65	-	80	80	0.50
	Annual	50	35	-	40	-	0.25
WHO***	8-hourly	-	-	10	-	-	-
	24-hourly	45	15	4	25	40	-
	Annual	15	5	-	10	-	-

Source: Field Measurement and Laboratory Analysis by EQMS, 2022

7.2.1.2 Water Quality (Surface Water)

(1) Monitoring Point

Water quality baselines were measured on 26 October, 2022 (wet season) and 13 December, 2022 (dry season) at the five locations shown in Figure 7.2.2.



Source: The consultant

Figure 7.2.2 Water Quality Monitoring Location Map

(2) Results

Results are shown in Table 7.2.2 and Table 7.2.3. The temperatures of the surface water samples were observed in the ranges of 27.6°C to 27.8°C in wet season and 19.80°C to 20.50°C in dry season. The pH ranges from 5.97 to 7.26 and 6.78 to 7.45 in wet season and dry season, respectively, in which, most of the samples is under the specified standard of 6.5 to 8.5 in wet season, indicates acidic in nature. Biochemical Oxygen Demand (BOD) values of the samples were found to be ranging from 66.0 mg/L to 164.0 mg/L in wet season and 52.0 mg/L to 234 mg/L in dry season, which are higher than the national standards for inland water quality. Such high BOD values confirmed the presence of high concentrations of biologically oxidizable organic matter in the receiving water bodies. Chemical Oxygen Demand (COD) values of the samples varies from 122.0 mg/L to 302.0 mg/L and 70 mg/L to 480 mg/L in wet season and dry season,

respectively. The higher COD level may be due to discharge of effluent from different industries. The Dissolved Oxygen (DO) levels at all locations exhibited values of 1.2 mg/L to 8.7 mg/L and 0.3 mg/L to 3.3 mg/L in wet season and dry season, respectively, indicating unfavorable conditions for the growth and reproduction of fish and other aquatic organisms in the water bodies except SW-1 in wet season. Suspended solids (SS) were found to be ranging from 324.0 mg/L to 612.0 mg/L and 360 mg/L to 14,253 mg/L in wet season and dry season, respectively. The Total Suspended Solids in all samples increased highly in dry season compared to wet season. Oil and grease in water sample collected ranges from 11.3 mg/L and 54.15 mg/L in wet season and 14.28 mg/L and 34.24 mg/L in dry season. The nitrate concentration ranges between 9.0 mg/L to 17.0 mg/L in wet season and 6.22 mg/L to 34.30 mg/L in dry season. The concentration of dissolved phosphorus in the surface water samples was found to be 0.32 mg/L to 4.74 mg/L and 0.12 mg/L to 4.62 mg/L in wet season and dry season, respectively. Coliforms are indicators of contamination from sewage and fecal matter. The total coliform contents of all the samples were found to be 0 CFU/100mL except SW-3 (morning) in wet season and SW-5 in both wet season and dry season (>1,600 CFU/100mL).

Table 7.2.2 Surface water analysis result – Wet Season

Items	Unit	SW-1		SW-2		SW-3		SW-4		SW-5		Bangladesh Standard*	IFC Standard**
		M	E	M	E	M	E	M	E	M	E		
Temp	℃	27.80	27.70	27.60	27.70	27.70	27.70	27.70	27.60	27.60	27.60	30	-
pH	-	7.26	6.40	6.99	7.23	6.07	5.97	6.02	5.33	6.17	6.37	-	6-9
BOD5	mg/L	66.0	134.0	83.0	106.0	134.0	164.0	131.0	144.0	118.0	137.0	40	30
COD	mg/L	122.0	241.0	142.0	198.0	258.0	302.0	238.0	281.0	202.0	258.0	-	125
DO	mg/L	8.70	7.90	2.30	2.40	1.80	2.10	1.70	2.40	1.40	1.20	-	-
SS	mg/L	348.0	402.0	376.0	510.0	436.0	486.0	324.0	392.0	608.0	612.0	100	50
Oil & Grease	mg/L	11.30	33.56	25.65	29.43	30.50	54.15	36.10	43.70	13.05	51.84	-	10
NO3	mg/L	12.42	15.81	9.00	16.20	10.80	10.20	17.00	14.00	11.30	14.70	250	-
PO4-3	mg/L	0.66	0.32	0.32	0.36	1.64	1.32	0.32	4.74	3.96	4.28	35	-
Total Coliform	CFU/ 100mL	Nil.	Nil.	Nil.	Nil.	>1600	Nil.	Nil.	Nil.	>1600	>1600	1000 (number /100ml)	400 (MPN/ 100ml)

Note: BDL = Below Detection Limit, ND = Not Detectable, M = Morning, E = Evening

* The Environment Conservation Rules, 1997, SCHEDULE – 9 Standards for Sewage Discharge

** IFC (EHS) Guidelines, Indicative Values for Treated Sanitary Sewage Discharges

Source: The consultant

Table 7.2.3 Surface water analysis result – Dry Season

Items	Unit	SW-1		SW-2		SW-3		SW-4		SW-5		Bangladesh Standard*	IFC Standard**
		M	E	M	E	M	E	M	E	M	E		
Temp	℃	19.80	20.10	20.10	20.20	19.90	20.10	20.10	20.20	20.50	20.30	30	-
pH	-	7.45	7.30	7.36	7.24	6.78	6.89	7.12	7.37	7.05	7.10	-	6-9
BOD5	mg/L	120.0	93.0	52.0	58.0	111.0	123.0	234.0	129.0	102.0	98.0	40	30
COD	mg/L	220.0	170.0	70.0	99.0	220.0	230.0	480.0	220.0	170.0	160.0	-	125
DO	mg/L	1.40	1.70	1.10	0.70	0.90	1.30	2.10	3.30	0.40	0.30	-	-
SS	mg/L	1540.0	1880.0	6920.0	360.0	490.0	660.0	790.0	890.0	13350	14253	100	50
Oil & Grease	mg/L	17.04	20.74	14.28	25.48	19.60	21.42	18.98	22.08	34.24	29.34	-	10
NO3	mg/L	6.42	7.71	34.30	28.21	10.80	10.20	6.22	9.17	18.24	13.29	250	-
PO4-3	mg/L	0.62	0.39	0.18	0.16	1.56	1.50	0.12	0.12	4.60	4.62	35	-
Total Coliform	CFU/ 100mL	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	>1600	>1600	1000 (number /100ml)	400 (MPN/ 100ml)

Note: BDL = Below Detection Limit, ND = Not Detectable, M = Morning, E = Evening

* The Environment Conservation Rules, 1997, SCHEDULE – 9 Standards for Sewage Discharge

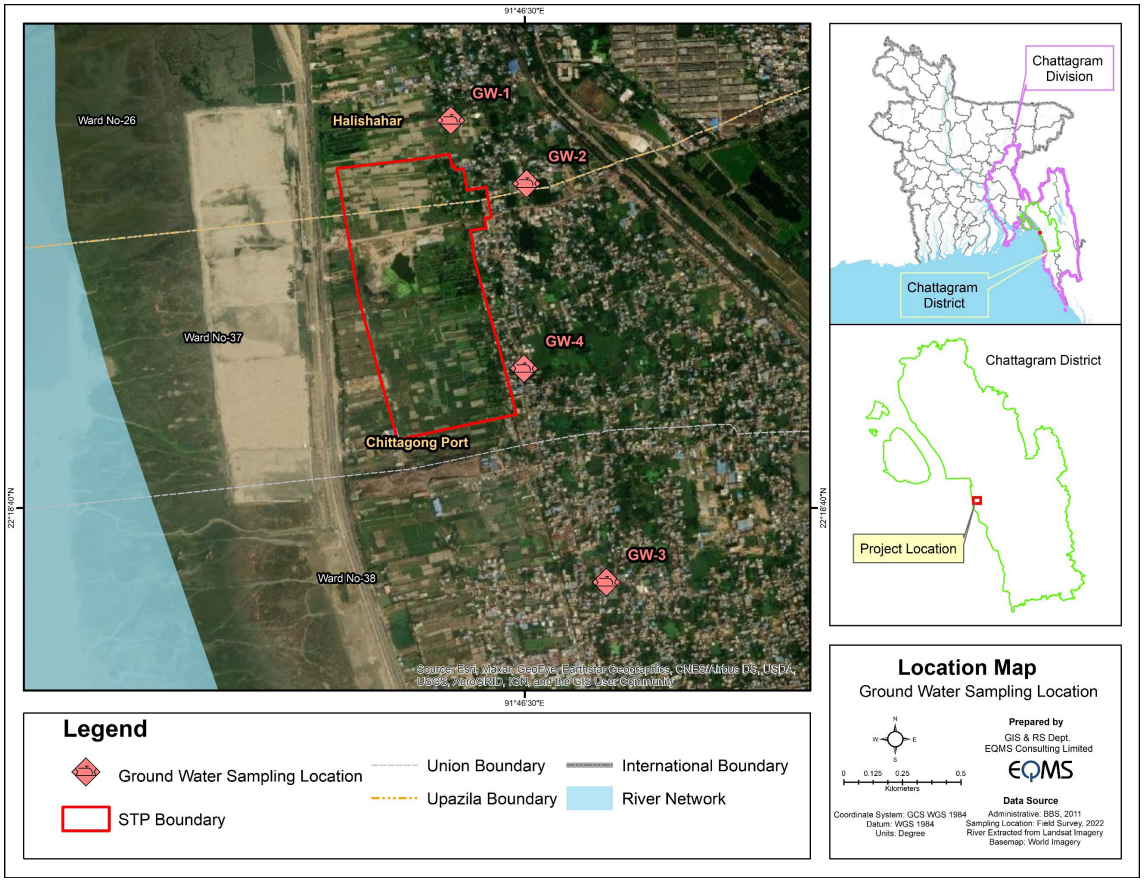
** IFC (EHS) Guidelines, Indicative Values for Treated Sanitary Sewage Discharges

Source: The consultant

7.2.1.3 Water Quality (Ground Water)

(1) Monitoring Point

Water quality baseline measurements were taken on December 13, 2022 at the four locations shown in Figure 7.2.3. Sampling was taken from wells located in the project site area.



Source: The consultant

Figure 7.2.3 Groundwater sampling locations

(2) Results

Results are shown in Table 7.2.4. The analysis results show that the pH ranges from 7.12 to 7.65, were found to be within drinking water standards (6.5-8.5). The Electric Conductivity (EC) levels at all locations exhibited values of 1.77 mS/cm to 6.74 mS/cm. The turbidity of all samples collected were found to be ranging from 13.0 NTU to 72.0 NTU. Chloride concentrations in all surface water samples were found to be 380 mg/L to 1570 mg/L, two out of four samples crossed the drinking water standard. Arsenic contents in all surface water samples were found to be below detection limits, in case of GW-1, it was found to be 0.03 mg/L and in compliance to the drinking water standard (0.05 mg/L). Iron is considered to be an important groundwater parameter since at higher concentrations it interferes with laundering operations and imparts objectionable stains. The concentration of iron in groundwater samples was found to be 0.099 mg/L to 0.308 mg/L.

Iron concentration in all the samples was in compliance to the acceptable limit (0.3-1.0 mg/L) of drinking water standard. Manganese concentration in groundwater depends on both natural sources, such as soil and rock, and human activities, such as industrial wastewater and the overexploitation of groundwater. The concentration of manganese in the groundwater samples was found to be ranging from 0.018 mg/L to 0.086 mg/L. Manganese concentration in the samples was in compliance to the acceptable limits (0.1 mg/L) of drinking water standard.

Table 7.2.4 Groundwater analysis results

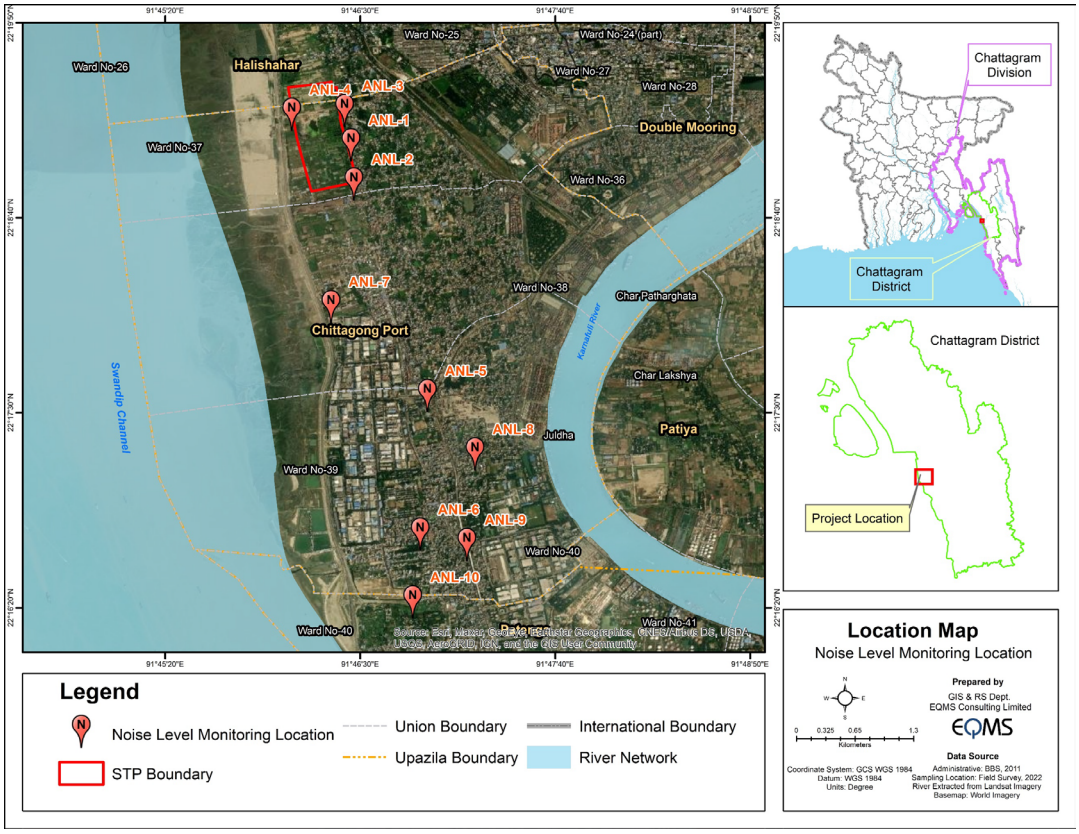
Parameters	Unit	Groundwater Quality					
		GW-1	GW-2	GW-3	GW-4	Bangladesh Standard	WHO Standards
pH	-	7.65	7.12	7.21	7.51	6.5 - 8.5	6.5 - 8.8
EC	mS/cm	3.53	1.77	6.74	2.37	-	-
Turbidity	NTU	17.0	33.0	72.0	13.0	-	-
Chloride	mg/L	770	380	1570	440	150-600	-
Arsenic	mg/L	0.03	BDL	BDL	BDL	0.05	-
Iron	mg/L	0.308	0.144	0.12	0.099	0.3-1.0	-
Manganese	mg/L	0.018	0.058	0.086	0.054	0.1	-

Source: The consultant

7.2.1.4 Noise

(1) Monitoring Point

Noise levels were measured at 10 locations during the period of December 8-12, 2022. The noise measurement locations are shown in Figure 7.2.4. These locations were set up to obtain representative data for Catchment 6.



Source: The consultant

Figure 7.2.4 Ambient noise monitoring location map

(2) Results

Results are shown in Table 7.2.5. Ambient daytime noise level (Leqday) was recorded in the range of 59.90 dB(A) to 72.22 dB(A). Whereas night-time results varied from 48.03 dB(A) to 57.37 dB(A). Maximum noise levels (Lmax) at the monitoring locations were recorded of 65.1 dB(A) to 93.1 dB(A) and the minimum were from 30.80 dB(A) to 44.20 dB(A). Most of ambient noise levels were higher than the national noise level standards and IFC Guideline Values due to domestic and commercial activities, heavy vehicle movement, and people's movement.

Table 7.2.5 Noise level in the study area

Sampling Locations	Location Setting (DOE/IFC)	Time	Noise Level in dB(A)			Bangladesh Standard	IFC Guidelines
			Leq	Lmax	Lmin		
ANL-1	Residential	Day	60.27	83.20	44.20	55	55
		Night	53.94	65.10	41.70	45	45
ANL-2	Mixed	Day	59.42	82.70	42.00	60	-
		Night	55.06	78.10	30.80	50	-
ANL-3	Residential	Day	59.21	81.10	41.40	55	55
		Night	50.92	69.80	30.80	45	45

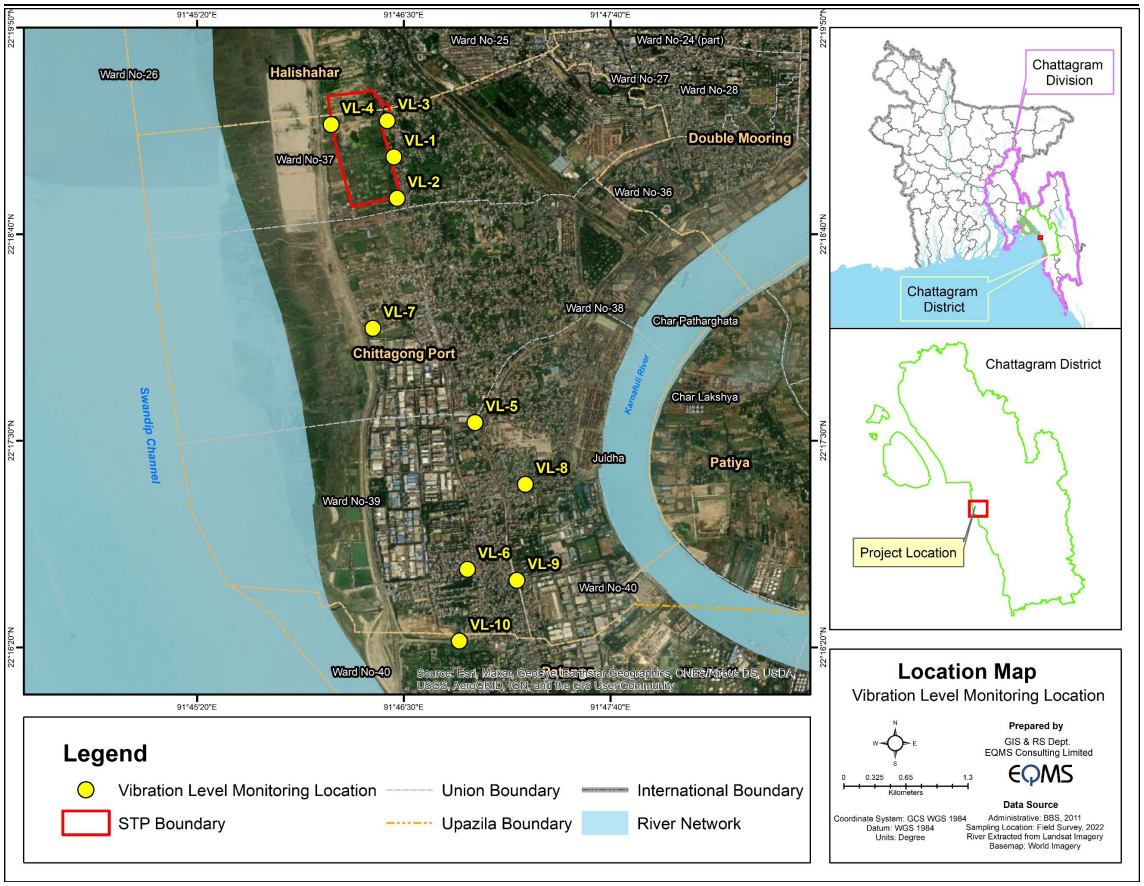
Sampling Locations	Location Setting (DOE/IFC)	Time	Noise Level in dB(A)			Bangladesh Standard	IFC Guidelines
			Leq	Lmax	Lmin		
ANL-4	Mixed	Day	67.88	86.80	32.70	60	-
		Night	52.55	66.90	30.80	50	-
ANL-5	Industrial	Day	72.22	91.80	38.70	75	70
		Night	52.29	74.40	34.10	70	70
ANL-6	Residential	Day	58.88	79.30	40.00	55	55
		Night	52.46	73.60	34.30	45	45
ANL-7	Residential	Day	62.79	82.50	31.60	55	55
		Night	55.59	80.50	30.80	45	45
ANL-8	Residential	Day	61.37	86.60	43.80	55	55
		Night	53.58	69.40	32.10	45	45
ANL-9	Commercial	Day	69.56	93.10	33.10	70	70
		Night	59.90	79.20	35.50	60	70
ANL-10	Residential	Day	57.37	69.00	32.70	55	55
		Night	48.03	69.00	30.80	45	45

Source: The consultant

7.2.1.5 Vibration

(1) Monitoring Point

Vibration levels were measured at 10 locations during the period of December 8-12, 2022. The noise measurement locations are shown in Figure 7.2.5. These locations were set up to obtain representative data for Catchment 6.



Source: The consultant

Figure 7.2.5 Vibration level monitoring locations

(2) Monitoring Point

Vibration level monitoring was carried out for 30 minutes during monitoring period. No such vibration activity was observed during the monitoring period. Details results are given in Table 7.2.6. Since there is no vibration standard in Bangladesh, Japanese standard is refereed. Based on the field level vibration level and comparison with the standard, it can be concluded that the baseline vibration levels are within the acceptable level.

Table 7.2.6 Vibration level in the study area

Locations	Average Vibration (ppv, mm/s)	Vibration velocity level in decibels (VdB)
VL1	0.13	62.1
VL2	0.05	53.8
VL3	0.07	56.8
VL4	0.15	63.4
VL5	0.118	61.3
VL6	0.145	63.1
VL7	0.08	57.9

VL-8	0.09	58.9
VL9	0.11	60.7
VL10	0.07	56.8
Vehicle vibration standard in Japan (Vibration Regulation Act)		
Peak component particle velocity at Daytime		dB
Residential		65
Residential, factory, and commercial facilities		70

Source: The consultant

7.2.2 Natural Environment

7.2.2.1 Flora and Fauna

An ecosystem and biodiversity assessment study were conducted in December 2022.

(1) Flora

A total of 51 terrestrial floral species were recorded under 28 families from the field survey. Among these plant species, 37 species under 18 families of trees and 14 species under 12 families of herbs and shrubs were recorded. Major floral species observed in and around the study area were Jackfruit (*Artocarpus heterophyllus*), Mango (*Mangifera indica*), Elephant Apple (*Dillenia indica*) Java Plum (*Syzygium cumini*), Mahagoni (*Swietenia mahagoni*), Coconut (*Cocos nucifera*), Shishu (*Dalbergia sissoo*) etc. Most of the recorded species produce fruits (41%) and timber (31%).

(2) Avifauna

A total of forty-four (44) species of birds under twenty-five families were recorded from the study area. The highest number of birds belong to the family Accipitridae. All bird species found in the study area are Least Concern (LC) both for Global IUCN Red List Status (Version 2022-2) and IUCN Bangladesh Red List (2015).

(3) Amphibians

A total of four (4) species of amphibians belonging to three (3) families were listed from the project area based on primary and secondary data. According to the IUCN Bangladesh Red-list (2015) and Global IUCN Red List Status (Version 2022-2), all species found in the study area Least Concern (LC).

(4) Reptiles

A total of eight (8) species of reptiles belonging to seven (7) were listed from the project area based on primary and secondary data. According to the IUCN Bangladesh Red-list (2015) and Global IUCN Red List Status (Version 2022-2), One (01) Near Threatened (NT) reptile species, Bengal Monitor Lizard (*Varanus bengalensis*), was found in the study area.

(5) Mammal

Six (6) terrestrial Mammal species belonging to four (4) families were reported to be observed in the AOI. Observed mammals are Small Indian mongoose (*Herpestes edwardsii*), Common Indian field mouse (*Mus booduga*), Indian Fruit Bat (*Pteropus giganteus*), Common House Rat (*Rattus rattus*), Asian house shrew (*Suncus murinus*) and Irrawaddy Squirrel (*Callosciurus pygerythrus*). All mammalian species found are Least Concern (LC) both locally and globally, according to IUCN Red List.

(6) Butterflies

Fourteen (14) species of Butterfly were recorded from the project site and the adjacent area. All the species found in the study area are very common in nature, widely distributed, and Least Concern as per the IUCN Red List of Bangladesh, 2015.

(7) Aquatic Flora

Aquatic vegetation (macrophytes) is mainly recorded in the ditches, bank of the canals, and aquacultural ponds. Diversified macrophytes were found in the study area due to the enriched presence of different water habitats (Freshwater and saline water). Major species observed in these habitats are Water fern (*Azolla filiculoides*), Common water hyacinth (*Eichhornia crassipes*), Water spinach (*Ipomea aquatic*), Pink morning glory (*Ipomoea carnea*), Blue lotus (Nymphaea nouchali), Helencha (*Enhydra fluctuens*), Narrowleaf cattail (*Typha angustata*), Alligator weed (*Alternanthera phyloxeroides*), Water lettuce (*Pistia stratiotes*), Taro (*Colocasia esculenta*), etc.

(8) Avifauna

The prime objective of the fisheries study is to examine and evaluate the overall fisheries status (capture and cultured fish species) in the study area. The project area is situated adjacent to the Bay of Bengal (western sides). Fish market Survey, informal consultation with local people, discussion with Fishermen, KII with District Fisheries Officer of Chattogram district was employed to know the fish species composition.

A total of Fifty-three (53) species of fish and thirteen (13) species of crustaceans were recorded. According to the IUCN Red List of Bangladesh, two Vulnerable species (*Gudusia chapra, Sperata aor*), three Near Threatened (*Mystus gulio*, *Cirrhinus cirrhosis*, and *Macrognathus aculeatus,*), and two Endangered (*Ompok pabda, Chitala chitala*) species were recorded. According to Global IUCN Red List status (Version 2022-1), one Vulnerable (*Cirrhinus cirrhosus*), four (4) Near Threatened fish species (*Hypopthalmicthys molitrix*, *Ompok pabda*, *Chitala chitala*, *Harpadon nehereus*), and one Endangered (*Pangasianodon hypophthalmus*) fish species were reordered.

Most of the Conservation significant species (*Cirrhinus cirrhosis, Ompok pabda, Chitala chitala, Gudusia chapra, Pangasianodon hypophthalmus*) come from culture ponds, canals, Kaptai lake

and other waterbodies. Consultation with the local fish sellers and aratdars indicated that cultured fish species, such as Rui, Catla, Mrigal, Silver carp, Bighead carp, Kalbaus, Sarphunti etc., came from Boalkhali Upazila and Karnaphuli Upazila of Chattogram district. Some shrimp and prawn species came from Satkhira, Bagerhat, Jessore, and Cox's Bazar districts. Commercially important fish species like Hilsha (*Tenualosa ilisha*) are abundantly caught during monsoon and post-monsoon seasons. Family-based fish species diversity

During the field visit, eleven (11) species of crustaceans under five (5) families were recorded. In addition, two crab species were observed dominant : Giant mud crab (*Scylla serrata*) and Red Ghost crabs (*Ocypode macrocera*). Red Ghost crabs were observed in the mudflat area (western and south-western side) adjacent to the project site.

7.2.2.2 Protected Forest

For the perspective of Environmental consideration and Bangladesh Environment Conservation Act 1995 (Last Amended in 2010), DOE has announced 13 areas which are ecologically critical. The location of the proposed site is not included among 13 areas which have been declared by the Department of Environment. Based on the department of forest, no protected reserve forest exists inside the study area.

7.2.2.3 Geomorphology and Geology

Chattogram is the second largest city of Bangladesh which has a unique topography and a wide variety of morphological features. On one side there is spectacular undulating hill topography and on the other side there is low lying coastal mud flats. This morphological shape has been achieved naturally. The Karnaphuli River in the east, Bay of Bengal in the west & Tertiary hill landscape in the north have been key influencers in origin, development and expansion of the city. A total of eight geomorphic units have been identified, which are Tertiary hills, piedmont and valleys, alluvial plain, ancient point bar, tidal mud plain, supra tidal plain, natural levee and sandy beach. The soil is made up of 93% loamy mainly with non-calcareous alluvium and non-calcareous flood plain soil. The remaining 7% has clayey texture.

The project areas are near Shah Amanat International Airport & Agrabad which indicates that Patenga & Halishahar are ancient point bar & Alluvial Plain in terms of landform respectively. The land use patterns & landform s are given in Table 7.2.7.

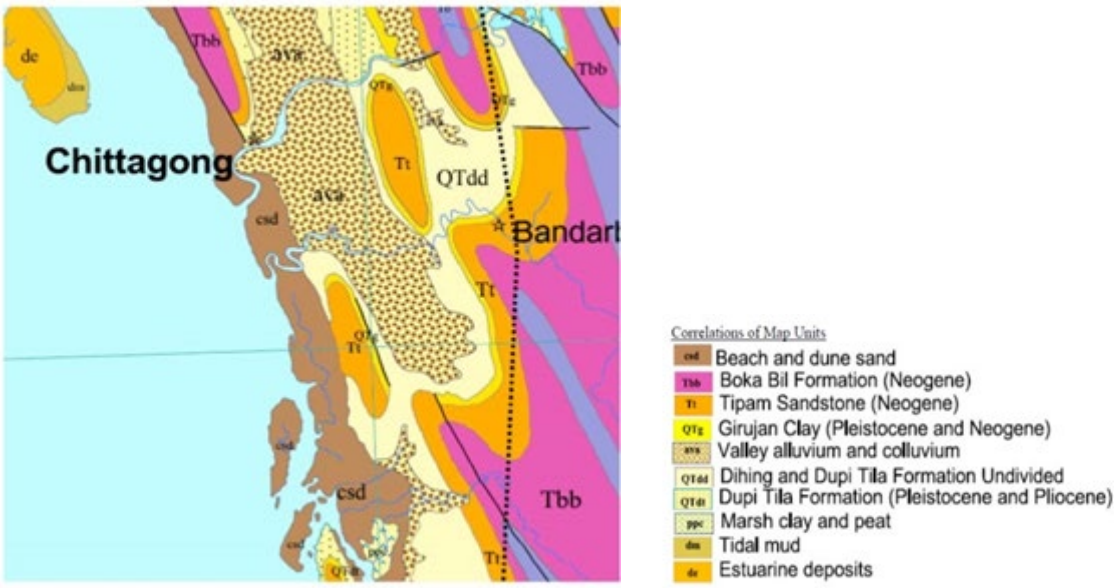
Table 7.2.7 Interrelation Between Land Use and Landform in Chattogram City

Landforms	Major Land Uses
Hill	High Class Residential Area, Vegetation Coverage, Vacant Land, Government Buildings
Piedmont	Middle Class Residential Area, Roads & Highways, Commercial Area, Industrial Area, Administrative Uses, Slums and Squatters, Educational Institutes, Religious Places, Park and Playground etc

Alluvial Plain	Agricultural Uses Middle Class Residential Area, Agrabad Commercial Area, Industrial Area, Administrative Uses
Ancient Point Bar	Agriculture, Mixed Residential Area, Industrial, EPZ Airport and Commercial Activities.
Supra Tidal Plain	Agricultural Area, low Income Residential
Tidal Mud Plain	Vacant, Mangrove Forest, Shrimp farms
Natural Levee	Port Activities, Navy Office and residents, Mixed Residential use
Sandy Beach	Recreational (Tourism), Vacant Land

Source Department of Geography and Environment, University of Dhaka

The river Karnafully with its strong tidal behaviour has been playing a major role to determine the land-ocean interface in city morphology. Except the hilly, valley and piedmont areas, remaining of the city is generally a plain land. The project area is located in the South Patenga plain which contains the interfingering of sand and silt-clay layers. The type of landform in Halishara and Patenga is recent alluvial, point bar and tidal deposits and abandoned channel and depression. The Geological map of Chattogram is shown in Figure 7.2.6.



Source: Feasibility study report for multi-road tunnel under the river Karnaphuli, Chattogram, 2013

Figure 7.2.6 Geomorphic Map of Chattogram

7.2.3 Social Baselines

The socio-economic baseline scenario describes the socio-economic characteristics of the project area on the basis of primary and secondary data. The socio-economic characteristics include an overview of demographic trends, sources of livelihood, land use, agriculture, fisheries, public health, communications, social infrastructure, gender issues, cultural resources, and other relevant issues. Demography is the scientific study of the number of populations, especially with reference

to their size, structure, sex distribution, population density, literacy rate etc. The core point is the Chattogram City Corporation, through which the project will pass through. Here the population number of is given along with some major related topics which are very relevant to demography. Chattogram Town, the main seaport of Bangladesh, is located at the estuary of the river Karnaphuli. The Town is also called the commercial capital of Bangladesh. The first Export Processing Zone (EPZ) of Bangladesh, established in 1983, is situated here. Chattogram Municipality was formed on 22 June 1863. It was turned into Chattogram City Corporation on 31 July 1990. It is divided into 11 Thanas including Bakoliya, Bandar, Bayazid, Chandgaon, Double Mooring, Halishahar, Khulshi, Kotwali, Pahartali, Panchlaish, and Patenga.

7.2.3.1 Population and Density

The Chattogram City Corporation is the second largest city corporation in respect of population with an area of 155.40 sq.km. The total population of the city corporation is 2,581,643 of which 1,360,125 are males and 1,221,518 are females. The literacy rate of the city is 68.8%. It consists of 41 wards and 238 mahallas. The entire city area is under the city corporation. The population of our study Area was 222,697 in 2001 (BBS). According to the trend population projection, this is estimated to grow to 317,000 in 2011 recording a rise of 94,303 persons over a 10-year period. This Plan estimates the population to rise to 399,690 in 2015. The population density is 4815 p sq km or 20 p acre in 2015. The population characteristics are shown in Table 7.2.8.

Table 7.2.8 Population of The Project Study Area (CCC website)

Area (Ward No.)	No.	Total Population	Male	Female
North Middle Halishahar	37	27,475	14,691	12,784
South Middle Halishahar	38	87,397	43,277	44,120
South Halishahar	39	123,397	61,029	62,368
North Patenga	40	50,000	28,000	22,000
South Patenga	41	30,863	17,337	13,526

Source: Chattogram City Corporation Website

According to Bangladesh Population Census, 2011, BBS data shows that in Chattogram Muslim form 83.92 percent of the population. Other major religions in the city are Hinduism, at 13.76 percent; Buddhism, at 2.01 percent; Christianity, at 0.11 percent; and others, at 0.2 percent. The city also has many ethnic minorities, especially members of indigenous groups from the frontier hills of Chattogram Division, including Chakmas, Rakhines and Tripuris; as well as Rohingya refugees. The Muslim population of Patenga Thana is 130,827, Hindu population is 7,471 and the population of Christian, Buddhist and other religion is 100, 1,748 and 77 respectively as shown in Table 7.2.9.

Table 7.2.9 Population Distribution by Religion

Location	Muslim (%)	Hindu (%)	Buddhist (%)	Christian (%)	Other (%)
Chattogram City Corporation	83.92	13.76	2.01	0.11	0.2

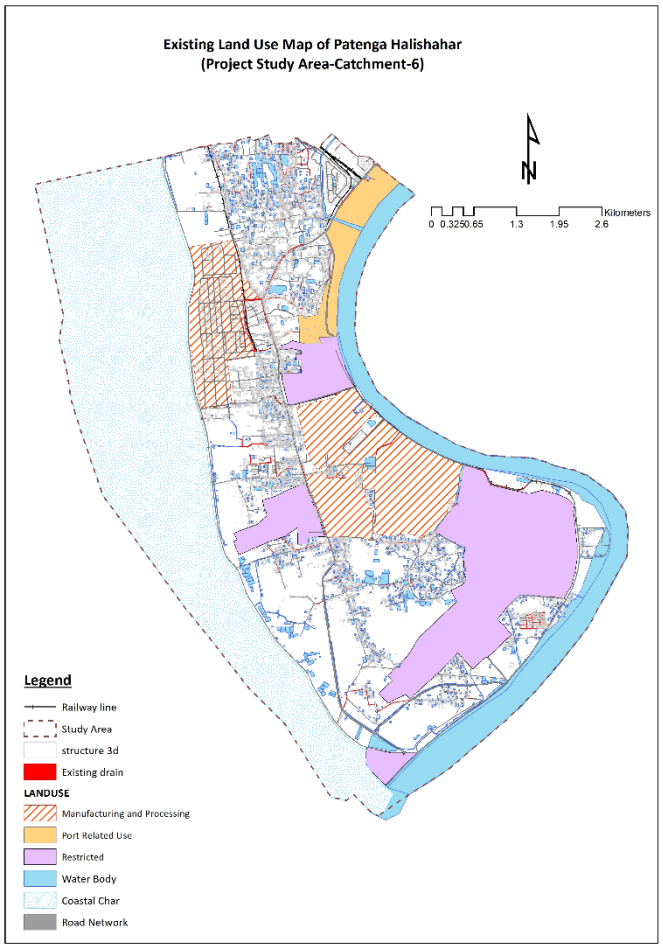
Source: ESIA report for THE CONSTRUCTION OF GALVANIZED CORRUGATED FLAT BOTTOM STEEL SILO WITH RCC FOUNDATION AND IT'S ANCILLARY WORKS AT CHATTOGRAM SILO SITE, 2019

7.2.3.2 Distribution of Settlement

According to census 2001(BBS) of the 66,840 HH some 39% are pucca and 18% are katcha & Jhupri. The remaining 43% are semi pucca. Pucca HH is mostly residence provided by the government. Piped water supply exists in 20% HH Electricity connection in 91% and sanitary toilet facilities in 86% HH. Formally principal employment was in agriculture (farming/fishing) 30% HH's own agricultural land. Due to the presence of Industries, mflux of large number of migrant workers has occurred. Some 43% of the populations (both sexes) are in the 18- 34 years age group.

7.2.3.3 Land Use Condition

Based on the Development Plan proposal conducted by Chattogram Development Authority, among the planning area of 170,702 acres or 267 sq. mile, 12,662 acres of that area has been allocated by Patenga-Halishahar as DPZ-01. Inside the whole area of Patenga-Halishahar, six wards from those areas have been chosen for this study such as Ward No: 37,38,39,40,41. The chosen areas have significant uses which are the port, airport, major Industrial areas and defense establishments as shown in Figure 7.2.7. Residential uses dormmate (31%), Water bodies consisting of khals; ponds and marshy areas, coastal chars and vacant land consist of 29.21% area. According to the DPZ-01, existing features are shown in Table 7.2.9.



Source: Existing Land use map from DPZ-01 by CDA

Figure 7.2.7 Land Use Map of Chattogram

Table 7.2.10 Current Land Use

Sl. No.	Types of use	Area (acre)	%
01	Agriculture and Fisheries	725 36	6.78%
02	Commercial Activity	52.23	0.49%
03	Education and Research	55.36	0.50%
04	Manufacturing & Processing	1325 25	13.04%
05	Miscellaneous	42.65	0.40%
06	Mixed Use	4.29	0.04%
07	Open/Community Space	36.6	0.33%
08	Residential	3323 04	31.04%
09	Restricted (port, airport and defense)	1273.36	12.54
10	Service Facilities	13.61	0.13%
11	Transport & Communities	725.36	6.78%
12	Vacant Land	1245 28	11.63%
13	Water Body (khals, ponds, marshy land)	1083.25	10.51%

Sl. No.	Types of use	Area (acre)	%
14	Coastal Char	756.36	7.07%
	Total	12,662	100%

Source: Land Use Survey 2006-2007

7.2.3.4 Source of Income

Formally principal employment was in agriculture (farming/fishing) 30% HH's own agricultural land. Due to the presence of Industries, influx of large number of migrant workers has occurred.

7.2.3.5 Indigenous and Ethnic People

In Bangladesh majority of tribal people live in Chattogram Hill tracts. It is the home of eleven tribes, the most beautiful indigenous people of Bangladesh. In this hilly area of immense beauty, eleven ethnic groups such as Chakma, Marma, Tripura, Tanchangya, Lushai, Pankho, Bawm, Mro, Khyang, Khumi and Chak live in harmony with nature. Among all of them the Chakma are the largest ethnic group in Bangladesh. Majority of them are Buddhists and the rest of them are Hindus, Christians etc. Also, a good number of mainstream Bangali live in this area. But their appearance, language and culture traditions are markedly different from others Bengali speaking people living in this area. None of the tribal people would be affected by the project activities.

7.2.3.6 Economic Activity

The main sources of income of the people of Chattogram mainly in study area are shown in Table 7.2.11.

Table 7.2.11 Income Sources of the Project Study Area

Income source	Percentages (%)
Agriculture	5.66
Non-agricultural Laborer	6.92
Industry	0.70
Commerce	12.48
Transport and Communication	4.46
Service	45.17
Construction	1.37
Religious Service	0.25
Rent and Remittance	4.95
Others	18.05

Source: ESIA report for THE CONSTRUCTION OF GALVANIZED CORRUGATED FLAT BOTTOM STEEL SILO WITH RCC FOUNDATION AND IT'S ANCILLARY WORKS AT CHATTOGRAM SILO SITE, 2019

7.2.3.7 Social Infrastructure and Public Facilities

In terms of arterial network in the study areas are Port Road, Patenga Road, Chittagong Port Access Toll Road, Strand Road and part of Halishahar Road. Toll Road has recently been made

operational to provide direct access from Dhaka Trunk Road to the port area. The other important roads are Naval H.Q Road, Kathgar Road, Zelepara Road and Nayahat Road. Another important transport feature of this area is the presence of two rail tracks, one connects the port and the other connects the Old Chittagong Steel Mill, presently known as Karnaphuli Export Processing Zone (KEPZ).

In terms of restricted areas consisting of the port, airport, and military operational and housing areas (Patenga Naval Base, Isha Khan Base, and Air force Base). The port is currently handling an estimated 600,000 TEUs and has been experiencing average growth rates in container traffic of 14.5% annually. It expects to be handling up to 2.5 million TEUs by 2020. The port is currently undergoing a major upgrading of its facilities.

There is a general lack of community facilities in terms of quality and area served.

The beach and coastal estuaries are a major source for recreation and tourism. A stretch of some 2km road along the Karnaphuli River is a favorite leisure area for city dwellers.

7.2.3.8 Historical and Cultural Heritage

Chattogram City and the neighboring areas have some historical/cultural/tourism locations such as the Tomb of Sultan Bayazid Bostami, World War II Cemetery, Shrine of Shah Amanat, etc. However, none of the locations are located in Catchment-6 and STP site.

7.2.3.9 Health, Sanitation, and Hazard

In terms of all wards inside the study area and according to the ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE CONSTRUCTION OF GALVANIZED CORRUGATED FLAT BOTTOM STEEL SILO WITH RCC FOUNDATION AND IT'S ANCILLARY WORKS AT CHATTOGRAM SILO SITE studied on 2019, the summary of the Health, Sanitation and Hazard inside the project study areas are given below:

Electricity: all the wards of the Thana are under electricity net-work; however, 84.40% of the dwelling households have access to electricity. Drinking water: most of the people are using tube-well water (77.04%) which is followed by tap-water (20.06%), pond water (0.73%) and others (2.17%). Sanitation: 82.75% households of the Upazila use sanitary latrines and 14.63% are hailing with non-sanitary latrines and 2.62% of households do not have latrine facilities.

7.2.3.10 Gender

A study related to gender policy has been conducted by DOE and their mission is to help secure a clean and healthy environment for the benefit of present and future generations. Many government ministries, international and multilateral agencies, national and international NGOs have recognized the need to systematically address gender issues and promote gender

mainstreaming, formulating their own gender policies. DoE will follow this trend while at the -2- same time remaining conscious of its uniqueness as a government organization, focusing on a range of activities including delivery of environment-related services and training. The UN Convention of the Elimination of All Forms of Discrimination Against Women (CEDAW) was ratified by the Government of Bangladesh (GOB) in 1984. It has made a commitment to take the necessary measures to eliminate discrimination against women in all forms. The constitution of Bangladesh in Articles 10, 19, 28 has granted the right of women to work in all professions; Article-10: Steps shall be taken to ensure participation of women in all spheres of national life Article-19 (2): The State shall adopt effective measures to remove social and economic in equality between man and woman and to ensure the equitable distribution of wealth among citizens, and of opportunities in order to attain a uniform level of economic development throughout the Republic. Article-28(2): Women shall have equal rights with men in all spheres of the State and of public life. To comply and follow these articles DoE felt an immense need to develop a comprehensive Gender Policy to elucidate the concept of gender within its workplace (Head Office, Divisional Offices and District Offices); at the stakeholder's level as well as within the entire sector. This policy stands on the principles to ensure a consistent and equitable approach towards mainstreaming the concept of gender and preventing gender disparities among employees and stakeholders. The policy will assist in integrating gender equity goals and objectives into its entire organizational processes and structures. The principles are- Equity and Equality Empowerment Management and Governance Working Environment.

7.3 Institution and Organization for Environmental and Social Considerations in The Host Country

7.3.1 Summary of the Relevant Legal System

7.3.1.1 Environmental Legislation

The environmental legislation in Bangladesh related to the sewerage development project is shown in Table 7.3.1.

Table 7.3.1 Environmental Law

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules 2023 (ECR, 2023)	In 1995, the Government of Bangladesh adopted a comprehensive environmental law called the Bangladesh Environment Conservation Act, which provides directions and legal bindings for conservation of the environment, improvement of environmental standards and control and mitigation of environmental pollution. Definition of ecologically critical areas, procedure for environmental clearance, categorization of industries based on pollution level. The Act also provides the standards for management of water, air and soil and defines certain environmental damages and offences and prescribes punishment for them. The Environment Conservation Rules, was adopted in 1997 and revied in 2023, which provided detail guidelines for the implementation of the Act of 1995. The Rules provides categorization of all the industries and development projects in different categories for the purpose of obtaining Environmental Clearance Certificate and Environmental Impact Assessment (EIA). It also stipulates procedure of stakeholder meeting.
Noise Pollution Control Rules 2022	Categorization of area based on maximum allowable noise level, Standards of maximum allowable noise level in different areas, allowable noise from vehicles
Environmental Court Act 2000	Environment Court Act 2000 (amended in 2010) established the environmental courts at the district levels and defines the jurisdiction of the courts and nature of offences and punishments. However, monitoring and compliance mechanisms remain very week in the basic environmental regulatory regime due to comprehensive legislative approaches and inadequate institutional structures in particular for mitigation and management of environmental damage and also for addressing the environmental damages.
National Water Policy 1999	National Water Policy intends to ensure protection, restoration and preservation of natural habitats, particularly wetlands, mangroves, other forests and endangered species that depend on them
Water Act 2013	This Bangladesh Water Act, consisting of seven Chapters, provides for the right to water when it is used for the purposes of drinking, sanitation and sewage disposal, water control, protection and conservation of water resources. In addition, it regulates land ownership requirements, surface water, etc. are subject to the provisions of this Act on the following matters: water, waste prevention, protection and

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
	preservation, the executive committee may issue a protection order against the landlord and the right to use such water without the permission of the competent authority shall not be transferable.
National Water Rules 2018	Bangladesh Water Rules was prepared and finalized following Bangladesh Water Act, 2013. Water Resources Planning Organization (WARPO) of Ministry of Water Resources has taken the lead coordination role make it happened and organized several consultations with relevant sector actors. It prescribes the rights for water use, international and regional cooperation in w er related matters, national water policy, implementation of the policy, removal of illegal structures on water bodies, inspection and monitoring, procedures for obtaining clearance certificates for projects related to water infrastructures, establishment of different committees for evaluating projects for providing clearance certificates, structure, roles and responsibilities of the committees It also regulates the areas of water related crisis and their management, no objection certificate (NOC) for project use of groundwater, management of natural water flows of water bodies, water storage prohibition, flood control area declaration procedure, water resources protection order and penalties for violation
Bangladesh Climate Change Strategy and Action Plan (2008)	The Government of Bangladesh's Vision is to eradicate poverty and achieve economic and social well-being for all the people. This will be achieved through a pro-poor Climate Change Strategy, which prioritizes adaptation and disaster risk reduction, and also addresses low carbon development, mitigation, technology transfer and the provision of adequate finance. It has six strategic pillars for action, including: (1) food security, social protection and health, (2) disaster management, (3) protective infrastructure, (4) research and knowledge management, (5) decreased carbon development, and (6) capacity building and institutional strengthening.
Bangladesh Biodiversity Act 2017	This act purports to protect biodiversity of Bangladesh and advocates sustainable uses of biodiversity resources, advocates to ensure proper distribution of benefits from bio-resources and knowledge of its uses
National Land Use Policy 2001	This policy advocates optimum uses of land and water, planned use of land and water resources and natural environment, integrating the uses of three natural resources for optimum results and prevents land depletion.

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
National Fisheries Policy 1998	This policy includes the maintaining biodiversity in all-natural water bodies and in marine environment, ensuring that chemicals harmful to the environment will not be used in fish shrimp farms, Using environment friendly fish shrimp culture technology, Expanding fisheries areas and integrating rice, fish and shrimp cultivation, Undertaking control measures against the activities that have a negative impact on fisheries resources and vice-versa, Formulating laws to ban the disposal of any untreated industrial effluents into the water bodies
EIA Guidelines for Industries 2021	DoE published the EIA Guidelines for Industries in 1997 outlining simpler procedure to be followed for preparing EIA and their review. However, DoE considered it desirable to revise that book of guidelines by taking into account the present environmental status as well as the need for rapid economic development of Bangladesh. These considerations had essentially been kept in view while revising the handbook of general EIA Guidelines for Industries.

Source: The Consultant

7.3.1.2 Social Legislation

Table 7.3.2 shows the outline of the social legislation in Bangladesh relating to the sewerage development project.

Table 7.3.2 Social Legislations Relating to the Project

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
Acquisition and Requisition of Immovable Properties Act (ARIPA), 2017	The Government of Bangladesh promulgated, and enacted new acquisition law titled "The Acquisition and Requisition of Immovable Property Act (2017)" replacing the 1982 ordinance II. The new law made some amendments in determination of property value fixation. According to this new law for land an additional 200 percent compensation on the market rate if any land is acquired for the government project and the compensation will be an additional 300 percent if the land is for any non-governmental organization. And also, this law provides affected person will get additional 100% for structures, trees, crops and other assets. This has also provision for resettlement of those who will displace from their homestead with living structures due to the project.
The Transfer of Property Act of 1882 (Act No. IV of 1882)	The Act relates to transfer of properties. It came into force on the first day of July 1982. The Act defined any transaction relating to immovable property is required by law to be and has been affected by registered instruments. According to the Act No. IV of 1882 donors can transfer

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
	his/their property for the benefit of the public in the advancement of religion, knowledge, commerce, health, safety, or any other object beneficial to mankind and the transfer must be enforced by registration.
Property Emergency Acquisition Act, 1989	The Act was formulated to expedite the emergency acquisition of land to enable the Government 'to control inundation, flood and upsurge caused by natural calamity and to prevent river erosion. Use of this Act to acquire land for development would require extremely compelling reasons.
The East Bengal State Acquisition and Tenancy Act, 1950 (Revised 1994)	The State Acquisition and Tenancy Act to define the law relating to the tenancies to be held under the State. An act to provide for the acquisition by the state of the interest of rent received and certain other interests in Bangladesh. This act mainly contains land to be retained in the possession of rent-receivers, cultivating raiyats, cultivating under raiyats and non-agricultural tenants, Acquisition of the interest of certain rent-receiver and their consequence, Preparation of record of rights.
Hats and Bazaars (Establishment)and acquisition Ordinance,1959;	An ordinance to control the establishment of hats and bazaars and acquire certain hats and bazaars already established. This act provides that no person shall establish any hat or bazaar in Bangladesh, Power of the government to acquire hats and bazaars and determinations of compensation, Interpretation and rulemaking power.
National Land Transport Policy (NLTP), 2004	The government approved the NLTP in April 2004, which established a transport sector coordination wing under the planning commission to introduce the concept of long-term network planning in economic activities and integration of transport policy, planning and appraisal across land transport modes. Objective is to safe and dependable transport system, Removal of unnecessary controls and formulations of laws and regulations, Fare control, to maintain an economic activity and environmental balance, Determining the roles of the Government sector and private sector, to ensure maximum good utilization of government funds, Poverty alleviation, Reduction of transport cost and creating awareness regarding better standard of life and safety etc.
Agricultural Khas Land Management and Settlement Policy, Bangladesh, 1997	The Government of Bangladesh Under the ministry of Land adopted a new Agricultural Khas Land Management and Settlement Policy, in April 1997.Agricultural Khas Land Settlement process passes through several stages and ends with handing over possession along with Khatian and title deed. The policy has given priority on the women's

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
	ownership over the settled land and the land title document is prepared both in the name of husband and wife. Widows are getting priority in the khas land settlement.
National Land use Policy,2001	The National Land Use Policy was enacted in 2001, aimed at managing land use effectively to support trends in accelerated urbanization, industrialization, and diversification of development activities. The policy urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. Major content of this policy is following: 1. Stopping the high conversion of Agricultural land to non-agricultural land 2. Utilizing Agro-ecological zones to determine maximum land-use efficiency 3. Adopting measures to discourage the conversion of agricultural land for under development purposes 4. Improving the environmental sustainability of land-use practice
National Land Use Policy,2011	The main objectives of 'National Land Use Policy 2011' are criteria-based uses of land, providing guidelines for usage of land for the purpose of agriculture (Crop production, fish cultivation and rearing of ducks and chickens), housing, afforestation, commercial and industrial establishments and providing guidance.
The Chittagong Hill Tracts Regulation ,1900	This regulation came into force on May 1, 1900 (Regulation I of 1900) is the regulatory framework for State sovereignty over the traditional rights of the *adibasis* living in the Chittagong Hill Tracts (CHTs) region. This Regulation has recognized the traditional customs and social laws of the tribes and ensured social security by recognizing the rights of the indigenous peoples to their lands. This act purports to protect biodiversity of Bangladesh and advocates sustainable uses of biodiversity resources, advocates to ensure proper distribution of benefits from bio-resources and knowledge of its uses
The Forest Act, 1927 (Act XVI of 1927)	The Act revised as of 2000 deals with Reserved Forest, Village Forest, Protected Forest, control over forests on lands not being the property of Govt. the duty on timber and other forest products in transit, collection of drift and stranded timber, penalties and procedure, cattle trespass, forest officers, subsidiary rules, miscellaneous.
The Chittagong Hill –Tracts (Land Acquisition) Regulation, 1958	This regulation was established on the 25th day of June 1958, under Article 193 of the Constitution of the Islamic Republic of Pakistan. This regulation's main focus point is

Act/Rule/Law/Ordinance	Key Features-Potential Applicability
	that when any land on valid title, which does not resemble under The Chittagong Hill Tracts Regulation ,1900 or rules made thereunder, is required for any public purpose, the deputy commissioner may acquire such land by an order in writing.
The CHT Regional Council Act, 1998	The National Parliament of Bangladesh on 24 May 1998 passed the Peach Accord 1997 as the ―Chittagong Hill Tracts Regional Council Act, 1998 (Act 12 of 1998). In addition to re- establishing peace, the Accord recognized the ethnic people 's right to land, culture, language, and religion.

Source: The Consultant

7.3.2 Environmental Standards

7.3.2.1 Environmental Standard of Air Quality

Environmental standard of air quality is shown in Table 7.3.3.

Table 7.3.3 Environmental Standard of Air Quality

No.	Items	Concentration (μ g/m^3)		Average Time
		National Standard	WHO Guidelines 2021	
a)	CO	5,000	-	8 hours
		20,000	-	1 hour
b)	Pb	0.25	-	Annual
		0.50	-	24 hours
c)	NO^2	40	40 (Interim target-1) 30 (Interim target-2) 20 (Interim target-3) 10 (Guideline)	Annual
		80	120 (Interim target-1) 50 (Interim target-2) 25 (Guideline)	24 hours
d)	PM10	50	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (Interim target-4) 15 (Guideline)	Annual
		150	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (Interim target-4) 45 (Guideline)	24 hours
e)	PM2.5	35	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (Interim target-4)	Annual

No.	Items	Concentration (μ g/m^3)		Average Time
		National Standard	WHO Guidelines 2021	
			5 (Guideline)	
		65	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (Interim target-4) 15 Guideline)	24 hours
f)	Ozone	180	-	1 hour
		100	-	24 hours
g)	Sulfur dioxide	250	-	Annual
		80	125 (Interim target-1) 50 (Interim target-2) 40 (Guideline)	24 hours
h)	Ammonia	100	-	Annual
		400	-	24 hours

Source: Air quality control rules, 2022

7.3.2.2 Environmental Standard of Surface Water Quality

Environmental standard of surface water quality is shown in Table 7.3.4.

Table 7.3.4 Environmental Standard of Surface Water Quality

Items	Unit	a	b	c	d	e	f
pH		6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
DO	mg/l	≥6	≥5	≥5	≥5	≥1	-
BOD	mg/l	≤2	≤3	≤3	≤6	≤12	≤12
NO_3-N	mg/l	7	7	7	7	-	5
NH_4-N	mg/l	0.1	0.3	0.3	0.3	2.7	1.5
PO_4^{3-}–P	mg/l	0.1	0.5	0.5	0.5	-	2
Total Cr	mg/l	0.02	0.2	0.02	0.05	0.1	0.1
Pb	mg/l	0.03	0.05	0.03	0.1	0.1	0.1
Hg	mg/l	0.001	0.001	0.001	0.004	0.05	0.002
Total Coliform	CFU/100 ml	≤100	≤50	≤5000	≤5000	-	≤50,000
TDS	mg/l	1000	1000	1000	1000	1000	1000
COD	mg/l	10	10	25	50	100	100

Note: Type of use is as follows:
*a) Source of drinking water for supply only after disinfecting:

*b) Water usable for recreational activity:
*c) Source of drinking water for supply after conventional treatment:
*d) Water usable by fisheries:
*e) Water usable by various process and cooling industries:
*f) Water usable for irrigation:

Source: ECR2023

7.3.2.3 Environmental Standard of Noise

Environmental standard of noise is shown in Table 7.3.5.

Table 7.3.5 Environmental Standard of Noise

No.	Category	Standard dBA (National Standard)*1		Standard dBA (IFC/WB EHS Guidelines, 2007)*2	
		Day Time	Night Time	Day Time	Night Time
a)	Silent zone	45	35	-	-
b)	Residential area	55	45	55	45
c)	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50	-	-
d)	Commercial area	70	60	70	70
e)	Industrial area	75	70	70	70

*1: Day time (7:00 AM - 10:00 PM), Night time (10:00 PM - 7:00 AM)

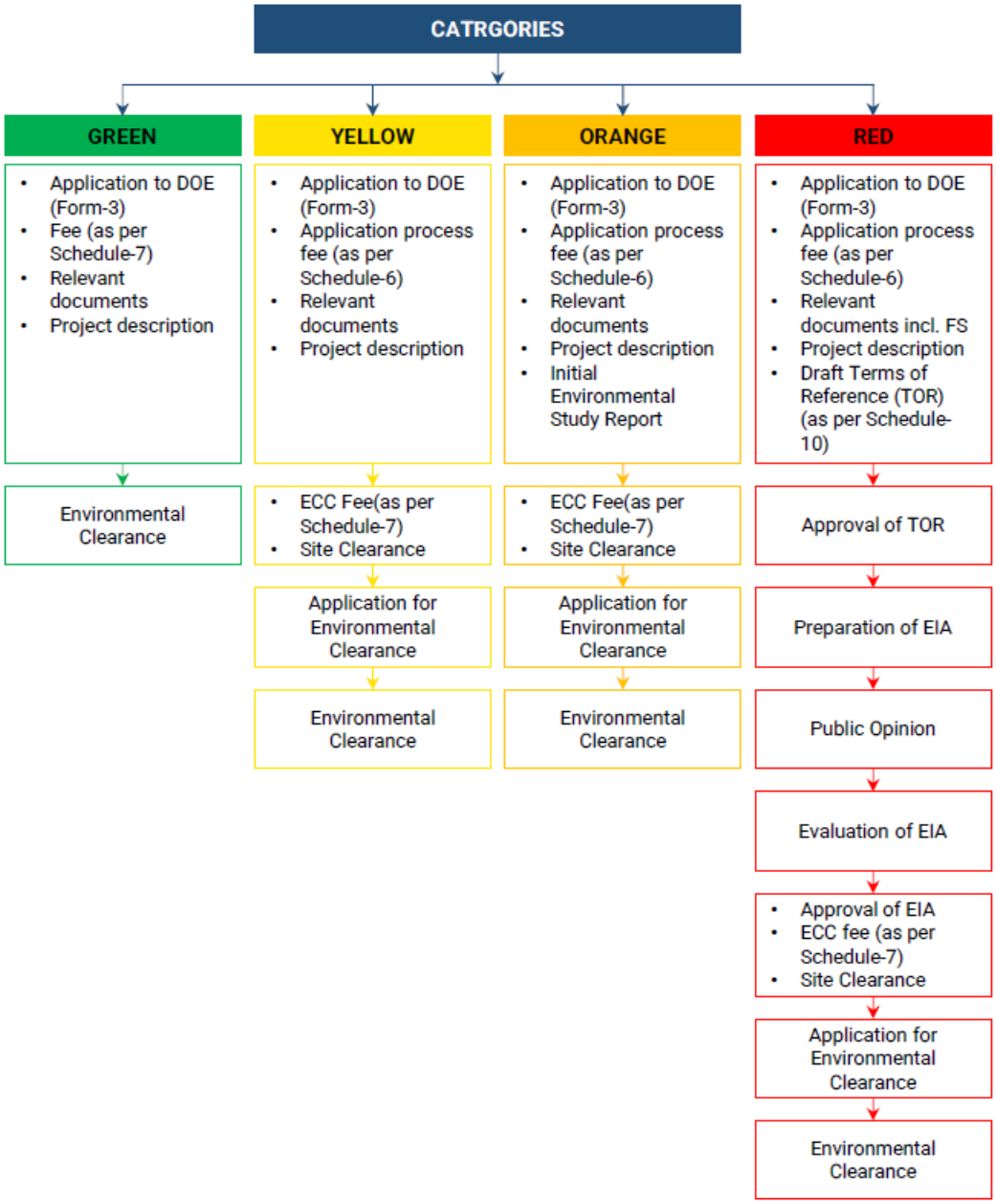
*2: Day time (6:00 AM - 9:00 PM), Night time (9:00 PM - 6:00 AM)

Source: Noise Pollution Control Rules-2006, IFC Environmental Health and Safety Guidelines, 2007

7.3.2.4 EIA System of The Country

ECR 2023 describes the EIA system by detailing the procedures for obtaining Environmental Clearance Certificate (ECC). It categorizes the industries into four types. These are Green, Yellow, Orange and Red. Schedule-1 of the ECR 2023 lists the industries as per above categories. Only the Red category project is required to conduct EIA study as a high impact project. The EIA in Bangladesh has been undertaken following a systematic process that predicts and evaluates impacts of a Project covering the aspects of the physical, biological, social/socio-economic, and cultural environment. Further, the Project will identify measures to avoid, minimize/reduce, mitigate, offset or compensate for adverse impacts; and enhance positive impacts where practicable. The EIA methodology follows the overall impact assessment approach illustrated in Figure 7.3.1. 30 working days for TOR approval, 45 working days for collecting public comments (after disclosure of draft EIA report), 30 working days for EIA report review (after EIA report submission), and 30 working days for issuance of EIA clearance (after application) are regulated.

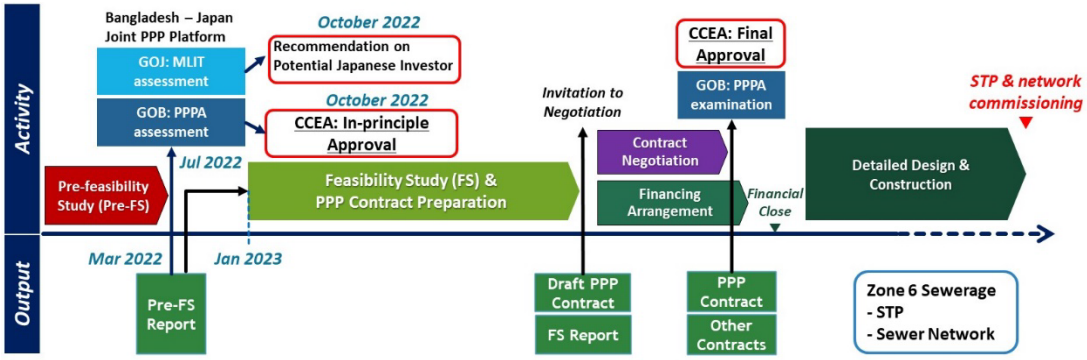
According to the Schedule -1 of ECR'97, the sewerage treatment project is categorized as a Red group. Thus, EIA study is necessary. The project proponent should get the EIA approval before the construction work.



Source: EQMS

Figure 7.3.1 Procedure of the EIA Study in Bangladesh

In JICA's environmental review of Category B projects based on the JICA Guidelines for Environmental and Social Considerations, the Environmental Assessment Report may be referred to if an environmental assessment procedure has been completed, but is not required. However, if approval of the environmental assessment report is required by the law of the country in question for Category B projects, it is preferable that the report be approved prior to the environmental review, if possible. The environmental review will be conducted prior to the signing of the agreed documents (e.g., loan agreement in this case), the timing of which is yet to be determined. As shown in Figure 7.3.2. since approval of the environmental assessment report takes about two months after its submission, it is preferable that the environmental assessment report be submitted two months prior to the time of the environmental review.



GOB: Government of Bangladesh, CCEA: Cabinet Committee on Economic Affairs, PPPA: PPP Authority

GOJ: Government of Japan, MLIT: Ministry of Land, Infrastructure, Transport and Tourism

Source: Marubeni

Figure 7.3.2 Project Schedule

7.3.2.5 Gap Analysis between National Laws and JICA Guidelines

There is Gap between Guidelines for environmental, social considerations of JICA (JICA Guidelines) and environmental law in Bangladesh. Table 7.3.6 shows the outline of gaps. The proponent shall take actions to fill the gap when they use JICA's assistance scheme for their PPP project. Note that the JICA guidelines also cover the Equator Principles, so compliance with the JICA guidelines will also satisfy the Equator Principles.

Table 7.3.6 Gap Analysis between JICA Guideline and Bangladesh Environmental Law

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
Basic Principles	1. Environmental and social impacts caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures must be examined in order to avoid such impacts as much as possible, and to minimize, reduce, or mitigate them when such avoidance is impossible. The result of the examinations must be reflected into the project plan. 2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis, and to be in a close harmony with the economic, financial, institutional, social, and technical analyses of projects. 3. The findings of the examination of environmental and social considerations, including alternatives and mitigation measures, must be documented as an independent document or as a part of other documents. Environmental assessment reports must be prepared for projects with potential significant impacts. 4. For projects which may have significant impacts in particular, or for controversial projects, a committee of experts may be formed so that	In Article 17 (3), the point to be considered in the evaluation of the EIA is stated as "possible alternatives of the concerned project, and if necessary, on- site inspection of the proposed site of the said project". Article 15 (1) states that "shall prepare an environmental impact assessment report by conducting an environmental impact assessment survey. Article 17 (1) states that "the concerned industrial establishment or project promoter shall be invited to the meeting of the Environmental Clearance Committee to provide clarification on the information and data of the environmental impact assessment report.	No gap.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	projects may seek their opinions, in order to increase accountability.		
Examination of Measures	1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts by the project and to choose better project options in terms of the environmental and social considerations. In the examination of measures, priority is to be given to avoid environmental impacts. When this is not possible, minimization, reduction, and then mitigation of the impacts must be considered, in accordance with the mitigation hierarchy. Compensation measures must be examined only when significant impacts still remained even with the aforementioned measures. 2. Appropriate plans and systems for measures, such as monitoring plans and environmental management plans, must be prepared. The costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. For projects with particularly significant impacts, detailed environmental management plans must be prepared.	Article 5 states that "Industries or projects in the red category have a severe impact on the environment, which needs to be avoided in order to preserve the environment to an appropriate extent. Significant mitigation measures are required to reduce the environmental impact of this class of industries or projects." In Article 18 (1), the point to be considered in the approval of the EIA is states as "whether the proposed environmental management plan and monitoring program are accurate, effective, practical, and adequate."	No gap.
Scope of Impacts to Be Assessed	1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water use, climate change, biodiversity, and ecosystem services, including trans boundary or global scale impacts. These also include social considerations such as: migration of population including involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor peoples and indigenous peoples, equality of benefits and losses and equality in the development process, gender,	In Article 18 (1), the point to be considered in the approval of the EIA is states as "whether the environmental or social impact has been adequately assessed" Necessity of assessment of derivative, secondary, and cumulative impacts of the project is not stated.	No major gaps. The study will cover the items in the guidelines. Derivative, secondary, and cumulative impacts of the project will also be examined as necessary.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. 2. In addition to the direct and immediate impacts of projects, derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects are also to be examined and assessed to a reasonable extent. It is also desirable to consider the impacts through a project life cycle.		
Compliance with Laws, Standards, and Plans	1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by host country governments, including local governments. Projects must also conform to the environmental and social consideration policies and plans of the host country governments. 2. In principle, projects must be undertaken outside of areas that are specifically designated for conservation of nature or cultural heritages by the host country governments, unless the main purpose of the projects is to promote or restore the protection of such areas. Also, projects shall not cause significant adverse impacts on such designated conservation areas.	In Article 18 (1), the point to be considered in the approval of the EIA is states as "Whether the concerned industrial establishment or project proposal is contrary to the government policy and plan."	There is a gap. Impacts to protected areas and cultural heritage sites as defined by relevant laws and regulations will be avoided as much as possible.
Social Acceptability	1. Projects must be adequately coordinated so that they are accepted in a socially appropriate manner for the countries and areas where the projects are planned. For projects with potentially significant environmental and social impacts, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans are examined. The outcome of such consultations must be incorporated into the project plans.	Article 16 states regarding the red category projects as "in the presence of the stakeholders concerned with the project and the officials of the concerned office of the directorate, measures shall be taken to verify the public opinion in the said industrial establishment or the area concerned with the project."	No major gaps. Stakeholder meeting will be conducted in accordance with ECR 2023 and due considerations to socially vulnerable groups will be given.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	2. Appropriate considerations must be given to vulnerable social groups, such as women, children, elderly peoples, people in poverty, indigenous peoples, persons with disabilities, refugees, internally displaced persons, and minorities. Such vulnerable social groups are susceptible to environmental and social impacts and may have little access to decision-making processes within the society.		
Climate Change	1. For projects that are expected to generate more than a certain amount of greenhouse gas emissions, the total amount of greenhouse gas emissions will be estimated and disclosed before the project implementation.	No provision.	There is a gap. Increase of greenhouse gas emissions by the project is expected; however, this will be studied in advance.
Biodiversity	1. Projects must not involve significant conversion or significant degradation of critical habitats or critical forests. 2. Illegal logging of forests must be avoided. Project proponents need to obtain logging permits from regulatory agencies, and are encouraged to obtain forest certifications for forestry projects, in order to ensure the prevention of illegal logging.	No provision.	There is a gap. The area categorized under protected area will be avoided as much as possible. If tree cutting is required, necessary permission will be confirmed to the related organizations.
Involuntary Resettlement and Loss of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be	No provision.	There is a gap. Required procedure of Bangladesh will be proceeded in accordance with

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible, and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities, and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, RAPs must be prepared and made available to the public prior to the resettlement and provision of compensation and support. In preparing the RAP, consultations must be held with the project affected people		ARIPA 2017. If there is a gap, gap-filling measures will be taken.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social Standard (ESS) 5 of the WB's Environmental and Social Policies.		
Indigenous Peoples	1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures for indigenous peoples must be taken to minimize the impacts and to compensate for the losses. 2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the Free, Prior, and Informed Consent (FPIC) of the affected indigenous peoples. 3. Measures for the affected indigenous peoples must be prepared as an Indigenous Peoples Plan (IPP), which may constitute as a part of other documents for environmental and social considerations, and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the IPP, efforts must be made to obtain the FPIC of the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, explanations are given in languages and forms that are understandable to the indigenous peoples concerned. It is desirable that the IPP includes the elements laid out in the ESS 7 of the	No provision.	There is a gap. However, impact to indigenous people is not expected.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	WB's Environmental and Social Policies.		
Monitoring	1. During the project implementation, project proponents monitor whether any unforeseeable situations occur, and the performance and effectiveness of the planned mitigation measures. Project proponents take appropriate measures based on the results of such monitoring. 2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents must ensure that the project plans include feasible monitoring plans. 3. Project proponents should make efforts to make the monitoring results available to local stakeholders involved in the project. 4. When third parties point out specifically that environmental and social considerations are not being fully undertaken, project proponents should make efforts to reach an agreement on the procedures to resolve the problems, through forums for discussions and examinations of the countermeasures with participation of stakeholders involved in the projects, based on sufficient information disclosure.	In Article 18(1), the point to be considered in the approval of the Environmental Impact Statement states as "whether the proposed environmental management plan and monitoring program are accurate, effective, practical, and adequate." Article 19 states that "It is further provided that while the red category industrial establishment or project is in progress, the directorate will issue instructions to the entrepreneur to update the environmental impact assessment report taking into account the effectiveness of the monitoring report and environmental management plan and any relevant new environmental or social issues."	No major gap. If complaint and problems are reported, monitoring results will be shared and solution will be discussed in the stakeholder meeting.
Grievance Redress Mechanism	1. A mechanism for handling concerns and grievances from people and communities affected by the project's environmental and social impacts must be in place. 2. The grievance redress mechanism needs to be easily accessible for the project affected people and communities. Project proponents disseminate the information about the grievance redress mechanism through consultations with local stakeholders. The project affected	No provision.	There is a gap. Grievance redress mechanism will be established and measure covering JICA Guidelines (GL) will be taken.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
	people and communities must not be disadvantaged by filing a grievance. 3. Project proponents should make efforts to respond promptly to the grievances they receive, taking into account the concerns and needs of the project affected people and communities.		
Information Disclosure	1. In principle, project proponents disclose information about environmental and social considerations of their projects. JICA assists the project proponents through implementing cooperation projects as needed. 7. Project proponents disclose information well in advance when they have consultations with local stakeholders in cooperation with JICA. On such occasions, JICA supports project proponents in preparation of documents in an official or widely used language(s) and in a form understandable by local peoples.	Article 16 (1) states regarding red category projects as "in the presence of the stakeholders concerned with the project and the officials of the concerned office of the directorate, measures shall be taken to verify the public opinion in the said industrial establishment or the area concerned with the project". Article 16 (2) states that "For verification of public opinion, the industrial organization or project promoter should apply to the concerned office along with three (three) sets of environmental impact assessment report and related Bengali summary and copy thereof should be sent to the head office." Article 16 (3) states that "Within seven (7) working days of receiving the application under Sub-rule (2), the concerned industrial establishment or project promoter shall fix the date, time, and place of public opinion verification and publish a notice in a widely circulated local and a national daily newspaper.".	No major gap.

Items	JICA ESC Guidelines	Bangladesh's Procedures	Gap between JICA ESC Guidelines and Bangladesh's Procedures/ Action to be Taken
		Article 16 (4) states that "Detailed information related to the verification of public opinion shall be published on the website of the directorate and the website of the said industrial organization or project promoter, if any."	

Source: The Consultant

7.4 Scoping and TOR for Survey for Environmental and Social Considerations

Considering the overall environmental and social impacts at this stage, the impact of the project is considered as limited and not significant. Although wastewater from industrial areas will be accepted under the Project, the quality of treated wastewater discharged from the STP is basically acceptable, as strict acceptance criteria for the industrial area will be established. This is also because the land on which the STP and pumping station will be constructed is owned by the government, and it is assumed that resettlement will not occur. Thus, it is appropriate to classify as Category B project on JICA's guidelines.

7.4.1 Introduction

The main objective of this section is to make a provisional identification of environmental and social impacts based on the Project description and overall environmental and social conditions in and around the Project area, which need to be addressed in subsequent EIA studies.

7.4.2 Methodology and Approach

Since the scoping process is conducted before the detailed field survey, the information from the desk study by the consultant team with preliminary assessment checklist/matrix depending on expert judgments was used to determine the assessing items which are the most critical issues to study.

7.4.3 Identification of Environmental and Social Impacts

The potential impacts result from the Project are preliminarily presented and analyzed in this Section with respect to the following aspects:

Pollution control measures;
Natural environment;
Social environment; and
Others.

Environmental and social impact assessment items which an impact of the project is assumed or unknown are marked with a 'v' separately for pre-construction (PC) stage, construction (CO) stage, and operation (OP) stage. For items marked 'v', reason for selected is described such as an assumed impact or necessity of investigation to clarify unknown impact. For items not marked with 'v', reason for not selected is described such as no impact is assumed or only negligible impact is assumed etc. The result of scoping for environmental and social impact assessment is shown in Table 7.4.1.

Table 7.4.1 Results of Scoping for Environmental and Social Impact Assessment

Category		Impacts	Selection		Reason for selected/not selected
			PC/ CO	OP	
Pollution control measures	1	Air quality	v		[CO] Due to the soil work, transportation of the construction vehicle and activities of the machineries, temporal air quality deterioration is predicted. [OP] Facilities and equipment in STP and pumping stations will not cause air quality deterioration.
	2	Water quality	v	v	[CO] STP is located near coastal line and drainage from construction site may cause water quality deterioration. [OP] Treated water is discharged into the sea and there is a draft plan of development of beach around discharged point.
	3	Waste	v	v	[CO] Certain amount of excavated soil from construction for pipeline and STP may be generated. [OP] Sludge is generated from the treatment process of STP.
	4	Soil contamination	v	v	[CO] Soil contamination due to reinforcement of the ground by injection of cement or chemical agent grout is predicted. [OP] Sludge generated through the wastewater treatment procedure is directly placed on the ground for drying before final disposal.
	5	Noise & vibration	v	v	[CO] Due to the construction vehicle transportation and activities of machineries, temporal impact of noise and vibration is predicted. [OP] STP and Pumping station may generate noise and vibration.
	6	Ground subsidence			[CO] No activities are assumed to cause impact to ground subsidence is predicted. [OP] No activities are assumed to cause impact to ground subsidence is predicted.
	7	Offensive odor		v	[CO] Construction activity will not cause offensive odor. [OP] Generated sludge may cause offensive odor.
	8	Bottom sediment			[CO/OP] No activities are assumed to cause impact to bottom sediment.

Category		Impacts	Selection		Reason for selected/not selected
			PC/ CO	OP	
					[OP] No activities are assumed to cause impact to bottom sediment.
Natural environment	9	Protected Area			[CO/OP] There is no protected area, reserved forest in the Catchment-6 and STP site.
	10	Flora/Fauna & Biodiversity	v	v	[CO] STP is located near sea, thus, impact to ecosystem of the sea due to construction work is not negligible. [OP] Treated water is discharged into the sea, thus, impact to ecosystem of the sea is not negligible.
	11	Hydrology			[CO/OP] There is no river within construction site and no activity is included to change current condition of river flow.
	12	Topography and Geology			[CO] Construction site is not located in mountainous area but urban area, thus no large scale of excavation work is implemented. [OP] The operation works of STP such as wastewater treatment and pumping water will not cause any impact to topography and geology.
Social environment	13	Involuntary resettlement	v		[PC] Land for STP and pumping stations are secured by Gov. of Bangladesh (Government land). However, a part of the land for STP is utilized for agriculture by some of farmers. Thus, crop compensation is necessary for these farmers. [OP] The operation works of STP such as wastewater treatment and pumping water will not cause involuntary resettlement.
	14	Poverty	v	v	[PC] A part of the STP site is currently used for agriculture by some of farmers and they are resettled based on crop compensation. Impact on poverty is not negligible. [OP] Positive impact to poverty is predicted such as job creation around the project site.
	15	Ethnic minorities & indigenous peoples			[CO/OP] The project site is urban area and existence of ethnic minorities and indigenous people is not confirmed. Thus, impact on ethnic minority and indigenous people is negligible.

Category		Impacts	Selection		Reason for selected/not selected
			PC/ CO	OP	
	16	Local economy (Employment)	v	v	[CO/OP] Positive impact to local economy is predicted such as job creation around the project site.
		(Livelihood)	v	v	[PC] A part of the STP site is currently used for agriculture by some of farmers and they are resettled based on crop compensation. Impact on livelihood is not negligible. [CO/OP] Positive impact to livelihood is predicted such as job creation around the project site.
	17	Land use and utilization of local resources			[CO/OP] The project activities are construction and operation of STP including pumping station, thus no impact is predicted to land use and utilization of local resources.
	18	Water usage	v	v	[CO] STP is located near sea, thus, impact to water usage of the sea water due to construction work is not negligible. [OP] Treated water is discharged into the sea, thus, impact to water usage of the sea water is not negligible.
	19	Existing social infrastructure and service	v		[CO] Temporal traffic congestion due to construction vehicles are predicted. [OP] The operation works of STP such as wastewater treatment and pumping water will not cause any impact to existing social infrastructure and services.
	20	Social institutions such as social infrastructure and local decision-making institutions			[CO/OP] The project activities are construction and operation of STP including pumping station, thus no impact is predicted to social institutions such as social infrastructure and local decision-making institutions.
	21	Maldistribution of damage and benefit			[CO/OP] The project activities are construction and operation of STP including pumping station, thus no impact is predicted to maldistribution of damage and benefit.
	22	Local conflict of interest			[CO/OP] The project activities are construction and operation of STP including pumping station, thus no impact is predicted to local conflict of interest.
	23	Cultural heritage			[CO/OP] There is no cultural heritage

Category		Impacts	Selection		Reason for selected/not selected
			PC/ CO	OP	
					within the Catchment-6 and STP site.
	24	Landscape			[CO/OP] There is no landscape resource within the project site.
	25	Gender	v	v	[CO/OP] Equal payment for same job of male and female worker/staff must be complied.
	26	Children's rights	v	v	[CO/OP] Clarification of securing children's right is necessary.
	27	Infectious disease and HIV/AIDS	v	v	[CO/OP] Risk of infectious disease and HIV/AIDS will be high due to increasing of construction workers/operation staff in the project site.
	28	Occupational health & safety	v	v	[CO/OP] There is possibility that risk of occupational incident due to construction and operation of STP will be high.
Others	29	Accident	v	v	[CO] Certain risk of accident due to use of construction vehicle and machines is predicted. [OP] Certain risk of accident in treatment facilities such as pond or tank etc.
	30	Cross-border impact, climate change			[CO/OP] Amount of GHG emission is not large and no impact is predicted to Cross-border impact, climate change.

Source: The Consultant

7.4.4 TOR of Environmental and Social survey in Feasibility Study

Based on the scoping results described in 7.4.3, terms of references (ToRs) for surveys of necessary environmental items as shown in Table 7.4.2 were developed to evaluate the project induced impacts qualitatively.

Table 7.4.2 TOR for Environmental and Social Impact Assessment

Item	Survey Item	Method
Pollution control measures		
Air Quality	- Confirmation of emission standard - Obtain baseline data	- Data collection on related legislation - Air quality survey
Water Quality	- Confirmation of effluent standard - Obtain baseline data	- Data collection on related legislation - Water quality survey
Waste	- Confirmation of waste management system	- Data collection on related legislation - Opinion hearing to related

Item	Survey Item	Method
		organizations - Collect information on good practice
Soil contamination	- Prevention measures for soil contamination	- Confirmation of construction contents and method
Noise and Vibration	- Confirmation of noise and vibration standard - Obtain baseline data	- Data collection on related legislation - Noise and vibration survey
Offensive odor	- Confirmation of waste management system	- Data collection on related legislation - Opinion hearing to related organizations - Collect information on good practice
Natural Environment		
Flora/Fauna & Biodiversity	- Confirmation of emission standard and environmental standard of sea water - Confirmation of mitigation measures for wastewater discharge	- Data collection on related legislation - Opinion hearing to related organizations - Collect information on good practice
Social Environment		
Involuntary resettlement	- Confirmation of land ownership of project site	- Site visit to confirm current situation - Opinion hearing to related organizations
Poverty	- Confirmation of land ownership of project site	- Site visit to confirm current situation - Opinion hearing to related organizations
Local economy	- Confirmation of income source	- Data collection on statistical information
Water usage	- Confirmation of the water source for daily life	- Site visit to confirm current situation - Opinion hearing to related organizations
Existing social infrastructure and service	- Location of household and public facilities such as school and hospital around the project site	- Site visit to confirm current situation
Gender	- Impact on gender	- Site visit to confirm current situation - Opinion hearing to related organizations
Children's rights	- Impact on children right's	- Site visit to confirm current situation - Opinion hearing to related organizations
Infectious disease and HIV/AIDS	- Confirmation of current situation of infectious disease prevalence	- Data collection on statistical information
Occupational health & safety	- Measures for occupational health and safety	- Site visit to confirm current situation - Opinion hearing to related organizations
Others		
Accident	- Expected increase of accidents	- Site visit to confirm current situation - Opinion hearing to related

Item	Survey Item	Method
		organizations

Source: The Consultant

7.5 Results of Environmental and Social Considerations Survey

7.5.1 Air Quality

7.5.1.1 Construction Phase

1) Dust Emissions

Dust particles released during trench excavation can contribute to poor air quality, leading to respiratory issues and other health problems for the residents. Excessive dust can reduce visibility, creating hazards for motorists and pedestrians.

2) Vehicular Emissions

Construction vehicles and equipment engine exhaust emissions include CO, PM2.5, PM10, and NO2. Such emissions will arise at construction work areas and where diesel-fueled construction equipment and generator sets will be used. Emissions will also be generated due to an increase in light-duty vehicles and heavy-duty vehicles moving along the existing road network. Apart from the movement of vehicles and equipment, traffic congestion due to any road diversions could also lead to increased vehicular emissions. It would be ensured that all vehicles plying during construction are properly turned and maintained to keep emissions within the permissible limits.

7.5.1.2 Operation Phase

1) Dust Emissions

The impact is mainly associated with dust emission from workers and maintenance transportation to and from site. However, the magnitude/severity of impacts of dust generation is insignificant.

2) Vehicular Emissions

The impacts for vehicular emissions during the plant operation and maintenance work are identical to impacts considered for the construction phase. However, the magnitude/severity of impacts of dust generation is insignificant.

7.5.2 Water quality

7.5.2.1 Construction Phase

During the construction phase of the proposed project, water will be used for the construction of civil structures, dust suppression, and drinking purposes. This may induce an impact on local hydrology in specific cases if not taken care of specifically debris, mud, etc. will be generated during construction. Changes to surface water quality within the study area may also arise from chemical and waste storage and handling during the pre-construction and construction stages.

Unplanned events such as hazardous material leakage from machinery, e.g., fuel from piling rigs and geotechnical equipment and overflow of the existing surface runoff infrastructure from the existing plant-operated areas caused by a major rainfall event could also impact surface water quality.

7.5.2.2 Operation Phase

There is a probability of the seepage of wastewater from the ponds and channels that may contain high concentrations of organic matter and heavy metals. Improper functioning or choking of inlet or outlet of the treated wastewater may also cause groundwater contamination.

7.5.3 Waste

7.5.3.1 Construction Phase

There is potential for the spread of construction debris to areas outside that are marked for construction. The debris generated from construction activities can be carried along with ponds and rivers flowing in the proximity of the plant. Construction debris can also contaminate wells, khal, etc. in the proximity of the activity.

7.5.3.2 Operation Phase

1) Wastewater

Accidental discharges of untreated wastewater in operation during maintenance of the treatment plant may cause contamination of river water quality. Impact on water quality may occur during the maintenance works as well. There is a probability of the seepage of wastewater from the ponds and channels that may contain high concentrations of organic matter and heavy metals. Improper functioning or choking of inlet or outlet of the treated wastewater may also cause groundwater contamination.

2) Solid waste

Improper storage and dumping of waste may also pollute soil, sewerage pipes and groundwater. It may also cause health problems for the staff and workers handling waste.

7.5.4 Soil contamination

7.5.4.1 Construction Phase

The majority of the generated waste will be non-hazardous. If improperly managed, hazardous waste could create impacts not only on land but also on local air quality, water quality, and human health. Contamination from spillage and leakage can have a long-term impact on soil.

7.5.4.2 Operation Phase

Emergency situations (spillage of wastewater in case of damage of pipelines or other

infrastructures) may also cause soil pollution. Inadequate/inefficient sewage treatment processes may cause direct, long-term negative impacts on soil quality.

7.5.5 Noise & vibration

7.5.5.1 Construction Phase

1) Noise

A significant source of noise during the construction phase is additional traffic to and from the project site as well as traffic on the site. Construction traffic is expected to be generated throughout the entire construction period; however, the volume and type of traffic generated will depend on construction activities being conducted, which will vary during the construction period. The movement of traffic during night hours can also disturb the local community. The receptors are present close to the project area, and along the approach road, therefore, people will feel discomfort due to the construction activities as well as the movement of vehicles on the access road.

2) Vibration

Ground-borne vibration will likely to be generated during the installation of driven piles and other construction equipment during the construction period. Vibration levels are expected to attenuate within 110 m of the construction work area. There is a significant receptor within this range at STP area (east side residence). It is anticipated that the staff and workers at the construction work area and residence near STP area, pump house, and sewage network may be exposed to vibration levels over a short-tern duration, i.e., up to a few hours a day.

7.5.5.2 Operation Phase

1) Noise

Due to the operation of proposed STP, noise may be produced from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population.

2) Vibration

Due to the operation of the proposed STP, vibration may be produced from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population.

7.5.6 Offensive odor

7.5.6.1 Construction Phase

No significant negative effects on odor are predicted during construction of the proposed development.

7.5.6.2 Operation Phase

The operation of STP will result in generation of fugitive emissions including hydrogen sulfide and methyl mercaptan (due to anaerobic conditions) and minor concentrations of N2 and ammonia (NH3) from biological tanks and from sludge. Foul odors can be indicative of underlying problems such as inadequate treatment processes, malfunctioning equipment, or insufficient maintenance.

7.5.7 Protected Area

There is no Nationally Protected Area and conservation significant area within the project AOI. According to the baseline study, there are two (2) PAs nearer to the project site- Sitakunda Ecopark (808 ha and 31 km North-west from the project site), and Dudpukuria-Dhopachari Wildlife Sanctuary (4,716.57 ha, and 31 km eastern side from the project site).

7.5.8 Flora/Fauna & Biodiversity

7.5.8.1 Construction Phase

1) Biota and Ecosystem

Floral species will be cut or change in alignment to some extent due to the excavation for sewer pipe network. It causes loss of vegetation and habitat alteration for wildlife.

2) Fisheries and Aquatic Biology

Construction activity is limited in the eastern part of outer ring roadside of Anandabazar area. However, the water quality of adjacent ponds/canals of proposed project is already polluted by anthropogenic sewage wastes, and untreated industrial wastes due to the presence of the landfill area (Anandabazar Dumping Station) in the southern boundary of the project site.

7.5.8.2 Operation Phase

1) Biota and Ecosystem

There are no other impacts on floral species expected from the operation phase (Operation of sewage network, Pumping station, sewage treatment plant) of STP-6.

2) Fisheries and Aquatic Biology

Seepage and accidental discharges of untreated wastewater due to the overflow, syphoning, or disruption in operation during maintenance of the treatment plant may cause contamination of water quality of ponds, canals, and coastal water. Wastewater containing huge organic loads might impair the chemical composition of those ponds, canals, and coastal water (discharged area) and trigger hazardous eutrophication process and lead to some extent of degradation of the aquatic ecosystem.

7.5.9 Involuntary resettlement

7.5.9.1 Before Construction Phase

No resettlement will be required for laying the pipeline or for the proposed sewage network of catchment 6. However, CWASA requires to obtain 750m^2 (18.534606 decimal) of land for construction of pumping station. Therefore, very few lands will be acquired and there might be a resettlement issue for pumping station area with minor impact on life and livelihood.

7.5.9.2 Operation Phase

No impact will be expected regarding involuntary resettlement during the operation phase.

7.5.10 Poverty

7.5.10.1 Construction Phase

There will be an impact on the poor, especially the hawkers and street vendors due to the excavation and lay down of pipe for sewage. Their business might have been hampered due to the construction and excavation work. As the city dwellers and low-income people buy and sell in the streets, therefore the main impact is economical and the impacted group is poor.

7.5.10.2 Operation Phase

No impact will be expected on poor people and on their business during Operation phase.

7.5.11 Ethnic minorities & indigenous peoples

7.5.11.1 Before/ During Construction Phase

The impact on indigenous or ethnic minority is low as there will be no direct impact on them due to the project intervention rather it will be on in general impact on whole community.

7.5.11.2 Operation Phase

No impact will be expected on minority group and indigenous people during Operation phase.

7.5.12 Loss of Livelihood

7.5.12.1 Before/ During Construction Phase

The proposed project will directly impact the livelihood of street vendors, businessman running their business along the road and the other type of informal income generating people those who do their income generating activities within the sewage network route.

7.5.12.2 Operation Phase

No impact is expected during the operation phase, so no mitigation measures are required.

7.5.13 Existing social infrastructure and service

7.5.13.1 Construction Phase

Due to the open cut of road and excavation for laying pipe for sewage treatment plant there will be some disturbance for easy access and might need to be access through an alternate way or accessibility may not be possible in somewhat for a certain hour.

7.5.13.2 Operation Phase

No impact is expected during the operation phase of the project, so no mitigation measures are required.

7.5.14 Social institutions such as social infrastructure and local decision-making institutions

7.5.14.1 Construction Phase

Due to the open cut of road and excavation for laying pipe for sewage treatment plant there will be some disturbance for easy access and might need to be access through an alternate way.

7.5.14.2 Operation Phase

No impact is expected during the operation phase of the project, so no mitigation measures are required.

7.5.15 Local conflict of interest

7.5.15.1 Construction Phase

Conflict might arise between the local people and migrant workers.

7.5.15.2 Operation Phase

There will be no impact during the operation period, therefore no mitigation measures will be required.

7.5.16 Cultural heritage

7.5.16.1 Construction Phase

Nothing was found in the network area which would be affected by the project. Therefore, no impact is expected on cultural heritage due to the proposed project implementation.

7.5.16.2 Operation Phase

No impact is expected.

7.5.17 Gender

7.5.17.1 Construction Phase

Probable impacts from the construction activity mainly cover for the women, elderly women, adolescent girls and mostly the women those who work in RMG sector and move through the roads twice or thrice in a day will face the major impacts generated from the proposed project.

7.5.17.2 Operation Phase

No impact is expected.

7.5.18 Children's rights

7.5.18.1 Construction Phase

Probable impacts from the construction activity mainly cover for the school going children move through the roads twice in a day will face the major impacts generated from the proposed project.

7.5.18.2 Operation Phase

No impact is expected.

7.5.19 Infectious disease and HIV/AIDS

7.5.19.1 Construction Phase

People will suffer from the anonymous disease out of a sudden and then it will spread to the entire community if they do not have any idea regarding the infection.

7.5.19.2 Operation Phase

No impact is expected.

7.5.20 Occupational health & safety

7.5.20.1 Construction Phase

All the aspects of occupational health and safety in the workplace have a strong focus on the state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity among the workers. The occupational safety and health addressing with many environmental hazards can harm workers and co-workers at their working place if proper mitigation measures and safety protocol is not maintained.

7.5.20.2 Operation Phase

All the aspects of occupational health and safety in the workplace have a strong focus on the state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity among the workers. The occupational safety and health addressing with many

environmental hazards can harm workers and co-workers at their working place if proper mitigation measures and safety protocol is not maintained.

7.5.21 Accident

7.5.21.1 Construction Phase

1) Pedestrian and Vehicle Circulation

Difficulty for pedestrians to walk along the streets and vehicular movement will be impacted and traffic congestion will occur during the entire construction period.

2) Community Health Safety

After pipe laying and trench filling, if the reinstatement of the carriage way is not properly done, some difference of level, most often subsidence, can be observed between the existing road and the reinstated strip. This may be harmful for driving comfort and safety and impact the surface drainage.

3) Accidents

Apart from the injury of construction works and handling machinery the movement of heavy vehicles, drum trucks and other heavy construction equipment will also enhance the accident rate within the proposed project area. Improper traffic management and safety issues can increase this problem significantly.

7.5.21.2 Operation Phase

No impact is expected.

7.5.22 Cross-border impact, climate change

7.5.22.1 Construction Phase

GHG will be released from vehicles and machinery during the construction phase. But the impact is not so significant considering the overall traffic numbers in the city area. Regular maintenance of heavy vehicles and implementation of the mitigation measures under the air pollution part will reduce the GHG emission as much as possible during the construction phase.

7.5.22.2 Operation Phase

Increases in water temperature due to climate change are expected to deterioration of water quality by decreasing the amount of dissolved oxygen and accelerating microbial decomposition of organic matter and nitrification with dissolved oxygen consumption. Impact by climate change is also expected such as extreme precipitation. Since the location of STP is along the coast, high tide water by extreme precipitation is one of the risks for STP operation. During high tide, flooding plants and seawater flow back may occur if mitigation measures are not taken.

7.6 Impact Assessment

The results of the environmental and social impact assessment are summarized in the table below. The positive and negative impacts are evaluated as follows;

- A+/-: Significant positive/negative impact is expected.
- B+/-: Positive/negative impact is expected to some extent.
- C: Extent of impact is unknown. A further examination is needed, and the impact could be clarified as the study progresses
- D: No impact is expected.
- N/A Impact assessment is not conducted because the item was categorized as no effect in scoping phase.

Table 7.6.1 The Results of The Environmental And Social Impact Assessment

Impacts	Selection		Evaluation		Results of Impact Assessment
	PC/ CO	OP	PC/ CO	OP	
Air quality	v		B-	N/A	**During Construction Phase:** • Earthworks such as land clearance and topsoil removal of the preparation of construction work areas and excavation for underground structures can generate dust. • Use of diesel-operated construction equipment, such as piling rigs, geotechnical equipment, generator set, etc. also contributes to air pollution. **Operation Phase:** • No significant impact is expected.
Water quality	v	v	B-	B-/ B+	**During Construction Phase:** • Turbid water by construction work may deteriorate the water quality of the nearest water bodies. • Changes to water quality within the study area may also arise from chemical and waste storage and handling. **Operation Phase:** • The construction of the proposed STP will result in improving the water quality of Karnaphuli River and water receiving khals to a great extent and will decrease the pollution load. • Inadequate/inefficient sewage treatment processes that affect the quality of receiving water in surface or subsurface sources.

Impacts	Selection		Evaluation		Results of Impact Assessment
	PC/ CO	OP	PC/ CO	OP	
Waste	v	v	B-	B- /A+	**During Construction Phase:** • Waste containing hazardous materials will be generated by construction work. **Operation Phase:** • The construction of the proposed STP will result in improving the water quality of Karnaphuli River and water receiving khals to a great extent and will decrease the pollution load.
Soil contamination	v	v	B-	B-	**During Construction Phase:** • Improperly managed, hazardous waste could create impacts not only on land but also on local air quality, water quality, and human health. • Contamination from spillage and leakage can have a long-term impact on soil. **Operation Phase:** • liner of the sludge storage ponds, while desludging may get dried and cracks may lead to the seepage of wastewater and thus contaminate the soil.
Noise & vibration	v	v	B-	B-	**During Construction Phase:** • A significant source of noise during the construction phase is additional traffic to and from the project site as well as traffic on the site. **Operation Phase:** • Noise impact is expected due to the STP operation.
Ground subsidence			N/A	N/A	No impact is expected.
Offensive odor		v	N/A	B-	**During Construction Phase:** • Construction work with odors is not expected. **Operation Phase:** • Operation of STP will result in generation of fugitive emissions including hydrogen sulfide and methyl mercaptan (due to anaerobic conditions) and minor concentrations of N2 and ammonia (NH3) from biological tanks and from sludge. • Strong and persistent odors can cause discomfort and negatively impact the quality of life for people living or working

Impacts	Selection		Evaluation		Results of Impact Assessment
	PC/ CO	OP	PC/ CO	OP	
					in the area.
Bottom sediment			N/A	N/A	No impact is expected.
Protected Area			N/A	N/A	No impact is expected as there is no protected area near the project site.
Flora/Fauna & Biodiversity	v	v	B-	B-/ A+	<Biota and ecosystem> **During Construction Phase:** • Floral species will be cut or change in alignment to some extent due to the excavation for sewer pipe network. It causes loss of vegetation and habitat alteration for wildlife. **Operation:** • The presence of noise, odor, and artificial lights can potentially have an impact on the terrestrial biota. <Fisheries and aquatic biology> **During Construction Phase:** • Accidental discharge of untreated wastewater from the construction facility will affect the primary productivity of the adjacent ponds and canals. **Operation Phase:** • The proper operation of STP will have an overall positive impact on the surface water quality by discharging treated wastewater into the Bay of Bengal. • Treated wastewater from STP plays a positive role for aquatic flora and fauna.
Hydrology			N/A	N/A	No impact is expected.
Topography and Geology			N/A	N/A	No impact is expected.
Involuntary resettlement	v		D	N/A	**During Construction Phase:** • No resettlement issue will be occurred due to the implementation of the project. **Operation:** • No impact is expected.
Poverty	v	v	B-	D	**Before/During Construction:** • There will be an impact on poor people, especially the hawkers and street vendors due to the excavation and lay down of pipe for sewage. Their business might have been hampered due to the construction and excavation work. **Operation Phase:**

Impacts	Selection		Evaluation		Results of Impact Assessment
	PC/ CO	OP	PC/ CO	OP	
					• No impact is expected on poor people and on their business.
Ethnic minorities & indigenous peoples			N/A	N/A	No impact is expected as no indigenous community is available in the project area.
Loss of livelihood	v	v	B+	C	**During Construction:** • Employment opportunities will be enhanced. • During pipeline installation along the road, shops/businesses might be hampered. **Operation:** • It is not clear at this stage.
Land use and utilization of local resources			N/A	N/A	No impact is expected.
Water usage	v	v	B-	A+	Same as <Fisheries and aquatic biology> of "Water quality".
Existing social infrastructure and service	v		B-	N/A	**Before/During Construction:** Regional traffic and transportation services will be disturbed by the construction work and movement of heavy vehicles. **Operation:** • No impact is expected.
Social institutions such as social infrastructure and local decision-making institutions			B-	N/A	**Before/During Construction:** • Due to the construction work and excavation for sewage network, impact for easy access of local people is expected. **Operation:** • No impact is expected.
Maldistribution of damage and benefit			N/A	N/A	No impact is expected.
Local conflict of interest			B-	N/A	**During Construction:** • Conflict might arise between the local people and migrant workers. **Operation:** • No impact is expected.
Cultural heritage			N/A	N/A	No impact is expected.
Landscape			N/A	N/A	No impact is expected.
Gender	v	v	B-	D	**During Construction:** • Probable impacts from the construction

Impacts	Selection		Evaluation		Results of Impact Assessment
	PC/ CO	OP	PC/ CO	OP	
					activity mainly cover for the women, elderly women, adolescent girls and mostly the women those who work in RMG sector and move through the roads twice or thrice in a day will face the major impacts generated from the proposed project. **Operation:** • No impact is expected.
Children's rights	v	v	B-	C	**During Construction:** • There is a possibility of disruption to PAHs and local community children commuting to school during construction as a result of project implementation, especially in the school areas. • There is a risk of child labor during construction period. **Operation:** • Not clear at this stage.
Infectious disease and HIV/AIDS	v	v	B-	D	**During Construction:** • Influx of workers may increase the risk of infectious diseases. **Operation:** • Not significant risk.
Occupational health & safety	v	v	B-	D	**During Construction:** • The construction workers may be at risk for occupational health hazards due to the materials handled and working conditions. **Operation:** • The STP staff and workers may be at risk for occupational health hazards due to the materials handled and working conditions.
Accident	v	v	B-	D	**During Construction Phase:** • Inappropriate traffic control or an increase in traffic may induce the accident. **Operation Phase:** • No significant impact is expected.
Cross-border impact, climate change			B-	N/A	**During construction Phase:** • The operation of construction machines and vehicles will produce greenhouse gas. **Operation Phase:** • No significant impact is expected.

Source: The Consultant

7.7 Mitigation Measures and Costs for Implementing Mitigation Measures

Mitigation measures in the construction phase are shown in the table below.

Table 7.7.1 Environmental Mitigation Plan During The Construction Phase

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Air Quality	Dust Emissions	• Follow the approved Environmental Management and Monitoring Plan throughout the pre-construction and construction activities. • Phase dust-generating activities such as land clearance, earthworks, and building construction to minimize the area of ground exposed and the volume of soil and construction material handled at any one time. • A grievance register must be kept on site during construction so that grievances can be recorded and then dealt with accordingly.	Appointed contractor	Appointed EHS officer
	Exhaust emissions	• Follow the approved Environmental Management and Monitoring Plan throughout the pre-construction and construction activities. • All equipment and machinery used at the construction worksites should be maintained and operated in a manner such that they will not give rise to smoke emissions and will comply with the regulation. • Implement regular checks of vehicles to ensure that emissions are within the prescribed limits.	Appointed contractor	Appointed EHS officer
Water Resources	Surface water contamination	• Follow the approved Environmental Management and Monitoring Plan throughout the pre-construction and construction activities. • Phase dust-generating activities such as land	Appointed contractor	Appointed EHS officer

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		clearance, earthworks, and STP and pipeline construction to minimize the area of ground exposed and the volume of soil and construction material handled at any one time. • Waste management measures should include provisions to contain and dispose of construction wastes, prohibit waste discharge on the ground or any surface watercourse, and practice recycling as far as practicable.		
	Groundwater contamination	• Implement a regular maintenance program for all equipment and machinery to prevent fuel spillage or leakage during construction activities. • Protect groundwater sources during construction by ensuring sanitary facilities for workers are available. Waste from such facilities should be properly managed.	Appointed contractor	Appointed EHS officer
Soil Quality	• Soil contamination • Soil erosion	• Implement a regular maintenance program for all equipment and machinery to prevent fuel spillage or leakage during construction activities. • Manage spills of soil contaminants using standard engineering practices. • Storage areas for oil, fuel, and chemicals to be surrounded by bunds or other containment devices to prevent any spilled oil, fuel, or chemicals from contaminating soils, sediment, water, or groundwater.	Appointed contractor	Appointed EHS officer

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Noise	Increased ambient noise	• Throughout the construction period, the schedule of the noisiest construction activities (in particular pilling) should be maintained at a specific period to minimize disturbance to the receptors. Operation times of noisy equipment and machinery should be limited, where possible. • Regular maintenance of equipment including lubricating moving parts, tightening loose parts, and replacing worn-out components shall be conducted. • Restrict public access to locations in close proximity i.e., 10 m to the construction work areas.	Appointed contractor	Appointed EHS officer
Vibration	Vibration generation	• Schedule of construction activities should be maintained at a specific period to minimize disturbance to the receptors. Operation times of vibratory equipment and machinery should be limited, where possible. • Use quieter pilling methods, for example, using bored pilling or pressed-in pilling with low soil displacement piles instead of hammers. • Undertake daily inspection in accordance with the management and monitoring measures.	Appointed contractor	Appointed EHS officer
Biota and Ecosystem	• Impact on floral species due to the excavation for sewer network. • Impacts on physiological processes due to dust generation.	• Dust suppression measures such as spraying of water should be implemented to minimize fugitive dust pollution during construction work. • Covering dust generates loose materials with tarpaulin sheets during transportation to the site. • Restrict vehicle movement within site to a speed less	Appointed contractor	Appointed EHS officer

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	• Impacts on the movements of herpetofauna, small terrestrial mammals.	than 20 km/hour at site to minimize potential for dust generation in the surroundings.		
Fisheries and Aquatic biology	• Impacts on untreated wastewater from construction camp facility. • Improper installation of Pipeline and erosion of excavated soil due to rainfall, leading to the contamination of adjacent water bodies.	• Provision of barriers/control walls at construction material storage areas to avoid contamination by surface runoff. • It is prohibited to store soil and other materials within 10 meters from canal/khal.	Appointed contractor	Appointed EHS officer
Loss of income and Livelihood	Temporary or mobile shop also known as Hawker/ Street Vendor will be directly impacted during the construction of sewage network within the edge of road and excavating for lay down of pipeline.	• EPC Contractor should try their maximum level to avoid any kind of loss of livelihood due to the construction. • Proper notification before starting any work should be maintained.	Appointed contractor	Appointed ESSO
Working Condition	Working conditions cover a broad range of topics and issues, from working time	• Maintain general OHS guidelines at workplace. • Implement a program that includes preparation, prevention, and recognition of fire risk.	Appointed contractor	Appointed EHS officer

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	(hours of work, rest periods, and work schedules) to remuneration, as well as the physical conditions and mental demands that exist in the workplace.	• Proper handling of combustible and flammable material.		
Public Utilities	Excavation for pipe laying and foundations of the STP can affect the buried network such as potable water, electricity, gas and telecommunication (optical fiber). After pipe laying and trench filling, if the reinstatement of the carriage way is not properly done, some difference of level, most often subsidence, can be observed between the existing road and the reinstated strip. This may be harmful for driving comfort and safety and impact the surface drainage.	• The PPS Consultant has collected available information and undertaken a utility survey within Catchment 5. • The Contractor shall collect all available data from institutions responsible for underground infrastructure in order to avoid incidents of disruption of water supply, gas, and other underground networks. • For both the STP site and the wastewater networks the Contractors should apply sufficient diligence in excavation to detect and not damage underground assets.	Appointed contractor	Appointed EHS officer

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Pedestrian and Vehicle Circulation	Most of the new sewage pipes will be laid along narrow two-lane roads (4-6m wide), without formal sidewalks, and the works (open trench, excavated material, pipes and machinery) will likely occupy one full lane of the carriage way. Often the sides of these narrow roads are occupied by mobile street vendors. Difficulty for pedestrians to walk along the streets and vehicular movement will be impacted and traffic congestion will occur.	• Rerouting of the traffic to avoid the road under construction work. • Scheduling of construction activities for minimization disruption of traffic on the Chattogram high traffic ways and areas. • Temporary covering of open trench segments to allow residents and service vehicles to access driveways.	Appointed contractor	Appointed EHS officer
Accident	Construction accidents and road accidents around the project site are expected due to the construction activities. Construction workers may have harmful and critical troubles. During construction	• Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors. • Provision of traffic sings, road mark, bump, zebra mark, guard rail and pole, curb stones, etc. • Recommendation to use late night period for the mobility of heavy construction vehicles and equipment.	Appointed contractor	Appointed EHS officer/OHS Manager

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	period, contractor will appoint numerous workers for civil work and there are some possibilities to occur accidents.			
Occupational Health and Safety	There would be a possibility to occur accidents and incident during construction works for the implementation of the Project. Physical trouble, Noise, vibration, lighting, nuisance dust, fire/explosion, machine grinding, working space, dusts, fumes, vapors, liquids are the major hazards which are harmful for workers health.	• Provide adequate health care facilities and first aid within construction sites. • Provide OHS training program and information of basic site rules of work, basic hazard awareness, site specific hazards, safe work practices, and emergency procedure. • Provide adequate facilities for the number of people expected to work in the facility.	Appointed contractor	Appointed EHS officer/OHS Manager
Community Health and Safety	Possible sources of impacts on community health and safety during the construction phase are Changes in environmental quality due to construction	• Protection (fencing) and signalization of work sites (especially excavation works for pipe laying construction), in particular during the night, with clear marking of the safety border of the works perimeter (highly visible taps or nets). • Avoiding the formation of stagnant water pools in	Appointed contractor	Appointed EHS officer/OHS Manager

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
	activities. Increased prevalence of disease arising from the influx of construction workers; and additional traffic movement.	and around the site. • Emphasizing safety aspects among drivers, particularly about the speed limit of 20 km/hr that will be enforced.		
Gender	As the entire area has a great influence on migratory RMG workers and most of them are female, there might have chance of gender related issue which can be created. As the construction work will require lots of workers and there might be a chance for gender-based violence in that area. Apart from the GBV issue women will suffer more from noise emission, vibration and possible air pollution caused by the works for pipe laying.	• Resident women should be closely informed about the days during which the works will occur in their streets. • EPC contractors should alert the labor and worker group for not being involved with such activity. • Proper guidelines and training should be provided to the workers regarding GBV.	Appointed contractor	Appointed ESSO

Source: The Consultant

Mitigation measures in the operation phase are shown in the table below.

Table 7.7.2 Environmental Mitigation Plan During The Operation Phase

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
Air Quality	Dust Emissions	• Maintenance of plant equipment.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
	Exhaust emissions	• All maintenance machinery must be serviced regularly and maintained to ensure that emissions are kept to a minimum. • Planting trees within the perimeter of the project area should be considered.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
	Offensive odor	• Enclosure of the major process equipment inside building structure, which is equipped with ventilation system to ensure adequate air exchange within the structure (in other words, maintaining negative pressure inside the structure). Further odor containment will be achieved by covering or confining the sewage channels, sewage tanks, and equipment with potential odor emission.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Water Resources	Surface water contamination	• Use suitable lining material to control the seepage and water contamination. • In case of maintenance/sludge removal, alternative	Appointed EHS officer/OHS	Designated officer from

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	**Supervision**
		ponds shall remain functional. • Water should be retained constantly in ponds to prevent drying out of compacted clay liners. In dry liner shrinkage cracks may occur, which may cause excessive leakage when ponds later refill.	Manager	STP management/ DOE
	Groundwater contamination	• Use suitable lining material to control the seepage and groundwater contamination.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Soil Quality	• Soil contamination • Soil erosion	• While de-sludging, the ponds shall be sprinkled with water. • Scum and sludge shall be removed regularly and disposed of safely. • In case of fuel/oil spill, cleaning of the territory and withdrawal of the contaminated soil and ground for further remediation.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Noise	Increased ambient noise	• Regular maintenance of vibrating parts through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels. • All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		• Undertake daily inspection and carry out noise monitoring in accordance with the management and monitoring measures to ensure compliance against limits in the Noise Pollution (Control) Rules, 2006.		
Vibration	Vibration generation	• Identical to measures considered for the noise.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Biota and Ecosystem	• Impacts on avian species, herpetofauna and terrestrial mammals due to noise, odor, and lights. • Uncontrolled increase of urban scavenger faunal species.	• Solid Waste and debris from wastewater should be stored safely in sealed and leakage proof containers to avoid dispersion. • Solid waste should be disposed in a regular basis.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Fisheries and Aquatic biology	• Promote the growth of both heterotrophic and autotrophic microorganisms, as well as zooplankton, macroinvertebrates, and fish abundance. • Accidental discharge of untreated water may lead the eutrophication.	• Regular maintenance of STP infrastructure is essential to minimize the occurrence of accidental discharges of wastewater from the sewer network and the facility. • Installation of sensors, alarms, and automated monitoring equipment to continuously monitor the treatment process and alert operators in case of any deviations or potential risks. • Designing the STP with appropriate containment systems will help to prevent untreated wastewater	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
		from reaching waterbodies in the event of an overflow or disruption of sewerage pipes.		
Community Health and Safety	Changes in environmental quality due to operation activities. Increased prevalence of disease arising from the influx of workers; and additional traffic movement.	• Confining all the fecal sludge storage and transport structures once the sludge discharged by the vacuum vehicles. • Transport of dewatered fecal sludge shall be fitted with a removable fabric or flexible plastic sheet cover to prevent spills, dust, and odor emissions during transport. • Emphasizing safety aspects among drivers, particularly about the speed limit of 20 km/hr that will be enforced.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Workers Health Safety	Possible sources of impacts on workers' health and safety during the operation phase are from the contact with septic water and sludge, small wounds, or injury from work.	• The STP and sewage network should comply with all requirements of the national legislation and international rules on occupational health and safety. • PPE for workers should be provided and regular check on each item for any damage or unwillingness to wear during work. • Workers should be trained with basic firefighting and first aid use.	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Living environment, health and welfare community	Living environment pollution.	• CWASA and connected industries defining the quality requirements for industrial effluents to be discharged into the CWASA sewage network. • CWASA will have to conduct it is own monitoring at the factory outlets and monitor the work accordingly. • A massive awareness-raising campaign on	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE

Affected Aspect	Potential Impacts	Proposed Mitigation/Enhancement Measures	Responsibility	
			Implementation	Supervision
people		connection to sewer shall be designed and implemented in the connected areas of the STP-6.		

Source: The Consultant

Cost estimates are prepared for all the mitigation and monitoring measures proposed in the EMP. The details of the cost estimates and the budget during the construction phase and operation phase for the mitigation and monitoring measures are given in the table below. The cost estimates for mitigation and monitoring measures during the operation phase are given yearly (for one year).

The cost estimates include the budget for environmental enhancement/compensation measures and environmental monitoring, but not include the budget for consultants for EMP implementation, institutional strengthening, and capacity building of the plant staff.

The total budget for EMP implementation during the operation phase is estimated to be about 4,390,000 BDT (for one year).

Table 7.7.3 Summary of costs for environmental management

Aspects	Phase	Tentative Cost in BDT		
		Mitigation Measures	Monitoring Measures	Total
Air quality	Construction	50,000	600,000	650,000
	Operation	30,000	-	30,000
Noise	Construction	50,000	200,000	250,000
	Operation	30,000	-	30,000
Surface water	Construction	50,000	300,000	350,000
	Operation	50,000	-	50,000
Groundwater	Construction	50,000	240,000	290,000
	Operation	50,000	-	50,000
Soil/Sediment	Construction	30,000	400,000	430,000
	Operation	30,000	Included in operational cost	30,000
Waste minimization control	Construction	50,000	-	50,000
	Operation	-	Included in operational cost	-
Odor Control	Construction	-	-	
	Operation			Included in operational cost
Effluent quality	Construction	-	-	-
	Operation			Included in operational cost
Sludge quality	Construction	-	-	-
	Operation			Included in operational cost
Terrestrial ecosystem	Construction	30,000	160,000	190,000

Aspects	Phase	Tentative Cost in BDT		
		Mitigation Measures	Monitoring Measures	Total
	Operation	100,000	160,000	260,000
Aquatic ecosystem	Construction	50,000	200,000	250,000
	Operation	100,000	200,000	300,000
Transportation management	Construction	40,000	-	40,000
	Operation	40,000	-	40,000
Occupational health and safety	Construction	75,000	-	75,000
	Operation	75,000	-	75,000
Community health and safety	Construction	50,000	-	50,000
	Operation	50,000	-	50,000
Fire Emergency	Construction	50,000	-	50,000
	Operation	50,000	-	50,000
Socio-economic condition enhancement	Construction	-	-	-
	Operation	450,000	-	450,000
Greenbelt development	Construction	-	-	-
	Operation	300,000	-	300,000

Source: The Consultant

7.8 Environmental Monitoring Plan

The Environmental Monitoring Plan in the construction phase is shown in the table below.

Table 7.8.1 Summary of The Proposed Monitoring Plan During The Construction Phase

Impact	Monitoring Means	Parameters	Location	Frequency	Responsibility	
					Implementation	Supervision
General	Visual inspection of all active work areas	General compliance with mitigation measures presented in the EMP	Project activity areas and construction worker's camp	Daily	Appointed contractor	Project management team and designated HSE team
Air quality	Measurement/sampling	PM_{10}, $PM_{2.5}$, CO, NO_X, SO_X, and Pb	Locations based on Figure 7.2.1	Quarterly		
Noise	Measurement	Leq (dBA)	Nearby sensitive receptors (Figure 7.2.4)	Quarterly		
Surface water and groundwater	Sampling	Temperature, pH, suspended solids, electrical conductivity, dissolved oxygen, BOD, COD, nutrients (nitrogen, phosphate, potassium, chloride, sodium), etc.	Tube wells located in the areas surrounding the plant area as suggested in Figure 7.2.3	Quarterly		
		Temperature, pH, DO, BOD, COD, turbidity, total dissolved solids, suspended solids, oil and grease, and heavy metals, etc.	Surrounding water resources as suggested in Figure 7.2.2	Quarterly		

Impact	Monitoring Means	Parameters	Location	Frequency	Responsibility	
					Implementation	Supervision
Soil	Sampling	pH, salinity, and nutrients (nitrogen, phosphate, potassium, chloride, sodium), heavy metal content (mercury, lead, chromium, copper, zinc, and cadmium)	Disposal site as well as in the adjacent agricultural land	Quarterly		
Solid waste	Audits, photographic documentation, and interviews	Generation, storage, recycling, transport, and disposal	Construction site	Monthly		
Biota and Ecosystem	Visual observation	Diversity, abundance, and mortality of wildlife	Project site and adjacent areas	Quarterly		
		Diversity and abundance of Migratory bird	Mud flat area, and waterbodies adjacent to the project site	Yearly (December and March)		
Fisheries and Aquatic Ecosystem	Fish Market Survey, Stakeholder consultation	Species Composition, Diversity, abundance, habitat suitability, etc.	Adjacent Fish Market, Ananda Bazar Ghat Area	Half-yearly		
Health and safety	Health and safety surveys	Proper use of PPE, presence of safety signs, first aid kit, firefighting devices, and injury/illness records	Construction site and sewer network	Continuously		

Source: The Consultant

The Environmental Monitoring Plan in the operation phase is shown in the table below.

Table 7.8.2 Summary of The Proposed Monitoring Plan During The Operation Phase

Impact	Monitoring Means	Parameters	Location	Frequency	Responsibility	
					Implementation	Supervision
Effluent quality	Sampling and analyzing using standardized method	Routine parameters	Inlet and outlet of STP	Daily	Appointed EHS officer/OHS Manager	Designated officer from STP management/ DOE
Sludge quality	Pooled sampling and analyzing using standardized method	Dry sludge (after drying beds): • Dry solids • Al, As, Cd, Co, Cu, Cr, Fe, Hg, Mn, Ni, Pb, Zn • N total, NH4, P total and K • Fecal coliforms	At the outlet of draying bed	Quarterly		
Sludge reused	Cnnsultation	• Number of farmers /framing companies using sludge • Agricultural surface (ha) • Quantity and % of sludge spread on agricultural land	Agricultural land surrounding STP	Yearly		
Sludge	Register consultation	Quantity of sludge disposed	Sludge landfill	Yearly		

Impact	Monitoring Means	Parameters	Location	Frequency	Responsibility	
					Implementation	Supervision
disposed		onto landfill				
Water pollution	In situ measurement with multiparameter probe	Analyses of Discharge Khal water: • Temperature, pH, turbidity, electric conductivity, redox potential, ammonium, nitrates, and chlorides	Fixed point (always the same if possible) located less than 10 m downstream of the outfall discharge point	Weekly (September to May)		
Sediment pollution	Sampling of the 0-10cm top layer in low water period: 5 samples pooled	Analyses of Discharge Khal Sediment • Al, As, Cd, Co, Cu, Cr, Fe, Hg, Mn, Ni, Pb, Zn • Total organic carbon	Fixed point (always the same if possible) located less than 10 m downstream of the outfall discharge point	Yearly		
Odor emission	Breathing the air and note the smell, if any	Number of days with noticeable odor	At the limits of the STP site	Daily (September to May)		
	Registration of complaints	Odor related complaints from STP neighbors	In the vicinity of STP site (eastern side)	Yearly		
Biota and Ecosystem	Visual observation	Diversity and abundance of wildlife	Project site and adjacent areas	Quarterly		
		Diversity and abundance of Migratory bird	Mud flat area, and waterbodies adjacent to the project site	Yearly (December and March)		
Aquatic	Fish Market Survey,	Species Composition,	Fish markets adjacent to	Half yearly		

Impact	Monitoring Means	Parameters	Location	Frequency	Responsibility	
					Implementation	Supervision
Ecosystem	Stakeholder consultation	Diversity, abundance, habitat suitability, etc.	the Project Site, Ananda Bazar Ghat	for 2 years		

Source: The Consultant

7.9 Implementation System

To be described in Final Report.

7.10 Consultation with Local Stakeholders

7.10.1 Identification of Stakeholders

Identification of stakeholders was carried out by EQMS in discussion with CWASA. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the Table below.

Table 7.10.1 Identification of stakeholders

S/N	Stakeholder Group/Category	Key Stakeholders	Description of the Stakeholder Profile
Primary Stakeholders			
1	Project Affected Persons (PAPs)	• Impacted Land Users • Impacted Landowners	• Landowners who sold their land to the project owners • Land users who are residing in the project area
2	Institutional Stakeholders	• Regulatory Authorities • CDA • CCC	• This stakeholder group comprises regulatory authorities at the district and national levels that are responsible for various permits and licenses pertaining to the Project.
3	Other Primary Stakeholders	• CWASA • EPC contractor	• This stakeholder is responsible for the whole project's implementation
4	Community	• Land sellers	• Primarily includes landowners who sold their land to the project company.
5	Project Financing Agencies/Institutions	• Financers and Investors	• This stakeholder group includes International Finance Corporation (IFC) and other investors who are evaluating a potential investment opportunity in the project.
Secondary Stakeholders			
6	Local Community	• Local community residing near the project footprint	• This stakeholder group comprises the community residing near the vicinity of

S/N	Stakeholder Group/Category	Key Stakeholders	Description of the Stakeholder Profile
			the project area. • This group is expecting to be indirectly impacted by the Project activities but may be indirectly impacted.
7	Institutional Stakeholders	• Department of Agriculture • Department of Fisheries • Forest Department	• This stakeholder group comprises experts in different sectors for providing inputs and information which are crucial for designing and project implementation.
8	Other secondary stakeholders	• Local NGOs • Civil Societies	• This stakeholder group comprises experts for providing input during project implementation.

Source: The Consultant

7.10.2 Individual and Key Informant Interview (KII)

Individual and KII techniques have been used to disclose the information regarding this project during the EIA exercise. During EIA preparation, significant numbers of KII and Individual consultation have been conducted with the relevant authorities. Individual consultation consultations have been conducted throughout the route network. 30 numbers of individual consultations were carried out with the street vendors and 22 numbers with shop owners in Sandwip para, Housing Colony, Akmol Ali road, Eidgha, Maiz para, Nazir para, Muslimabadh, Steel Mill Bazar, Kathgor Bazar and Freeport Bazar. Table 7.10.2 shows the participant details of key informants and individual consultations. The details of consultation with key informants and individual consultation with shopkeepers and street vendors are presented in Appendix-7.

Table 7.10.2 Participant Details of Key Informant Interview

Date	Stakeholder (Individual) Details	Details of Participants	Method of Consultation
16.05.2023	Chattogram City Corporation (CCC)	Mr. Abu Bakkar (Executive Engineer – CCC)	KII
16.05.2023	Chattogram Development Authority (CDA)	Mr. Shamim Ahmed (Executive Engineer – CDA)	KII
16.05.2023	Department of Environment	Mr. Abdullah Al Matin (Assistant Director – Chattogram Metropolitan Office, DOE)	KII

Date	Stakeholder (Individual) Details	Details of Participants	Method of Consultation
11.05.2023	Department of Marine Fisheries	Mr. Faruq Hossain Sagor (Assistant Director)	KII
13.05.2023	Chattogram City Corporation (CCC)	Mr. Saleh Ahmed (Councilor Ward – 41, CCC)	KII
13.05.2023	Chattogram City Corporation (CCC)	Golam Mohammad Chowdhury (Councilor Ward – 38, CCC)	KII
17.05.2023	Chattogram City Corporation (CCC)	Mrs. Shahanur Begum (Female Councilor Reserved Ward – 39,40,41 *General Ward – 14)	KII
12.04.2023	Chattogram City Corporation (CCC)	Mrs. Afruja Johur (Female Councilor Reserved Ward – 27, 37, 38 *General Ward – 12)	KII
28.04.2023 to 18.05.2023	Shop keepers and Street Vendors of sewage network	Ward-38, 39, 40, & 41	Individual Consultation

Source: The Consultant

7.10.3 Stakeholder Consultation Meeting

This tool has been used to disclose information on a large scale involving the stakeholders of a particular area. A schedule of the meeting was circulated well in advance and discussions can involve feedback sessions from the stakeholders. The meeting was conducted on the premises of the village hotspot for proximity and familiarity purposes.

The stakeholder consultation meeting was held on 9 March 2023 Moon View Community Center, Steel Mill Bazar, Patenga, Chattogram. CWASA representatives, Nippon Koei officials, local community members and relevant stakeholders participated in this Public Consultation Meeting. The meeting was attended by a total of 34 people.

The stakeholder consultation meeting minutes have been given in Table 7.10.3.

Table 7.10.3 Brief overview of the stakeholder consultation meeting

S/N	Name	Person Details	Comment/suggestions
1	Riazul Islam	President, Shaikat Housing Society	• He has inquired about the plans for the development of water supply pipelines and sewerage/drainage system for this project.

S/N	Name	Person Details	Comment/suggestions
			• He has also raised concerns about the excessive levels of iron and salt in the groundwater of the area and wants to know what steps the Chattogram Water and Sewerage Authority (CWASA) is taking to address the issue. • In addition, despite having installed a water line to get water from the Chattogram Water Supply and Sewerage Authority (CWASA), the locality is experiencing difficulties in getting water from that source.
2	Wahidul Alam Chuwdhury	Businessman, 41 no. Ward	• In order to ensure the successful implementation of the sewerage system development project, it is advisable for CWASA to visit each ward and involve all relevant stakeholders in the study. • According to him, the rate of waterborne diseases in this area is alarmingly high. However, he expresses optimism that this project would play a significant role in mitigating the spread of waterborne diseases in this region. • It is very important to provide water in the South Patenga area as salinity is very high in this area.
3	Jahangir Hossain Shanto	Businessman, Mokbul Housing Society	• He stated that despite consistently fulfilling their payment obligations to CWASA over the course of the last four years, the residents of Mokbul Housing Society have yet to receive any water supply. • The high salinity levels in the groundwater due to the proximity of the area to the seashore necessitates the supply of treated water from CWASA. • Additionally, he inquired whether CWASA has any plans for repairing or providing compensation for the damage caused to roads and pedestrian areas during the construction phase of this project.
4	Md. Nazrul Islam	Retired Navy Officer, Akmol Ali Road	• They are passing a bad situation for water crisis. CWASA should take steps for solving the issue as soon as possible.

S/N	Name	Person Details	Comment/suggestions
5	Md. Saifuddin	Personal Secretary of 41 no. Ward Councilor	• He has emphasized the need for safe water. • They are paying bills but getting no water supply. • The proposed project is very important for society by reducing waterborne diseases and for making a clean city.
6	Md. Humayun Kabir	Businessman, 41 no. Ward	• He has also highlighted the need for safe water. They are not getting water supply even after paying CWASA.
7	Sharmin Faruk Sultana	Social Worker and Politician, 38 no. Ward	• As per her perspective, the current endeavor undertaken by CWASA is highly praiseworthy. The primary objectives of this project include promoting cleanliness within the city, reducing waterborne diseases, and improving the overall health and well-being of the citizens residing within the area.
8	Mohammed Yusuf	Executive Engineer, CWASA DPD, Chattogram Metropolitan Sewerage Project for Pantenga Catchment-6	• He has expressed that the Chattogram Water Supply and Sewerage Authority (CWASA) has implemented several measures for the maintenance of the sewerage system in Chattogram. • Therefore, CWASA is currently involved in various other projects aimed at providing safe and treated water to the local residents. This includes the installation of new pipelines in select areas and the repair of pipelines in several locations. • The estimated completion time for the construction of this sewerage project is around the year 2027.CWASA is installing around 52 km of pipelines in this project area. • As part of the construction and maintenance work, certain roads may need to be cut. In such instances, the Chattogram Water Supply and Sewerage Authority (CWASA) will provide compensation to the Chittagong City Corporation for repairing the affected roads. Additionally, CWASA is currently contemplating the possibility of taking up

S/N	Name	Person Details	Comment/suggestions
			the responsibility of repairing any damaged roads or structures in the future, under the guidance of CWASA. • CWASA is also going to create a MOD in Catchment 6 area.

Source: The Consultant

7.10.4 Focus Group Discussion

FGDs are important when gauging with a group of stakeholders on issues related to the project activities. FGD has been used to understand the needs, perceptions, and concerns of the group. The discussion also gave space for the members to voice their concerns and suggestions. During EIA preparation, FGD with various groups including women and projected people those who are going to be affected by the project was conducted in different location throughout the project area. Table 7.10.4 shows the details of FGD Participants. The findings of the FGD are given in Appendix-7.

Table 7.10.4 Details of FGD Participants

S/N	Date	Place	Target Group	No. of Participant		
				Male	Female	Total
1	30.04.2023	Steel Mil Bazar	Merchants	6	0	6
2	30.04.2023	Akmal Ali Road	Female Group	0	8	8
3	02.05.2023	Muslimabadh	Local Community	8	0	8
4	02.05.2023	Nazirpara	Migrant Workers	2	4	6

Source: The Consultant

CHAPTER 8 ECONOMIC AND FINANCIAL ANALYSIS

8.1 Assumptions for Economic and Financial Analysis

8.1.1 General Assumptions

This information is confidential corporate information and is not for public disclosure.

Table 8.1.1 General Assumptions of Economic and Financial Analysis

This information is confidential corporate information and is not for public disclosure.

8.1.2 Estimated Water Consumption and Wastewater Treatment Volume

This information is confidential corporate information and is not for public disclosure.

Table 8.1.2 Estimated Number of Beneficiaries, Water Consumption and Treatment Amount

This information is confidential corporate information and is not for public disclosure.

8.1.3 Project Cost

This information is confidential corporate information and is not for public disclosure.

8.1.3.1 Capital Investment Cost

This information is confidential corporate information and is not for public disclosure.

Table 8.1.3 **Estimated Project Cost**

This information is confidential corporate information and is not for public disclosure.

8.1.3.2 Operation and Maintenance Costs

This information is confidential corporate information and is not for public disclosure.

Table 8.1.4 **Annual O&M Cost of the Project**

This information is confidential corporate information and is not for public disclosure.

8.1.3.3 Replacement Cost of Equipment

This information is confidential corporate information and is not for public disclosure.

8.1.3.4 Residual Value

This information is confidential corporate information and is not for public disclosure.

8.2 Financial Analysis

This information is confidential corporate information and is not for public disclosure.

8.2.1 Revenue Projection

This information is confidential corporate information and is not for public disclosure.

Table 8.2.1 General Assumptions of Revenue Projection

This information is confidential corporate information and is not for public disclosure.

Table 8.2.2 Collected Revenue Amount of the Project

This information is confidential corporate information and is not for public disclosure.

8.2.2 Result of financial analysis

This information is confidential corporate information and is not for public disclosure.

This information is confidential corporate information and is not for public disclosure.

Figure 8.2.1 Revenue and Cost Flow under Alternative 6 Case (+6%/year)

Table 8.2.3 Result of Financial Analysis

This information is confidential corporate information and is not for public disclosure.

8.3 Economic Analysis

This information is confidential corporate information and is not for public disclosure.

8.3.1 Potential Economic Benefits

This information is confidential corporate information and is not for public disclosure.

Table 8.3.1 Potential Economic Benefits of the Project

This information is confidential corporate information and is not for public disclosure.

8.3.2 Benefit of Improvement of Sewerage Service

This information is confidential corporate information and is not for public disclosure.

8.3.3 Benefit of Reduction of Medical Expenditure

This information is confidential corporate information and is not for public disclosure.

8.3.4 Benefit of Reduction of Cleaning Expenditure of Septic Tank

This information is confidential corporate information and is not for public disclosure.

8.3.5 Benefit of Land Price Escalation

This information is confidential corporate information and is not for public disclosure.

8.3.6 Result of Economic Analysis

This information is confidential corporate information and is not for public disclosure.

Table 8.3.2 Result of Economic Analysis

This information is confidential corporate information and is not for public disclosure.

This information is confidential corporate information and is not for public disclosure.

Figure 8.3.1 Economic Benefit and Cost Flow under Base Case using ATP

Table 8.3.3 Result of Sensitivity Analysis

This information is confidential corporate information and is not for public disclosure.

8.4 Cash Flow Analysis

This information is confidential corporate information and is not for public disclosure.

8.4.1 General Assumptions

This information is confidential corporate information and is not for public disclosure.

Table 8.4.1 General Assumptions of Cash Flow Analysis

This information is confidential corporate information and is not for public disclosure.

8.4.2 Revenue and Cost Projection

This information is confidential corporate information and is not for public disclosure.

Table 8.4.2 Revenue and Cost Projection

This information is confidential corporate information and is not for public disclosure.

8.4.3 Result of Cash Flow Analysis

This information is confidential corporate information and is not for public disclosure.

Table 8.4.3 Availability Payment Amount Under Different Cases

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CHAPTER 9 EVALUATION OF THE PROJECT

9.1 Technical Evaluation

This information is confidential corporate information and is not for public disclosure.

9.2 Evaluation of the Project Structure

This information is confidential corporate information and is not for public disclosure.

9.3 Environmental and Social Evaluation

This information is confidential corporate information and is not for public disclosure.

9.4 Economic and Financial Evaluation

This information is confidential corporate information and is not for public disclosure.

9.5 Conclusions

This information is confidential corporate information and is not for public disclosure.

Appendix 1. CWASA Organogram

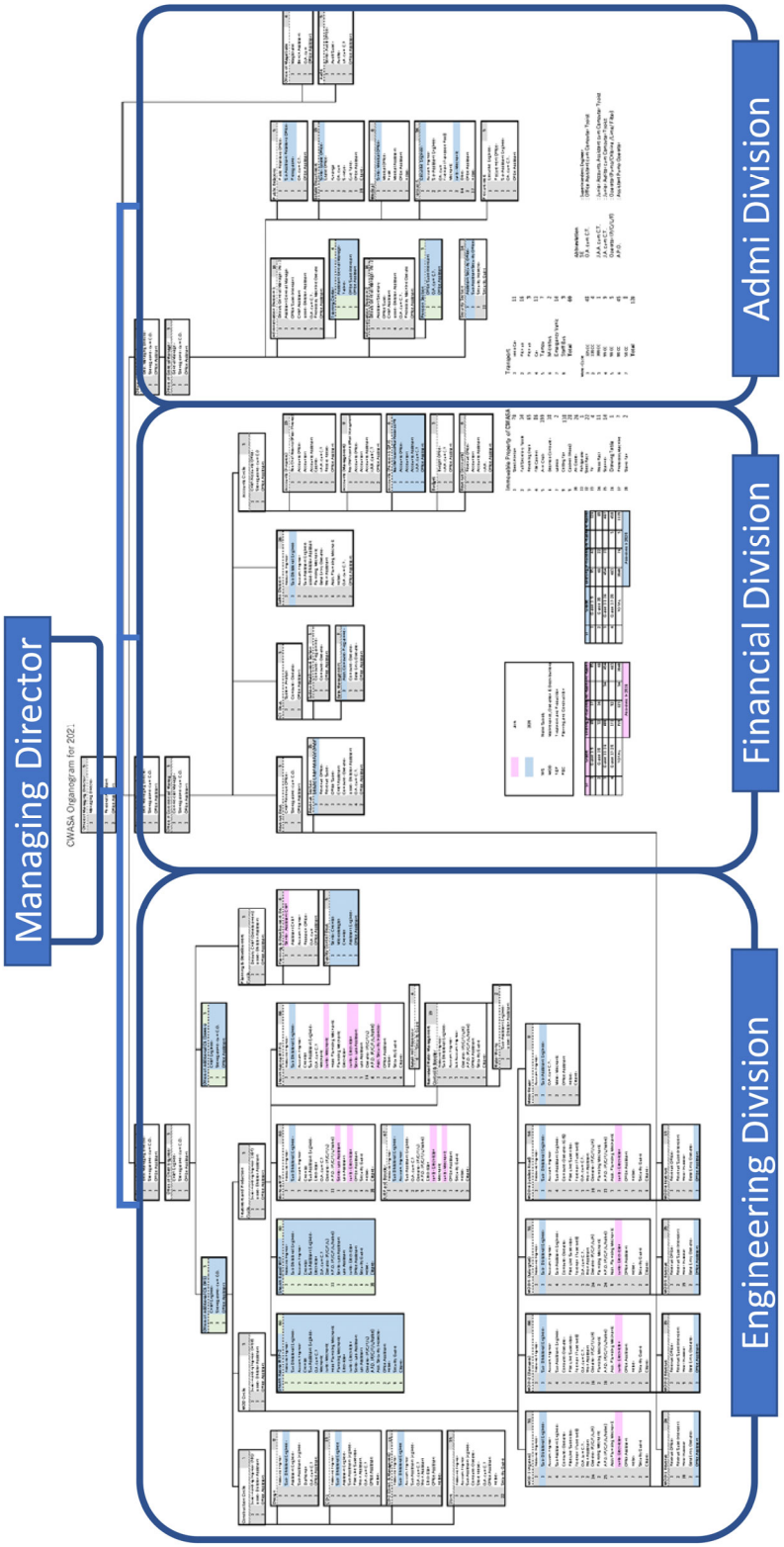


Figure 1-1 CWASA Organogram (Summary)

Engineering Division

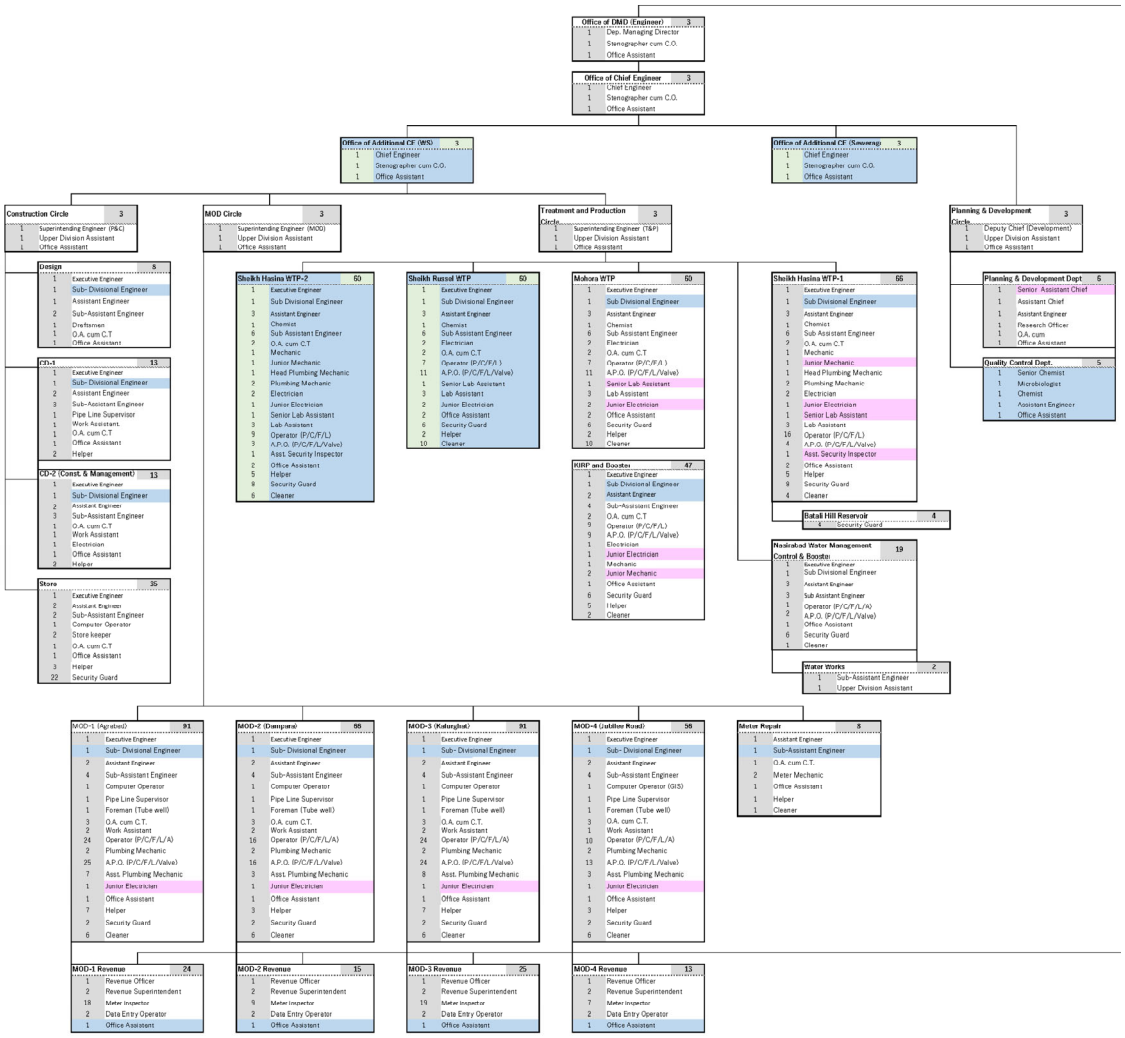


Figure1-2 CWASA Organogram (Engineering Division)

Financial Division

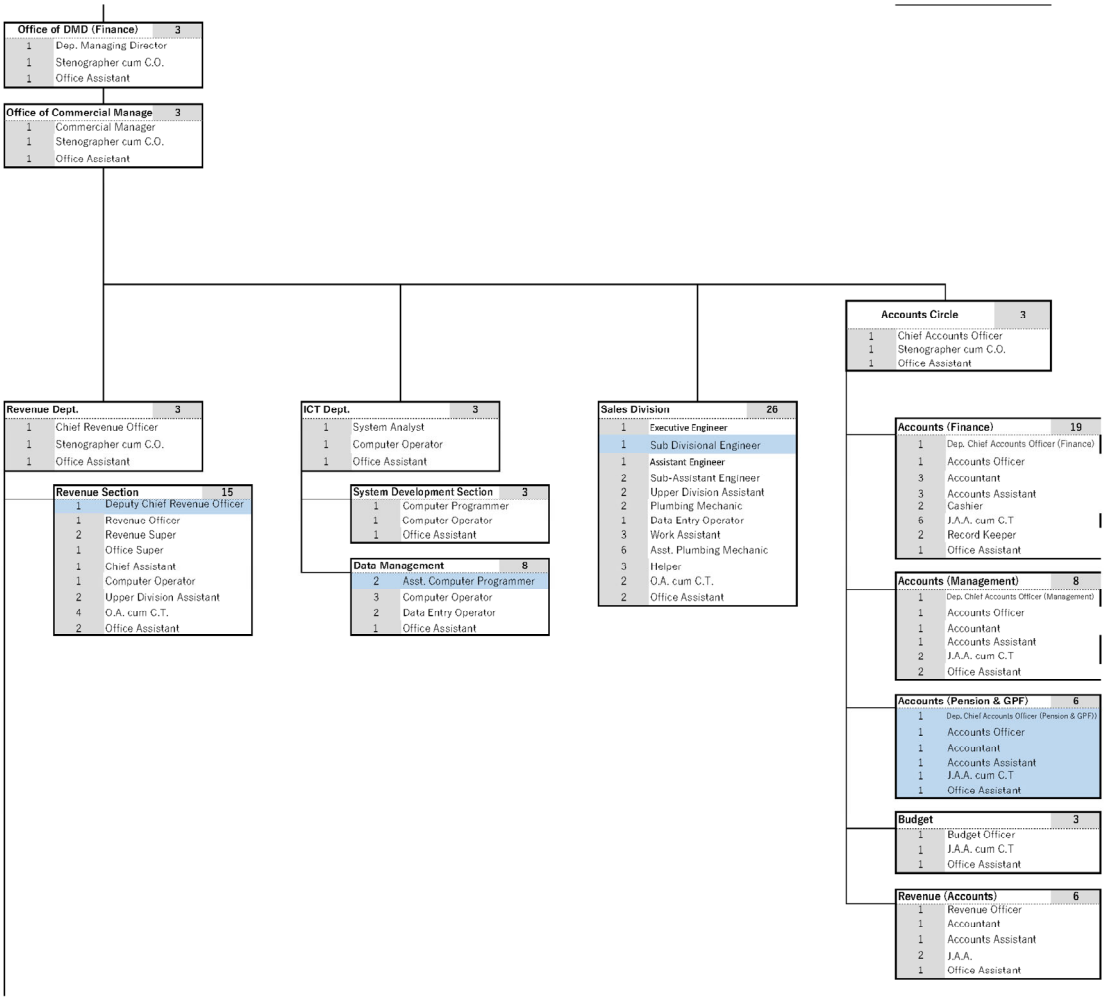


Figure1-3 CWASA Organogram (Financial Division)

Administrative Division

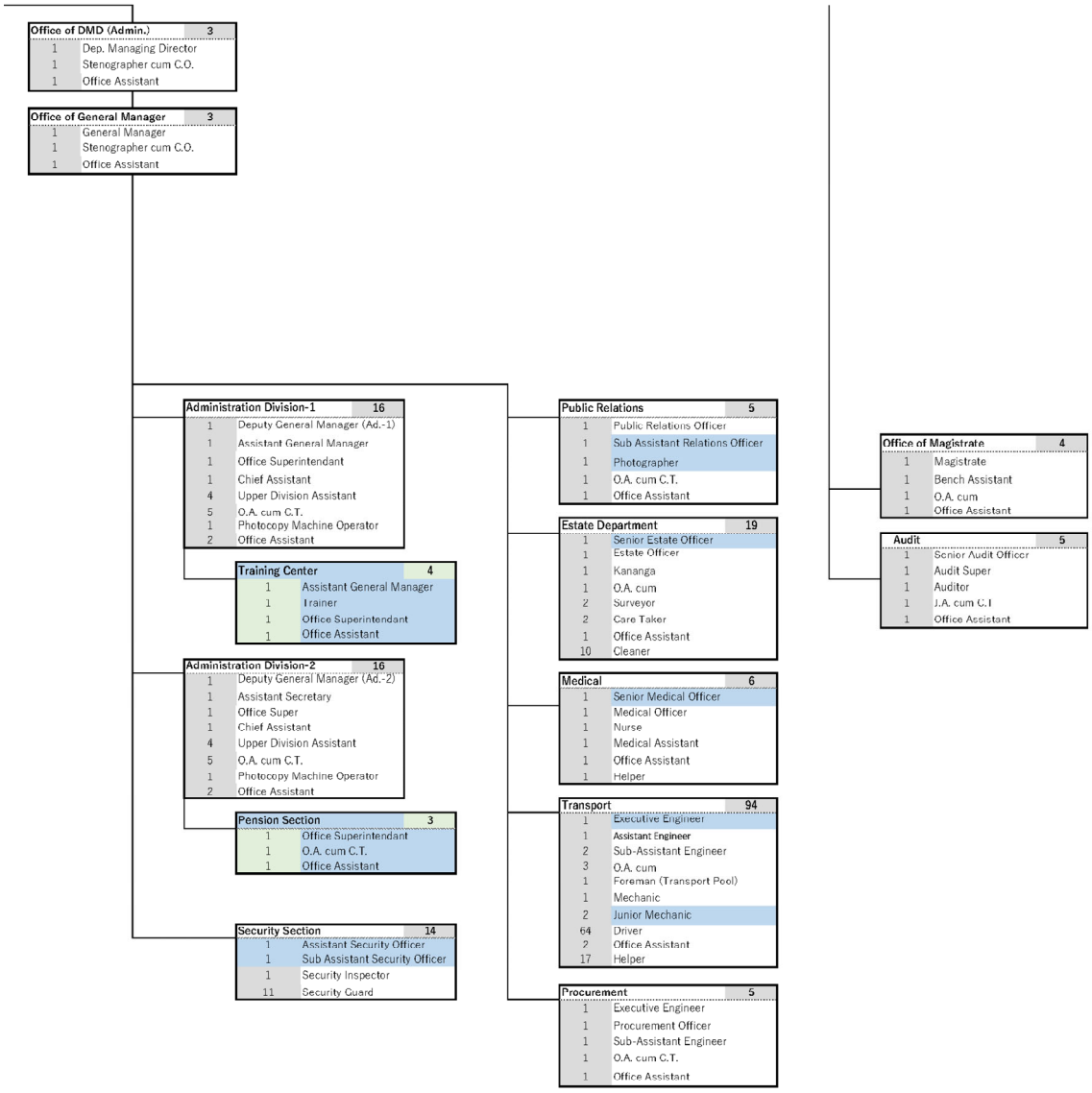


Figure1-4 CWASA Organogram (Administrative Division)

Appendix 2. Letters related to Industrial Wastewater

This information is confidential corporate information and is not for public disclosure.

Figure2-1 Letter from CEPZ

This information is confidential corporate information and is not for public disclosure.

Figure2-2 Letter from KEPZ

Appendix 3. Letters related to Utility Company

This information is confidential corporate information and is not for public disclosure.

Figure3-1 Letter to Power Development Board (Electric)

This information is confidential corporate information and is not for public disclosure.

Figure3-2 Letter to Karnaphuli Gas Distribution Company

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Figure3-3 Letter to Bangladesh Telecommunication Company Limited

Appendix 4. Draft Letter to DOE and DOE's Reply

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Figure4-1 Draft Letter to DOE

This information is confidential corporate information and is not for public disclosure.

Figure4-2 Reply from DOE

Appendix 5. Related to Financial and Economic Analysis

Table5-1 Financial Cost and Revenue Flow of Financial Analysis under 4 Alternative Case (unit: BDT million)

This information is confidential corporate information and is not for public disclosure.

Table5-2 Economic Cost and Economic Benefit Flow of Economic Analysis with Sensitivity Analysis (unit: BDT million)

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Appendix 6. Flow Calculation Sheet

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